NUREG-0170
VOL. 2

FINAL ENVIRONMENTAL STATEMENT ON THE TRANSPORTATION OF RADIOACTIVE MATERIAL BY AIR AND OTHER MODES

Docket No. PR-71, 73 (40 FR 23768)

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CHAPTER 8
COMMENTS ON NUREG-0034 AND MAJOR CHANGES THAT HAVE OCCURRED SINCE NUREG-0034 WAS ISSUED

8.1 INTRODUCTION

The purpose of this chapter is twofold: (1) to provide a brief outline of the major changes made since the issuance of the draft version of this report (NUREG-0034), most of which were in response to comments received during the public review period and (2) to give detailed responses to each of these comments. A list of all comments received is given in Appendix J.

8.2 MAJOR CHANGES SINCE NUREG-0034 WAS ISSUED

Major changes in the Draft Environmental Statement were made both in response to certain public comments and as a result of new information. The purpose of this section is to outline these changes, both editorial and technical, and to discuss briefly the impact of these changes on the overall results. The changes are listed chapter by chapter. Items that affect the results are marked with an asterisk and are discussed in more detail in Section 8.3.

8.2.1 CHANGES IN CHAPTER I (INTRODUCTION)

*1. Data from the recently issued 1975 Radioactive Material Shippers Survey are now included and form the basis of the standard shipments model.

2. A section on experience with radioactive material transportation has been added.

3. The discussion from Chapter III of NUREG-0034 on radioisotope uses has been rated into Chapter 1.

4. Figure I-2 (HTGR fuel cycle diagram) has been deleted.

5. Table I-1 (Radioisotope Shipment Summary - July 1, 1975) and Table I-2 (Standard Shipments for the Nuclear Industry) of NUREG-0034 have been replaced by a summary of the standard shipment model information from Appendix A.

6. Table I-3 (Radioactive Material Shipments) of NUREG-0034 has been expanded to include packages per year, TI per year, curies per year, miles per year, and the expected number of latent cancers per year computed in this assessment and incorporated into Table 1-2.

7. The discussion in NUREG-0034 of the fault-tree/logic-model approach has been eliminated.

8.2.2 CHANGES IN CHAPTER II (THE REGULATIONS GOVERNING RADIOACTIVE MATERIALS TRANSPORT)

1. The consolidation of the DOT regulations into Title 49 of the Code of Federal Regulations has been incorporated.

2. "Exempt" quantities are now referred to as "limited" quantities.

3. Miscellaneous errors in Table II-5 of NUREG-0034 have been corrected.

8.2.3 CHANGES IN CHAPTER III (RADIOLOGICAL EFFECTS)

1. The concept of RBE is explained more fully.

2. Table III-1 of NUREG-0034 has been expanded.

3. The discussion in NUREG-0034 of background radiation has been significantly expanded.

*4. The discussion in NUREG-0034 of hazards of radiation has been subdivided into three separate sections: acute effects, carcinogenesis, and genetic effects. Genetic effects are now quantitatively discussed.

5. A discussion of sensitivities of other life forms to radiation has been added.

6. The section in NUREG-0034 on radiological properties of transported radionuclides has been eliminated. Certain selected sections of that discussion have been incorporated into Chapter 1.

7. Table III-8 of NUREG-0034 has been deleted. Selected values have been incorporated into Appendix A.

8. Figure III-3 of NUREG-0034 has been revised to incorporate new data concerning early effects of inhaled, long-lived, alpha-emitting isotopes.

8.2.4 CHANGES IN CHAPTER IV (TRANSPORT IMPACT UNDER NORMAL CONDITIONS)

1. References and figures in NUREG-0034 concerning the original fault-tree/logic-model methodology have been deleted.

2. Figure IV-1 has been redrawn.

*3. The normal dose calculations are based on the new standard shipments model.

*4. Some aspects of the computational scheme used to determine normal dose have been changed. The entire scheme is discussed in Appendix D (replacing Appendix E of NUREG-0034).

*5. Discussions of maximum individual dose have been added for each population subgroup.

*6. A revised demographic model has been incorporated and is explained in Appendix E.

7. The section on nonradiological impacts has been rewritten.

8. The section on abnormal occurrences has been expanded.

*9. A section on import and export shipments has been added.

*10. Results of the genetic effects analysis have been added.

8.2.5 CHANGES IN CHAPTER V (EFFECTS OF TRANSPORT UNDER ACCIDENT CONDITIONS)

1. The title of the chapter has been changed to "Impacts of Transportation Accidents."

2. The chapter has been reorganized into what is felt to be a more logical sequence.

3. The explanation of the concept of "risk" has been expanded.

4. All equations in NUREG-0034 have been deleted from the text and placed in Appendix G, where they are explained.

5. Figure V-1 has been revised and expanded.

6. The logic model figures in NUREG-0034 have been deleted.

*7. The computations are based on the new standard shipments model.

*8. The new demographic model has been incorporated into the calculations.

*9. The severity derating scheme for aircraft accidents on real surfaces has been revised, and a description of the derating is given in Appendix H.

*10. The overall accident rate for aircraft has been revised to incorporate a newer and more substantial data base.

11. The Integrated Container Vehicle has been added as the primary mode for transport of recycle plutonium in 1985.

*12. The values for fractions of accidents occurring in various population zones for trains have been modified.

13. A section on waterborne transport (barge and ship) has been added.

*14. The release fraction model has been modified based on recent test data. Three additional sets of release fractions are used; for Type B plutonium containers, one release fraction

set for 1975 Pu containers has been introduced and one for 1985 Pu containers. A second release fraction model has been introduced for casks.

*15. The atmospheric dispersion model has been modified to include dry deposition and resuspension. In connection with this, a section on surface contamination has been added.

*16. The "worst case" analysis has been expanded to include other materials. Both consequences and probabilities are presented for category VIII accidents involving these materials in an urban area with a population density of 15,400/km^2.

17. Figures V-10, -11, -12, and -13 and Tables V-8, -9, -10, and -11 of NUREG-0034 have been deleted.

*18. The dose calculations (both early and long-term) are no longer based on Pu-239 dosimetry. The new dose calculation methodology is discussed in Appendix G, and the parameters used are given in Appendix A.

*19. The method used to compute early fatality probability has been revised and is explained in Appendix G.

*20. Results of the genetic effects analysis have been added.

8.2.6 CHANGES IN CHAPTER VI (ALTERNATIVES)

*1. The following alternatives are no longer considered: all cargo-only air shipments shifted to passenger aircraft, VFR-only flights, daytime-only flights, specific aircraft model requirements.

*2. The following alternatives have been added: a 0.5-mrem/hr maximum dose at seat level in passenger aircraft, all feasible irradiated fuel shipments by barge, and aircraft package monitoring. The discussion of the alternative to restrict irradiated fuel shipments to special trains has been revised and expanded.

*3. The alternatives evaluated for plutonium only in NUREG-0034 are now evaluated for all "high-hazard dispersible" materials. (These are defined in Section 6.2.4.)

4. Only the alternatives that were found to be cost effective are now included in the summary at the end of the chapter.

8.2.7 CHANGES IN CHAPTER VII (SECURITY AND SAFEGUARDS)

1. A section discussing the potentials for misuse of SNM and radioactive isotopes and waste has been added.

2. The section on "Transportation Security Systems" has been revised to contain an assessment of current physical protection measures. It has been renamed "Physical Protection of Highly Enriched Uranium and Plutonium During Transit."

3. An Alternatives section has been added. This section consists of a discussion of the Federal Guard Force, the ERDA Transport System, the Department of Defense, protection against a higher level threat, and restricting transport (of SNM) to a particular mode.

8.2.8 CHANGES IN APPENDIX A (ENVIRONMENTAL IMPACT LOGIC MODEL)

1. Appendix A of NUREG-0034 has been deleted.

8.2.9 CHANGES IN APPENDIX B (PLUTONIUM)

1. Appendix B of NUREG-0034 is now Appendix C.

2. Figure B-1 of NUREG-0034 has been deleted.

*3. Tables B-1 and B-2 of NUREG-0034 have been revised and expanded to include dosimetric effects.

4. A figure showing deposition fractions versus particle size has been added.

5. A section on genetic effects has been added.

6. The section on toxicity has been revised and expanded.

8.2.10 CHANGES IN APPENDIX C (INCIDENTS REPORTED TO DOT INVOLVING RADIOACTIVE MATERIALS)

1. Appendix C of NUREG-0034 is now Appendix F.

2. An introductory section has been added.

3. A figure showing the Incident Report form has been added.

8.2.11 CHANGES IN APPENDIX D (REGULATIONS)

1. Appendix D of NUREG-0034 is now Appendix B. No further changes were made.

8.2.12 CHANGES IN APPENDIX E (POPULATION DOSE FORMULAS FOR NORMAL TRANSPORT)

1. Appendix E of NUREG-0034 is now Appendix D.

*2. The methodology used to compute dose to crew, dose to surrounding population while moving, dose to population on the transport link, and dose while stopped has been revised. The revised equations were derived from first principles.

8.2.13 CHANGES IN APPENDIX F (PRODUCTION OF A NUCLEAR EXPLOSION BY AMATEURS)

1. Appendix F of NUREG-0034 has been deleted.

8.2.14 CHANGES IN APPENDIX G (SENSITIVITY ANALYSIS)

1. Appendix G of NUREG-0034 is now Appendix I.

2. The method used to analyze the sensitivities of the radiological risks to the parameters used in their determination has been revised.

8.2.15 CHANGES IN APPENDIX H (STATE AND LOCAL REGULATORY AGENCIES)

1. Appendix H of NUREG-0034 has been deleted.

8.2.16 NEW CHAPTERS AND APPENDICES

1. Chapter 8 has been added. This chapter discusses changes that have been incorporated since the draft version was published and addresses public comments in detail.

2. Appendix A has been added. This appendix discusses the development of the Standard Shipments Model used for the risk analysis in Chapters 4, 5, and 6.

3. Appendix E has been added. This appendix discusses the demographic model used in Chapters 4, 5, and 6.

4. Appendix G has been added. This appendix specifies the calculational scheme used for the accident calculations in Chapters 5 and 6.

5. Appendix H has been added. This appendix discusses the aircraft accident derating model introduced in Chapter 5.

6. Appendix J has been added. This appendix consists of copies of each of the comments received by NRC during the public review period.

7. Appendix K has been added. This appendix consists of copies of the comments received after a February 1977 meeting of the Working Group on Transportation of the Advisory Committee on Reactor Safeguards at which the February 1977 draft FES was discussed.

8.3 MAJOR CHANGES THAT HAVE RESULTED IN CHANGES IN CONCLUSIONS/ANALYSIS SINCE NUREG-0034

1. The incorporation of the shipment data from the 1975 shippers survey increased the number of packages by a factor of 4, the number of curies by a factor of 100, and the number of TI by a factor of 16. The net effect produced by these and the analysis changes was an increase in the annual normal LCF by a factor of 1.02 and in the annual accident LCF by a factor of 8.4.

2. The incorporation of the new demographic model changed population densities as follows:

	Population Density (km^{-2})	
	NUREG-0034 (Draft)	NUREG-0170
Rural	40	6
Suburban	400	719
Urban	4000	3861

3. The relative contributions of the various population subgroups to the normal risk differ from those in the Draft as a result of both the new standard shipments model and the new method of computing the normal dose, as outlined in Appendix D. The changes are evident in the following table:

Population Subgroup	Percent Contribution to Normal Risk	
	NUREG-0034 (Draft)	NUREG-0170
Passengers	9.03	23.8
Crew	0.88	32.1
Attendants	0.56	1.1
Handlers	6.1	17.8
Off-link	55.0	4.3
On-link	1.4	4.0
Stops	14.9	11.1
Storage	12.0	5.8

4. Estimates of maximum individual dose are included in Chapter 4 in an attempt to add additional perspective on the normal impact of radioactive material transport.

5. Export and import shipments were analyzed explicitly and were found to make only a small contribution to the total risk.

6. The results of the revised real-surface derating scheme for aircraft are compared below with that used in NUREG-0034:

Accident Severity Category	Fraction of Real-Surface Accidents of a Given Severity	
	NUREG-0034	NUREG-0170
I	0.57	0.447
II	0.16	0.447
III	0.099	0.0434
IV	0.077	0.0107
V	0.033	0.0279
VI	0.036	0.0194
VII	0.022	0.0046
VIII	0.003	0.0003

7. The aircraft accident rate in NUREG-0034 was 5.6×10^{-8} per mile for cargo aircraft and 1.8×10^{-8} per mile for passenger aircraft. The value used in this assessment is 2.3×10^{-8} per mile for all air modes.

8. The fraction of train accidents occurring in each population zone are revised as follows:

Accident Severity Category	NUREG-0034 Urban	NUREG-0034 Sub.	NUREG-0034 Rural	NUREG-0170 Urban	NUREG-0170 Sub.	NUREG-0170 Rural
I	0.1	0.45	0.45	0.8	0.1	0.1
II	0.1	0.45	0.45	0.8	0.1	0.1
III	0.1	0.45	0.45	0.3	0.4	0.3
IV	0.1	0.45	0.45	0.3	0.4	0.3
V	0.1	0.45	0.45	0.2	0.3	0.5
VI	0.1	0.45	0.45	0.1	0.2	0.7
VII	0.1	0.45	0.45	0.1	0.1	0.8
VIII	0.1	0.45	0.45	0.05	0.05	0.9

9. The values for release fractions for Type A and Type B packagings (not used for shipping plutonium) have been revised as indicated below:

Accident Severity Category	Type A Package NUREG-0034	Type A Package NUREG-0170	Type B Package NUREG-0034	Type B Package NUREG-0170
I	0	0	0	0
II	0	0.01	0	0
III	0	0.1	0	0.01
IV	0	1.0	0	0.1
V	0.1	1.0	0	1.0
VI	0.2	1.0	0	1.0
VII	0.5	1.0	0.1	1.0
VIII	1.0	1.0	0.5	1.0

In this assessment the containers are conservatively assumed to begin to fail just above the severity at which they were tested.

10. Three additional packaging categories, B-Pu-1975, B-Pu-1985, and Cask have been added. The release fractions for Type B-Pu containers reflect recent test data for plutonium shipping containers and apply only to plutonium shipments. The cask data allows for cracking of a massive cask with subsequent direct exposure hazards.

11. The atmospheric dispersion model was revised to consider dry deposition and to restrict upward diffusion of the debris cloud to 1400 meters. The net effect of this revision is to reduce the downwind concentrations of the transported material that is available for inhalation.

12. The dose calculations were modified to allow for dose resulting from the resuspension of deposited material.

13. An extreme urban population density of 15,444 persons/km^2 based on New York City census information was used in assessing the consequences of certain class VIII accidents in urban areas.

14. The dose calculations are now based on a standard dosimetric model, not on Pu-239 data. The dosimetric calculations are explained in Appendices A, D, and G.

15. The dose-probability calculation for early fatalities has been changed. The derivation of the equations used in the revised calculation is presented in Appendix G.

16. The combination of the revised standard shipments model and revised release fractions, aircraft accident rates, real-surface deratings (particularly classes VII and VIII), meteorology, dosimetry, population densities, etc., resulted in an increase in the overall accident LCF by a factor of 8.5 and a decrease in the accident LCF resulting from plutonium shipments by a factor of 8.4. The greatest contributions to the accident LCF are made by Po-210 and mixed fission/corrosion product shipments, each contributing approximately one-fourth of the total. Plutonium shipments account for about 15% of the total accident LCF. This result is significantly different from that of the draft version of this document, in which it appeared that plutonium shipments completely dominated the accident risk.

17. Because the shipments of plutonium do not dominate the accident risk as in NUREG-0034, shipments of all "high-hazard, dispersible" materials, including plutonium, are considered for the various alternatives that previously considered only plutonium. The criteria used to determine which dispersible material shipments are to be considered "high-hazard" are a rem-per-curie inhaled value greater than 10^6 and a quantity per shipment greater than 100 curies.

8.4 DISCUSSION OF COMMENTS RECEIVED DURING PUBLIC RESPONSE PERIOD

NUREG-0034 was issued in March 1976, and a public comment period ending May 17, 1976, was provided. Comments received during that period are compiled and presented in their entirety in Appendix J to this document. This section addresses each of the comments received individually. In order to make the reader's task easier, each comment is presented, followed by the staff response to that comment.

General Comments: 1

City of New York - Comment 1

"The rule-making proceeding to which this DES is addressed arises from a nationwide expansion of the nuclear material transportation program. However, even if the DES at issue were adequate (as it is not) as a generic environmental statement, if the rules purport to apply to transportation within and through New York City, there must be an additional DES prepared for shipments in and through New York City."

State of Georgia - Comment 7

"In addition to the general considerations of transportation of nuclear materials throughout the United States, specific consideration must also be addressed with regard to large metropolitan areas such as Atlanta, ports of entry, and other large transportation centers. NRC has a definite and specific responsibility in the development and application of proper procedures for the transportation of nuclear materials through such areas in order to insure the complete protection of the citizens of the area. Such procedures must be useable and acceptable by the States that are impacted."

State of Georgia - Comment 5

"In general, the EIS is too general and non-specific to be of much use as a planning tool for specific areas. As was stated in above, NRC has the obligation and responsibility to issue a report that is useable by the States."

Staff Response - The annual risk estimates in this report are made using average population density values of 3861, 719, and 6 persons per square kilometer, respectively, for urban, suburban, and rural areas. Appendix E shows that only 18 cities in the United States have population densities exceeding 3861 persons per square kilometer, including New York City, which in the 1970 census had an average urban density of 15,444 persons per square kilometer. This higher population density was used in the evaluation of severe accident consequences in Section 5.6 of this report. Since average urban population density is used in the risk analysis, the risk to individual urban areas is included in the total risk assessed.

General Comments: 2

ERDA - General Comment 1

"This document contains much pertinent information relative to NRC and the Department of Transportation regulations for the shipment of fissile and other radioactive material and reflects considerable work in summarizing information concerning personnel exposure limits and radiological effects. However, it was difficult to verify results presented due to incomplete discussion of the material in the text. Although we are familiar with the subject and the associated technology, we found the organization of the statement somewhat difficult to understand.

We would like to suggest that you may wish to revise the organization of the statement for better continuity."

State of Georgia - Comment 1

"The draft EIS deals with the transportation of all types of radioactive materials, including pharmaceutical as well as spent fuel. It is broad, general, and non-specific. Because of the way it is organized and presented, it is practically impossible to sort out the real issues and impacts associated with an area of prime interest such as the transportation of spent fuel. The NRC should separate out the issue of spent fuel and do a separate detailed and factual EIS on its transportation aspects."

Staff Response - The general discussion in Chapters 4 and 5 has been expanded, and more detailed derivations have been provided in Appendices D and G. It is hoped that these clarifications and reorganizations will enable the reader to extract the desired information. In all cases, impacts due to shipment of irradiated fuel are specifically delineated.

General Comments: 3

ERDA - General Comment 4

"Our staff also strongly recommends that a more thorough evaluation be given to the need for decontamination after an accident involving rupture of containment. The ingestion pathway discussed in Appendix A should be carefully evaluated for the radionuclides which may cause special problems."

Staff Response - Section 5.5 on contamination/decontamination has been added to Chapter 5. Ingestion problems are discussed in that section.

General Comments: 4

ERDA - General Comment 3

"Because of the subject matter of this statement, we would suggest that a glossary be added at the beginning of the statement. Some examples are transport index, half-life, effective half-life, latent cancer fatality, competent authority certification, and others. We feel that such an addition would be quite helpful to all readers. Furthermore, NRC might wish to consider the use of photographs in the statement to also assist the reader."

Staff Response - In view of the extensive references to source documents that include photographs and explanations of terms, neither photographs nor a glossary have been added to this document.

General Comments: 5

City of New York - Comment 4

"The DES purports to review a 30-year program but fails to include increases in nuclear shipments beyond 1985. Nor is there adequate basis for the DES's forecast of a 250% increase of shipments."

Staff Response - The DES does not "purport to review a 30-year program." The 30-year period mentioned on page ii refers only to the period during which cancers induced in 1975 would prove fatal. The basis for the projections to 1985 is discussed in Appendix A.

General Comments: 6

Mrs. Virginia Karstedt - Comment 3

"You are badly in need, it seems to me, of more current data. I ran an average of the dates for all references listed at ends of chapters. The average age of your data is 4 years. Some of your references date back to 1958. Yet you went ahead and published your draft without fresh material. It's just a rehash of old studies."

Staff Response - The technique to "average the dates of all references" to gauge the applicability of the references is totally invalid. The 1958 reference cited was used in an historical background section and is considered to be a standard reference. Current data from ongoing studies were used where available and applicable. This document is not a "rehash of old studies," since no generic transportation study of this sort has been issued previously. Data from many sources have been compiled for the report and each datum was carefully reviewed for validity and applicability before it was included.

General Comments: 7

City of New York - Comment 5a

"While the DES purports to be evaluating certain existing regulations, there is no attempt to deal with the critical issue of compliance with, and enforcement of those regulations. The NRC, in the course of its purportedly close supervision over shipments of nuclear materials, appears to have no accurate idea of how many shipments are made per year, where they go, by what route they go and to what extent their transport is in accord with applicable law. We submit that no proper assessment of the environmental impact of the nuclear transportation program can be made in the absence of both accurate data and an evaluation of the extent to which existing rules and regulations in fact achieve their purpose."

State of New York - Dept. of Environmental Conservation - General Comment 8

"Information should be added to the Draft Statement that clearly establishes the level of enforcement action being undertaken by the U.S. Department of Transportation, the Nuclear

Regulatory Commission and various states in connection with the transportation of radioactive materials. This information should include tabular material about the number of inspections relating to radioactive materials that have been undertaken and the type and number of enforcement actions that have been taken in connection with radioactive materials during the last five years. There should also be an indication of the number of inspections that are scheduled during the coming year."

State of New York - Dept. of Environmental Conservation - General Comment 24

"It is recommended that the environmental statement be expanded to include Federal monies expended, (1) in the development of regulations and (2) in the enforcement of regulations followed by a discussion as to the optimal amount of money that should be expended to effectively minimize the hazard to the Public from the transportation of radioactive materials."

Staff Response - The goal of the DES was to evaluate the environmental impact resulting from the shipment of radioactive materials. The data used were obtained by NRC in the course of its regulatory function as well as from other reliable sources. Compliance with regulations has been assumed in calculation of the impacts, with a conservative estimate made for the additional impact brought about by a level of noncompliance estimated from a limited amount of bad experience. Recent studies have shown relatively good compliance with those regulations directly affecting radiological impacts.

The costs involved with the inspection and regulation programs are not germane to this statement since the aim is to establish the extent of the environmental impact and the changes that would be realized for various alternative actions. The costs involved in regulation would be more appropriately included in the analyses associated with specific regulation changes resulting from this statement.

General Comments: 8

HEW - Comment 1

"We note that the June 1975 public comments on the proposed rulemaking concerning air transportation of radioactive materials are not included in the draft document."

Staff Response - Those comments are for consideration in the rule making portion of the proceedings, not the impact assessment portion.

General Comments: 9

State of New York - Dept. of Environmental Conservation - General Comment 4

"The draft statement should reference and thoroughly discuss the safety analyses performed for the development of spent fuel shipping containers and the accident parameters used to develop safety analyses."

Staff Response - The regulatory design criteria, including the Type B package accident parameters, are specified in 10 CFR Part 71. A reference to 10 CFR Part 71 in this context is included in Section 2.3 of the Final Statement.

General Comments: 10

State of Georgia - Comment 3

"With reference to accident analysis, the EIS seems to look at alternatives in a broad, general context and only related to the average exposure concept. It is questionable as to whether some of these same alternatives would still be valid if the maximum exposure concept were used."

Staff Response - The alternative impacts are also presented in terms of reduction in early fatalities. There is no reason to believe that any of the alternatives considered would reduce the population dose and at the same time increase the maximum individual exposure.

General Comments: 11

ERDA - General Comment 5

"We agree with the general conclusions of the statement that the risk from radioactive material shipments is low compared to other societal risks. However, we are concerned that the accident risk analysis overestimates the transportation accident risk and is too simplified to make valid comparisons of the relative risks between the various radioactive materials. The danger in this is that people might scale the accident risk results in an attempt to determine the shipping level at which the accident risk would become unacceptable. When and if the industry approaches this shipping level at some future time, the overestimation could lead to unwarranted concern over the accident risk."

Staff Response - In the absence of data or valid analysis, realistic but conservative assumptions were made. Wherever this was done, it was clearly stated. If newer data show the values used in the DES to be excessively conservative, the analysis can be updated. However, it would be improper to formulate a document to be used for decision making that involves public safety on unsubstantiated facts or "ballpark estimates."

General Comments: 12

State of New York - Dept. of Environmental Conservation - General Comment

"The various modes of transportation including options within each mode should be subjected to systematic analysis wherein all of the risks, (i.e., normal transportation; accidents and security consideration), are interrelated so that both the impact and a transportation strategy could be developed. The Draft Environmental Statement fails to perform this function and, therefore, does not provide a meaningful comparison of the benefits and risks of alternative transportation modes."

Staff Response - Chapter 6 addresses both the normal and accident risks quantitatively for each alternative evaluated. The analysis includes many of the most likely alternatives but not all possible permutations of actions that might be taken. The impact of specific changes in regulations can be addressed as they are proposed.

General Comments: 13

State of New York - Dept. of Environmental Conservation - General Comment 1

"In spite of low probability of a major release of plutonium, the severe consequences of the accident merit attention to the further analysis of the alternative transportation and packaging modes and security implications thereof in order to futher reduce the probability of plutonium release in an accident. Therefore, New York State suggests that the alternative modes of transporting plutonium be considered separately from other radionuclides. In such a separate review, the need for developing an 'air-safe' container for plutonium shipment must be considered as part of the requisite overall analysis of the environmental consequences (in normal and accident situations) of alternative modes of plutonium transportation and packaging and the security requirements associated therewith."

Staff Response - Shipment of plutonium is the specific subject of several recently issued or ongoing reports. The development of "air-safe" containers is also being considered and evaluated separately in connection with recent congressional action that caused NRC to prohibit plutonium air shipments pending development of such a container. However, it is appropriate to include plutonium with the other radionuclides in this generic statement since it is intended to form a picture of the industry as of mid-1975. Note that several alternatives considered impinge on plutonium shipments and represent activities currently under way relating to plutonium shipping safety.

General Comments: 14

State of New York - Dr. John Gofman - General Comment 1

"These comments will be limited to the subject of plutonium and its health hazards, in the context of the DES. The DES is totally unacceptable in its evaluation of the inhalation hazard of plutonium, since the errors in treatment of this subject are numerous and large. Consequently all the evaluations of the consequences of plutonium dispersal in the event of container failures are not only irrelevant to the true problem, but they do a severe disservice in grossly underestimating the true medical cost of such dispersals."

State of New York - Dr. Marvin Resnikoff - Comment 2

"We have examined certain parts of the DES dealing with toxicity of materials, containerization, dispersion, crash environments and risk analyses of various modes of transportation and it is our conclusion that the DES is a fatally defective document and, as such, cannot be relied upon as an accurate or adequate document by the Congress or the public."

City of New York - General Comment

"It is our view that the DES is fatally inadequate and thus cannot serve as a basis for determining the effectiveness of NRC's present rules governing the air transportation of radioactive materials and of possible alternatives to those rules."

Staff Response - Specific comments related to these general statements have been evaluated elsewhere. Where the comment had merit, an appropriate change in the document and/or analysis was made; otherwise the reason for not accepting the comment was given.

General Comments: 15

Dr. K. Z. Morgan - Comment 7

"There are too many rather arbitrary and unsubstantiated assumptions."

Dr. K. Z. Morgan - Comment 8

"There are serious inconsistencies between this and previous NRC reports and statements by NRC officials."

Staff Response - Without more specific reference to the assumptions or inconsistencies under discussion, no detailed answer to this comment can be provided.

General Comments: 16

ERDA - Comment 70

"It has been suggested that the report title be shortened to: 'The Transportation of Radioactive Materials.'"

Staff Response - The title of the report reflects the aims and limitation of the analysis as perceived by NRC.

DES Summary and Conclusions: 1

ERDA - Comment 1

"The first paragraph here gives the person-rem per year, but does not give the comparative person-rem per year in the U.S. from background radiation. We think it would be appropriate to make this explicit as the the conclusion on page v notes the small fraction contributed by the transportation phase. We did not find an explicit number anywhere in the text.

"We found no comparison of the excess exposure received by aircraft passengers and crew from cosmic radiation at flight elevation vs. the background radiation they would have received

had they stayed on the ground. The comparison of this number with that arising from exposure from packages containing radioactive material carried in the aircraft should be constructive."

Staff Response - Background exposure and exposure due to high altitude flight have been added.

DES Summary and Conclusions: 2

ERDA - Comment 2

"Page ii, Paragraph 3a states, '. . .an aircraft carrying a bulk shipment of plutonium oxide. There are presently less than 100 bulk shipments of plutonium per year. . .'

"The terminology, 'bulk' shipments, may be construed to be loose or unpackaged. We are unaware of any such shipments of plutonium. We suggest that these statements be reevaluated since they may convey a connotation different from that intended in respect to shipment of plutonium."

Staff Response - The word "bulk" has been changed to "large."

DES Summary and Conclusions: 3

State of New York - Dr. Marvin Resnikoff - Comment 20b

"The specific origin of the Latent Cancer Fatalities figure (20 per year for 30 years) (p. ii), which allegedly could be produced from the DES' plutonium accident scenario, cannot be found anywhere. Throughout the numerical presentations the reader is forced to do detective work to find the computational framework (often apparently guesswork) utilized by the authors, often without success."

Staff Response - The value of 20 per year for 30 years merely expresses the latency-plateau model for cancer risk. The total number of cancers expected are 600 and they are assumed to appear over a 30-year plateau period following a latency period of some 10-15 years.

DES Summary and Conclusions: 4

ERDA - Comment 3

"It is not clear in the text, page II-25 [III-25], whether curve A, B, or C is used. If A has been used in the calculations, then it would be appropriate to state in 'e' that no medical precautions are taken."

Staff Response - Curve B, which assumes that "supportive medical treatment" is provided, was used and a clarifying statement has been added to FES Figure 3-2.

DES Summary and Conclusions: 5

ERDA - Comment 4

"Another alternative which could be considered is requiring the carrier to survey packages prior to acceptance or loading. If this check and balance had been in effect, we might not have experienced some of the notable exposures in aircraft transportation."

Staff Response - An evaluation of this alternative is now included.

DES Summary and Conclusions: 6

State of New York - Dept. of Environmental Conservation - Comment 10

"The Draft Statement indicates (p. iv) that a few individual transport workers whose radiation exposures exceed the limits established for members of the general public should be, and in most cases are, monitored and otherwise treated as radiation workers. There does not seem to be clear indication of when such transportation workers are to be treated as radiation workers. It is necessary that workers required by their job to work with radioactive materials and radiation, whether in a laboratory or on a loading platform, are dealt with in a consistent manner. Therefore, it is important that the class of transportation workers and work situations involving significant shipments of radioactive materials should be identified so appropriate radiation protection measures can be taken."

Staff Response - The matter of when, if ever, transportation workers should be considered to be occupationally exposed to radiation is being studied by the staffs of DOT and NRC. Such a policy decision may ultimately involve other agencies as well.

DES Detailed Summary: 1

Dr. K. Z. Morgan - Comment 5a

"On page XIX we find the statement, 'It is estimated that the total annual population exposure resulting from normal transport is about 9600 person-rem.' Such a statement is completely meaningless and valueless because the year is not indicated and there is no indication of whether this man-rem is to the total body, thyroid, trabecular bone, deep lung compartment, etc."

Staff Response - The person-rem estimate is stated as being based on "current shipping practices," which is specified on page i to be as of June 30, 1975. This assumption is discussed in greater detail on DES pages I-15 and I-19.

The organs involved are discussed in detail in Chapters 3 and 4. It is clear from those chapters that the estimated person-rem refers to whole-body exposure.

DES Detailed Summary: 2

Friends of the Earth - Comment 3

"We refer the NRC to the affidavits of Drs. John Gofman, Marvin Resnikoff and Karl Z. Morgan, prepared for the New York State Attorney General in his lawsuit against the U.S. government to halt air shipments of plutonium. The above are leading scientists with expertise in plutonium toxicity and dosimetry; the NRC figures of one fatality and sixteen latent fatalities are unsubstantiated by any expert studies or data and are therefore indefensible."

Staff Response - Although the three persons referred to have made statements relating to plutonium toxicity, their conclusions are at variance with other experts in the field. Because there is disagreement between NUREG-0034 results and those of the "experts" doesn't mean that the NUREG-0034 results are "indefensible." Accident calculations are based on the best information known to NRC.

DES Detailed Summary: 3

ERDA - Comment 5

"What is the basis for the statement 'A Factor of twenty decrease in accident risk and consequences seems attainable by this technique (change in physical form) for plutonium shipments.'? We agree with the principle but question the technical basis of this factor."

Staff Response - It is shown in Section 6.4 that a reduction of 0.005 LCF in total accident risks would result if it were possible to change the form of the plutonium in such a way that the respirable fraction were limited to 1 percent.

DES Detailed Summary: 4

Friends of the Earth - Comment 2

"We take issue here, as elsewhere, with the reprehensible practice of averaging radiation exposure over large populations and thus submerging individual health effects. This averaging is misleading in that it infers lower radiation releases than actually occur; it also ignores the very real health effects, short- and long-term, on the individual who is unfortunate enough to contract cancer or leukemia, suffer genetic mutations, or give birth to a deformed infant. For this individual the risk is one, e.g., certainty.

"One could compare this habit of averaging to the argument used by nuclear proponents in trying to refute public concern over plutonium toxicity. These individuals denigrate public concern by saying that perfectly uniform dispersal and ingestion of plutonium oxide is highly unlikely and therefore we should not worry about plutonium releases. Here, however, it is the NRC that is guilty of assuming - for their own purposes of underplaying the seriousness of radiation releases - that radiation resulting from an accident will be uniformly dispersed and uniformly received by vast populations numbering in the hundreds of thousands, even millions.

Nuclear opponents and critics have never assumed such perfect dispersal, and we therefore insist that the NRC not make a similar assumption, and discontinue its use of the term man-rem."

Dr. K. Z. Morgan - Comment 9

"Average cases and the standard or reference man data are used in estimating cancer risk. Don't the children, the persons with respiratory diseases, etc., count? It seems we should protect them as well as the healthy adult worker to whom the standard man data apply."

Staff Response - In the normal transportation case the dose to those persons surrounding the transport links, passengers, handlers, etc., is calculated making estimates in each case of the number of persons exposed. A package in normal transport does give a small dose to a lot of people, because of the nature of the transportation process.

Nowhere is the assumption of uniform dispersal made in the accident case. The dispersion model, a Gaussian diffusion model, is discussed in Chapter 5.

The BEIR statistics used for latent cancer fatality assessment are adjusted to account for differences in the sensitivity of the fetus, child, or adult with respect to radiation-caused carcinogenesis (WASH-1400, Appendix VI, page G-4, para. G-1.2).

The question of potential synergistic effects of respiratory disease and lung cancer is not specifically addressed. Two points concerning this question should be noted: (1) The BEIR values are acknowledged to have large uncertainties associated with them. They are average values, not absolute values. (2) The fact that persons with respiratory illnesses have a shorter life span anyway might very well offset any increase in their susceptibility to radiogenic lung cancer.

DES Detailed Summary: 5

Friends of the Earth - Comment 4

"We take strong exception to the statement in paragraph d that nuclear fuels produce lower levels of gaseous and solid pollutants - not because the statement is false but because it compares apples and oranges, e.g., fails to note that nuclear fuels do in fact produce pollutants that are qualitatively different and much more lethal, namely radioactive fission products, in normal operation, through waste accumulation, activation products, and in unplanned releases. Furthermore, the potential for large radiation releases is always present in all parts of the nuclear fuel cycle, normal operational releases aside."

Staff Response - Although the nuclear pollutants are qualitatively different and may be more lethal in concentrated form, one cannot ignore the relative quantities of pollutants introduced into the environment by the various methods of producing electricity. The comment does have some validity, however, in that the paragraph implies less pollution from nuclear fuels than from conventional fuels, which, while probably true, is not within the scope of this document and has been deleted.

DES Detailed Summary: 6

Department of Interior - Comment 1

"It would be helpful to summarize the proposed action more clearly at the outset of the environmental statement. We conclude that it is proposed to continue regulating the transport of radioactive materials under present Federal regulations, pending completion of further studies of the costs and effectiveness of alternate transportation systems. While these studies are referred to generally (i.e., page v, paragraph 3), we find no summary of the specific studies in progress or of their expected date of completion.

"The non-radiological consequences of accidents involving vehicles used solely for transport of radioactive materials are variously given as 'two injuries and less than one fatality each four years' (for example, page iii, page xx, page xxiii). It would be advisable to use the same terminology throughout. In addition, some indication should be given of what percentage of transport is by vehicles used solely for transport of radioactive materials; otherwise, the figures on non-radiological consequences of accidents have little or no meaning or relevance to an evaluation of overall risk to individuals."

Staff Response - This EIS does not refer to any specific proposed action. Rather, it is an evaluation of the current state of affairs and possible alternatives that might be applicable in the future.

The nonradiological effects are discussed in detail in Chapter 5. An estimate of the percentage transported by exclusive-use vehicles is included in that chapter.

DES Detailed Summary: 7

HEW - Comment 2

"As presently contained in the document, the detailed summary does not present the reader with a thorough examination of the probable effects expected to occur from a shipping accident involving radioactive materials. Information should be included in the final document on the individual effects of each of the various types of accidents that could happen, modes of shipment, and the identity and quantity of materials involved. These should be described with and without ameliorating actions and/or safeguards. Comparing the overall exposure to populations from accidents involving radioactive material to the overall exposure from other sources does not address the consequences of a shipment accident in absolute terms."

Staff Response - Some of the information is included in the summary section. More details relating to shipments, modes of transport, and accident effects are included in Chapter 5 and in the Standard Shipments shown in Chapter 1.

To provide the detail requested would increase the size of the document many times without providing any real increase in information. Certain accident scenarios with more severe consequences are considered explicitly, but most are treated implicitly in the accident risk estimate.

This gives the desired balance between detail and general treatment which seems necessary for a generic study.

DES Detailed Summary: 8

Mrs. Virginia Karstedt - Comment 2

"..., your statistical conclusions reported in the Summary and Conclusions at the beginning of the book do not include data about shipment of irradiated fuel from nuclear power plants. And your stated purpose of answering public concern about nuclear fuel cycle material is not answered."

Staff Response - The summary and conclusions sections include data from fuel cycle shipment from 1975 and best estimates of those in 1985.

DES Chapter I: 1

United Airlines - Comment 1

"This reference page states that the purpose of the publication is to assess the impact upon the environment from the transportation of radioactive materials, primarily by aircraft, etc.

"This would appear to indicate that an effort has been made to justify an increase in the allowable limits for air movement. We will need to be extra careful in reviewing future rule making actions."

Staff Response - NUREG-0034 is intended to evaluate the transportation of radioactive material, not justify changes. Changes in regulations may be considered based on conclusions on safety, security, or the cost/benefit ratio from NUREG-0034.

DES Chapter I: 2

State of New York - Comment 11

"The Draft Statement indicates (p. I-3) that updated shipment information will be available in time for use in the final version of the Statement. We urge that such shipping data be incorporated fully into the final Statement. The newer data, in other words, should be used not only to revise Tables I-2 and I-3 but also to recompute transport impacts and to reevaluate alternative transport modes in the event that the newer data warrant such effort. If this information significantly alters the results of the draft environmental statement, then NRC should issue another draft statement for comment prior to the issuance of a Final Environmental Statement."

Staff Response - The revised standard shipment model based on the new data is used throughout the Final Environmental Statement.

DES Chapter I: 3

State of New York - Comment 12

"This section should present quantitatively the various applications for which radioactive materials are used and the benefits to society from these applications."

Staff Response - Detailed analysis of the benefits arising from the use of radioactive materials is beyond the scope of this report. A statement of the uses for such materials is included to provide background information necessary to understand the breadth of the transportation industry. This statement deals only with the transportation of materials, not with the benefits derived from their uses.

DES Chapter I: 4

Department of the Interior - Comment 3

"Throughout the statement there is little information on the adequacy of regulations as applied to the transport of large-curie radiation sources that are stated to contain as much as hundreds of thousands of curies for use in large-scale sterilization operations (page I-9). These are described as consisting chiefly of the radioisotopes cobalt-60 and cesium-137. Large curie sources of up to 10,000 curies are also said to be shipped to cancer treatment centers both in the United States and abroad, with overseas transport by ship and domestic transport by truck or rail (page I-9, paragraph 2). However, we found little or no information on the size or weight of the casks, or particularly on the adequacy of protection afforded the transport of the large-curie radiation sources under existing regulations."

Staff Response - Specific information on size or weight of casks is not germane to the report. The size and weight of the cask are more a function of the type of radiation emitted from the contained radioactive material than of the total hazard of that material if released. The adequacy of large-quantity shipments of radioactive materials are explicitly considered (see Section 5.5).

DES Chapter I: 5

State of New York - Comment 13

"The DES uses a figure of 600,000 packages of radioactive material shipped annually. This differs from other estimates previously used, including an estimate of 800,000 packages cited by the U.S. Atomic Energy Commission on page 61 of WASH-1238, dated December 1972. The reason for using the 600,000 figure should be indicated."

Staff Response - The value of 600,000 was used as the best available information. The detailed PNL study indicated that the actual value is closer to 2.5 million, and that value is used in the final report.

DES Chapter I: 6

ERDA - Comment 6

"We suggest that these be revised to indicate the following: (1) there are no commercial reprocessing plants presently operating; (2) liquid high level wastes must be solidified within five years of production and (3) an acceptable waste disposal method, not just site approval, is needed before a permanent waste repository will be available."

Staff Response - A comment to the effect that there are currently no reprocessing plants has been added to the final report. Comments have also been added to reflect the current state of national radioactive waste management plans and the solidification requirement of Appendix F to 10 CFR Part 50.

DES Chapter I: 7

Friends of the Earth - Comment 5

"Paragraph 1 has an unfortunate error; the substitution of the word safeguards for the word security. Or is the NRC implying that highly radioactive spent fuel will never be the object of attempted diversion or sabotage because of its innate hazards? Or does the NRC mean that irradiated fuel needs no safeguarding, period?"

Staff Response - The context of the paragraph is safeguards, as is evidenced by reference to 10 CFR Part 73. Part 73 requirements do not include safeguarding of irradiated fuel because it is extremely unlikely that a thief could steal the plutonium from it. Security is a different subject, and the statement is never made that spent fuel could not be the target of attempted sabotage.

DES Chapter I: 8

HEW - Comment 3

"It is noted that the shipments listed and their modes of transport are representative of the radioisotope industry (Table I-1). There are no estimates for postal shipments, which probably use any and all modes of transportation. Although these are of small individual quantity, they may be large in volume."

Staff Response - "Limited" quantities of various materials shipped by the postal service are now included in the overall assessment and are explicitly mentioned in FES Table 1-1.

DES Chapter I: 9

ERDA - Comment 7

"Table I-1 lists shipments which include all nuclear fuel cycle material; however, the statement fails to address U-core, U_3O_8, normal and enriched UF_6, fresh and recycled fuel assemblies, and radioactive wastes. We suggest that these should be addressed in the statement.

"We also suggest that the category 'Low Level Wastes' shipped from 'Fuel Fabricator and Reprocessor' to 'Commercial Burial Site' by 'Truck or Rail' might be added to this table."

FEA - Comment 1

"The 'Standard Shipments' used in assessing potential environmental impacts include plutonium, but do not include enriched uranium. Although the concern expressed during the past year by public officials and others about the air shipment of special nuclear materials has emphasized plutonium, uranium has not been excluded. If the NRC is able to certify to the Joint Committee on Atomic Energy (JCAE) that a safe container for plutonium has been developed and tested which will withstand the crash of a high-flying aircraft, the public concern over air shipments could

shift to enriched uranium. Accordingly, we suggest that low enriched uranium typically used in light water power reactors be included in the 'Standard Shipments' analyzed in NUREG-0034."

ERDA - Comment 8

"We suggest that the category 'Fresh Fuel and Radioactive Waste Shipments' be added."

Staff Response - The front-end fuel-cycle shipments are included in the revised standard shipments model. Low-level wastes have been added to FES Table 1-1 and are also included in the revised standard shipment model.

DES Chapter I: 10

HEW - Comment 4

"Weapons shipments and all shipments in government-owned vehicles are not considered. These omissions may have seriously affected the calculations presented in the statement."

City of New York - Comment 2

"The DES is made virtually worthless by its unexplained exclusion, as 'outside the scope of this document' (I-19), of all government shipments. The degree of such shipments is unstated, but they are undoubtedly substantial in number and in degree of radioactivity. The cumulative impact on the environment of all shipments to and from an area must be assessed in a proper ES. Clearly, no meaningful assessment of cumulative impact, either nationwide or in a given area, can be made if a substantial portion of the shipments are arbitrarily excluded and treated, in effect, as if they make no adverse contribution to the environment. There is thus a failure to make the required comprehensive and integrated assessment of the environmental risks associated with the transportation of nuclear materials."

EPA - Comment 5

"With the exception of weapons-related shipments where the country's security might be compromised, we cannot understand the exclusion of government transportation statistics. Since this group of statistics is surely a large collection, the public release of this information is not only desirable but could certainly aid in the assessment of the environmental impact created by the transportation of radioactive materials."

Staff Response - The DES was in error in stating that shipments in government-owned vehicles were excluded from its scope. The scope of the EIS is the same as the scope of the Radioactive Material Shipments Survey (BNWL-1972) on which it is based and excludes defense-oriented shipments of weapons and weapons components and other shipments in military vehicles. These shipments are excluded because they are outside the jurisdiction of NRC and are controlled by other requirements. Also, the need for such shipments is judged on a totally different basis because of national security considerations - an area outside the scope of the Statement.

DES Chapter I: 11

Department of the Interior - Comment 4

"Tabular data in Chapter I, that appear to provide comprehensive information for most classes of radioactive materials shipments, provide little or no information on the large-curie radiation sources, which appear to be among the potentially most hazardous materials shipped. For example, Table I-2 (page I-20) shows no shipment class having an average of more than 5,000 curies per package. We feel that comparable information, including the number of packages shipped annually in 1975 and 1985, should be provided for the teletherapy sources containing up to 10,000 curies of radioactivity and for the radiation sources that contain as much as hundreds of thousands of curies of activity, particularly in view of the fact that some of the large-curie sources are said to be shipped to locations abroad and by means of truck, rail, and ship. These shipments appear particularly important for inclusion in this evaluation because it is noted that 6,600 industrial 100-curie sources were estimated to be shipped in 1975 (Table I-2), but a single shipment of a radiation source containing hundreds of thousands of curies of radioactivity appears to be potentially as hazardous as thousands of the 100-curie-source shipments."

Staff Response - Large radiography or teletherapy sources are included in the revised standard shipment model.

DES Chapter I: 12

Transnuclear - Comment 1

"Table I-2 on page I-20 shows a total of 370 spent fuel packages per year in 1975 with a truck/rail split of 14.2/85.8 percent. However, the Baseline Shipment Information as shown on Table IV-1, page IV-11, shows 54 shipments by truck and 326 by rail for a total of 380. The percentage split in Table I-2 is compatible with the number of shipments in Table IV-1, so perhaps the 370 total packages per year is incorrect."

State of New York - Comment 6

"The last sentence of the middle paragraph states: 'The annual numbers of spent fuel shipment for 1975 and for 1985 are estimated to be be 370 and 3600 respectively.' The NYS Department of Transportation notes that the number of 370 shipments for 1975 appears to be too low . . ."

State of New York - Comment 14

"Table I-2 indicates that 85.5% of the estimated 370 spent fuel shipments transported in 1975 were shipped by rail and that the other 14.2 percent were moved by truck. This information does not agree with information provided to 'the State' regarding 186 motor truck shipments of spent fuel to the West Valley, New York reprocessing plant in 1975."

Staff Response - The value used for the analysis was 380 shipments per year. This number has been significantly revised, however, in the new standard shipments model, which is based on the 1975 survey information. This model is intended to be generic, i.e., applicable to all transportation in, into, and out of the U.S. but not to segments thereof; therefore, although it covers the impact of transportation for all facilities, it may not reflect the actual mode split on shipments to or from a specific facility.

DES Chapter I: 13

Mrs. Virginia Karstedt - Comment 1

"... yet in Table I-3, p. I-21 you have excluded fuel cycle shipments - stating in a footnote that 'this data is expected to be updated by a more extensive survey now in progress. In other words you are not including fuel cycle shipments in this study because you do not have necessary data."

Mrs. Virginia Karstedt - Comment 5

"P.S. I note that Table I-3, p. I-21 is based on a speech presented in 1974 concerning transportation of hazardous material in air commerce. Yet in the table you do not make this clear. It looks like those are all packages shipped by any mode."

Staff Response - Table I-3 is a summary table of gross shipment numbers. It was not used in either the normal or accident evaluation. All types of shipments, including fuel cycle shipments, were included in this assessment. Although the information was presented at an Air Commerce Conference, it represents overall industry data. The only shipments excluded were shipments of weapons and weapons components and shipments on military vehicles.

DES Chapter I: 14

Friends of the Earth - Comment 6

"If the subject of possible accidents in transport of radioactive materials were not so serious, one could be amused by the NRC's use of the geometric mean of the extremes in curies per package for shipments. The statement 'The geometric mean was chosen to avoid attaching undue significance to the relatively few large quantity shipments' could be re-phrased to read: . . . 'to avoid undue attention to the potential hazards from radioactive releases of those shipments exceeding the geometric mean.'

"On hardly needs to point out that accidents do not space themselves out for our convenience so as to select only small-quantity shipments. An accident is as likely to occur to a large package as to a small one. Does the NRC mean to infer that the health effects from dispersal of a 100-kilogram plutonium shipment (such as those that took place at Kennedy Airport up until last year) are negligible? That the likelihood of large quantities being dispersed is smaller than that for small quantities? In this particular stochastic game, the NRC has fallen flat on

its face. One hopes that we do not need an accident involving plutonium to pull them to their feet."

Staff Response - The commenter implies that the use of a geometric mean is a deliberate attempt to cover up the consequences of accidents involving shipments of quantities greater than the geometric mean. On the contrary, accidents involving large-quantity shipments are considered explicitly as separate scenarios in the standard shipments model in both the draft and final versions of the EIS (see, for example, Section 5.6). The technique of using geometric means was used to estimate the total number of curies shipped for each type of radionuclide. The revised shipments model provides sufficient data to obviate use of that technique and instead uses the average value from the extensive survey data and explicitly includes large-quantity shipments.

DES Chapter I: 15

ERDA - Comments 9 & 10

"What is the basis for the statement that spent fuel shipments represent 'a significant transportation risk'? We could find nothing in Reference 7 to support this statement.

"What is the basis for and meaning of the statement that 'a similar risk occurs in the transport of high level radioactive wastes'?"

Staff Response - The implication is that these shipments are a significant transportation risk within the nuclear fuel cycle, not as compared to all other radioactive shipments. This is supported by both WASH-1238 and 1248. The statements in question have been deleted, however, and the detailed analysis of the revised standard shipments model (FES Appendix A) is used to specify which shipments represent the major parts of the small overall risk from all transportation.

DES Chapter I: 16

Dr. K. Z. Morgan - Comment 5

"On page I-24 we have another useless statement because of insufficient qualifications. I refer to, 'The total amount of Pu shipped annually is estimated to be 2000 kg.' Presumably, this was for 1974? From WASH-1327 we find that for a BWR-1.15 SGR fuel discharge after 120 days decay we have 574 kg of Pu. Thus the 2000 kg corresponds to only 2000/574 = 3.5 reactor discharges per year assuming 1000 MWe per reactor."

Staff Response - The 1975 shipments have been variously estimated as 2000 kg (NMIS) or 700 kg (PNL). WASH-1327 (GESMO) specifically addresses a 1990 equilibrium recycle situation (see page I-3, para. 4 of WASH-1327). Since there is currently no recycle and very little is projected for the early 1980's, the calculation indicated does not apply to the current shipments. Values used for plutonium in the revised standard shipments model are taken from the 1975 detailed survey performed by PNL.

DES Chapter I: 17

State of New York - Dept. of Environmental Conservation - Comment 15

"The first sentence of the second paragraph (page I-25) refers to 'Figure I-2.' It appears that it should refer to 'Figure I-3.'"

Staff Response - The typographical error has been corrected.

DES Chapter II: 1

ERDA - General Comment 2

"In Chapter II (p. II-3) where it is stated that ERDA was created by the Energy Reorganization Act of 1974, it would be desirable at this point to describe the role of ERDA in authorizing packaging for use by contractors."

Staff Response - ERDA's special role in issuing package approvals has been explained in Section 2.2, "Regulatory Agencies."

DES Chapter II: 2

ERDA - Comment 11

"The statement is made that implies the NRC regulations regarding packaging of radioisotopes are included in 49 CFR 174-177, clarification of this is in order."

Staff Response - The correct reference, 10 CFR Part 71, is now cited.

DES Chapter II: 3

ERDA - Comment 12

"In the requirements stated for 49 CFR 173.395(c)(2), we suggest the wording on the U.S. Atomic Energy Commission be updated."

Staff Response - Since the phrase appears in a direct quote, it would be inappropriate to change it.

DES Chapter II: 4

City of New York - Comment V

"In addition, in order for the public and Congress to be able to evaluate a DES, it is essential for the DES to explain the assumptions made therein. The DES at issue is replete with unexplained assumptions and references to what unspecified 'experimental work' or 'private communication' has shown (see, for example, pp. II-9, II-10, V-14, V-24). It is also replete with reliance on undocumented and apparently unrequired and unenforced industry 'practice' (see, for example, pp. II-8 and II-30). Such reliance hardly provides assurance to the public that the NRC has adequately evaluated the environmental impact of the nuclear transportation program."

Staff Response - The "unspecified 'experimental work'" referred to by the commenter is covered by the reference stated earlier in the paragraphs in question. The "industry practices" are merely means of complying with the regulations. The NRC does not specify how to comply, only that one does comply with dose and packaging requirements.

DES Chapter III: 1

ERDA - Comment 13

"The sentence reads as though the range of a 'one MeV gamma' is 11 cm in tissue. We suggest that NRC might consider expanding the discussion to correct this impression."

Staff Response - The sentence in question has been rewritten to clarify the presentation of the concept of gamma-ray half-thickness.

DES Chapter III: 2

EPA - Comment 1

"Last paragraph: It should be noted that the length of time over which energy is absorbed is also critical to creating biological effects."

Staff Response - The discussion has been modified to mention the fact that dose protraction may affect the biological effect of exposure.

DES Chapter III: 3

ERDA - Comment 14

"The statement and the equation following Table III-1 are misleading. Theoretically, the equivalent biological effect can be achieved when the relative biological effectiveness (RBE) of the radiation for each exposure consequence is known. The quality factor (QF) is used primarily for radiation protection purposes and in our opinion is not adequate for the purposes of comparing exposure risks from the mixture of sources discussed in this paper.

"Furthermore, neither quality factor or relative biological effectiveness are defined; they are not equivalent and should not be used interchangeably, particularly when such diverse effects as acute death and lung cancer are considered. We also suggest that NRC might want to consider expanding the discussion of the rem to rad conversion."

Staff Response - The discussion of RBE and QF has been expanded.

DES Chapter III: 4

EPA - Comment 2

"Since there were 5.5 million examinations in 1972 using technetium and the most useful form cited was used a mere 120,000 times, it is not clear what happened with the other 5,380,000 examinations."

Staff Response - The discussion of radioisotope uses has been moved to FES Chapter 1, and it has been modified to refer to an American College of Radiology report that quantifies the use patterns for radiopharmaceuticals. The cited discrepancy has been corrected in the new text.

DES Chapter III: 5

ERDA - Comment 15

"Inhaled naturally-occurring alpha emitters include thorium daughters as well as radon daughters."

Staff Response - The discussion of naturally occurring radioactivity has been expanded to include more detailed information from additional references.

DES Chapter III: 6

HEW - Comment 5

"It is stated that the Biological Effects of Ionizing Radiation (BEIR) report was used in the Health Effects Model. Actually, the Health Effects Model used is that found in Appendix VI of the Reactor Safety Study (WASH-1400). WASH-1400 significantly modified the risk estimates contained in the BEIR report by introducing 'Dose Effectiveness Factors' (Table VI, 9-70, Appendix VI, WASH-1400). These factors do not access a straight linear extrapolation, (as does the BEIR report), making those risk estimates of low doses and dose rates used in the draft statement lower by a factor of five than those found in the BEIR report. It is erroneous to give the impression that the health effects calculated in this draft document would be equivalent to those that would be arrived at by using the BEIR report.

"Also, references are made to studies which seem to indicate that rodents exposed to radiation have longer life spans. It has been theorized that radiation creates a more sterile environment, thus reducing the probability of respiratory infection in rodents, increasing their life span in a radiation environment. We are of the opinion that the draft statement should clearly state the reasons for an increased life-span among the rodents, as well as mention the above cited hypothesis."

EPA - Comment 4

"EPA believes that use of the BEIR report in its unmodified form is the most reasonable model to use to calculate health effects in this statement at this time. Since the debate over the health effects model in WASH-1400 is still continuing, it is premature to base this analysis on WASH-1400 premises."

Staff Response - The WASH-1400 health effects model was used for convenience in referencing a large block of information and analysis in one source, but the dose-effectiveness factors in WASH-1400 were not used in the DES as alleged. The values in Table III-9 are derived as

discussed in Section 9.3.2 of Appendix VI to WASH-1400 using population age-cohort adjustment. The section on the lengthening of the rodent life span has been deleted.

DES Chapter III: 7

EPA - Comment 3

"The statement, 'The dose limits proposed by NCRP and adopted by EPA . . .' is not correct. EPA is currently operating under the 1960 guidelines of the Federal Radiation Council (FRC). The EPA is currently working in an interagency effort to review and update the FRC guidelines; the NCRP dose limits are being consulted in this effort but have not been adopted."

HEW - Comment 6

"The source should be cited for the statement that declares that EPA has adopted the dose limits proposed by the National Council on Radiation Protection (NCRP). We are of the impression that EPA is in the process of reviewing these radiation standards but has not agreed to the limits proposed by NCRP."

Staff Response - The sentence has been revised to read "The dose limits proposed by NCRP, recommended as guidance for Federal agencies by FRC, and adopted for that purpose by the President of the United States on May 13, 1960, are tabulated in Table 3-6." Reference FR Doc. 60-4539 Filed May 17, 1960; 8:51 a.m.

DES Chapter III: 8

EPA - Comment 2

"We point out that EPA has proposed standards concerned with normal operations in the uranium fuel cycle (40 FR 23420) which include doses received during transportation of radioactive materials. These standards would limit individual doses to 25 mrem to the whole body. EPA believes that this will have little or no effect on the economics or operations of the transportation industry because, as it now exists, the dose levels appear to be less than 1 mrem per year, well below 25 mrem per year. The fact that EPA has formally proposed standards which would apply to the transportation of uranium fuel cycle materials and yet is not recognized in the draft statement is an oversight which should be corrected."

Staff Response - The EPA proposal in 40 FR 23420 has been incorporated into Section 3.5 of Chapter 3 and into Chapter 4.

DES Chapter III: 9

ERDA - Comment 9

"We suggest that this paragraph be rewritten since it implies that the MPC (air or water) is a unit of exposure rather than being based on the permissible exposure to critical organs."

Staff Response - The section on MPC has been rewritten to clarify the concepts of chronic exposure and critical organs.

DES Chapter III: 10

ERDA - Comment 17

"We suggest that the average or mean effect of radioactive transport be added to compare transport dose effect to background and medical dose effect."

Staff Response - The calculated effect of radioactive material transport has been added to FES Table 3-8.

DES Chapter III: 11

EPA - Comment 4

"We suggest rewriting the sentence beginning 'Technetium-99m can be given . . .' as, 'Technetium-99m can be given in relatively large amounts with little radiation exposure.' 'Relatively' emphasizes comparison with other isotopes and 'amounts' eliminates possible confusion resulting from using the word 'dose' which is used in a medical context rather than the radiological context in which it had previously been used."

HEW - Comment 7

"We suggest that line 12 in paragraph 2 read as follows: 'Technetium-99 can be given in rather large quantities with little radiation dose.' As presently used in the draft document, the word 'dose' refers to pharmaceutical dose (which in this instance is not the case). Also a discussion of the short half-life of Technetium-99 should be included in the final document as a means to support the above statement."

Staff Response - This section has been moved to FES Chapter 1 and rewritten to read "Relatively large amounts of Tc-99m can be administered with little radiation dose." Half-life information is included in the section.

DES Chapter III: 12

Friends of the Earth - Comment 7

"We question the reliance on the WASH-1400 health effects model. The Union of Concerned Scientists-Sierra Club critique of the Rasmussen reactor safety study has criticized the assumptions of low numbers of health effects posited by WASH-1400 on the grounds that the study assumed near-perfect evacuation of the metropolitan New York area within several hours, while simultaneously assuming that most of the population would be indoors or underground and therefore shielded from radiation. More recently, Dr. J. Martin Brown, Assistant Professor of Radiology at Stanford University School of Medicine has criticized WASH-1400 for neglecting to assess

long-term cancer deaths from a reactor core meltdown (Rasmussen uses only immediate deaths of people in the immediate vicinity). Nor does Rasmussen calculate genetic disorders, thyroid disease, etc."

Staff Response - The only aspect of WASH-1400 health effects model that is used is that relating to response to dose. No evacuation or shielding is assumed, and long-term fatalities (from cancers) are specifically addressed. The question of genetic effects is discussed in Chapter 3 and thyroid cancer is considered in Chapters 3 and 5.

DES Chapter III: 13

HEW - Comment 8

"It should be noted that the use of pertechnetate for brain scanning is relatively low, amounting to 1.5 million administrations during 1972. The impact of other technetium compounds and kits as well as ^{67}Ga, ^{75}Se, and ^{133}Xe should also be considered."

Staff Response - The standard shipments model has been revised to include the recently available 1975 survey data. The text in question will be revised to reflect the newer model and the survey data from the American College of Radiology. This section has been moved to FES Chapter 1.

DES Chapter III: 14

HEW - Comment 9

"It is important that the basis for simplifying assumptions be documented, even if only briefly, since they can significantly influence the risk estimates."

Staff Response - The assumptions used are briefly outlined.

DES Chapter III: 15

ERDA - Comment 18

"We suggest that the phrase 'specific radionuclide' replace the phrase 'radioactive specie' which is used throughout. The latter phrase is confusing since it could refer to animals or plants.

Staff Response - The phrase in question has been changed to the suggested one.

DES Chapter III: 16

ERDA - Comment 19

"For PuO_8 (sic) we feel that the biological half-life in liver and bone, as well as in lung must be stated and identified.

"For Pu, the biological half-life listed is for the deep lung. The value for bone is 36,000 days. Using the isotopic composition and specific activities found in Appendix B, p. B-5 and the dose conversion factors from Table III-8, we find the following Pu dose conversion values, in rem/curie inhaled.

	Dose commitment over:	
	1y	50y
Lung	4.2×10^6 rem/Ci	1.1×10^7 rem/Ci
Bone	1.2×10^5	4.4×10^7

"We cannot agree with the value of 2×10^8 listed in Table III-7 for PuO_8 (sic). Conversion to rem/g yields 50 year dose commitment conversion factor of:

Lung	1.4×10^8 rem/g (inhaled)
Bone	5.4×10^8

"These values are closer but still do not agree with that listed in the table. We suggest that the data presented in the table be reevaluated in light of these comments."

Staff Response - The rem/curie values were based on a specific activity that did not include the β-emitter Pu-241. Thus the 2×10^6 rem/Ci was associated with a specific activity of 0.5 Ci/g. This has been revised to specifically account for the isotopic composition (including β-emitters) shown in Appendix B.

The biological half-life and effective half-life in bone are included in the ORNL code from which these data (which are also used in WASH-1400) were taken. Since the liver is not considered the critical organ for insoluble forms of Pu, it is not included.

DES Chapter III: 17

ERDA - Comment 20

"Is it not the relative risks that are to be compared and not the person-rem?"

Staff Response - The sentence has been rewritten to emphasize that the thrust is toward relative risk.

DES Chapter III: 18

HEW - Comment 10

"We do not agree with the statement made in paragraph one. Soluble Plutonium is listed in Table III-7 and represents a material that can enter the food chain. Since I-131 constitutes an inhalation hazard, it also represents a potential health threat to the food chain in the event that a dairy or truck farming area were to become contaminated."

Staff Response - As shown in DES Table III-7, the dose per curie ingested is 4 orders of magnitude lower than the dose per curie inhaled for plutonium. In addition, there are environmental dilution factors involved in resuspension, soil transport, and plant uptake that make the effect of ingested plutonium negligible as compared with inhaled plutonium, assuming a single accidental release (versus a continuing release).

The effects of I-131 on dairy products or cropland are addressed in the decontamination/interdiction section which has been added to FES Chapter 5.

DES Chapter III: 19

Dr. K. Z. Morgan - Comment 3

"Table III-8 is given without explanation and I have reason to question its reliability. I was chairman from the beginning until 1972 of the Internal Dose Committee of ICRP that made such calculations and set the standards for all these radionuclides (and I was chairman of the NCRP internal dose committee for 20 years). Since 1972, I have been busy with research and teaching at Georgia Tech, so I am not completely up-to-date with the latest ICRP calculations. However, the following Table shows discrepancies I found in your table for Pu radionuclides in comparison with ICRP Committee 2 values as of 1974, and I doubt there have been substantial changes since then.

Values of Rem/Ci Given by NUREG-0034 and by ICRP

Plutonium Radionuclide	Table III-8 Values			Values Given by ICRP (1974)				
	Lung	Bone	Marrow	Lung	Bone*	Marrow	Liver	Ovaries
Pu-238	3.1×10^{8}	7.6×10^{8}	1.3×10^{6}	3.1×10^{8}	4.0×10^{9}	6.7×10^{3}	3.6×10^{8}	1.7×10^{8}
Pu-239	2.0×10^{8}	8.7×10^{8}	1.5×10^{6}	2.9×10^{8}	4.6×10^{9}	4.4×10^{3}	4.1×10^{8}	2.0×10^{8}
Pu-240	2.0×10^{8}	8.7×10^{8}	1.5×10^{6}	3.0×10^{8}	4.7×10^{9}	7.6×10^{3}	4.1×10^{8}	2.0×10^{8}
Pu-241	5.8×10^{5}	1.7×10^{7}	3.2×10^{4}	5.5×10^{5}	9.8×10^{7}	1.3×10^{3}	8.3×10^{6}	4.4×10^{6}

*This value is for trabecular bone. I do not know for what type of bone the Table III-8 is representative.

"From the above it is seen there are some significant discrepancies. For example, the bone risk (where most of the malignancies develop from Pu) is underestimated by a factor of 5. The risk to the liver and ovaries may be as great as that to the lungs, but they are not even considered. Surely some consideration should be given to the genetic risk."

State of New York - Dr. John Gofman - Comment 1

"The lung dose per curie inhaled is given as 2×10^{8} in Table III-7 (for insoluble PuO_2). This value is manifestly incorrect. Gofman and Cohen agree that the dose is 2×10^{9} rems per

curie deposited. Correcting this, from deposited to inhaled, we should reduce the value four-fold. Therefore, the correct value is 5×10^8, which is 2-1/2 times as great a dose as presented in the DES. But this is only the beginning of the serious underestimate of dose from plutonium in the DES. All calculations of the DES are based upon the ICRP Model (Figure B-2 in Appendix B). That model makes the erroneous assumption that no plutonium is retained for long-term delivery of dose to the bronchial region, an assumption based upon no evidence whatever and totally in contradiction with evidence concerning the impairment of bronchial ciliary function in cigarette smokers and in non-smokers. When this is taken into account and when the small mass of the cancer-relevant bronchial tissue is taken into account, (one gram instead of the 570 grams of the whole lung), we end up with the following correction factors that must be applied to the DES estimates of dosage:

For cigarette smokers, dose must be multipled by 103 times,
For non-smokers, the dose must be multiplied by 8.2 times.

"Therefore, overall, incorporating these factors and the 2-1/2 factor above, the DES underestimates the dose for plutonium inhalation by 257.5 times for cigarette smokers and by 20.5 times for non-smokers. These errors, alone, are sufficient to invalidate all the consequences of dispersion estimated in the DES. But these are not the only serious errors concerning effects estimation."

State of New York - Dr. Marvin Resnikoff - Comment 18

"Another area of disagreement lies in the biological effectiveness (i.e., effect on tissue) of a given gram of plutonium. The DES uses a figure of 2.0×10^8 rems/curies. The NRC's WASH-1535 at Table II.G-10 presents a figure of 8.6×10^8 rems/curie. According to the USEPA (Id.), ICRP now uses 16.5×10^8 rems/curie for Pu-239. Since the DES relies on the Pu-239 value of 2.0×10^8 for its conversion calculation of the biological effectiveness of reactor type Pu (that shipped through a JFK) (Page B-4), it is clear that the danger of plutonium inhalation may be understated by the DES by over 8 times. At any rate, the resulting impact calculated from the 2.0×10^8 number cannot be considered a 'worst case' impact."

Staff Response - Table III-8 is taken (and referenced) from Appendix VI to WASH-1400. The values listed are for a single exposure to a log-normal particle size distribution with a mean size of 1.0 μm AMAD. The values cited by Dr. Morgan and Dr. Gofman represent chronic exposure to a uniform particle size of 1 μm, not a distribution, hence the larger dose per curie values in Dr. Morgan's tabulation.

The question of ciliary impairment has been addressed in rebuttals to Dr. Gofman's paper on Plutonium Cancer Hazards. In these rebuttals a strong argument is presented that Dr. Gofman has misinterpreted data on ciliary degradation and that his theory of lung clearance impairment leads one to the conclusion that all heavy smokers should be dead from respiratory blockage.

The question of "cancer-relevant tissue" is also addressed in rebuttals to Dr. Gofman's articles. It is merely a restatement of the so-called "hot-particle theory." Numerous agencies

(NAS, NRC, BEIR, NCRP, ICRP) and numerous reports have concluded that no experimental evidence has shown nonuniform lung deposition to be more hazardous than uniform deposition.

The statement that most Pu malignancies develop in bone is debatable. Bair has stated that no bone cancer has been reported in any animal specie after inhalation of $^{239}PuO_2$ (Biomedical Aspects of Plutonium, BNWL-SA-5230, 12/74) even though approximately 5 percent of the Pu eventually translocates to the skeleton. Cohen (Hazards of Plutonium Dispersal) suggests that the lung cancer risk from inhaled Pu is approximately a factor of 4 higher than bone cancer. Using information from WASH-1400, GESMO, and BEIR the cancer deaths per curie inhaled for lung and bone are roughly comparable (235 for lung and 258 for bone). The DES uses the WASH-1400 model.

The question of effects to the liver and ovaries are addressed by Bair (Biomedical Aspects of Plutonium). He states that bile duct tumors have occurred in experimental animals, but they also occurred in the control group (see DES Appendix B). He also states that only 0.05 percent of the concentration of Pu in the circulating blood deposits in the testes and 0.01 percent in the ovaries. It appears, therefore, that the stated ovary dose is the dose per curie deposited in the ovaries rather than the dose per curie inhaled. Since the gonadal deposition is so low, genetic effects from inhaled plutonium are considered to be negligible compared to other effects.

DES Chapter III: 20

ERDA - Comment 21

"The table [Table III-9] has not been correctly copied and adequately referenced. 'Whole body' is actually 'Total (excluding Thyroid).' Also the table contains those values used in WASH-1400 for external exposure. What was used in this analysis for internal exposure? The risk number shown for the thyroid is surely not a mortality estimate--morbidity maybe, but not mortality. Finally, if the estimates of Table III-9 are based on the absolute model, it should be so noted."

State of New York - Dr. Marvin Resnikoff - Comment 20

"The authors of the DES chose 22.2 LCF/million person-rem for lung cancer on the basis of the BEIR report (p. III-23). This number is smaller than that in a number of other reports. USEPA has assumed 50 LCF/million person rem. Dr. John Gofman reports that Cohen has used 39 LCF/million person-rem and assumed 762 LCF/million person-rem himself. From these data it can be clearly shown that the DES has understated the danger of plutonium inhalation by as much as 34 times."

State of New York - Dr. John Gofman - Comment 2

"In Table III-9 the DES estimates latent cancer fatalities as 22.2 deaths per 10^6 person-rems of exposure to the population. The data of reference 1 point to a more correct value of 762 deaths per 10^6 person-rems on the same calculation basis. Therefore, the DES estimate is some 34.3 times too low in its cancer estimate. If this underestimate of effect is combined

with the underestimates of dose, we arrive finally at the following error estimates for the DES evaluation:

> "For cigarette smokers, effects must be 3533 times larger than DES estimates,
>
> For non-smokers, the effects must be multiplied by 281.3 times to correct the DES estimates.

"The final result of such corrections is to make the DES estimates totally meaningless as they stand in the report."

Staff Response - Table III-9 was not copied from WASH-1400; it was assembled using data in WASH-1400. WASH-1400 is referenced as the source for the information. The correct interpretation of the table is that exposure of one million person-rem to any of the specified organs would be expected to result in the specified number of cancer fatalities. Table III-9 is a combination of Tables VI-9-4 and VI-9-5 from WASH-1400. The BEIR report, which was the source for those tables, did not distinguish between the irradiation of an organ from an internal or external source in its overall statistics. The important item is the total radiation received by the various organs. The thyroid value of 13.4 per million person-rem is a mortality value based on discussion in paragraph 1 of Section 9.3.5 on page 9-26 of Appendix VI to WASH-1400 and on the expected thyroid cancer figure of 134.1 per million person-rem given in Table VI-9-8 on page 9-37 of the same appendix.

The value chosen for LCF for lung cancer from accidental exposure is based on an age-cohort-corrected version of the 1.3 per million person-rem per year as discussed in WASH-1400. Gofman's value of 762 LCF per million person-rem has been disputed by many experts in the field. The value used by Cohen and EPA are not age-cohort corrected.

DES Chapter III: 21

ERDA - Comment 22

"This figure was taken from p. 9-7 of WASH-1400 Appendix VI. However, the referenced figure does not contain a curve for alpha emitters. Any subsequent argument pertaining to acute effects (death) of alpha emitter inhalation is unsupportable without these data and suggest that NRC might wish to include these data."

Staff Response - The curve for α-emitters in Figure III-2 has been replaced in FES Figure 3-3 with a new curve from Reference 3-20.

DES Chapter IV: 1

EPA - Comment 5

"It is stated that tiers 6, 7, and 8 in Figure IV-3 schematically illustrate the procedure that the FAA employed to arrive at the various dose estimates in their assessment, reference IV-2 in the statement. However, tiers 7 and 8 do not appear in Figure IV-3. They should be added in the final statement."

Staff Response - Figure IV-3 has been deleted.

DES Chapter IV: 2

ERDA - Comment 23

"Table IV-2 gives population dose to crew and passengers from packages. We suggest that it also include the differential received by same populations as a result of cosmic radiation at flight altitudes. Such a number would be several times the 1400 for Passengers-I* and many times the Crew-I* numbers."

Staff Response - Comparison of dose from cosmic radiation with that from radioactive material shipments has now been included.

DES Chapter IV: 3

ERDA - Comment 24

"There is inconsistency between PuO_2 shipping distance noted in this table and that noted in Table V-10 on p. V-37."

Staff Response - The inconsistency has been corrected.

DES Chapter IV: 4

ERDA - Comment 25

"Person-rem/yr are calculated on this and following pages. We think it appropriate that background exposure doses also be calculated and presented for comparison. For example, the 5042 person-rem/yr is a big number to the layman or the person taking data out of context. However, it becomes small when compared to the population background exposure of 22.5 million person-rem/yr."

Staff Response - Background population exposure has been added.

Department of the Interior - Comment 3

"Several statements suggest that the study is based on surprisingly incomplete information in some important areas pertinent to transport of radioactive materials. For example, it is stated: 'While no specific information is at hand to suggest that radioactive materials are not shipped on passenger trains, no evidence of such use was discovered in an informal survey of the industry' (Page IV-31, paragraph 1). This suggests that the facts now available to the staff provide no information on whether or not radioactive materials are shipped on passenger trains. It is also stated that 'it is suspected that barge may be a method for transport of new and spent fuel to reactors and reprocessors located on appropriate waterways' (page IV-34, paragraph D.4-1). This lack of certainty on the part of the Nuclear Regulatory Commission regarding even the basic mode of transport in use for such materials does not provide reassurance that transport of radioactive materials is being carefully regulated in all cases."

State of New York - Dr. Marvin Resnikoff - Comment 37

"The alternative of transporting materials by water is given only minimal consideration in Chapter IV, Section D.4, page IV-34. No information is given about the present volume of material shipped by water. It seems clear that in certain localities, water transport may indeed be an alternative to conventional inter-city ground transport modes, and might result in significant reductions in exposure in both normal and accident situations. Although plutonium is the major contributor to accident latent cancer fatalities, it has a long half-life. Thus the shipment of plutonium by water may be economically feasible as well."

EPA - Comment 6

"We feel that the water transport discussion was not thorough enough. The only reason cited for this treatment is a 'paucity of information' concerning water transport. However, the discussion in the draft statement on the manufacture of floating nuclear power plants (NUREG 75/113) provides a brief but much more adequate discussion of the subject. If it is believed that a projection to 1985 is too uncertain this is understandable and should be so stated, but a more thorough discussion would be more informative for the public and would not as likely appear to be a sidestepping of the issue. Therefore, further basic discussion of water transport and an explanation for its exclusion in the further analyses is warranted."

Staff Response - Shipments on passenger trains consist only of a few exempt postal shipments, and their contribution is negligible. Based on the results of the 1975 survey, water transportation is a very small portion of the total shipping industry. Water transportation is not practical for many materials (radiopharmaceuticals, etc.) because of the time required for the shipment. Water transport is also impractical for many other materials because of the lack of canals or waterways in the inland United States. To the extent that this mode is viable, it has been discussed in Chapter 4 and included as an alternative in Chapter 6.

DES Chapter IV: 6

ERDA - Comment 26

"It is assumed that there will be a two-hour 'storage' period associated with time spent in rail yards. Is this a realistic figure, particularly where interline transfer is required, or are these transfers taken into account in arriving at this figure?"

Staff Response - The rail yard storage time per trip has been changed to 24 hours based on testimony given at the Interstate Commerce Commission hearings regarding special trains for transport of irradiated nuclear fuel and wastes.

DES Chapter IV: 7

ERDA - Comment 27

"We feel that transport index system can be based on dosage from the package or the maximum number of packages considering criticality. Hence, the label does not inform as to which of two potential hazards exists. This could be important in accident recovery.

"Likewise, the terms Type A, Type B, or large quantity are meaningless to all but a very few persons. Some improvement might be obtained if the labels provided explicit relevant information. We suggest that NRC may wish to study this suggestion as an 'alternative' toward reducing mislabeling and mishandling occurrences."

Babcock and Wilcox - Comment 1

"The DES assumed that dose rates were proportional to the transport index. While this is true for non-fissile material, it is not so in the case of plutonium, where the transport index is derived from criticality considerations. It is felt that the exposure rate is the correct number to use, and it is not clear that this number was used in the DES. (See Page IV-42, for example.) Experience has shown the exposure to be about 1 mr/hr at one meter from a container of PuO_2. Thus, the transport index of 5 that was applied to shipments of PuO_2 in the DES is too large by a factor of five."

Staff Response - The use of fissile TI to predict normal radiation dose is clearly conservative (49 CFR 173.389(i)). Since actual radiation data were not available and since fissile materials are small contributors to normal dose even with fissile TI, that approach has been retained.

DES Chapter IV: 8

ERDA - Comment 28

"Since 10% of the incidents that involve release are in the Type A category and that these packagings are relatively inexpensive, it seems reasonable that requiring crush and puncture resistance characteristic of service conditions be explored as an alternative."

Staff Response - Not 10%, but virtually all incidents in which there are releases of radioactive material involve packages that are not designed against accidents. These are designed to provide protection against a reasonable level of crush and puncture conditions. To protect some two million packages against a very unlikely higher level of puncture and crush does not appear reasonable considering the limited consequences of incidents involving such packages.

DES Chapter IV: 9

EPA - Comment 7

"In the second paragraph of Section F.3, there is no factual basis cited for the statements leading to the 0.5 mrem/year 'expected' dose rate. This section needs to be more thoroughly documented to indicate which radionuclides were considered and in what proportions. Further, information on whether certain types of packages are damaged more frequently than others and, if so, which, is certainly of importance to the analysis of this section."

Staff Response - Section 4.5 of the FES has been rewritten, and exposures that were estimated using release data from actual shipping experience have been incorporated.

DES Chapter IV: 10

EPA - Comment 8

"The method of modifying equation 2 to arrive at the given equation is not clear, further elucidation is requested.

"If there are records indicating 'an average of 5 losses per year over the last 9 years,' it seems there might also be records indicating for how long these packages were lost. Such information would eliminate another estimate, i.e., the '7-days lost' figure, to allow a more precise appraisal of possible population doses."

Staff Response - The equation on page IV-42 used the integrated form of equation (2) where K takes the form of $K\ e^{-\lambda t}$ (λ = decay constant and t = time of exposure). Thus

$$\text{Dose} = 3.7 \times 10^{-7} \times P \times TI \times \int_0^T e^{-\lambda t} dt$$

where T = total time of package loss
λ = decay constant for material

This treatment has been modified to use the updated equations now provided in FES Appendix D. In addition, a loss-time figure of 14 days based on incidents reported since December 1975 has been used in the FES.

DES Chapter IV: 11

ERDA - Comment 30

"The subject of this section and that of Section D.4 (page IV-34) might well be considered in light of the prospect of using ferry barge shipments to circumnavigate cities or states which embargo nuclear shipments or areas where rail carriers are refusing to haul nuclear shipments. We do not feel that the regulations contemplated the casual public in such proximity to nuclear shipments, particularly spent fuel casks, for the typical time period involved. We feel that this situation lends itself to be analyzed in the draft."

Staff Response - Barge shipments are considered in more detail in the FES. It should be noted, however, that there are only a few current or potential sites that are serviceable by large-scale barge traffic. The rail carriers have not refused to carry nuclear-shipments; rather they have requested that some shipments be made by special trains. This restriction would not avoid casual public exposure.

DES Chapter IV: 12

HEW - Comment 11

"Page IV-43, item 7 indicates that a few individual transportation workers might possibly be exposed to radiation limits which exceed those established for the public. The draft document devotes little attention to the problems of identifying, monitoring, and controlling the exposure to 'truckers', 'handlers' and others."

State of Georgia - Comment 2

"Throughout the document, the dose estimates are related to the average exposure to population in man-rems. The NRC should also include dose values based on the maximum exposure to individuals."

EPA - General Comment 1

"There is a lack of analysis pertaining to individual doses to passengers from normal shipments on aircraft. The only mention of the problem is in Table IV-2 where an unacceptably high maximum dose of 340 mrem/year and an average dose of 60 mrem/year are given. Doses of this magnitude to individuals, which are large fractions of the FRC guidance, are the most significant impact from normal air shipments. As EPA recommended to the FAA and pointed out in its document, 'Considerations for Control of Radiation Exposures to Personnel from Shipments of Radioactive Materials on Passenger Aircraft' (December 1974), the population doses are small and can probably be considered insignificant. However, the exposures to individual passengers are unacceptably high considering there are cost-effective measures which can be taken to reduce them. Several alternatives were addressed in the report and it was found that at least one cost-effective method is readily available. EPA recommended to FAA that a dose limit of 0.5 mrem per hour at seat level be established to provide protection of aircraft passengers.

EPA believes, therefore, that this subject must be addressed by NRC in much greater detail in the final statement and that EPA's recommendations must be considered."

EPA - Comment 9

"The discussion shows that it is currently possible for workers to exceed 500 mrem/year simply handling shipments. It is clear that if the number of shipments increase as they are projected to do that these workers will routinely exceed 500 mrem/year. Any provisions which have been made to prevent this from occurring should be indicated. Furthermore, if the doses mentioned on p. IV-44 do not include unnecessary doses (e.g., sitting on or standing near radioactive cargo), which they apparently do not, the problem becomes worse than estimated on p. IV-44. We believe that if unnecessary exposures are indeed a fact of life, they should be included in the environmental impact assessment. Any plans underway to mitigate or eliminate these unnecessary exposures would be of interest also."

Staff Response - The question of maximum individual doses from normal transport is now addressed in FES Chapter 4, and EPA's recommendation is considered in FES Chapter 6.

DES Chapter IV: 13

EPA - Comment 16

"In the 'Dose to Crew' equation the 'D_c' factor is unnecessary. Its inclusion squares the dose rate."

Staff Response - This typographical error has been corrected.

DES Chapter IV: 14

HEW - Comment 12

"The average individual dose from transportation is stated as 0.5 mrem/year. This is a factor of 2, not 20 less than the average per capita dose from radiopharmaceuticals (Table III-3)."

Staff Response - This typographical error has been corrected.

DES Chapter IV: 15

Dr. K. Z. Morgan - Comment 10

"The man-rem dose for normal and accident operations should be integrated over the entire population for all age groups and for all dose rates. Arbitrary cut-offs, and boundary assumptions lead to serious underestimates of the risk."

Staff Response - The dose for accidental or normal transport is integrated over all age groups. The only dose-rate restrictions are those imposed in line-of-sight distance for direct exposure

and the finite distance of debris cloud travel (100 km) in the accident case. This procedure results in an accumulated 50-year lung dose of less than 200 person-rem (for a plutonium release) which is negligible.

DES Chapter IV: 16

ERDA - Comment 29b

"However, some of the more notable incidents have derived from packaging errors. We do not feel that this section discusses this matter in proportion to its importance -- either as to requirements or as to cost-benefit or corrective action. It is implied elsewhere that a preconsignment survey of the package would be beneficial in reducing labeling errors. However, the benefit of a quality assurance over-check as to labeling and proper packaging and closure should be considered as an alternate."

State of New York - Skinner/Willen - Comment 51

"Many accident modes within each transportation pathway have been overlooked. Such likely occurrences as fork lift puncture and container leakage are not treated in each pathway."

State of New York - Skinner/Willen - Comment 52

"No discussion in the Draft Impact Statement can be found relating to errors in record-keeping, radiation monitor errors, container maintenance hazards, and other miscellaneous causes of inadvertant over exposure to the public during transportation."

Staff Response - The subject of packaging errors is addressed in more detail in this revised version.

DES Chapter V: 1

Friends of the Earth - Comment 8

"We dissent from the statement that 'The most severe accidents are generally the least likely to occur' as yet another departure from logic and from knowledge of stochastic events. If the NRC wishes to persist in this type of argument, they should provide us with the mathematical model supporting this position. Similarly, they refer to 'The complete logic model' of accident sequences leading to an environmental impact. A complete logic model is by definition impossible, since if all accident causes and sequences could be articulated, in theory all accidents could be foreseen and avoided. What disturbs us are those sequences that will be left out of the logic model and therefore are unknown."

State of New York - Dept. of Environmental Conservation - General Comment 16

"While the use of average exposure is reasonable to predict the effects resulting from normal transportation, the use of the estimated average accident risks can be misleading. The low average accident risk results from taking the very low accident risks associated with the large number (some 70% of total shipment) of radiopharmaceutical shipments and distorts the risks associated with the transportation of plutonium."

Staff Response - Regarding the commenter's objection to the statement "The most severe accidents are generally the least likely to occur," accident statistics show that this is, in fact, the case. Although the average annual risk could be misleading if dealt with in isolation, consequences of severe accidents are also considered in that "worst case" results are listed with their respective occurrence probabilities.

DES Chapter V: 2

ERDA - Comment 31-1

"We assume this equation was used to calculate accident risks. We have several questions on the methods used to develop numerical values for input into the equation. A primary concern is the term D_{ij} (estimated release fraction for the type of shipment being considered and for the accident severity class). The method of development of D_{ij} appears to be oversimplified. Release fractions used for each accident severity class are presented in Table V-6 (page V-25). Questions are raised for both the values used and the use of the release fraction in the analysis. The statement is made (page V-24) that 'Model 1 would be an accurate model if packaging were not better than required by present standards.' We disagree that it would be accurate; experience indicates that not all material will get out and become dispersed when a package is breached. We are not sure of the basis for Model II. It was our understanding that the reference testing was under impact conditions. If so, how does one apply the results to, e.g., puncture conditions?"

Staff Response - The release fraction model has been revised to incorporate more recent Sandia Laboratory container test data.

The reviewer is correct in noting that the referenced Sandia tests were impact tests. However, since the initial report, further tests involving fire, crush, puncture, impact, and immersion have been conducted, and these results have been taken into account in the FES.

DES Chapter V: 3

ERDA - Comment 31-2

"Does a category VII accident in air transport involve the same forces as a category VII accident in truck transport? If not, we would expect different release fractions for different modes (since the same container could be used in any mode).

"We would not, in general, expect the same release fraction from an accident involving a category VII impact and one involving a category V impact and a category III fire. According to Figure V-6 (Page V-9) the latter is also a category VII accident. Whether or not a category III fire will contribute to a release depends on specific package characteristics and specific contents characteristics."

Staff Response - The severity categories were assigned based on the forces estimated to produce a given release. Thus, a category VII truck accident is equivalent to a category VII plane accident in terms of amount of material released.

The model does not consider category V impacts or category III fires separately. It does consider category V, etc., accidents that can involve various combinations of impact force and fire duration. Thus, as discussed above, the severity classification scheme does postulate a given release fraction for a given severity accident, regardless of the combination of forces that cause the accident of that severity to occur. The use of a simple set of accident severity categories for several different transport modes is not new (see W. A. Brobst, Nuclear News, May 1973).

DES Chapter V: 4

Dr. K. Z. Morgan - Comment 6

"I believe the severity of aircrash assumed in this report comes far short of the worst case."

Staff Response - The minimum accident impact velocity on an unyielding surface for a class VIII accident in which any accompanying fire lasts no longer than 30 minutes is 256 feet/sec (375 mi/hr). This is a factor of 3 greater than the impact velocity required for flight recorder design (80-90 feet/sec). Thus, the minimum impact energy for a package involved in a class VIII aircraft accident is a factor of 10 greater than that for flight recorders that are designed to survive intact in all but the worst air crashes.

DES Chapter V: 5

ERDA - Comment 31-3

"It is also not clear how the normalized population dose (K_i in Equation (1)) is obtained. We know it involves figure V-11 but there is no reference as to source of figure V-11 nor how the curve was developed."

Staff Response - Figure V-11 has been simplified for the FES (Figure 5-7). The function represented by the curve is curies inhaled per curie released versus area. When it is integrated over an area containing a uniform population density and combined with a rem/curie inhaled value for a particular isotope, a value of person-rem/curie released is obtained. This is the K_{ij} in Equation 1. This explanation has been clarified and Appendix G has been added to further explain Equation (1).

DES Chapter V: 6

ERDA - Comment 69B

"There is a VII just above II and a III next to II. Should they not both be III?"

EPA - Comment 17

"The squares listed for the following figures are apparently mislabeled: Figure V-6; 0-0.5 hour fire, 30-55 mph and, 0.5-1 hour fire, 11-30 mph; Figure V-20: 1-1.5 hour fire, 40-60 mph."

Staff Response - The typographical errors have been corrected.

DES Chapter V: 7

State of New York - Dept. of Environmental Conservation - Comment 16

"The basis is not provided for the distribution of accidents among the various population densities for each of the transportation modes considered. Although some description of the basis for the fractions used for aircraft accidents is provided, almost no basis is provided for expecting the low severity truck accidents to occur mainly in urban areas. If these assumptions are based on a statistical analysis, that analysis should be identified."

Staff Response - The subsections on each of the transport modes describe the fractional breakdown for accidents in various population zones and the rationale behind the values assigned. No statistical analysis was performed to arrive at those values.

DES Chapter V: 8

ERDA - Comment 32

"A fire temperature of 1875 F is referenced. We wonder if it would not be appropriate to discuss the 1475 F used in container (MC 0529, 10 CFR 71, etc.) and the impact of the difference."

Staff Response - The 1875 F fire temperature should be 1850 F; this correction has been made. The 1850 F value was used to facilitate comparison with the data of Clarke et al. Since the fire damage is usually taken to be proportional to the temperature-time product, the fire duration may be scaled accordingly. This correction is now included in FES Chapter 5.

DES Chapter V: 9

State of New York - Dr. Marvin Resnikoff - Comment 9

"Nothing in the text of the DES indicates how the authors established accident type classifications on the basis of papers by 'Clarke et al.' (p. V-60). Since the NRC has made the work of Clarke et al. central to the determination of these 'type classes', specific discussion of all relevant portions of that material must be provided if this part of the DES is to have any validity."

City of New York - Comment VI

"At pages V-8 through V-15, there, the probability of spillage model which purports to calculate accident statistics, takes accident data not from actual aircraft accidents but from Clarke's model, based upon laboratory simulations of crashes on unyielding surfaces. Clarke's results are then modified by an unexplained process of 'engineering judgment' (at page V-13 an explanation is included which provides no proofs nor any basis for the assumptions made). No attempt is made in this analysis to use actual aircraft collision data in a study similar to that performed by Bovet, 'Preliminary Analysis of Tanker Collisions' D. M. Bovet. Reported by U.S. Coast Guard Office of Research and Development, November 30, 1970, or Monorksy, 'An Analysis of Ship Collisions with Reference to Protection of Nuclear Power Plants,' Journal of Ship Research, October 1959."

Staff Response - Clarke et al. use a method of accident classification based on five categories that used actual data where available. The authors of the Clarke document were asked to provide similar probabilities for an eight-category analysis. This rationale is specified in Section B.1 of the DES.

DES Chapter V: 10

City of New York - Comment 6-3

"The accident classification scheme improperly relates severity of an accident to fire duration and speed of impact. It fails to evaluate crush and puncture damage."

State of New York - Dr. Marvin Resnikoff - Comment 8

"The DES presents an abbreviated analysis for the complex and controversial area of accident environments. The authors of the DES consider only that damage inflicted on the containers by assumed fire and speed of impact factors and do not consider crush and puncture damage, the very damage mechanisms deemed to be so significant in the earlier Sandia report which was placed on the record of the State's case by the defendants themselves (Def. Aff. Nussbaumer, Exh. C, D and F)."

Staff Response - The categorization of aircraft accident severity by fire duration and impact force is an accepted technique. Crush and puncture were not included in the aircraft analysis because the results of Clarke et al. showed that, for aircraft accidents, the effects of impact and fire are much more significant than crush and puncture. Crush and puncture were considered in the evaluation of truck and rail accidents in Sections B.2 and B.4 of Chapter V (FES Sections 5.2.2.2 and 5.2.2.4).

DES Chapter V: 11

EPA - Comment 10

"The scheme of the de-rating of aircraft accidents seems somewhat unrealistic in one sense and quite arbitrary in another. First, airline routes do not blanket the entire country uniformly, especially flights carrying radioactive materials. It would seem much more realistic to determine the proportion of flights carrying radioactive cargo over the various land surfaces and then de-rate the accidents. Second, the reasons for choosing the number of accident severity classes by which accidents are de-rated are not apparent. The arbitrary nature of the statements brings them into immediate question."

Friends of the Earth - Comment 9

"Paragraph one states that 'only 10 percent of the land area of the United States could be considered as "unyielding surfaces" such as rock, concrete, or rock covered by soil. However, it should be pointed out that if air transportation is utilized to any great degree in the future (something we strongly oppose), this will mean a larger number of shipments departing from and arriving by air over concrete air strips. Thus, a large percent of shipments would be at risk."

Staff Response - The explanation of the derating scheme has been expanded and included as FES Appendix H. The data used for surface occurrence probability are based on actual air carrier flight paths. It should be pointed out that a concrete runway is not an unyielding surface, and very few air crashes at a velocity at which derating is important occur on runways.

DES Chapter V: 12

Friends of the Earth - Comment 10

"Paragraph three states that accidents of severity VII or VIII are expected to occur randomly. If so, then how does the NRC justify its statement (see above, Chapter V, pp. V-2, 3) that the most severe accidents are the least likely to occur? And how does the NRC justify non-random dispersal of radioactive materials?"

Staff Response - Aircraft speeds in takeoff and landing accidents are considerably smaller and altitudes are considerably lower than in inflight accidents. Category VII and VIII accidents, being inflight accidents, occur at random locations, in contrast to the less severe accidents, which would be expected to occur near airports.

DES Chapter V: 13

State of New York - Skinner/Willen - Comment 50

"No discussion appears in the alternatives section concerning the impact of facility location on the severity of accidents and the probability of their occurrence."

City of New York - Comment 6(3)(b)

"The accident classification scheme fails to consider population density as a contributing factor to accident severity."

Staff Response - Accident consequence, not severity, is a function of accident location (i.e., population density). It is not clear that the specific location of facilities would have any effect on accident severity.

DES Chapter V: 14

ERDA - Comment 33

"Crush forces are load dependent. Therefore, if, for example, a shipment is made in a sole use vehicle which contains only a few small radioactive material packages the crush force severity categories (e.g., category VIII, 5% of accidents involve a crush force greater than 500,000 pounds) are likely to be incorrect.

"Also it would be appropriate to define the phrase 'crush force.'"

Staff Response - The reviewer has misquoted the percentage of category VIII truck accidents. Table V-2 (FES Table 5-3) states it is 0.0015 percent, not 5 percent. We agree that the number of packages and package loading configurations is important. However, this effect is very difficult to treat quantitatively because of the wide variation in loading schemes. This problem is discussed in the text.

DES Chapter V: 15

State of New York - Dept. of Environmental Conservation - Comment 17

"This section indicates that in the case of accidents involving motor carriers the dominant factors in the determination of accident severity are crush and fire. Currently, packaging standards do not include crush specifications. It is recommended that the responsible regulatory agencies consider implementation of a crush standard."

Staff Response - Crush force standards designed to simulate the normal transport environment for Type A packages are specified in Appendix A to 10 CFR Part 71. Regulatory agencies are currently considering the introduction of crush standards for Type B packages.

DES Chapter V: 16

State of New York - Dept. of Environmental Conservation - Comment 20

"The first sentence of the last paragraph refers to 'Table V-2.' It appears that it should refer to 'Table V-6.'"

ERDA - Comment 69C

"Should it not be Table V-6?"

Staff Response - The typographical error has been corrected.

DES Chapter V: 17

EPA - Comment 2

"With regard to transportation accident analysis, the relationship of the shipping package test requirements and the performance of the packaging under various accident categories has not been established to our knowledge. Thus, the information on failure rates and release fractions are presented in Table V and the conclusions drawn are based solely on engineering judgment. This fact should be indicated in the final statement."

EPA - Comment 11

"EPA previously stated and still believes that a technical analysis should be performed relating packaging test requirements to the forces a package may experience in an actual accident environment since primary protection in transportation is currently provided by the packaging itself. Special attention would be given to the probable extent of damage expected to be suffered by the package and the resulting quantity of radioactive materials which may be released to the environment under the various accident conditions. In developing this analysis, it is important to use as much test data as possible rather than relying on unverified engineering models. EPA is encouraged that data is now being gathered from actual tests, however, it

appears that insufficient data makes it too early to use 'Model II' in Table V-6. In our opinion, Model I should be used as the basis for the risk assessment at this time, with Model II used only as a comparison."

Staff Response - The release fraction model has been revised to incorporate the recently available Sandia Laboratories' data. This model is discussed in Section B.6 of DES Chapter V (FES Section 5.2.6).

DES Chapter V: 18

Friends of the Earth - Comment 11

"NRC states that present shipping containers exceed required standards, apparently in reference to the Sandia Laboratories tests comparing severity of the thirty-foot drop onto an unyielding surface to a 2,000-foot drop onto hard prairie. The parameter excluded here is the 2,000-foot drop onto a hard surface, e.g., the surface of airports, which by the NRC's own standards, would therefore exceed both of the aforementioned tests."

Staff Response - There have been more recent impact tests on plutonium shipping containers performed at Sandia onto unyielding surfaces (steel over reinforced concrete). The implication that all aircraft accidents occur on runway surfaces and that all runways are unyielding surfaces is incorrect. The Sandia container tests involved impacts at speeds much greater than would be achieved in a 2000-foot drop.

DES Chapter V: 19

State of New York - Dr. Marvin Resnikoff - Comment 4

"Whether or not plutonium powder will escape its container during an air accident is dependent on two factors, the strength of the container and the severity of the accident environment. Considering the first of these, the DES makes only a passing reference to the wealth of material available as a result of the work done by Sandia Laboratories, and others, as well as a great deal of data supplied by the many experts appearing in the case of State of New York v. Nuclear Regulatory Commission, et al., United States District Court for the Southern District of New York (75 Civ. 2121 [WCC]). No data whatsoever can be found in the DES to dispute the criticism in the affidavits previously filed by the State in that case and in the Nuclear Regulatory Commission ('NRC') proceeding on transportation noticed at 40 Fed Reg. 23768."

State of New York - Dr. Marvin Resnikoff - Comment 5

"It has been determined under performance test conditions that the integrity of these containers are breached by levels of test crash environment intensity which are significantly less severe than actual air crash environments (Def. Aff., Nussbaumer, Exh. D; Pl. Aff., Pinkel, p. 6; Resnikoff, [6/12/75], p. 3). In fact, during test drops done for NRC at speeds of only 130 feet per second, even the inner pressure vessels were caused to leak (P. Aff., Resnikoff [6/12/75], p. 3; Def. Aff., Nussbaumer, Exh. D.). The Sandia Laboratory Report, 'Special Tests

for Plutonium Shipping Containers,' annexed to the Nussbaumer affidavit as Exhibit D, candidly admits that, if impact speeds were raised to 150 feet per second, spillage of nuclear material is likely (Pl. Aff., Pinkel, p. 6; Def. Aff., Nussbaumer, Exh. D). Yet the DES classification scheme for accident severity categories assumes that no material will leak from cannisters in such accidents. Hence, these assumptions in the DES directly contradict the earlier affidavits of defendants submitted to the Federal District Court and the NRC."

State of New York - Dr. Marvin Resnikoff - Comment 7

"Cannister strength is lightly treated by the DES on pages V-24, 25, and 26 and VI-48 and 49. At this late date the NRC admits that 'only a limited number of containers [have been] tested.' The DES assumes that 'Model I' packaging (that is cannisters meeting current regulations) would fail (p. V-12). As to cannister 'Model II', which is deemed by the NRC to be a conservative approximation of 'real containers in an accident environment' (VI-26), and hence the critical link for NRC's allegations as to safety of containerization, the authors rely on unspecified 'personal communications' for substantiation of their various assumptions. This totally undermines the validity of this analysis for the purposes of this DES. The authors arbitrarily define fractions of plutonium powder shipments which will be released in the event of an air accident of a given severity class. Of the two references presented to support these arbitrary assumptions, one (9) (p. V-24) is a private communication. A 'private communication' is also referred to earlier on page V-14 in regard to population densities across the country. 'Private communications' are a highly suspect source for a very important parameter for study of this area. No specific data is ever identified as stemming from this 'personal communication'; and hence, no basis is given for the authors assumptions as to accident severity classes and release model fractions. These models are unverifiable and, as a result, highly questionable, to say the least."

Staff Response - The most recently available shipping container data have been used in the FES. It should also be pointed out that the breach of a container does not necessarily result in release of all or part of the contents and that release of contents does not necessarily imply aerosolization of all or part of the released materials. Since no data base ever includes all possible data, some degree of engineering judgment is required. The Sandia Laboratory report, "Special Tests for Plutonium Shipping Containers," was seriously misquoted by Dr. Resnikoff. It does not say "if impact speeds were raised to 150 feet per sec, spillage of nuclear material is likely." What it did conclude was: "It appears that any increase in impact velocity for the SP 5795 and L-10 containers would seriously damage the vent valves in the top of the pressure vessels and might permit loss of contained liquid." And in the fire tests, "The 6M container failed to retain the solution which leaked from the bottle inside the pressure vessel. The leakage referred in both cases to liquid contents. Referring to the 6M, the report went on to say "Had there been a metal or oxide contained within the pressure vessel, it appears that there would have been no leakage from the pressure vessel." The 1975 Survey data indicated that virtually all plutonium shipments in 1975 were in metal or oxide form. Furthermore,, 10 CFR § 71.42 requires that, after June 17, 1978, all plutonium in excess of 20 curies per package must be shipped as a solid.

DES Chapter V: 20

State of New York - Dr. Marvin Resnikoff - Comment 6

"No thought has been given to the potential of penetration damage due to shrapnel-like fragments of disintegrating airplane components resulting from an air accident (Pl. Aff., Pinkel, p. 7). Dr. Chapman, formerly of the Cornell Aeronautical Laboratory, is in agreement with Mr. Pinkel and Dr. Resnikoff when he concludes that, given the present containers, there is little assurance of containment of materials in air crash environments, which are clearly more severe, more complex and of greater impact than accidents in other modes of transport (Pl. Aff., Chapman, pp. 2-3; see also Pinkel, Resnikoff). The containers now in use by the NRC, their agents and licensees are clearly not designed from a complete knowledge of the air crash environment and continued use of such containers in air transport jeopardizes human life (Pl. Aff., Pinkel, p. 10)."

Staff Response - The analysis of air crash environments by Clarke et al. (SAND 74-0001) concluded that damage by shrapnel impacts that might puncture the container was an order of magnitude less likely than damage by the overall container impact.

DES Chapter V: 21

ERDA - Comment 34

"From this statement and the discussion near the top of page III-17, the reader is left with a confused picture. Is the calculation for ^{131}I and ^{137}Cs release consequences based on the milk path or on the inhalation path only? The statements in Chapter III imply that only the inhalation was included in which case the consequences for ^{131}I and ^{137}Cs releases are underestimated. This should be clarified in the final statement."

Staff Response - The part of Section C that conflicts with Chapter III has been deleted. The current model does consider only inhalation doses for I-131 and Cs-137. This is justified in the case of I-131 by assuming that affected milk or crops will be impounded for 60-80 days to permit decay (for I-131) or destroyed (for Cs-137). Hence, minimal ingestion would occur. This assumption is reasonable because of the relatively small quantities of material released.

DES Chapter V: 22

HEW - Comment 13

"This represents two cycles incorporated into one and is usually referred to as 'grass-cow-milk-man' and 'grass-cow-man' cycles."

Staff Response - The phrase in question has been deleted.

DES Chapter V: 23

Friends of the Earth - Comment 12

"We disagree with the statement that 'Consequences to the aquatic environment are less well understood than for the land.' At least one thing is known about living organisms in aquatic environments, namely that they concentrate radionuclides in their flesh (and bones, if they are bony fish), and that these concentrations can easily end up in the food chain that terminates with man. It is also quite obvious that radioactive spills in water are irreversible and cannot be cleaned up, unlike contamination of buildings, solid materials, etc. Consequently, radioactive contamination of bodies of water and of aquatic organisms is likely to be highly detrimental to non-human species of plants and animals, whereas radioactivity released into air can be more injurious to human beings through ingestion or high whole-body doses from gamma radiation."

Department Of The Interior - Comment 5

"The report does not specifically analyze consequences of accidents resulting in significant quantities of radioactive materials entering surface waters. While the probability of such occurrences would no doubt be very low, such an analysis might still be desirable to determine if conditions could arise requiring emergency measures to protect public water supplies."

Staff Response - The commenter disagrees with a statement that "consequences to the aquatic environment are less well understood . . ." because it is known that fish concentrate radioactivity in their flesh and bones. In order for them to do so they have to ingest some radioactivity either through water or food. Many radioactive materials, including plutonium dioxide, are comparatively insoluble in water. It is difficult to imagine an accident of such severity that the entire contents of the container would be spilled into the water except possibly for Type A packages. These are primarily radiopharmaceuticals that have very short half-lives. For Type B package incidents, packages would normally be recovered. A single radioactive spill in the ocean depths would soon be diluted to safe levels. In the interim, restrictions requiring monitoring of fish taken from the contaminated water, in much the same way as was done for deer taken by hunters from the grounds of the Savannah River Plant, would minimize the direct impact to man. The low frequency of transportation accidents involving radioactive material shipments and the very small probability that such an accident would occur over water reduces any danger of significant contamination of water and the associated aquatic food chain to a very low level.

DES Chapter V: 24

State of New York - Dr. Marvin Resnikoff - Comment 16

"The DES assumes 10,000 people/square mile to be a 'High Population Density' (P. V-30). Examination, however, of the Tri-State Regional Planning Commission 1970 Census population distribution shows that there are only a few square miles within a zone of maximum impact in

New York City with 10,000 persons or less (Pl. Aff. Skinner-Wang sworn June 13, 1975, exhibit 7). The Skinner-Wang affidavit utilizes 40,000 persons/square mile as a more representative value for a 'worst case' accident at JFK. According to that affidavit a four-fold increase in the population density would result in a four-fold increase in the impact presented in figure V-12 and V-13 of the DES."

State of New York - Dr. Marvin Resnikoff - Comment 25

"Although many variables have been mentioned herein as being underestimates, only one of these, population density, is analyzed in the DES for sensitivity in the accident scenarios. As mentioned before (Pl. Aff. Skinner-Wang, sworn June 13, 1975, Table A) we maintain that 40,000 people/square mile is a more representative population density for the New York City region imperiled by plutonium air shipments. This represents a 400% increase over the baseline population density (10,000/mile) NOT 10% as the DES assumes."

Staff Response - In terms of population density in the United States, New York City is a singularity. The assumed urban density of 10,000/mi^2 includes 90 percent of the "cities" in the U.S. with populations greater than 100,000. The worst-case analysis in the final environmental statement includes an analysis of an area with a population density of 40,000 people per square mile.

DES Chapter V: 25

ERDA - Comment 35

"There is no discussion or reference to explain the model used to calculate the area enclosed by isopleths. When area as large 10^4km^2 is involved (see figure VII), the model used for this calculation is very much of interest since this area exceeds by more than four orders of magnitude the areas plotted in Meteorology and Atomic Energy. Also, such a large area would depend more on regional than on local meteorology. The atmospheric stability and wind speed should be mentioned as well as the method by which values of the dispersion parameters σ_y and σ_z are determined."

State of New York - Dr. Marvin Resnikoff - Comment 12

"Both Robert Barker of the NRC (Def. Aff. sworn May 30, 1975) and Dr. Marvin Resnikoff (Pl. Aff. sworn April 25, 1975 and June 2, 1975) (one of the deponents herein) utilized Gaussian models with full explanation of the input parameters and sensitivity thereto. The DES, inconsistent with the analysis of the NRC's own expert, Barker, does not even explain these differences in approach between the DES and the Gaussian analyses. The discussion of contradictions later in these comments shows that the DES predicts 617 Latent Cancer Fatalities, Barker 15,000, and Resnikoff 107,000. Since the DES arrives at conclusions different than either of those models, some explanation is required before the DES can possibly be relied on as having any validity."

State of New York - Dr. Marvin Resnikoff - Comment 13

"Dispersion is also dependent on the meteorological conditions assumed. Calm weather increases the amount of individual dosages and turbulent conditions decrease dosages. In the DES the authors state: 'A year or more of data record (sic) for these parameters is used in the model, which was obtained at two different locations' (p. V-29-30). Neither the data recorded nor the locations studied were presented; yet these factors quite obviously have tremendous impact on the conclusions presented in Figure V-10. Such data were presented by Barker (Def. Aff. p. 17 and exhibits) and Resnikoff (Pl. Aff. April 25, 1975 Table 2). Once again this omission precludes reproduction of the DES's conclusions by the reader. The DES's use of only average conditions from the 'year or more of data' recorded does not present scenarios capable of producing 'worst-case accident consequences' found in figures V-11 and V-12."

Staff Response - The dispersion analysis that was used in the DES is explained in Section C of Chapter V. Contrary to the allegations of the commenter, atmospheric dispersion is calculated using a Gaussian plume model and a substantial set of actually measured meteorological data; the 95th percentile values were chosen for use in the dose calculation rather than the average. Using 95th percentile data provides a good approximation to worst-case meteorology. The meteorological data were gathered at meteorological stations in Savannah River, Georgia, and White Sands, New Mexico. The authors acknowledge that diffusion models are not as accurate at large distances such as 100 km as they are at smaller distances from the release site. The discussion of the atmospheric dispersion model used in the DES has been expanded in the FES.

DES Chapter V: 26

Friends of the Earth - Comment 13

"In paragraph three, the NRC states certain population densities as their method of calculating person-rems from accidents involving radioactive materials, and then states that 98% of the U.S. area has a population density lower than any of these densities. However, they have overlooked the fact that insofar as air transportation is involved, most airports are located in metropolitan areas, particularly those of the heavily populated northeast where a good proportion of existing nuclear facilities are now located. Since only 25 states have no commercial nuclear reactors, it hardly matters what their population densities are. It is the population density in the areas near nuclear facilities that count."

Staff Response - The population densities of 90 percent of all U.S. cities with populations greater than 100,000 are less than that value used to represent urban areas in the DES. In addition, most airports are located near, not in metropolitan areas. If nuclear power reactors are meant to be "existing nuclear facilities," the criticism has little validity since no shipments to and from nuclear reactors are made by aircraft. Not all shipments considered by the DES use the air mode, but any shipment between two locations must pass over the intervening territory where accidents can and do occur. This is the reason that lower population densities areas were considered in the DES.

DES Chapter V: 27

ERDA - Comment 36

"Figure V-10 is self-explanatory although the normalization dose value of 0.8 rem seems odd and there is no explanation of it in the text. This figure, however, and figure V-11 on page V-38 are inconsistent. From figure V-10 the 10-meter release height curve yields a value of 4×10^6 m^2 at the 95 percentile. Thus, the area enclosed by the 8×10^{-4} rem per gm of ^{239}Pu released is 4×10^6 m^2. In figure V-11, however, the ordinate corresponding to 4×10^6 m^2 is 9×10^{-3} rem/gm of ^{239}Pu released. This discrepancy should be corrected."

Staff Response - Figure V-10 has been deleted, and Figure V-11 has been redrawn (FES Figure 5-7) to accommodate changes in the atmospheric dispersion model.

DES Chapter V: 28

State of New York - Dr. Marvin Resnikoff - Comment 3

"For the purposes of the DES the authors assumed an air shipment of plutonium with a size of four packages containing five kilograms each for a total of 20 kgs. (Tables V-13, V-12, V-7.). Actual practice seems to indicate that larger sized shipments are more realistic. For instance, two JFK PuO_2 shipments on July 29, 1974 and February 24, 1975 weighed 48.3 kilograms and 45.1 kilograms respectively, each more than twice the size assumed by the DES. This assumption undercuts the credibility of the 'worst-case' scenario."

Dr. K. Z. Morgan - Comment 2

"Table V-7, V-12, and V-13 are good examples of an attempt to give the impression of a very conservative consideration of the problem and an evaluation of the 'worst case accident' and yet your worst case assumes a shipment of only 20 kg of Pu when it is an established fact that larger Pu shipments have passed through some of our airports. When the reader notes such tactics used to depreciate the risks, he is inclined to question the credibility of the rest of report."

Staff Response - The revised standard shipment model includes explicitly a 100 kg (6000 Ci) shipment of $Pu^{239}O_2$, which passed through New York City during late 1974.

DES Chapter V: 29

ERDA - Comment 37

"In the last sentence a cloud height of 10 meters was assumed; however, we feel that atmospheric stability and wind speed assumption should be made and stated."

State of New York - Dr. Marvin Resnikoff - Comment 43

"For a diffusion model used to assess the consequences of release of radioactive materials, figure V-10, page V-31, what release height figures are used; and why are these chosen for each mode?"

State of New York - Dr. Marvin Resnikoff - Comment 46

"In the release consequences analysis (Chapter V, section E, page V-43), how do worst-case release heights vary from one mode of transportation to another (e.g., truck or helicopter accidents)?"

Staff Response - The weather conditions used in the analysis were 95th percentile values as discussed in the expanded section on the meteorological model. The 10-m release height was chosen for the reasons discussed in Section 5.3 and was used for all modes of transport and all releases.

DES Chapter V: 30

State of New York - Dr. Marvin Resnikoff - Comment 11

"The degree to which the public would become exposed to plutonium powder in the event of an air accident is dependent on the parameters discussed earlier and on several others as well; dispersion is one of them. The DES presents an almost incomprehensible complex of figures and explanations on this topic. A number of factors necessary for the reader's reproduction of the conclusions as to dispersion are omitted or inadequately described. The basic input term of deposition velocity, necessary for standard Gaussian analyses, is completely missing. Apparently Figure V-11, 'Specific Dose vs. Area,' is important to the DES's determination of areas which would be covered by plutonium powder after an accident. The term, Specific Dose (rem/gm), is depicted as varying with the area enclosing such a dose. This is an internally inconsistent concept (rems/gram of plutonium does not vary – it is a constant). Yet the concept becomes, by the use of other vague factors, the basis for figures V-12 and V-13, which set forth the number of people affected. Because of the inconsistencies and lack of descriptive information contained in the DES on this issue, we have been precluded from further comment on this analysis."

State of New York - Dr. Marvin Resnikoff - Comment 14

"Resuspension of the powder once it has settled out of the atmosphere onto buildings, vehicles, roads, etc., will plague decontamination and evacuation efforts and increase exposures to the public. The DES states only that 'the contribution to the total dose from cloud shine, ground shine, and resuspension can be obtained by the application of established factors to the results shown in figure V-11 . . .' (p. V-39). No use or actual application of these highly important 'factors is to be found in the DES."

Dr. K. Z. Morgan - Comment 1

"Here I read 'The Contribution to the Total Dose from Cloudshine, Groundshine, and Resuspension can be obtained by the application of established factors to the results shown in Fig. V-11. For ^{239}Pu and other isotopes of interest, these radiation effects are negligible . . .'

"I believe one has to be a bit naive to assume resuspension makes a negligible contribution to the human Pu dose. For example, several papers at the IAEA San Francisco meeting (November 1975), indicated the importance of resuspension. Here Romney (University of California) indicated that small particles of Pu are rapidly blown away from the source, and when resuspended they are deposited on plants that are eaten by animals and man. Most of the Pu found in vegetation got there by resuspension of dust. Jakublick (of Germany) indicated this PuO_2 on the soil migrates 100 times faster than soluble Pu (e.g. nitrate). Bondietti (of ORNL) indicated the Pu in soil forms complexes that are much more available for uptake by plants and animals. Becker (of EPA) suggested that the action of microorganisms in the soil may render this Pu available for uptake. McLendon (Savannah River Plant) found a high concentration of Pu in plants (1/10 that of core samples). This all suggests we cannot disregard the Pu in the soil where, in time, it may be transformed such that its fractional uptake by the human body may increase from 10^{-6} to 10^{-2}."

Staff Response - Deposition velocity and resuspension have been included in the dosimetric model both from a surface contamination and inhalation dose point of view. The typographical error on Figure V-11 has been corrected.

The commenter has significantly overstated the ingestion hazard for plutonium. The ingestion hazard is low because of several factors: GI tract absorption factors vary from 10^{-2} to 10^{-6}; resuspension factors are on the order of 10^{-4} m^{-1}; soil transport and plant uptake of insoluble plutonium are very low. The dose commitment from ingested plutonium is several orders of magnitude lower than that due to inhaled plutonium, if a single accidental release is postulated.

DES Chapter V: 31

ERDA - Comment 38

"We do not understand the shape of this curve. The dose should be proportional to the atmospheric dilution factor, E/Q or x/Q' and the area as a function of x/Q' as plotted in Meteorology and Atomic Energy has a concave shape to it, whereas this one (figure V-11) is convex. Since no model is described or referenced, it is impossible to check. As previously noted, we suggest that the source of this figure and how the curve was developed be referenced."

Staff Response - Several items are germane to this comment: (1) The reference is apparently to Figure A-8 on page 414 in Meteorology and Atomic Energy. This is function $\chi\bar{U}/Q'$ not χ/Q'. (2) Figure A-8 assumes a ground-level release; Figure V-11 in the DES assumes a 10-m release

height. (3) Figure A-8 assumes no initial dilution; Figure V-11 assumes the initial dilution in the 10-m cloud. (4) The curves in Figure A-8 are specific to wind speed and Pasquill stability category; Figure V-11 results from a Monte Carlo compilation of many combinations of wind speed and Pasquill category. The net result of these differences, especially the initial cloud height and initial source dilution makes Figure V-11 compatible with Figure A-8.

DES Chapter V: 32

ERDA - Comment 39

"A computer code is mentioned. Which code is it? Is it documented? There is an ANSI Standard for computer codes which if followed gives the reader some assurance that the code has been reviewed and checked for accuracy. Has this been done for the codes used in this document?"

Staff Response - The computer code referred to is the one that performs the Monte Carlo Gaussian calculations. The code is not adequately documented in unclassified literature, so the explanation of the calculation in Section C (FES Section 5.3) has been expanded to describe the calculations.

The ANSI standards review is strictly devoted to computer format, not theoretical basis. Hence, a review of that sort carries no implication of calculational accuracy.

DES Chapter V: 33

State of New York - Dr. Marvin Resnikoff - Comment 15

"Plutonium powder comes in various size gradations, depending on the source, some being more likely to settle in the lung than others. The more plutonium which settles in the lung, the greater the degree of risk of lung cancer. The authors of the DES assume 20% will be a candidate for deposition on the basis of particle size gradation of Fast Flux Test Facility ('FFTF') feed material (p. V-40) stated by the DES to be 20% respirable. However, plutonium oxide shipments through JFK in 1974 and 1975 (p. V-43) were admitted by the NRC to be 40% respirable. Indeed even the DES assumption of 40% respirability for JFK shipments is far too low as the authors have based that figure on a statistical construct of a 3.3 micron mean size of particles in those shipments. However, uncontested information in the record of the State's case against the NRC indicates that the range of particle size (.92 - 1.12 microns) did not include 3.3 micron particles at all, much less a mean particle size of 3.3 microns (Pl. Aff. Skinner, Appendix B). Since particles below 3.3 microns are '. . .considered to be respirable and candidates for deposition in the pulmonary tissue. . .' (p. V-40), it is accurate to say that 100% of the JFK shipments were candidates for lung deposition. Use of a 20% respirability figure represents a significant underestimate of plutonium's dangers. Again the DES proves to be a document replete with invalid assumptions."

ERDA - Comment 40

"We do not feel that taking 20% respirable as a median for 10% and 40% is conservative."

Staff Response - The value of 0.92 to 1.12 μm size is a mean value obtained by a measurement technique that examines the bulk surface characteristics of the particles. For biological response studies the characteristics of the mass distribution of plutonium with size was required. The information was inferred from the surface-related data using standard techniques. To assert that there were no particles larger than 1.12 μm or that biological data related to that diameter are those to be used is incorrect.

According to the ICRP Lung Dynamic Task Group analysis, particles of mean size 0.92 to 1.12 microns would be deposited between 20 percent and 30 percent in the pulmonary region, not 100 percent as alleged by the commenter.

The 20 percent respirable assumption is considered to be a conservative mean value because it is at the upper end of the data representing PuO_2 of U.S. manufacture, even though the value is below that of shipments that arrived at JFK in 1974 and 1975.

DES Chapter V: 34

Dr. K. Z. Morgan - Comment 10

"The ICRP lung model is used improperly. If the 750 ml lung tidal volume curve had been used (for the child) instead of the 2150 ml curve, it would be noted that about 28% and not 14% of the particles of 3 microns mean size distribution are retained in the lower pulmonary compartment of the lungs, and in either case (for the child or the adult) the larger Pu dust particles should not be neglected in the calculations of risk."

Staff Response - We believe the ICRP lung model is used properly for a 1-micron AMAD particle. The pulmonary deposition increase from a tidal volume of 750 ml to one of 2150 ml is small at this diameter (0.25 at 750 ml versus 0.23 at 2150 ml). If a 3.0-micron AMAD particle is assumed, the change is more significant (0.30 at 750 ml versus 0.20 at 2150 ml). Numbers are cited from Table 1 of "Deposition and Retention Models for Internal Dosimetry of the Human Respiratory Tract" (ICRP Task Group II report).

The effect of larger Pu particles, which settle principally in the nasopharyngeal and tracheobronchial regions, is negligible because of their rapid mucociliary clearance to the GI tract (biological half-times on the order of a few minutes to a few hours).

DES Chapter V: 35

ERDA - Comment 41

"No support or descriptions are given for either of the two components in the 'third factor.' The statement 'For plutonium this fraction is approximately 11/24' is unsupported as

is the statement 'ratios of irradiation rates and clearance rates. . .this factor is approximately unity for plutonium.' A geometric standard deviation of 3 (footnote) signifies a very wide range of particle sizes, and a most difficult aerosol from which to derive 'irradiation rates.' This lack of information renders the entire remainder of this section unsubstantiated and therefore of little value. We strongly suggest that additional information be supplied.

"Also, we would like to know what is the significance of 11 and 24 in the fraction 11/24 and is there any reference for these figures."

Staff Response - The "third factor" is the particle size distribution factor, which accounts for the fact that the actual plutonium particle size encountered is larger than the size used in the dosimetric calculations. This value, 11/24, is derived using the upper curve on Figure V-12 as a probable "realistic value" for respirability (11%) and comparing this value with the maximum value (24%) used in the dosimetric model. The section has been rewritten to clarify this point.

The geometric standard deviation of 3 was taken as a likely upper limit value for a JFK shipment in order to estimate its respirable fraction. This shipment was not used in the calculations in Chapter V.

DES Chapter V: 36

ERDA - Comment 42

"Radionuclide name is missing on first line. We assume this should be ^{239}Pu."

State of New York - Dept. of Environmental Conservation - Comment 21

"Table V-11 does not identify the first radionuclide on the list. It appears that it should specify Plutonium."

Staff Response - Table V-11 has been completely rewritten to reflect the revised standard shipment model. It now appears in FES Appendix A as Table A-6.

DES Chapter V: 37

State of New York - Dept. of Environmental Conservation - Comment 18

"These tables should include the consequences of accidents involving spent fuel."

Staff Response - Spent fuel has been added because of the large amount of interest in the consequences of transportation of that material.

DES Chapter V: 38

State of New York - Dr. Marvin Resnikoff - Comment 23

"Another significant underestimate in impact consequences can be found in Table V-13's use of the 'Integrated 1 year dose' factor. Instead of presenting the number of people who would have suffered irradiation over their 50-year adult lifetime, the DES presents a smaller number on the basis of only a 1 year dose. The text of the DES does not describe how this integration was done, which precludes adequate analysis by ourselves at this time."

Staff Response - The 50-year doses were omitted from Table V-13 because the emphasis in that table is on the early effects from the irradiation; 50-year dose commitments (in terms of integrated population dose) may be found in Table V-12.

DES Chapter V: 39

State of New York - Dr. Marvin Resnikoff - Comment 21

"Of interest as well is the DES's use of cutoff points for the production of LCF's from population exposure. Standard epidemiological analysis utilizes the formulas described above (LCFs/10^6 person-rems) based on the whole population exposed. This method is necessary to integrate the natural variability of people's response to carcinogens. Although the DES uses the above epidemiological tool, it applies that tool only to a part of the population, that part which has sustained more than a given dose, thereby eliminating a significant number of exposed persons (or person-rems) from consideration. Table V-13 employs a cutoff of 15 rem. That part of the exposed population, perhaps millions of people who, receiving less than 15 rem, are excluded from epidemiological consideration i.e., they are deemed by the DES as not being potential cancer victims. Such a method is contrary to standard epidemiological practice (as utilized in the Skinner-Wang affidavit of June 13, 1975, Exhibit 1). The method employed by the DES significantly reduces the impact of a dispersion accident."

State of New York - Dr. Marvin Resnikoff - Comment 22

"A similar cutoff or threshold was applied to calculations underlying figure V-10. The cutoff of .8 rem was used for depicting the area enclosing populations dosed at that level. Since this figure is based on a one kilogram release and the DES worst case scenario was based on a 20 kg release, one can readily see that the actual cutoff is not .8 but actually (1) 20 x (0.8) or 16 rems or (.5) (20) x (.8) or 8 rems depending on the fraction of a shipment released (p. V-25)."

Staff Response - The only "cutoff" used in Table V-13 was the restriction of plume propagation to a maximum area of 10^9 m^2. This allows doses of order hundredths of millirem. Table V-13 merely lists 15 rem as a benchmark point since it is an NCRP recommended limit. The same misinterpretation was apparently used on Figure V-10. This figure was merely presented as being illustrative, not as one end or the other of the dose spectrum analyzed. It has been deleted from the final report.

DES Chapter V: 40

State of New York - Dept. of Environmental Conservation - Comment 19

"For the 20 kg Pu Case, the number of persons receiving doses greater than 15 rem, 10^4 rem, and 10^5 rem are listed. Since the number of persons receiving a dose greater than 15 rem is several orders of magnitude greater than those receiving a dose greater than 10^4 rem, the number of persons receiving doses at intermediate levels should be provided."

Staff Response - Table V-13 is not meant to show the entire dose spectrum; 15 rem was selected because it is a regulatory organ dose guideline, and 10,000 and 100,000 rem were chosen because of their particular health effect implications as discussed in Chapter V.

DES Chapter V: 41

State of New York - Dr. Marvin Resnikoff - Comment 17

"Radioactive material has a normal decay half-life of the material itself. In addition, when a radioactive material is taken up by the body, natural biological processes can expel a part of that uptake. The rate at which the expulsion takes place is known as the biological half-life. For the purposes of the DES the authors chose 500 days (page III-16). This assumption appears to be a significant underestimate. In the appendix to the DES (page B-7), the authors admit the '. . .lung clearance half-time' is 200-1,000 days. In order to obtain the worst-case scenario as described in figures V-12 and V-13, the authors should have used 1,000 days, not 500. There is significant authority for the use of such a value. The U.S. Environmental Protection Agency ('EPA') reports in its publication, 'Environmental Analysis of the Uranium Fuel Cycle, Part III - Nuclear Fuel Reprocessing,' 520/19-73003-D, that the new International Commission on Radiation Protection ('ICRP') lung model assumes a 1,000 day half-life as does the NRC's WASH-1535 'LMFBR Program Environmental Statement' in that document's Table II.G-9."

Staff Response - The actual value used for PuO_2 lung clearance half-time was 1,000 days as per WASH-1400 for category Y pulmonary clearance. This value is used to generate the value of 2×10^8 rem/curie; hence, it does in fact represent the "worst-case" clearance time.

DES Chapter V: 42

State of New York - Dr. Marvin Resnikoff - Comment 10

"It is significant that the earlier analysis by Resnikoff (Pl. Aff. April 25 and June 12, 1975), which only assumed 1/16 of the DES 'worst-case' release, resulted in the tens of thousands of Latent Cancer Fatalities ('LCF's'). Had he used a 20 kilogram release instead, hundreds of thousands of people would have become LCF's in all three cases of meteorological stability. (See Pl. Aff. Resnikoff, April 25, 1975, Appendix B.)"

State of New York - Dr. Marvin Resnikoff - Comment 29

"The DES presents accident impact conclusions which, in part because of the nature of the assumptions used, were smaller than those previously claimed by the NRC in the NRC affidavit by Barker (p. 5-12). Unfortunately lack of clarity and documentation in the DES precludes complete comprehension of all the origins of these discrepancies. Therefore preliminary analyses were made using known dispersion models with the major known impact assumptions used in the DES."

State of New York - Dr. Marvin Resnikoff - Comment 32

"Because of the lack of clarity and specifics in the DES model, we were unable to use that model and we utilized the Barker model instead, changing only the amount of plutonium oxide released. The Barker model originally used a release of approximately 1.25 kgs (page 1 BNL memo). We changed this amount to the amount utilized in the DES, 10 kgs. All other inputs were kept the same. This changed the value of latent cancer fatalities of 15,000 people which the Barker model predicted in Table No. 6 of the BNL memo (Pl. Aff. Skinner-Wang, sworn to June 13, 1975, Table A) to an astounding total of 53,000 people. The DES on the other hand, on page ii, predicted only 617 fatalities. The only possible explanation for this conflict lies in the many assumptions used by the DES which remain secret and unavailable for scrutiny by Congress or the public."

State of New York - Dr. Marvin Resnikoff - Comment 36

"Assuming GESMO utilized the worst-case conditions, stability Class F (Case B in Pl. Aff. Resnikoff, Table 2), over 1.4 million people would be exposed in the dispersion arc to 54 rems or more. On the other hand, the DES states in table V-13 that only 280,600 persons are being exposed to 15 rems or more. This massive inconsistency between the DES and other NRC documents totally undercuts the validity of the health effects model of the DES for air transport of plutonium."

Staff Response - The alleged massive inconsistencies between computation using other dispersion and dosimetric computational schemes are largely a function of varying input data such as assumed population density, assumed respirability, assumed Pasquill stability category, assumed material toxicity. The factor of 5 between the DES and GESMO models could be accounted for by any of these and may not be inconsistent when taken in context. In other words, the GESMO assumption may be for different circumstances than the DES assumption. If the Resnikoff assumptions are used in the DES model, a value of 4.0×10^6 is obtained. It is believed that the assumptions used in the DES analysis are more valid, and hence they are employed.

DES Chapter V: 43

ERDA - Comment 43

"Delete the word 'physiological' since it is meaningless as used here."

Staff Response - The phrase in question has been deleted.

DES Chapter V: 44

ERDA - Comment 44

"We suggest that Equation (1) should be given or referenced."

Staff Response - Equation (1) is given on DES page V-1. The FES refers the reader to Appendix G for more detailed equations and the method by which risk is calculated.

DES Chapter V: 45

ERDA - Comment 46

"The risk reported in this table of accidents in the shipment of PuO_2 is (for the same annual shipment quantity) at least four orders of magnitude greater than that found in a detailed assessment of the risk of shipping plutonium by truck. (T. I. McSweeney, R. J. Hall, et al., 'An Assessment of the Risk of Transporting Plutonium Oxide and Liquid Plutonium Nitrate by Truck,' BNWL-1846, Battelle Pacific Northwest Laboratories, Richland, Washington, August 1975).

"We feel that this is extreme conservatism in the accident risk analysis."

Staff Response - There are numerous differences in analytical methodology between BNWL-1846 and NUREG-0034. The area of principal difference appears to be in the release fraction model and in the aerosolization model. In both of these cases, the BNWL values are orders of magnitude lower than those used for NUREG-0034. Available data should be used to predict release fractions. That data base forms the basis for the DES release model.

DES Chapter V: 46

Friends of the Earth - Comment 14

"NRC inexplicably says that the risk of plutonium accidents goes down in the 1985 projections. We would like to inquire: why? How can this statement be justified, in view of the government's determination to proceed with experimental, and later commercial, plutonium recycle and the fast breeder plutonium economy? It is not unreasonable to assume that greater use and transport of plutonium increases the risk of accidents due to plutonium release (or diversion)."

Staff Response - The statement was that the percentage of the risk due to plutonium accidents decreased slightly; the actual risk increased, but the percentage of the total risk caused by plutonium shipments actually decreased. The question is now academic, however, because the standard shipment model has been revised using the 1975 survey data.

DES Chapter V: 47

State of New York - Dr. Marvin. Resnikoff - Comment 19

"Recycle of plutonium in today's light water reactor fuels will increase the concentrations of certain isotopes of plutonium in any shipments by air as shown below:

Plutonium Constituents

Constituent	DES (B-5)	JFK*	WASH-1327**
Pu-238	1.9%	0.6%	4%
Pu-239	63.0%	72.0%	43%
Pu-240	19.0%	18.7%	26%
Pu-241	12.0%	7.0%	15%
Pu-242	3.8%	1.6%	11%
Am-241	0.6%		1%
Rems/curie	10.6×10^6	39×10^6	83×10^6

(See April 25, 1976 Resnikoff affidavit - table 2 for calculations of Rems/curie)

"These increases mean that the latent cancer danger of plutonium powder will increase by about 100% when plutonium recycle matures. This effect has not been taken into account in tables V-16 and V-17 of the DES."

Staff Response - The effect of isotopes other than Pu-239 in recycle fuel or discharged LWR fuel is discussed in DES Appendix B (FES Appendix C). The numbers derived there are used for the 1985 plutonium toxicity values.

DES Chapter V: 48

HEW - Comment 14

"The statement does not project the latent cancer fatalities (LCF) or early fatalities (EF) to the year 1985. Although exposure is projected to increase by a factor of approximately 3 from 9589 (1975) to 28,590 (1985), this suggests the LCF could increase from 1.2 in 1975 to 3.6 in 1985 as a result of normal transport only. Assuming the increase of a factor of 3 and an essentially equivalent population exposure, one may project the fatality data on pg. xx to be as follows:

	1975	1985
Early Fatality	1	3
Other deaths	16	48
Latent cancer deaths (30 yr. period)	600	1800"

Staff Response - LCFs due to accidents for 1985 are predicted in Tables V-16 and V-17 and EFs for 1985 are predicted in Table V-18. The LCFs due to normal transportation are (as inferred) 3.6 in 1985. The early fatality and LCF predictions from page xx should not be scaled as suggested in the comment. These values are based on a single "worst-case" analysis. The parameters for that analysis are shipment size, population density, material characteristics, and meteorology. None of these parameters will change with the number of shipments, which is the basis for the cited scale factor (3). The aspect of the "worst-case" accident that will change is the annual probability of occurrence, since this is a function of number of shipments. The observation that the alternatives in the DES were not projected to 1985 is correct, but the alternatives in the FES are based on 1985 risk.

DES Chapter V: 49

ERDA - Comment 69D

"Should it not be 0.2 fatalities per year? (Page V-54 of DES)."

State of New York - Dept. of Environmental Conservation - Comment 22

"The last sentence of the first paragraph refers to a number of injuries and fatalities 'per reactor year.' It appears from what is presented previously in the paragraph that it should refer to the number of these events 'per year.'"

Staff Response - The data from WASH-1238 is on a reactor-year basis. Hence the text was correct as written.

DES Chapter V: 50

State of New York - Dept. of Environmental Conservation - Comment 23

"Justification should be given for assuming that the population at risk is 75 million persons."

Staff Response - The selection of 75×10^6 persons at risk has been explained in more detail.

DES Chapter V: 51

State of New York - Skinner/Willen - Comment 48

"Your analyses have considered impacts of transportation accidents in terms of population dose only. Careful consideration must be in the final document of the clean-up costs of all postulated accidents as well as a qualitative description of the inconveniences suffered by residents adjacent to and within accident contamination zones."

State of New York - Skinner/Willen - Comment 49

"Your analyses should contain reviews of typical accidents which have already occurred and the costs and difficulties of clean-up at each. These reviews should include plutonium clean-up operations at Thule, Greenland and Palomares, Spain."

Staff Response - A section on contamination/decontamination has been added to FES Chapter 5. This section includes a discussion of cleanup costs, etc., based on WASH-1400, Appendix VI, data. The authors feel that source is the most current and applicable material on that subject.

DES Chapter V: 52

State of New York - Dept. of Environmental Conservation

"The draft statement should also discuss indemnification for any damages that may result from transportation of radioactive shipments made under Federal regulations including human exposure, contamination limits, etc."

Staff Response - Although the extent of the insurance coverage may have an effect on the way people respond to an environmental impact, insurance does not appear to directly affect the impact itself. An analysis of insurance coverage is therefore not included in this statement. Information on insurance coverage can be obtained from the following reference:

> Joint Committee on Atomic Energy - HR-8631, "NRC Staff Study Concerning Financial Protection Against Potential Hazards Caused by Sabotage or Theft of Nuclear Materials," Appendix D, "To Amend and Extend the Price Anderson Act," Part IIB, "Geographic Limitation on Coverage."

DES Chapter VI: 1

EPA - Comment 18

"The act referred to as the National Environmental Protection Act is correctly cited as the National Environmental Policy Act of 1969."

Staff Response - The error has been corrected.

DES Chapter IV: 2

ERDA - Comment 47

"One section noticeably missing is a detailed history or 'Track Record' of fissile and other radioactive materials during the past 15-20 years and the analysis of that data utilizing the parameters used in this study. This omission is not understood since the first sentence in paragraph 2 on page VI-1 states, 'The environmental impact of an alternative in radioactive materials shipments is meaningful only when compared to the impact of the current shipping practice.' The evaluation of low consequence events of the past could then be compared to projected consequences of future shipments to assess the method used.

"No assessment is made of risks resulting from human error or faulty equipment which could result in dropping or puncturing containers during handling (fork-lifting) operations.

"In addition, no mention is made of specialized training for personnel involved in the various facets of fissile and radioactive materials shipments and the impact it might have in precluding incidents and accidents."

Staff Response - A "track record" section has been added to Chapter 1. The human error problem is addressed in Chapter 4 (in context with Appendix C).

DES Chapter IV: 3

HEW - Comment 14b

"The alternative analysis is based on current shipment impact, pg. VI-1, and does not appear to be projected in terms of conditions which might be expected in 1985. Essentially, the alternatives are compared on a basis of cost benefit versus radiological effect(s), pgs. VI-1 and VI-3. If one accepts the figure of $\$8.22 \times 10^6$ per LCF or any other death, an investment benefit in terms of citizen protection may be calculated."

Staff Response - The alternatives were all discussed relative to the baseline 1975 data in the DES but are based on 1985 data in the Final Environmental Statement. The cost-benefit is assessed by using the value $\$8.22 \times 10^6$ per LCF and comparing the equivalent dollar value for a reduction in LCF with additional costs to provide this reduction.

DES Chapter VI: 4

ERDA - Comment 48

"We suggest that the annual population dose due to accidents be included."

Staff Response - Population dose (in person-rem) has been added to Table VI-1.

DES Chapter VI: 5

State of New York - Dr. Marvin Resnikoff - Comment 40

"How are cancer fatality figures for normal and accident transport situations calculated? (Table VI-1, pg. VI-2)."

State of New York - Dr. Marvin Resnikoff - Comment 41

"What is the basis for figures in Table VI-1 on annual person-rems in normal transport for each type of radionuclide? How are the annual person-rem figures calculated in the alternative section (e.g. Table VI-4, pg. VI-10)?"

State of New York - Dr. Marvin Resnikoff - Comment 38

"There is a major difficulty in determining the areas of sensitivity when the various parameters in the risk equation for accident scenarios, pg. V-8 are changed in alternative situations. We are provided with a set of figures for the baseline and alternative situations, but nowhere are there any intermediate or exemplary calculations which would show what, specifically, contributed to the change between the baseline and alternative figures. For example, in Table VI-3, page 41-7, we are given the set of figures for all air shipments being instead transported by truck. But it is impossible to tell from these new figures alone, just what contributed to the alternative results -- a difference in vehicle miles/year, probability of accidents, accidents of different severity classes, etc. Without the benefit of intermediate calculations, it is impossible to determine why the proposed alternatives result in the changes given in the summaries."

State of New York - Dr. Marvin Resnikoff - Comment 44

"In the summaries of results for each transport mode, how are figures for "probabilities of $\geq$ 1 early fatalities/year" derived, e.g., Table VI-4, page VI-10?"

Staff Response - The calculation methods specified in FES Chapters 4 and 5 and Appendices D and G are used for all baseline and alternative analysis. The alternative section has been expanded to specify the reasons for changes in radiological consequences in more detail.

DES Chapter VI: 6

ERDA - Comment 49

"Table VI-4 and following give baseline and alternative calculated values then a change, usually in percent. Giving this change in percent rather than in absolute value tends to be misleading. This is particularly true when evaluating the sum of LCF for normal and accident. For example, on page VI-22 we find a normal transport LCF increase from 1.166 to 1.195 or 0.029 or 2% while accident LCF decreases 21%. Stopping there it sounds like a substantial overall LCF decrease. But looking farther we see the 21% decrease is from 0.000529 to 0.00044 or 0.000089 decrease off-setting 0.029 increase or a net 0.0289 increase. We recommend showing the change in absolute values throughout this section.

"Furthermore, we feel that the text could be strengthened by the addition of narrative which place the differentials between alternative modes in perspective relative to the probable accuracy of the result (i.e., relative to the confidence limits in the data). For example, what is the confidence in, or significance of, the computed 21 percent decrease in latent cancer fatalities due to accidents?"

City of New York - Comment 6a

"Computed estimates of alleged risk are singularly deficient in statistical confidence limits. For example, the risk assessment relies upon a progression of modelling stages; the cumulative effect of the degree of precision lost at each stage makes the study of little or no value."

Staff Response - The percentage changes in LCF have been deleted; only the absolute values are given. It is very difficult to present confidence limits in a calculation of this type. For example, it is doubtful whether confidence limits could be applied to the package response model because of the paucity of the package test data. However, throughout the calculation, a conservative approach has been taken in those stages of the model where the degree of confidence is unknown. Therefore, the computed values for risk are not statistical averages about which one would place confidence limits but more like a conservative upper bound.

DES Chapter VI: 7

ERDA - Comment 50

"The annual air cost minus truck cost in dollars for plutonium shipments should be 2.8×10^3, not 3.4×10^3, based on the information in this table. Also, the footnote for this table is confusing since it is indicated that the plutonium shipping distance is 1200 miles but the cost is given for a 2000 mile trip."

Staff Response - The two errors in Table VI-6 have been corrected.

DES Chapter VI: 8

State of New York - Dr. Marvin Resnikoff - Comment 42

"How are mileage, exposure time, and population dose figures determined for alternative transportation modes? (e.g., switching from all passenger to all cargo aircraft, paragraphs 1 and 2, pg. VI-16)."

Staff Response - Any changes in parameters used in the baseline 1985 study derived for the alternative calculation were based on data for the mode established earlier and on estimates of increased (or decreased) mileages necessary for performing specific mode shifts or service pattern changes. Wherever possible supporting reference material was cited.

DES Chapter VI: 9

ERDA - Comment 51

". . .States, 'additional secondary mode mileage. . .' This is in conflict with statement on page VI-17, B.1-3 which says, 'shorter distance in secondary mode.'"

Staff Response - There is an error in the assignment of additional secondary mode costs in the shift from cargo air to passenger air, and this error has been corrected. Because of the greater number of airports providing passenger air service, the average secondary mode mileage would be shorter for transport by passenger aircraft.

DES Chapter VI: 10

Friends of the Earth - Comment 15

"In discussing the alternative of shifting all radioactive cargo to passenger aircraft, the report states that although this would increase passenger exposure, it would decrease the exposure (presumably to the public at large) by reducing the total miles travelled in secondary modes. We take issue with the practice of separating passengers - or cargo handlers - or nuclear industry workers - from the public at large, specifically as it relates to the genetic effects of radiation. NRC can hardly take issue with the fact that there is gene flow via reproduction between workers and non-workers, or between passengers and non-passengers. This indefensible distinction becomes particularly odious when one becomes aware of recent studies indicating that ingested plutonium may concentrate in the gonads."

Staff Response - This alternative decreases the total amount of exposure to the public, which is a net positive effect. It is not essential to discuss the exposure to various groups such as cargo handlers in order to assess the risk. As for genetic effects, the discussion in WASH-1400, Appendix VI, indicates that these are negligible compared to somatic effects. The comment about ingested plutonium being concentrated in the gonads is irrelevant to discussions of normal transport.

DES Chapter VI: 11

Transnuclear, Inc. - Comment 2

"In Chapter VI the discussion in Section B.1-6 indicates that seven times as many shipments will be required by truck as compared to rail. However, in Table VI-17, there are 380 shipments per year by truck and none by rail. This value should be 54 + 7(326) = 2336 if all 326 rail shipments are to be transferred to truck. If the radiological impacts as reported in Table VI-18 are based on Table VI-17, there may be significant errors in the results."

Staff Response - The FES includes more accurate treatment of spent fuel shipments, including capacities of truck and rail cars.

DES Chapter VI: 12

ERDA - Comment 52

"The discussion fails to acknowledge the aggravated logistics and increase in facilities and labor required at a reprocessing plant receiving about 5 metric tons of fuel per day by truck relative to rail. This is important also in light of the added potential for operator error, and dosage to plant operating personnel.

"Some mention of the efficient utilization of transport fuels is probaly appropriate A 1000 MWe light water reactor might originate 60 spent fuel cask shipments per year by truck or 10 cask loads by rail. Fuel consumption is typically 670 BTU per ton mile by rail; 2400 BTU per ton mile by truck. Assuming a 1000 mile trip (each way), rail shipments would save over 64,000 gallons of diesel fuel per reactor year."

Staff Response - This information has been incorporated in the FES.

DES Chapter VI: 13

Transnuclear, Inc. - Comment 3

"We also question the economics of spent fuel transport as reported in Section B.1-6.2. A recent study by the Edison Electric Institute on Nuclear Fuels Supply reported in Appendix V:

"'The cost of transporting a normal spent fuel annual discharge for a 1200-1300 MWe reactor over a distance of 1000 miles to a reprocessing plant is about $680,000 using a legal weight truck, $275,000 using an overweight truck, $460,000-$530,000 for a non unit train, and $750,000-$860,000 for a unit train.'

"We suggest that the alternative for spent fuel transport be presented as follows:

	Legal weight truck	Special permit truck	Rail
PWR elements/cask	1	3	7
Trip distance miles	1,000	1,000	1,000
Trips per year (1975)	2,336	780	334
Cost per assembly	11,300	4,600	7,600-14,300

"The radiological impacts should be calculated using the above values."

Staff Response - The EEI information has been incorporated into the discussion of the alternative in the FES.

DES Chapter VI: 14

United Airlines - Comment 2

"To prohibit shipments of radioactive material during adverse weather would be impractical because it changes so quickly in widely separated geographic areas."

Staff Response - A statement concerning the impracticability of this alternative has been incorporated into the FES.

DES Chapter VI: 15

United Airlines - Comment 3

"To restrict movement to daytime flights would eliminate most freighter flights. This would be very undesirable."

Staff Response - Restriction of flights to daytime hours has been eliminated as an alternative.

DES Chapter VI: 16

United Airlines - Comment 4

"It would not be practical to restrict movement by air to airports in low population areas, since service by air is so limited at such locations. A better alternative, if this is a valid concern, would be to prohibit transport by air."

Staff Response - Qualification "a" in Section B.2-2.3 (Qualification 1 in FES Section 6.3.1.2) discusses the limited air cargo service to suburban airports.

DES Chapter VI: 17

City of New York - Comment 3c

"Not only is there a failure to adequately analyze alternative modes of transportation, there is a virtually total lack of discussion of the impact of alternative routing of nuclear transportation shipments. The DES acknowledges the importance of population density in determining the significance of an accident (V48), but nonetheless fails to discuss routing alternatives which would take difference in population density into account."

Staff Response - Routing alternatives for aircraft are discussed in paragraph B.2-2.3 of Chapter VI. Routing alternatives for truck/van are discussed (qualitatively) in paragraph B.2-3.1 of Chapter VI.

DES Chapter VI: 18

EPA - Comment 12

"The discussion on the mitigation of accident consequences which precedes this table [Table VI-25] in this section indicates a decrease in the 'Accident L.C.F.' rather than an increase as given in Table VI-25. The reason for this seeming inconsistency should be explained."

Staff Response - In the discussion preceding the table, it was stated that, by requiring radioactive material flights to avoid zones of high population density, the risk to the population from flight accidents would be lower. However, these restrictions would severely limit the number of available airports, thereby increasing the average secondary mode mileage. The increased number of secondary mode accidents would produce the overall increase in accident LCF.

DES Chapter VI: 19

State of New York - Dr. Marvin Resnikoff - Comment 47

"On page VI-41, Section B.2-3.1, what procedure is used to determine reduction in truck accident rates due to the 3 alternatives given?"

Staff Response - The accident rate reductions for these alternatives are discussed in the cited reference.

DES Chapter VI: 20

ERDA - Comment 53

"States 'Restricting trucks to good weather driving. . .'A restriction of this type would precipitate confusion as to the definition of 'good weather driving' and would prevent the

driver from exercising discretion as to whether road conditions are safe or unsafe (he should be in the best position to make that determination)."

ERDA - Comment 54

"This section discusses restriction on truck travel on weekends. Since truck costs are based on miles covered, denial of weekend travel would severely escalate costs of shipments by this restriction. Long-haul operations that are currently on the road for greater than five days would be severely affected."

Staff Response - These observations have been incorporated into the discussion of the alternative in the FES.

DES Chapter VI: 21

State of New York - Dr. Marvin Resnikoff - Comment 45

"Why are certain alternatives evaluated only with regard to cost, while discounting seemingly significant decreases in accident latent cancer fatality figures, e.g., Table VI-28, page VI-44."

Staff Response - A dollar value was assigned to LCF values in an attempt to put accidents, normal transport, and overall cost into perspective.

DES Chapter VI: 22

ERDA - Comment 55

"In view of recent railroad actions, we feel this section deserves more emphasis and perhaps some expansion. Specifically, is there any basis in statistical data to suggest that the addition of special train units (extra's) operating over trackage otherwise scheduled, but at less than normal freight train speed would increase accident frequency or consequences relative to normal freight service?"

Association of American Railroads - Comment 1

"The conclusions on pages VI-44-45 were predicated on regular train service and a number of accidents (most of which were assumed not to be of a serious nature), but should have been predicated upon special train service with no accidents."

Staff Response - The section on special trains has been revised to include safety and economic data from several sources. These sources (notably, an analysis of AEC weapon transportation) indicate that a reduction in accident rate occurs, perhaps by as much as a factor of 7; however, special trains are certainly not immune to accident as suggested.

DES Chapter VI: 23

EPA - Comment 13

"Correction of the term 'ny' is necessary to clarify the sentence's meaning.

Staff Response - The typographical error has been corrected.

DES Chapter VI: 24

Friends of the Earth - Comment 16

"In this table of alternative transportation modes, two modes that could reduce radioactive exposure are inexplicably left out: avoiding cities (by barging materials where possible, as with Brookhaven National Laboratories, and the Shoreham and Jamesport reactors on Long Island); and barges themselves as an alternate or for part of a trip. Cities could be avoided by the use of not only barge but of trucks and railroads; surely the avoidance of populated areas - a general government policy where hazardous materials are involved - could substantially reduce potential effects from accidents or releases. Why is this not considered? Why were barges not considered?"

City of New York - Comment 3a

"There is a failure to make a rigorous and objective evaluation of all reasonably available alternatives. To take but one egregious example, barging is described as creating a "negligible" population exposure (IV-34), and barging has been recognized by USEPA as a desirable alternative to land transportation, yet no assessment of it is made in 'Chapter VI - Alternatives' or in the 'risk assessment section of Chapter IV.'"

Staff Response - The use of barges has been more adequately discussed in the Final Environmental Statement.

DES Chapter VI: 25

State of New York - Dr. Marvin Resnikoff - Comment 39

"The methods of obtaining figures for normal and accident L.C.F. in both baseline and alternative transport situations are quite unclear. There is no derivation given for the equation from which the baseline risk figures are obtained. (The equation itself is very difficult to find, especially in light of its exclusive use in determining the final figures). The variables used in this general equation are also hard to locate and several of them (e.g., vehicle miles/year for each type of shipment, probability/vehicle mile of a specific severity class accident) can only be obtained through a series of separate calculations. Calculations of the alternative results are made by changing a specific parameter in the original equation and following this through; this is obviously done with a computer program, but no program is provided, making it very difficult to reproduce these results. In addition, inconsistencies

with the language used to show the changes between baseline and alternative situations make the results confusing and occasionally misleading. While most of the changes are represented in percentages, the very large reductions are not, e.g., a 'factor of 16 decrease', which seems fairly small, actually represents a 94% decrease in the baseline figure, a very significant change. Particularly puzzling are the rankings of truck, rail, and passenger air transport (VI 53-55)."

ERDA - Comment 56

"This table [Table VI-29] shows a factor of 16 increase for one item and 100% decrease for another. We suggest consistency in these tables. Same comment applies to table VI-30, page VI-49."

Staff Response - The calculational scheme is now specified in greater detail in FES Appendices D and G, and the language inconsistencies mentioned have been removed.

DES Chapter VI: 26

ERDA - Comment 45

"Accident LCF reduction in table [Table VI-30] is by a factor of 23, but the text refers to a 23% LCF reduction. This discrepancy should be corrected."

Staff Response - The text has been corrected.

DES Chapter VI: 27

ERDA - Comment 57

"States '. . .Since accidents involving plutonium shipments are expected to produce 98.6% of the total risk. . .' If this statement is true, then the packaging requirements for all quantities of plutonium shipments should be upgraded. Perhaps consideration should be given to require all transuranics to have a super classification of containers to be used for all modes of transport."

Staff Response - NRC is currently evaluating standards for packagings for plutonium.

DES Chapter VII: 1

Friends of the Earth - Comment 1

"The draft environmental statement refers here to air transport as an "effective means of protection" against theft and sabotage of radioactive materials. We strongly disagree. Sabotage of aircraft could lead to a crash and fire and possible dispersal of radioactive materials. Air transport is therefore not an alternative to ground modes of transport since it offers additional potential for such dispersal, in fact triple potential, through aircraft malfunction, pilot error, or sabotage. In our opinion, air transport is the least acceptable and by far the most risky of all transportation modes. Rather than offering an "effective means of protection," it offers instead a wider variety of possible events that could result in dispersal of radioactive materials."

Staff Response - The FES reflects the NRC conclusion that, regardless of the mode of transportation, adequate protection can be provided against theft and acts of sabotage that would result in a significant radiological hazard.

DES Chapter VII: 2

Friends of the Earth - Comment 15

"The report goes to great lengths to assert its desire to protect civil liberties while maximizing safeguards. Yet the Special Safeguards Study has already suggested considering such anti-civil liberties measures as wiretapping, surveillance, and infiltration of groups that the government considers potentially subversive or violent."

Staff Response - The Special Safeguards Study (authored by D. Rosenbaum, et al.) discussed the cited measures in the context of domestic intelligence-gathering activities that are not among the responsibilities of the NRC. Domestic intelligence activities would contribute but marginally to the protective capabilities possessed by NRC licensees. NRC programs for the security of fixed sites and transportation links are designed to benefit from, but not depend upon, any intelligence indicators that may be generated. The NRC attempts to minimize the societal impacts of a nuclear industry by ensuring that each facility and each transportation link is sufficiently secure within itself to minimize the risk of theft or sabotage.

DES Chapter VII: 3

Friends of the Earth - Comment 16

"The footnote referring to an NRC ban against plutonium air shipments is in error. NRC should be reminded that they refused to implement such a ban, and that only a Congressional amendment introduced by Congressman James Scheuer put such a ban into effect. The ban unfortunately does not apply to ERDA shipments."

Staff Response - The NRC ban on air transport of plutonium referred to in this comment implemented legislation passed by Congress. The text of the FES has been revised to reflect this fact.

DES Chapter VII: 4

United Airlines - Comment 5

"Air transport should not be required for the movement of radioactive shipments based on security considerations. The much more important consideration relates to the exposure of people, equipment and facilities to radiation and it is these concerns that should determine whether radioactive shipments can and should be carried by air.

"The transport of radioactive material by air should be limited to only that which is absolutely necessary. In our opinion, this is primarily material related to medical applications including research, diagnosis and treatment."

Staff Response - This comment implies that the DES suggested that air transport should be required on the basis of security considerations. In this regard, it is noted that the FES expresses no such conclusion. It does note, however, that air transport is one of a number of modes for which effective means to protect radioactive material from theft and sabotage have been and can continue to be provided.

DES Chapter VII: 5

City of New York - Comment 1

". . .(The discussion of barging in the Safeguards section (VII 13-14) lists some difficulties with escorting barges carrying nuclear wastes. It is stated that the level of security of escorted trucks is not attainable with barges. We would suggest that the Coast Guard be consulted on this conclusion and would refer the writers of the DES to the Coast Guard's 'procedures for the Movement of LNG/LPG,' Captain of the Port, New York. 1. October 1975, for a discussion of the types of safety measures that can be taken for hazardous marine cargoes.)"

Staff Response - The use of barges under such circumstances would necessitate transfers from one mode of transportation to another thereby making a needless extra step in the transit of the material. Certainly, shipment by barge should not be totally discounted as a viable means of transportation solely because of these limiting factors. The DES discussed the security aspect of such shipments only in terms of escort measures. It is noted that the FES concludes that the level of protection of shipments attainable by barge, if such a mode were utilized, would be comparable to that attainable through other transportation modes.

State of New York - Affidavit of Mason and Leamer, Nov. 30, 1975 - Comment 4

"Each of the following military assisted transportation alternatives for enriched uranium is considered less vulnerable to terrorist action than current commerical practice. The least vulnerable alternative is presented first, the most, last:

(1) long haul military air cargo, leaving from and flying into a military airfield, and connecting with short haul military helicopter service between the airfield and the origin/ultimate destination;

(2) same as (1) but with military surface transport service between the airfield and the origin/ultimate destination;

(3) long haul commercial air cargo, leaving from and flying into a military airfield, and connecting with short haul military helicopter service between the airfield and the origin/ultimate destination;

(4) same as (3) but with military surface transport service between the airfield and the origin/ultimate destination;

(5) long haul commercial air cargo, leaving from and flying into a military airfield, and connecting with commercial surface (truck) service or commercial air (helicopter) service between the airfield and the origin/ultimate destination."

State of New York - Enclosure to Letter of May 17, 1976 - Comment 2 (partial)

"b. indicate that the military has the current safeguard capability to move SNM by surface transport which is significantly less vulnerable to terrorists than commercial air transport and related connecting transport;

c. specifically evaluate the air transport of uranium (as opposed to plutonium) and demonstrate that any one of five (5) military assisted transportation system alternatives is significantly more secure against terrorist action than commercial air transport, because of:

(1) rigorous control of future shipment movement information;
(2) more secure in-transit communications;
(3) reliable and highly motivated personnel with security training and clearances;
(4) appropriate selection of weapons and vehicles;
(5) superior reaction capability;
(6) physical remoteness of airfields and facilities;
(7) psychological deterrent of a U.S. military protection force."

Staff Response - The discussion of assessments and military options in the FES points out that the physical protection affordable through the private sector is adequate to protect against the postulated threat level and the use of military forces is neither legal nor necessary.

DES Chapter VII: 7

State of New York - Affidavit of Mason and Leamer, Jan. 20, 1976 - Comment 19

"Recent Information

19. We note that in a January 12, 1976, p. 11, col. 1 New York Times article by David Burnham, the following was reported:

> 'The commission (NRC), however, is considering recommending the possibility that an existing Defense Department agency such as the Army's special forces be given training to enable it to react to a situation where a terrorist band seizes and holds a nuclear facility for a relatively long period of time.'

"Moreover, it was stated in the New York Times, January 18, 1976, News Of The Week in Review, p. 3, col. 2:

> 'The Federal Nuclear Regulatory Commission is preparing to recommend that Congress consider, instead of creating a special police force to guard nuclear power plants, training Army units to prepare for attacks on the installations by terrorist groups.'

"It is clear that even defendant NRC now considers military safeguards against terrorist attack against nuclear facilities and materials to be necessary and desirable."

Staff Response - The articles incorporated by the comments speculate that the NRC is considering the use of military [Army] personnel for guarding certain nuclear installations or reacting to possible terrorist attacks. While many types of alternatives have been proposed and considered in evaluating what requirements might be appropriate if an increased level of protection were to be found necessary in the future, no conclusion to require an increased level of protection should be inferred at this time. A discussion on the use of military resources to protect SNM is included in the FES.

DES Chapter VII: 8

State of New York - Letter of Aug. 4, 1976

"The NRC is now once again urged to recognize that the continued commercial transport of SNM runs an unacceptable risk of diversion or loss of SNM. More secure modes of transport must be immediately designed and implemented. As this office has previously stated, it is our view that the NRC should require that shipments of plutonium be made by military surface transport and that shipments of uranium** be made by military air transport, using military bases as points of shipment and interim storage for all SNM."

Staff Response - The section of the FES describing the physical protection requirements for SNM in transit has been substantially revised to reflect recent improvements in the physical protection system. Specific note should be taken that features of this system include the use of an armored vehicle or the equivalent as the transporter, escort by a minimum of five armed individuals, a separate escort vehicle (two if at night), redundant means of communications, and several armed guards to protect SNM transfers. These measures have had the effect of significantly increasing the capability of NRC-licensed shipments of SNM to counter possible attempts of theft or sabotage of SNM in transit.

DES Chapter VII: 9

State of New York - Letter of May 17, 1976 - Comments 3 and 4

"3. The only discussion of military assisted air transport alternatives in the DES is limited to approximately one-half of a page (p. VII-12). What little discussion there is emphasizes only the military airfield aspect of these alternatives. It is apparent that the 5 military assisted options for uranium transport detailed in our affidavit of 30 November, 1975 (pp 4-7) were not considered.

"4. The DES does admit that the use of military airfields and/or aircraft 'appears technically feasible.' However, in a footnote, the DES suggests that the use of military airfields and aircraft may be prohibited and cites a law said to provide that: 'Except as otherwise provided by law, sums appropriated for the various branches of expenditure in the public service shall be applied solely to the objects for which they are respectively made.' 31 U.S.C. 628. In light of the obvious danger to the national security inherent to commercial air transport and related connecting transport of SNM, the failure of the DES to demonstrate that there are no sums appropriated which might properly be applied to the use of military airfields and aircraft for transport of uranium is significant."

Staff Response - As pointed out in response to comments on military alternatives elsewhere, the use of military resources is both unnecessary and illegal. The NRC does not agree that commercial air transportation and related connecting transportation of SNM constitute a danger to national security.

DES Chapter VII: 10

State of New York - Enclosure to Letter of May 17, 1976 - Comment 6

"6. Even though the DES makes no specific mention of military helicopters, it does make brief reference to helicopters generally (VII-13). This reference to helicopters, and STOL aircraft, together with their range and payload parameters, is without any qualification and hence without substance. After all this time, only conclusory speculation is offered. It is generally known, however, that a wide range of helicopters is used in the military and in industry with considerable flexibility in range and payload. In fact, a quick check reveals, for example, the following:

Helicopter Manufacturer/Type	Range	Payload (lbs.)
Boeing Vertol model 234	240 nm	20,000
	320 nm	4,000
Bell model 222 (undergoing modification)	425 nm	1350 (Estimated)"

Staff Response - Although no licensee currently utilizes helicopter or STOL modes of transporting SNM, there is no prohibition to do so since the NRC concludes that all modes can be afforded adequate physical protection.

DES Chapter VII: 11

State of New York - Affidavit of Mason and Leamer of Jan. 20, 1976 (Referring to J. Edlow Affidavit of January 1976) - Comments 5 and 6

"5. In paragraph 3. Edlow's concurrence with his father's recommendation of 'expediting' falls short of accomplishing the task of deterring a determined terrorist from successful seizure of SNM. The statement that '[t]his method and this method only will provide early notice that shipment is astray or diverted' is somewhat after the fact and does not preclude the possibility of diversion by seizure or hijacking. The only reaction to the discovery, or 'early notice,' that a shipment is diverted, is to notify the NRC or 'an appropriate law enforcement authority.' This is not security in the prevention sense and unless a more secure mode of transport is provided at the same time, seizure is not prevented and potential for recovery may be meager.

"6. As we have indicated in our earlier affidavits, one of the weakest links in the current security chain with respect to prevention of successful terrorist action is the wide dissemination of advance shipment information. 'Expediting,' as described by Edlow, is directed toward loss through misrouting or casual theft. However, such programmed pre-scheduling of times, routes, mode of transport, etc., provides precise information on shipment movement and unless access to such information is strictly limited, may add to a successful terrorist act. According to Peter N. Skinner, affidavit of April 20, 1975, a minimum of 124 people had knowledge of the details of the arrival of a specific shipment of plutonium before it arrived at J. F. Kennedy Airport from Brussels on February 25, 1975. As can be seen, the question of knowledge prior to shipment is one of the greatest short-comings of the civilian transport mode and one of the advantages of the military mode. Mr. Edlow at paragraph 15 of his affidavit stated categorically that 'SNM cannot be lost or diverted under current regulations....' Such an unqualified statement raises questions about his expert objectivity. We would not categorize the current system as failsafe."

State of New York - Affidavit of Mason and Leamer of Jan. 20, 1976 (Referring to Affidavit By Captain Echols (ALPA)) - Comment 11

"Captain James A. Echols, Affidavit of 28 November, 1975

"11. Captain James A. Echols' affidavit of 28 November, 1975 recounts numerous terrorist acts occuring aboard commercial aircraft and/or associated with commercial air facilities and

installations. The MITRE report itemizes no less than 26 commercial aviation-related terrorist acts in the last 6 years. These findings are consistent with the view expressed in one earlier affidavit that successful terrorist action against commercial aviation is feasible. We believe that transport SNM in commercial aircraft provides the terrorist with particularly attractive incentive for action."

State of New York - Affidavit of Mason and Leamer of Jan. 20, 1976 - Comments 12 and 13

"Assessment of 10 CFR 73 through 73.36 and 73.72 as Amended

"12. At paragraph 56 of our affidavit of 16 June 1975 we stated that the regulations as republished on December 28, 1973 were not adequate to prevent or deter a determined group of terrorists from succeeding with their mission. Those regulations were the regulations in effect on March 4, 1974. A review of 10 CFR 73.1 through 73.36 and 73.72 as amended through December 15, 1975, was made to determine whether amendments after March 4, 1974 would substantially alter our assessment of the vulnerability to terrorist action of SNM carried in commercial transport.

"13. Our assessment has not changed. The thrust of these Part 73 regulations remains that of protecting against loss, misrouting and casual commercial theft. Assuming full compliance with the letter and spirit of those sections of Part 73 by all responsible parties (an assumption with which we disagree), the amended regulations do not provide for adequate personnel, equipment or procedures to effectively deter and prevent successful terrorist action or organized theft."

State of New York - Affidavit of Mason and Leamer of Jan. 20, 1976 - Comments 17 and 18

"17. It is apparent that the conditions in the commercial transportation industry described by Sam Edlow in the 1969 speech attached J. Edlow's affidavit as Exhibit 1 have not substantially improved. Sam Edlow characterized the industry as untrustworthy (Exhibit 1, p. 3) and incompetent (Id. p. 9) and the environment in which the industry operates as one of criminality (Id. p. 6). Indeed he felt that the most that might be accomplished by strengthening requirements within the commercial industry might be early detection and recovery rather than prevention (Id. pp. 6, 10, 11, 12). As pointed out above in paragraphs 5, 6 and 7 current regulations regarding what Sam Edlow called 'expediting' refect (sic) a goal of detection, rather than prevention of diversion.

"18. As to demonstrating that the commercial air system is potentially unsafe from the terrorist threat viewpoint, the recent bombing of LaGuardia Airport is indicative of a level of vulnerability to terrorist activity which far exceeds the vulnerability of military controlled systems, vehicles and installations."

State of New York - Enclosure to Letter of May 17, 1976 - Comments 1a, 5 and 7

"The prior Mason/Leamer affidavits were submitted to:

a. Demonstrate that there is a substantial likelihood a higly motivated group of terrorists could be successful in destroying or seizing for destructive use special nuclear materials (SNM) in the course of commercial air transport, or related connecting transport, notwithstanding existing safeguard regulations and/or actual practice;

"5. The statement that 'adequate protection can be afforded at civilian airfields' (VII-12) is not supported by substantive discussion and misses the point that a military airfield has numerous advantages including inherent security, control of movement information, cleared, motivated and trained personnel, reaction capability, and location outside of highly populated areas.

"Military Assisted Transportation Alternatives for Plutonium

"7. The DES makes no reference whatever to the military surface transport alternatives for shipment of plutonium set forth in our Affidavit of 16 June 1975, pages 20 through 22."

Staff Response - Substantial increases have been made in the level of physical protection afforded to SNM in transit since the time referred to in the foregoing comments. Among other features described in the revised text, the current system of physical protection provides for a higher number of guards and the use of equipment with features of passive resistance to both theft and sabotage. Transfers of SNM from one mode to another now also require an increased complement of guards to be in attendance. (This is in addition to the greater participation of airport guards that is being provided as a result of heightened airport security awareness of the possibilities of hijacking and as required by FAA regulations.) As a consequence of the increased protection afforded to NRC-licensed shipments, the current level of protection for such shipments is considered to be adequate and comparably effective to that afforded to ERDA shipments.

The utilization of military forces and facilities as stated in the revised Chapter VII would be an unnecessary use of such forces.

DES Chapter VII: 12

State of New York - Affidavit of Mason and Leamer of Nov. 30, 1975 - Comment 17

"Although the entire affidavit thus far has addressed itself to enriched uranium transport, one comment regarding plutonium transport is worth making. A recent report by Ensign Dwight L. Gertz, USN, in Terrorist Weapons and the Terrorist Threat, 'U.S. Naval Institute Proceedings,' October, 1975, pp. 113, 114, confirms our conclusion expressed in our 16 June, 1975 affidavit that the terrorist motivation and threat to destroy aircraft is real and the weapons are readily available. In a recent instance, five Arabs rented an apartment in Ostia near Rome, 4 miles from Leonardo da Vinci Airport, directly underneath the North-South runway approach, and were only hours away from initiating a planned attack on a commercial airliner. They were equipped with two Russian made Grail missile launchers and a supply of missiles. In a second recent instance, when authorities were informed that terrorists in the Brussels area had been shipped Grail launchers, hundreds of troops were called out to cordon off airports in Brussels and

London. The Grail is combat proven and available to Soviet supplied nations and some 'neutral' countries. The missile is heat-seeking. The launcher is hand held and simple to use.

"In-transit dispersion of plutonium oxide in many instances would be both a highly effective terrorist act and one of far lesser difficulty than seizure and escape. Hence the threat becomes one of destruction of the aircraft in order to breech (sic) the plutonium oxide containers and disperse their contents."

State of New York - Affidavit of Mason and Leamer of Jan. 20, 1976 (Referring to J. Edlow Affidivit of January 1976) - Comment 4

"4. In paragraph 6, of his affidavit, J. Edlow's reference to 'strategic' quantities of SNM misses the point. Apparently Edlow is referring to the fact that CFR Sec. 73.30 sets minimum requirements for NRC licensee shipments of certain amounts of SNM computed by formula, which include 5,000 grams or more of plutonium. This regulation fails to cover various significant dangers. For example, any amount of PuO, if used as a dispersant, could cause death and injury. Also, the psychological aspects of SNM seizure are almost equally as real whether the material is low or highly enriched, or in small or large quantities. Any amount of SNM in the hands of a terrorist group would be of great blackmail value and could certainly be used to their advantage. Finally, the factor of multiple thefts must be taken into consideration, with the possible stockpiling of seized SNM."

State of New York - Enclosure to Letter of May 17, 1976 - Comment 9

"9. On page VII-7, the DES admits that plutonium oxide can be used as a dispersant in weapon form or by dispersing plutonium in transit by bursting its container and that such use would have serious consequences. However, in Appendix F, page F-4, the consequences of using plutonium oxide are said to be uncertain and such use is said to be inconsistent with observed behavior of terrorists. Peter Skinner's affidavit of 2 May, 1975 indicates that the consequences of use of plutonium oxide as a dispersant are not uncertain. While it may be true that terrorists have not yet used poisonous agents, that does not mean that they will fail to use them in the future. Moreover, terrorists might find particular appeal in a radioactive poison, not only because of its greater psychological value (over more conventional poisons), but also because of its extermely long life, assured effectiveness and its particular macabre method of destroying human tissue."

Staff Response - As indicated in the expanded section of the FES dealing with plutonium hazards, sabotage of a plutonium shipment of less than a strategic quantity would not result in a catastrophe, and even if plutonium oxide were dispersed in the atmosphere, relatively minor consequences would be expected. Calculations by Cohen indicate that, in a city, a fatality rate of one cancer death per 15 grams of plutonium would be anticipated if dispersal occurred without warning, the cancer death associated with the event resulting 15 to 45 years after the event. A ten-fold reduction in the death rate could probably be effected if warning of the dispersal were given.

DES Chapter VII: 13

State of New York - Affidavit of Mason and Leamer of Jan. 20, 1975 - Comment 16

"16. The Mitre report contains extensive corraboration of numerous points made by us in our current and previous affidavits e.g.:

Terrorists -- 54 pages directed to the history, tactics, capabilities, affiliations, motivations and recent activities of terrorists operating throughout the world. (Mitre Report, pp. 1-55)

Transport Industry -- 10 pages devoted to the extensive role of crime, corruption, employee colusion, and international influences in undermining industry services. (Mitre Report, pp. 55-64)

Weapons -- 6 pages citing types of weapons, their availability and recent employment by terrorists. (Mitre Report, pp. 65-70)

"Conclusions reached include 'terrorism has become commonplace in the Western World and weapons of large caliber and full-automatic fire can be easily procured,' and 'a veritable army of criminals and hoodlums in this country is waiting and willing to undertake any activity, including murder, if the profit justifies it.'"

Staff Response - The conclusions of the MITRE study are among several inputs to the NRC that are being evaluated and weighed in the continuing effort of determining whether to require an increase in the level of protection afforded to strategic quantities of SNM at facilities and in transit. Conclusions reached by firms under contract to the NRC should not be regarded as binding on the NRC.

DES Chapter VII: 14

State of New York - Enclosure to Law Letter of May 17, 1976 - Comments 12 and 13

"12. Plaintiff has demonstrated in three affidavits that the current requirements and practice regarding safeguards are inadequate to cope with the terrorist threat. The DES does not address itself in any meaningful way to the inadequacies previously specified by plaintiff. Indeed, the DES admits (VII-3) that 'present requirements are designed to protect against theft, diversion, or sabotage by one or two employees with access to the plant and material, by a small armed force attacking a plant or vehicle, or by both acting in combination.' '(S)mall force' is not defined in the DES. But, as to nuclear facilities, the Atomic Energy Commission ruled that licensees were only responsible for providing adequate security to repel not more than one or two individuals acting in concert (Nuclear Fuel Services, Inc. - UNC Docket #50-201, Atomic Safety Licensing Decision, November 29, 1974, p. 11). However, it is almost certain terrorists would employ 4, 5 or more persons. Moreover, the AEC ruled that licensees were not required to protect nuclear facilities against a well armed band of saboteurs whatever the size of the band; licensees need only concern themselves with 'an amateur group' (Id. p. 15).

"13. Given the purpose for which the safeguard requirements (10 CFR 73) were designed it is not surprising that the requirements and practice are grossly inadequate to cope with terrorism."

Staff Response - As the revised text of the FES points out, the significant improvements that have been made in the physical protection afforded to SNM in transit provide a system that can handle the postulated threat and that would not fail catastrophically under more violent attacks.

DES Chapter VII: 15

State of New York - Dept. of Environmental Conservation - Letter of Transmittal of Comments Dated June 3, 1976

"Therefore, the State of New York urges the Commission to consider the environmental impacts, and the alternative modes of transporting Plutonium and the security implications thereof separately from all other radioisotopes. Only in this way can the environmental consequences, benefits to society, and costs of alternative modes of transport and packaging requirements be adequately assessed."

Staff Response - The FES includes a discussion of theft and the consequences of sabotage involving shipments of plutonium.

DES Chapter VII: 16

State of New York - Enclosure to Letter of May 17, 1976 - Comment 11

"11. Plaintiff pointed out in the Mason/Leamer Affidavit of 20 January, 1976 that the provisions of 10 CFR 73 apply only to licensees shipping certain amounts of SNM computed by formula, which include 5,000 grams or more of U-235 enriched to 20 percent or more, or 2,000 grams or more of plutonium. Failure to subject smaller quantities to such regulations subjects the public to significant dangers specified in the above-mentioned Mason/Leamer Affidavit. The FES does not respond to this point."

State of New York - Affidavit of Mason and Leamer of Jan. 20, 1976 - Comment 14 (Partial)

"14. The requirements of Part 73 which may give the appearance of providing good security are grossly inadequate. Among the inadequacies are:

(1) shipments of less than 5,000 grams of SNM are not covered."

Staff Response - As pointed out in the revised text of the FES, the threshold for SNM in transit requiring physical protection measures relates to the prevention of an illegal nuclear explosive device. The quantities of plutonium at and below this threshold, even if dispersed in highly populated areas, would not result in catastrophic consequences.

DES Chapter VII: 17

State of New York - Affidavit of Mason and Leamer of Jan. 20, 1976 - Comments 7, 8, & 10

"7. In paragraph 11, Edlow's reference to the two principal additions to the regulations which 'prevents the possibility of loss or misrouting of SSNM while being transported,' i.e., 'continuous visual surveillance' and 'frequent communications,' again oversimplifies terrorist and related security problems. Adherence by shippers to these two requirements is intended to provide a degree of protection against misrouting and casual thefts but standing alone, it is inadequate protection against determined terrorist attacks and organized theft.

"8. Further, a report prepared for the NRC, released only in December, 1976 (MITRE Technical Report 7022, September, 1975, The Threat To Licensed Nuclear Facilities ('MITRE Report') para. 3.12.3, page 88) points out the inadequacy of current communications systems, 'One weakness in the operation of these private firms involves the communication system and the difficulties incurred during communication blackouts. Vehicles equipped only with a radio-telephone to handle communications to a base station are subject to periodic blackouts due to terrain and atmospheric conditions. Thus, to comply with a necessary two-hour check with headquarters (10 CFR Sec. 73.31) the driver must on occasion leave his vehicle and use a hand-line telephone. During these blackout periods and during the time the driver leaves his truck to use a telephone, the potential for a hijacking or theft is increased.'

"10. The MITRE Report confirms and augments the observations and conclusions stated in this and our earlier affidavits regarding the inadequacies of the requirements regarding visual surveillance and communications and armed guards, as outlined by NRC's 10 CFR Part 73, of April 1975."

Staff Response - A requirement for an escort vehicle with additional communication capability to accompany all road shipments of SNM was imposed by license condition in May 1976. Subsequent license conditions were issued in February 1977 to formalize security measures currently in use. These included an increase in guard strength and the use of an armored vehicle or equivalent as the transporter vehicle. These increases in physical protection requirements are reflected in the revised section of the FES.

DES Chapter VII: 18

State of New York - Affidavit of Mason and Leamer of Jan. 20, 1976 - Comments 14 (partial) and 15 (partial)

"(4) Communication requirements in terms of the frequency of communication in transit as well as the number and capability of communication channels is inadequate.

"b. So long as contact is not always possible with vehicles carrying high security material, the present communication system will contain weaknesses. Response capability suffers accordingly."

Staff Response - The May 1976 licensing actions by NRC have required additional radio communications capabilities to be provided for all SNM shipments. The February 1977 license conditions restricted road travel to major highways during daylight hours unless an additional (second) escort vehicle is also provided (Section 7.4.2).

DES Chapter VII: 19

State of New York - Enclosure to Letter of May 17, 1976 - Comment 17

"17. Plaintiff has previously demonstrated the wide dissemination of information regarding future SNM shipments (Affidavit of Peter Skinner, 2 May 1975) and emphasized the danger which this presents. The DES makes no response. Plaintiff has also pointed out the inadequacy of current communication systems used in commercial SNM transport. Again, the DES fails to respond."

Staff Response - The NRC does not believe the dissemination of SNM shipping information that is required by regulation represents danger to the transport of SNM. Response to the second point of the comment has been made elsewhere, and the text of the FES has been revised to reflect the current physical protection systems.

DES Chapter VII: 20

State of New York - Enclosure to Letter of May 17, 1976 - Comment 18

"18. The DES (VII-10) asserts that local law enforcement agencies located along a truck route would supply a secondary response. This is all well and good but for the fact that the regulations do not require communication equipment or frequency of contact which assures that such persons would be alerted when required. In connection with truck transport from airports to facilities, the DES (VII-11) states that convoys will have the additional protection of the facility's security force to act as a response capability, but fails to deal with the practical aspects involving distance, transport, communications, and on site responsibilities. The DES statement (VII-11) that 'airplane security personnel' would be present during airport SNM transfers in addition to the guards accompanying the truck is not supported by the regulations. The regulations do not provide for armed airplane security personnel."

Staff Response - The measures currently required for physical protection of SNM have been described in the FES and are referred to in response to several other comments. The NRC believes that these measures adequately protect against the postulated threat and ensure delay until local law agencies can respond in case of possible larger threats.

DES Chapter VII: 21

State of New York - Affidavit of Mason and Leamer of Jan. 20, 1976 - Comment 9

"9. Regarding Edlow's statements (Aff. paras, 12-14) concerning delivery by armored truck with armed guards, one should note that the MITRE Report, para. 3.12.4, page 69, points out:

'It should be noted that armed guards of an interstate shipment have no statutory authority to carry weapons in states other than the one in which they are licensed or across state lines, yet regulations require that they carry weapons in exercising their primary duty of protecting SNM in their custody. These guards are probably often in violation of both state and federal laws.'

"In other words, the fact that a guard is armed, and in an armored truck, is not necessarily a strong deterrent to terrorist or organized attack; the guard probably knows that he may be in violation of a state or federal statute or law, and, when faced with an armed attack situation, may simply not use the weaponry available for fear of legal, as well as physical, consequences to himself."

State of New York - Enclosure to Letter of May 17, 1976 - Comment 16

"16. Nevertheless, the DES (VII-6) makes the bold assertion:

'Licensee guards are expected at all times to (1) interpose themselves between SNM and any adversary attempting entry and (2) intercept anyone exiting with such material. A sufficient degree of force should be applied to counter that degree of force directed at them, including the use of deadly force. . . .' Considering the number of personnel and the weapons selection likely on both sides in a confrontation with terrorists, it would be tantamount to suicide for licensee guards to act in the manner suggested by defendant."

Staff Response - License conditions have made clear to licensees that guards are to be instructed to take appropriate action to thwart theft or sabotage of SNM. Guards are expected to "interpose themselves...and use force including deadly force if they have a reasonable belief their lives or that of another is threatened." The NRC expects guards to be trained in accordance with commitments contained in approved plans and expects the licensee to meet all requirements for the protection of SNM including the possession and use of weapons.

DES Chapter VII: 22

State of New York - Affidavit of Mason and Leamer of Jan. 20, 1976 - Comment 14 (partial) and 15 (partial)

"(2) Though plans for selecting, qualifying and training guards as well as for specially-designed trucks are called for, neither minimum standards or implementation dates are specified:

"(3) The number of guards provided for and their arming is minimal:

"15. The Mitre report states: (para. 3.12.5, pp. 89-90)

'a. A wide dispartiy (sic) presently exists in the various screening techniques used in selecting guard personnel and in the training they receive.'"

State of New York - Enclosure to Letter of May 17, 1976 - Comments 14 and 15

"14. The DES fails to respond to plaintiff's previously specified criticisms of various aspects associated with the use of private guards: inadequate training, lack of security clearances, low pay, and lack of military type motivation. When the DES discusses the number of guards employed it is misleading. At one point (VII-10), it states that in truck transport 'the number of guards would be varied to suit the particular shipment and preceived (sic) threat,' the regulations do not require this. At another point (VII-4), the DES states that when cargo aircraft are used, enroute transfers must be observed by more than one armed person; the regulations do not necessarily so require.

"15. Plaintiff has previously pointed out that the weapons and vehicles employed by private guards are inadequate for coping with the terrorist threat. The DES offers no meaningful response."

Staff Response - Regulatory Guide 5.20 was published in April 1974 to provide guidance to the industry on selection and training of guards. This guide is also used by the NRC staff in evaluating the adequacy of guards. Specific additional training requirements for guards escorting shipments of SNM were added in May of 1976. License conditions were issued in February 1977 to formalize security measures currently being employed. These included an increase in the minimum number of guards required and the use of armored vehicles or equivalent as transporters."

DES Chapter VII: 23

State of New York - Affidavit of Captain James A. Echols (ALPA) of November 28, 1975 - Comment 3

"3. Critical to the safety of commercial air transport of SNM is the severely inadequate security within the air cargo industry. Presently, regardless of cargo, multi-million dollar aircraft and pilots are subject to selection at any time as a 'target of opportunity' by sky-jackers, extortionists, terrorists or saboteurs. We received a clear lesson as to the very real terrorist threat as 3 Boeing 747's burned to ashes on a patch of Jordanian desert while crew and passengers were held hostage under the muzzles of terrorist sub-machine guns. We have seen as well:

- mid air sabotage
- grenade attacks on land
- attacks on terminals
- abductions
- diversions
- over 370 global acts of terror
- endangering 16,000 people.

"As I have stated, the lesson is clear, SNM must be removed from commercial air transport."

Staff Response - The commenter's affidavit reflects concerns predating the increased airport security measures required by FAA that have reduced hoaxes, threats, attempts, and diversions

of passenger aircraft within the USA. It also does not take account of security measures required by NRC for SNM shipments that have been instituted in the interim and are reflected in the FES.

DES Chapter VII: 24

State of New York Letter of May 17, 1976 - Comment 4

"The DES safeguards discussion bases portions of its analysis on the as yet incomplete and unreleased analysis of safeguards in the Generic Environmental Statement on the Use of Recycle Plutonium in Mixed Oxide Fuel in LWR's. WASH 1327 ('GESMO'). General references to uncompleted studies in other proceedings render the DES legally inadequate.

Staff Response - The safeguards discussion in the FES Chapter 7 is based on current efforts related to the overall level and quality of protection accorded the nuclear industry as a whole. The analysis and subsequent conclusions presented therein are not dependent in any way on the outcome of any uncompleted studies or decisions stemming from the NRC review of safeguards related to the wide-scale use of plutonium mixed oxide fuels (GESMO deliberations).

DES Chapter VII: 25

ERDA - Comment 58

"Page VII-1, Third Paragraph

"This paragraph indicates, according to the text, that nuclear material is subject to security procedures and safeguards intended to preclude the diversion or theft of nuclear material or sabotage of the nuclear facilities in which it is handled.

"This statement in regard to the safeguarding of strategic quantities and types of special nuclear material is misleading and should be revised. There is no option to safeguard special nuclear material in this category. NRC regulations prescribe the safeguarding both at fixed facilities and in transit. Additionally, safeguards and security procedures are not limited to "strategic quantities" but to all special nuclear material.

"That part of the paragraph which speaks to radioisotopes, such as cobalt-60 should be eliminated. There are no security and safeguards features in the context within which they are discussed, i.e., to preclude diversion or theft or sabotage, applicable to the handling of radioisotopes by NRC. Mentioning cobalt-60 raises numerous related questions regarding other hazardous radioactive materials not subject to NRC safeguards and security type control (e.g., radium)."

Staff Response - This section of the FES has been substantially revised to more clearly state the potentials of misuse of the various categories of radioactive materials. The revision describes those measures currently in effect that limit the hazards from misuse of cobalt-60. It also more clearly describes the basis for providing physical protection to special nuclear material.

DES Chapter VII: 26

ERDA - Comments 59-61

"59. Page VII-2 B(2) and (3)

"Meaning of 'Contractors' unclear. Contractors to NRC, U.S. Government, nuclear industry or what?

"60. Page VII-5, Second Paragraph

"The meaning of "supporting safeguards security systems" requires clarification.

"61. Page VII-8, Third Paragraph

"We see no reason to specify 'escort guards' but would refer to 'guards' without the qualification since it is unlikely that guards would be used solely for escort purposes. The same sentence apparently intends to refer to 'the transportation mode' rather than 'the transporation model.'"

Staff Response - The ambiguities and typing errors cited in the above comments have been resolved in the FES.

DES Chapter VII: 27

State of New York - Enclosure to Letter of May 17, 1976 - Comment 8

"8. In our Affidavit of 16 June 1975, pages 14-16, we cite a number of authorities in support of the following propositions:

a. That the information necessary for the design of a nuclear device is publicly available; and

b. That a technically competent group of terrorists could fabricate an effective, even if crude, nuclear device notwithstanding the fact that it had no prior experience in fabricating such a device.

"Notwithstanding some discussion regarding the benefits of prior experience in the fabrication of such a device, the DES admits that persons without such experience could produce a device with a low tonnage yield, apparently a yield of one kiloton or less, or even a device with a substantial yield (F 1-3). Moreover, the DES admits that 'the potential consequences arising from any nuclear explosive are so serious as to warrant the utmost vigilance, however low the probabilities may be.' (F-2). The DES places great emphasis on the supposed difficulty of 'emplacement' of a nuclear device because law enforcement agencies would be watchful (p. F-4). However, this is not very comforting when one considers the almost infinite opportunities for emplacement in a large city."

Staff Response - Primary reliance against the possibility of a terrorist group acquiring a nuclear explosive device is placed on denying the acquisition of SNM not on any technical difficulties in fabricating such a device. (Appendix F of the DES has been deleted.)

DES Chapter VII: 28

Enclosure to New York State Department of Law Letter dated May 17, 1976 - Comment 10

"10. The DES makes a significant admission regarding the NRC's overall policy on safeguards. The DES states (VII-2) that while safeguards must be capable of preventing acts which could result in a 'major civil disaster,' safeguards need only provide a 'high degree of protection' against acts that could result in 'serious civil damage.' No justification or analysis is presented to support such a policy and no definitions are provided for any of the salient concepts employed. One would think that, given the immense danger posed to the public by terrorist use of SNM, safeguards should be capable of preventing any such use."

Staff Response - This section of the FES has been revised to accurately describe the NRC responsibilities.

DES Chapter VII: 29

State of New York - Enclosure to Letter of May 17, 1976 - Comment 20

"20. The statement in the DES that hardware and techniques are currently available to allow an effective recovery effort is inexplicable in light of the admission that recovery cannot be relied upon as the strong link in the security system (VII-9)."

Staff Response - The recovery aspect of the national capability, which relies to a considerable extent on the expertise and organization structure developed to protect ERDA/DOD weapons programs, involves coordinated action by many Government agencies. Should nuclear materials be stolen or diverted, the national system would use the collective resources of the various departments and agencies involved in nuclear safeguards, including the FBI, ERDA, DOD, USCG, the intelligence community, and local law enforcement agencies (LLEA).

DES Chapter VII: 30

State of New York - Enclosure to Letter of May 17, 1976 - Comment 21

"21. With regard to monitoring and inspection of safeguard systems, the statements in the DES (VII-5) appear to be wishful thinking. Not even the DES claims this monitoring and inspection of SNM transport actually occurs."

Staff Response - The NRC inspects for compliance with physical security requirements all imports and exports of SNM shipped under the provisions of 10 CFR Part 73. These currently comprise approximately 90% of all such SNM shipments. Domestic road shipments are periodically inspected while in route.

DES Chapter VII: 31

State of New York - Enclosure to Letter of May 17, 1976 - Comment 22

"22. The fact that the DES fails to respond to the plaintiff's previous affidavits is not surprising when one notes that the DES admits that an 'in depth analysis of safeguards' is currently being undertaken (VII-9) and that studies are being completed to determine 'the cost and effectiveness of alternative systems' to safeguard SNM (VII-15). Thus, at this late date, NRC admits that it has not yet analyzed and studied the safeguards issue involved in the air related connecting transport."

Staff Response - Chapter 7 of the FES has been substantially revised. The analysis of safeguards for transporting SNM indicates to the NRC staff that the current measures for control of radioactive material in transit (including physical protection for certain quantities of SNM) are adequate. (See response to DES Chapter VII: 24.)

DES Chapter VII: 32

City of New York - Comment 8

"Scenarios involving sabatage (sic) or diversion of spent fuel or fissionable materials by terrorists or criminal elements are mentioned tangentially but are incompletely evaluated."

Staff Response - The section of the FES dealing with the potential for misuse for the various classes of radioactive materials has been expanded.

Dr. K. Z. Morgan - Comment 4

"There seem to be large discrepancies between this table and the values given in the GESMO report, WASH-1327, which I reviewed earlier. These discrepancies are shown below:

Radionuclide	% by weight in Table B-1	% by weight in WASH-1327	Ci calculated WASH-1327	g in WASH-1327
Pu-238	1.9	3.49	3.47×10^5	0.20×10^5
Pu-239	63.0	43.63	5.30×10^3	2.50×10^5
Pu-240	19.0	26.00	3.37×10^4	1.49×10^5
Pu-241	12.0	15.65	1.00×10^7	0.90×10^5
Pu-242	3.8	11.21	239	0.64×10^5
Am-241	0.6		2.52×10^4	7.78×10^3
Am-243			6.78×10^3	3.66×10^4
Cm-244			1.70×10^6	2.04×10^4

"When each new NRC report uses a new set of assumptions about the SGR-GESMO-120 day spent fuel inventories, how can we be expected to believe any of the numbers or evaluate the data? Which NRC report are we to believe?

"I have added also my calculations of Curies using the WASH-1327 data. Here we note that most of the risk is not from ^{239}Pu but from ^{238}Pu, ^{241}Pu, ^{244}Cm and ^{241}Am. Also, I have shown (HPJ 10, 151, 1964) that ^{238}Pu is 150 times more hazardous (Curie-for-Curie) than ^{239}Pu, ^{241}Pu is 3 times more hazardous, ^{244}Cm is 32 times more hazardous, and ^{241}Am is 16 times more hazardous. In addition, this 2.04×10^4 g of ^{244}Cm comprises 2.2 Ci of neutrons for which extra precautions must be taken."

Staff Response - The percent-by-weight values were taken from column 1, Table IV D-4, of Volume III of WASH-1327 (GESMO). Values closely approximating those suggested by Dr. Morgan also appear in that table in column 3. In using the values from that column, Dr. Morgan has made the tacit assumption of equilibrium plutonium recycle. Since the DES evaluated 1975 and 1985 only, the assumption of high-burnup LWR fuel is far more accurate and certainly doesn't represent a "new set of assumptions."

The risk comparison cited by Dr. Morgan (HPJ 10, 151, 1964) is a relative risk comparison ostensibly discussing the risk to laboratory or engineering process line personnel exposed to releases of material. It defines hazard by H = specific activity/MPC. This is an occupational analysis and is not suitable for application to an atmospheric release of material. The relative hazard of all isotopes shown to be present in plutonium obtained from high burnup versus LWR

fuel was taken into account in the DES. However, note that Table IV D-10 of GESMO does not show any curium isotopes although Dr. Morgan lists a significant amount.

DES Appendix B: 2

ERDA - Comment 69a

"Clearance half-time of 150-200 on page B-7 omitted units."

EPA - Comment 19

"The clearance time for soluble plutonium needs to have units added to it."

Staff Response - Units have been added.

DES Appendix B: 3

EPA - Comment 146

"The movement of particles captured in the mucoid lining is properly termed transported not sloughed."

Staff Response - The phraseology has been changed.

DES Appendix B: 4

ERDA - Comment 62

"A portion of material deposited in the tracheobronchial region may also pass directly to blood, depending on initial solubility. The term 'reticuloendothelial cells of the alveoli' is ambiguous; it is not clear whether this refers to fixed or mobile pulmonary macrophages."

Staff Response - The suggested addition has been made. Both types of pulmonary macrophages are involved in the phagocytosis process. The sentence will be changed to read "...in the alveolar region." to attempt to clarify this distinction.

DES Appendix B: 5

ERDA - Comment 63

"'Soluble plutonium' is a thoroughly non-specific term. Translocation half-times and fractions can vary several-fold depending on inhaled particle size, specific chemical form, and isotopes of plutonium. Use of the narrow range '150-200' is misleading and may be dangerous in risk estimates; the unit of time is not even given."

Staff Response - The discussion concerns plutonium in soluble chemical form that has already reached the pulmonary region. Material of this sort does translocate with the stated half-time.

DES Appendix B: 6

ERDA - Comment 64

"This figure is taken directly from publications by J. F. Park and W. J. Bair at Battelle Pacific Northwest Laboratories; reference and credit should be given.

Staff Response - The reference cited (Reference 7) was the source for the figure.

DES Appendix B: 7

ERDA - Comment 65

"This discussion is not complete; the lethal biological effect of progressive pulmonary fibrosis leading to death by respiratory insufficiency is not even mentioned. We suggest that this section be expanded."

Staff Response - This paragraph is not intended to deal with biological effects to specific organs. The discussion of effects of acute pulmonary exposure is given in Section E.3 of Appendix B (FES Appendix C, Section C.5.4).

DES Appendix B: 8

State of New York - Dr. John Gofman - Comment 4

"On page B-10, the DES states, 'Cancers have been induced in laboratory animals, although no cancers attributable to plutonium have been observed in humans.' This statement is not only meaningless, it is dangerous. What the DES should state is, 'No meaningful study has been undertaken to determine how many lung cancer fatalities have been caused by plutonium handling.' For the population-at-large, the best estimate currently available is that plutonium fallout has condemned 1 million persons in the Northern Hemisphere to lung cancer deaths. (Gofman, (3).)"

EPA - Comment 14d

"In the cited case of the Los Alamos personnel, the draft statement indicates that '. . . none of these people has shown any evidence of radiation injury.' It seems this statement is probably too broad and could be optimistic. We doubt that all possible indicators have been checked and even if they have it is quite unlikely that there has been no radiation damage. This statement, if taken literally, would indicate that the NRC has adopted a threshold model for radiation effects. If this is true, the decision should be documented."

Staff Response - Dr. Gofman's implication that the continuing studies of Manhattan Project workers, Rocky Flats workers, etc., are meaningless is questionable. These studies include

chest counts, urinalysis, and autopsy information and have been carried out by LASL, PNL, and other respected scientific organizations. The "best estimate of 1 million condemned people" is based on Dr. Gofman's own unconfirmed analysis. Healy et al. (Ref. C-28, Appendix C) have examined Dr. Gofman's plutonium lung cancer estimates in detail and concluded that "Gofman's speculations require the arbitrary acceptance of too many numerical parameters and unconfirmed mechanisms to be acceptable as even an approximate numerical estimate of potential lung carcinogenesis by plutonium." Several other reputable studies have also rejected Dr. Gofman's analysis (see Appendix C, Section C.6).

The assertion that the statement in paragraph 3 represents a threshold model is invalid. The statement is made that no one has shown any evidence of radiation injury, not that radiation injury at those body burdens is impossible. The conclusion drawn is that current data does not support some of the claims of excessive plutonium toxicity.

DES Appendix B: 9

EPA - Comment 14c

"On page B-10, to prevent confusion, a beta particle is not an ion and it is confusing to describe its nature as ionic, its nature is more properly termed that of a charged particle; also, beta particles can travel much further than a few microns in body tissue, in fact into the centimeter range."

Staff Response - The nature and range of beta particles has been clarified.

DES Appendix B: 10

ERDA - Comment 66

"Terms 'high,' 'low,' 'lower,' and 'relatively' should be given values or ranges; 'relatively high body burdens (.00007 to .09 microcuries)' spans 3 orders of magnitude. We suggest that '.00007 to .09 microcuries' be changed to '0.005 to 0.420 microcuries.' (Reference - WASH-1320, page 25)."

Staff Response - The suggested change has been made.

DES Appendix B: 11

EPA - Comment 14e

"In section E.3, first, there are no references cited for the information given; second, there are apparently symbols missing from the amounts of plutonium cited, 0.5 curies Pu-239/gram of lung is the same as 8.2 grams Pu-239/gram of lung."

Staff Response - The references are now cited and the curie values have been corrected to read microcuries.

DES Appendix B: 12

Dr. K. Z. Morgan - Comment 12

"Although the dose to the pulmonary lymph nodes is 100 or more times that to other lung tissue, this dose is ignored in the risk evaluations. I realize the ICRP has depreciated this risk because the ERDA studies of Thompson et al at BNW have failed to produce cancers in this part of the reticulo endothelial system in animal studies. However, I am uneasy in applying these data to man who lives 70 years instead of 20 years (dog's life span) and Thompson has in fact observed some malignancies in tissues adjacent to the lymphatic tissue which may suggest that blood vessels leading into these organs or tissue just beyond the α-particle complete kill within the lymph nodes may be the tissue at greatest risk in the case of man."

Staff Response - The question of lymphatic cancer is addressed in DES Appendix B (FES Appendix C). A qualifying statement has been added to indicate that dog and rodent experiments are not completely conclusive with regard to lymphatic cancers. As Dr. Morgan points out, however, the ICRP does not consider the lymph system to be a potential cancer site.

DES Appendix B: 13

ERDA - Comment 67

"It should be pointed out that 'increases in urinary excretion in some cases by orders of magnitude' may represent only a decrease of a few percent in long-term lung burden of insoluble plutonium."

Staff Response - This paragraph has been modified to specify that DTPA therapy is only effective in mitigation of exposure to soluble plutonium.

DES Appendix B: 14

EPA - Comment 14f

"The discussion in section F on chelating agents does not mention any side-effects on their use; e.g., possible deposition in other organs, rather than excretion, which could create worse problems."

Staff Response - "Advances in Radiation Biology" (Vol. 4) suggests that DTPA is very effective at reducing the overall body burden of systemic soluble plutonium. It states that the use of that material appears to reduce the concentration in liver and bone by causing the plutonium complexes to mobilize to extracellular fluid from which urinary excretion is likely. This does not appear to imply that redeposition in other organs is likely.

DES Appendix B: 15

EPA - Comment 14g

"And, finally, the comparisons given on p. B-12 are too simplistic. Nowhere is it stated that the effect of these materials depend on innumerable factors, e.g., exposure time, time between intake and effect, condition of the victim, and how the material acts in a biologic system. This should be corrected in the final statement."

FEA - Comment 2

"On page B-12, the median lethal dose of plutonium is compared with the lethal dose of other toxic materials. We suggest that this paragraph also point out that the projected death from the referenced dose of plutonium would result from cancer at some undetermined time after a latent period of approximately 15 years, but that death from the other toxins would occur within a short period of time."

ERDA - Comment 68

"We suggest that NRC staff may wish to reference Dr. J. N. Stannard's paper 'Plutonium Toxicology and Other Toxicology' in The Health Effects of Plutonium and Radium (Jee, W. S. S., ed.). J. W. Press, Salt Lake City, Utah (1976) pp. 363-372 rather than the B. L. Cohen reference. ERDA staff feels the suggested reference to be more current."

Staff Response - The toxicity section has been rewritten using Stannard's information. Both acute effects and carcinogenesis are included. The factors mentioned in the EPA comment have also been included.

DES Appendix B: 16

State of New York - Dr. John Gofman - Comment 3

"In Appendix B, page B-12 the DES refers to '...the median lethal dose of plutonium as 260 micrograms.' This statement is not only meaningless, it is grossly erroneous. The dose that guarantees a lung cancer fatality is 0.058 micrograms of Pu^{239} for cigarette smokers and it is 7.3 micrograms for non-smokers. Thus, for cigarette smokers, a dose 4483 times smaller than the DES will kill all humans, whereas the DES estimates their dose will kill 1/2 those exposed. Thus the DES is much more than 4483 times too low on plutonium toxicity. For non-smokers the amount required to guarantee fatality is 35.6 times lower than the dose DES calculates will only kill one half the exposed. Unless the Nuclear Regulatory Commission learns something of the true toxicity of plutonium, it is likely to continue to make such absurd statements as that on page B-12 that 'Although plutonium is certainly a potentially dangerous material, it is not orders of magnitude more potent than numerous other existing materials.'"

Staff Response - The values of 0.058 and 7.3 micrograms are based on Dr. Gofman's own unconfirmed analysis. Healy et al. (Ref. C-28, Appendix C) have examined Dr. Gofman's plutonium

lung cancer estimates in detail and concluded that "Gofman's speculations require the arbitrary acceptance of too many numerical parameters and unconfirmed mechanisms to be acceptable as even an approximate numerical estimate of potential lung carcinogenesis by plutonium." Several other reputable studies have also rejected Dr. Gofman's analysis (see Appendix C, Section C.6).

DES Appendix B: 17

EPA - Comment 14a

"The list of references should be more specific where appropriate when only one part of a book or one article in a collection is used. Other references need to give more information to be complete, such as numbers 5 and 12."

Staff Response - The list of references has been corrected.

DES Appendix C: 1

ERDA - Comment 29a

"Appendix C does not provide a deciphering code."

EPA - Comment 15

"The listing of incidents as presented is hard to follow since there are neither dates indicating when incidents occurred nor meanings of the abbreviations used. Such data needs to be included in the final statement."

City of New York - Comment 7

"The discussion of reported incidents involving transportation of nuclear materials is grossly inadequate. Appendix C, does not even contain an explanation of its codes. Nor is there any discussion of possible unreported incidents. Based on the DES's own figures, incidents in 1975 may well have doubled those reported in the four-year period 1971-1974 (IV-38), yet the risk assessment, which used the number of shipments projected for 1985 apparently relied on 1974 accident data."

Staff Response - The use of the information in Appendix C has apparently been misinterpreted: (1) No effort was made to project the effect of abnormal transport occurrences to 1975. (2) The listing of incidents in Appendix C includes incidents from the first 3-1/2 months of 1975. (3) It would be speculative at best to attempt to assess unreported incidents. The FES includes an explanatory section to accompany the data in Appendix C (FES Appendix F).

DES Appendix G: 1

State of New York - Dr. Marvin Resnikoff - Comment 24

"The sensitivity analysis presented in Appendix G of the DES covers a number of factors which can be varied for an examination of the range of effects on calculated impact. The 'theoretical basis' for this analysis is in equation (2). $\Delta I = dI/dX\Delta X$. This is an elaborate way of saying that, if the dependent variable (X) is changed by a certain amount (ΔX), ΔI will change on the basis of dI/dX. For the few variables analysed in this manner, none of the dI/dX components are presented and the methods and assumptions utilized to get them are missing as well."

Staff Response - The ΔI values are shown for a fixed variation of 10 percent in all X parameters that were analyzed. The text has been revised to clarify the computational method.

DES Appendix G: 2

State of New York - Dr. Marvin Resnikoff - Comment 26

"Assuming a linear dI/dX term, the 5.1% increase in baseline value (Figure G-2) would be increased by a factor of some 204%. Therefore LCF numbers would be doubled due to the four times greater density of population in the region at risk. The sensitivity of this parameter in the DES is contradicted by an uncontested affidavit filed by the State in its case against the NRC (Skinner and Wang, sworn to June 13, 1975). The affidavit shows that a 400% increase in population density would occasion a 400% increase in lung cancer fatalities (see Tables 1-9). The analysis of Annual Early Fatality Probability increases (DES Figure G-3) does not consider population density in such a way as to be meaningful in terms of figure V-13."

Staff Response - As discussed earlier, New York City is not a "representative" urban area because of its abnormally high population density. A 400 percent change in any parameter is not appropriate to a sensitivity analysis. Consideration of much higher population densities is included in the Final Environmental Statement.

DES Appendix G: 3

State of New York - Dr. Marvin Resnikoff - Comment 27

"This section in the DES on sensitivity analysis is totally inadequate, having failed to analyze those variables we have discussed herein and having further failed to consider other variables essential to a valid final impact assessment (e.g., shipments by barge, putting plutonium in 'bulk' form)."

Staff Response - Barge shipments are now discussed in FES Chapter 6, and "form" restrictions for plutonium were considered even in the DES, but not in the sensitivity analysis section. The number of parameters covered by the sensitivity analysis has been expanded in the FES.

8.5 DISCUSSION OF COMMENTS RECEIVED ON THE DRAFT FINAL ENVIRONMENTAL STATEMENT DATED FEBRUARY 1977

Dr. Karl Z. Morgan, ACRS Consultant

Comment 1

"My general impression of NUREG-0170 is that it is not an attempt to assess the effects on health and the risks of surreptitious diversion of fissile or radioactive materials during shipping, but rather an attempt to prove the effects on health and the risk of surreptitious diversion are completely negligible. Sometimes there is only a shade of difference in these two styles of writing, but the effect of one is concurrence and acceptance of the public and the result of the other is a challenge to the public to show the NRC is wrong. The job of the NRC would be easier if the public were made to believe NRC was simply stating the true facts and explaining their meaning. Nuclear energy could sell itself better sometimes without the aid of a salesman."

Staff Response - The assessments made on NUREG-0170 were performed in an objective manner. There was neither prejudging of the situation nor influencing of the results toward any particular conclusions.

Comment 2

"I do not believe this report treats adequately the long term problems of wide spread contamination of a city by plutonium and transplutonium following a major shipping accident. In Rocky Flats, Colorado, we have many square miles contaminated with plutonium above the 2.2 dpm level and this contaminated desert land is resulting in serious immediate and long-term problems. Not many persons would care to live in a building or make their home in a city that is badly contaminated with plutonium."

Staff Response - Decontamination costs attributable to transportation accidents are covered in Section 5.5 of NUREG-0170. Long-term effects on cities will be examined in the "Generic Environmental Impact Statement on Transportation of Radionuclides in Urban Environs" now being prepared by the NRC staff.

Comment 3

"I think a poor case is made for shipping plutonium and transplutonium material by air."

Staff Response - This Environmental Statement makes no attempt to promote any type or mode of shipping radioactive material. It presents facts about the current situation as it already exists.

Comment 4

"The cost comparisons for shipment via air, truck, train and barge are biased because of transhipments at each end. What would be the cost (in man-rem) were barge or train terminals

located at all nuclear facilities? In a proper comparison, I believe the man-rem cost by rail would be about 1/10 that by truck and the cost by barge would be about 1/100 that by truck."

Staff Response - The person-rem costs of rail, truck, and barge shipments are already quite small. A detailed analysis of alternative transportation modes is not justified by the small total dose.

Comment 5

"I would like to see the estimated saving in costs (in man-rem) were we to completely change our future nuclear power program and do the following:

a. Discontinue the LMFBR program for the present.
b. Establish large reactor parks over suitable bedded salt formations such that:
   1) High level waste would not have to be shipped
   2) Build converter (Pu ^{232}Th + ^{233}U) reactors at the parks
   3) Denature the ^{233}U with ^{238}U when it is shipped outside the park to reduce the risk of hijacking and diversion.
   4) Have proper isolation of these parks
   5) Several studies at Georgia Tech suggest Th-breeders are possible which would have a negative void coefficient in the coolant, and would have a doubling time much less than that of the LMFBR.
   6) Pu and trans-Pu elements would not be produced
   7) The problems of ^{232}U and ^{234}U production in the Th cycle are minor compared with the Pu problems.
   8) Of course, the parks would have fuel reprocessing and fabrication plants as well as power reactors (convertors and breeders)."

Staff Response - The suggested alternatives listed go far beyond the intended scope of this Environmental Statement. It is not possible to evaluate them within the constraints of the Statement.

Comment 6

"I think NUREG-0170 should have given more attention to the recommendation of the Special Panel to Study Transportation of Nuclear Materials and its report to the JCAE of Congress (December 17, 1974)."

Staff Response - All recommendations have been given the attention considered appropriate to the intent and scope of NUREG-0170.

Comment 7

"It was indicated by Mr. Hoppins (sic) in answer to my question that some of the shipping containers that were improperly designed and approved by the AEC (now NRC) are still in use under the grandfather clause. This presumably includes the C-10 industrial source shipping

container which occasioned the serious accident into Atlanta in which I became involved a few years ago. It was indicated that NRC places reliance on administrative control rather than upon safe design in these cases. I think this is a very serious situation because unless the operator is careful about what he is doing, the source will be pushed outside the C-10 shipping container where no shielding protection is provided. I think NRC must share responsibility for any accidents that result during the term of the grandfather clause because it (or the AEC) is responsible for this ridiculous design in the first place."

Staff Response - In the case of the container mentioned (C-10 container), the NRC has required it to be redesigned. The new design makes it impossible to misplace the source in the shield. In general, the Department of Transportation is phasing out the "grandfather clause" authority for using existing shipping packages.

H. M. Parker, ACRS Consultant

Comment 1

"I understand that it [the Environmental Statement] started in support of proposed rulemaking concerning air transportation of radioactive materials (Federal Register June 2, 1975). Such a study would have considered alternatives to air transport but only for such packages as a reasonable person would have contemplated sending by air as one option. That vital distinction has not been observed so that one immediately becomes involved with the whole gamut of transportation scenarios."

Staff Response - The scope of this study as originally presented in the Federal Register (June 2, 1975) dealt only with air transportation. Subsequently the scope was expanded to include all modes of transport, referencing those environmental studies that had already been carried out. These studies include the "Environmental Survey of Transportation of Radioactive Materials to and from Nuclear Power Plants, WASH-1238," and the "Assessment of the Environmental Impact of the FAA Proposed Rulemaking Affecting the Conditions of Transport of Radioactive Materials on Aircraft (Draft)" sponsored by the Federal Aviation Administration. The scope was broadened in response to public interest in the entire area of transporting radioactive material. This study does investigate alternatives to air transportation of radioactive material. Using data from a survey of shippers, it looks at the effect of shipping by land or sea those packages actually shipped by air. These alternatives are discussed in Sections 6.2.1, 6.2.2, and 6.2.3.

Comment 2

"They [shipment models] are so different from the earlier NUREG-0034 versions in number and activity that one wonders whether a third look would bear any resemblance to either -0034 or -0170 tallies."

Staff Response - The standard shipment model used in NUREG-0034 was based on limited data from interviews with the shipping industry, while the NUREG-0170 model is based on a comprehensive shippers survey conducted for the NRC.

Comment 3

"They [shipment models] contain packages whose 'hazard properties' are polar extremes."

Staff Response - Packages with very different hazards have been included in the analyses because they are the packages actually shipped. Differences in the degree of hazard have been considered in the analyses.

Comment 4

"In NUREG-0170 the so-called alternatives group all these classes together so that real differences between modes tend to cancel each other out."

Staff Response - Some of the differences do tend to cancel each other, but the study shows that the contribution from individual nuclides to the overall risk is too small to justify an individual analysis for each.

Comment 5

"The quoted differences in health effects for the various scenarios, are in my opinion below the uncertainty level of any of the calculations of risk and cost-effectiveness."

Staff Response - It is true that the health effects for the various scenarios differ by amounts less than the total uncertainty. However, other factors taken into account in assessing cost-effectiveness (shipping costs, for example) in some cases differ enough to establish whether or not the alternative is cost effective.

Comment 6

"I, for one, believe that air shipments should be limited to cases where speed is of the essence*--in practice, to the radiopharmaceutical case, where the public does accept a compensating social benefit. If that analysis had been made separately it would at once have been clear that innovative alternatives have not been included... one should make the alternatives for each generic type of shipment--not for all taken together."

Staff Response - Section 6.2.4 examines the effect of transporting all high-hazard dispersible material by land. All the remaining radionuclides shipped by air would then be less hazardous materials, mostly radiopharmaceuticals. Further detailed examination did not appear to be justified by the level of impact. In addition, the restrictions on shipments by air imposed by the Congress in the Transportation Safety Act of 1974 limited the available alternatives.

Comment 7

"Table IV-19 (p. IV-55) displays an annual individual dose to an airline passenger of 108 mrem... In view of the NRC's efforts to get reactor fencepost doses down to the range of 10

mrem/yr, casual acceptance of 108 mrem/yr for an unsuspecting passenger is incredible Surely the ALARA principle calls for reduction by about one order of magnitude."

Staff Response - This 108 mrem/yr figure, about the same as the natural background dose, was calculated as the maximum credible dose to any individual. It is not an expected dose to any real group of passengers. A more realistic figure is the 0.34 mrem calculated as the average annual dose to airline passengers from radioactive material shipments. An average dose of this size does not justify relocating radiopharmaceutical facilities, adding shielding, or radically changing the distribution system. Implementing the ALARA principle requires detailed consideration of such factors as economic and social impacts. We do not feel such a detailed study is justified by the small average exposure or by the estimated maximum dose.

Comment 8

"As examples, let it be assumed that estimated doses from air shipments are too high. Then, at the source of the transportation web, one must analyze the merits of radiopharmaceutical preparation at more and better chosen locations. Upon loading on planes, one must consider packaging with one thick shielding face under the passengers instead of conventional equal shielding on all sides.

"At the natural terminals, usually large cities with clustered hospitals, one must examine the possibility of underground tube delivery, and so on."

Staff Response - The small impact from transporting radiopharmaceuticals does not justify the effort necessary to investigate redesigning the distribution system.

Comment 9

"Genetic effects are excluded on the grounds of scarcity of information. Curiously, this is one area in which there is essential agreement on a dose and dose-rate effect. There is no real way to add genetic effects and cancer fatalities on a common scale, but some arbitrary allowance has to be shown."

Staff Response - Genetic effects are now quantitatively considered in NUREG-0170.

Comment 10

"There is much more scarcity of information on the somatic side than is reflected by an LCF Index of 121.6 per 10^6 person-rem. The implied precision for a number that may be 12 (or even zero) on the one side or perhaps 600 on the other side is entirely out of place."

Staff Response - The 121.6 figure, although perhaps overly precise, is the value implied by the "Reactor Safety Study" (WASH-1400).

Comment 11

"The best efforts of NRC to set dollar indices such as $1000 per person rem, or $8 million per LCF simply cannot be accepted."

Staff Response - The $1000 per person-rem figure is one established by United States Government agencies and reflects the best available data. The figure of $8 million per LCF is derived from the $1000 per person-rem figure and the 121.6 LCFs per 10^6 rem figure discussed in FES Section 3.7.

Comment 12

"Some of the basic dosimetry equations need better support. Even the point source formulation

$$\frac{Ke^{-\mu D}B(D)}{D^2}$$

where μ is some formal absorption coefficient and B(d) is a Berger build-up factor is arbitrary. The relevant absorption factor is rarely well known and the build-up factor is both empirical and terrain-variable. What is known is the total energy emitted from any well described source. Then, the integration of energy absorption over all space would demonstrate the appropriateness of the combinations of μ and B(d) used.

"In the integration of dose at a point from a source moving uniformly in a straight line, we have mathematically the same issue as dose at a point from a uniform line source, the familiar Sievert equations published in Acta Radiologica in 1928. Formal demonstration of this equivalence would have improved confidence in the result.

"In the second stage of double integration as in Fig. D-2 of p. D-4, the same result should be obtained by integrating the dose from an infinite disc of radioactive material (also a familiar Sievert equation) as the receptor moves uniformly across a diameter."

Staff Response - Although we did not recalculate the dosage results using the Sievert equations or energy considerations, we have established that the methods suggested by this comment do support the results of this study. A summary of the NRC staff calculations is available in the NRC Public Document Room in Washington, D.C.

Environmentalists, Inc

Comment 1

"The impact of transporting radioactive nuclear materials associated with nuclear weapons is excluded."

Staff Response - The relation of benefits to impacts for transporting nuclear weapons is evaluated on a different basis than that for transporting other radioactive material. The Atomic Energy Act of 1954, as amended, exempts nuclear weapons from licensing and other regulatory controls. Thus their transportation is not within the scope of this study.

Comment 2

"Accidental releases are not among the factors included in the models used to calculate radiation dose predictions. The long-term detrimental environmental impact from a major transportation accident, such as an unplanned release of radioactive materials, is not included in the models used to calculate radiation dose predictions. The pathways by which such radioactive releases might continue to increase the public's exposure to radiation are not considered."

Staff Response - Accident releases are included in the dose predictions of Chapter 5.

Comment 4

"The increase of radiation exposure to the public and to workers at those points where delays in shipment occur are not included as part of the model calculations, i.e., on highways, in rail, air, and barge transport, during switch operations in freight yards, and at transfer points."

Staff Response - The average transit times for all modes include allowances for reasonable delays. Specific cases have been analyzed for some modes.

Comment 5

"The failure to calculate radiation exposures with consideration for the converging of transportation routes to one central point is conspicuous."

Staff Response - Specific routing was not included in this Generic Environmental Study but will be included in the Urban Study now being prepared. Nevertheless, estimates of the total cumulative dose to the population have been made, and the risk from that exposure has been assessed. Thus the overall environmental impact of the convergence of routes has been evaluated.

Comment 6

"The study fails to include an estimate for the releases that might result during hijacking, theft, and other terrorist activities."

Staff Response - Consequences of terrorist activities are qualitatively treated in Chapter 7, which covers Safeguards.

Comment 7

"There is an absence of any evaluation of genetic damage resulting directly from transportation activities or indirect damage to the gene pool from such activities."

Staff Response - Genetic effects are now quantitatively treated in Section 3.7 of NUREG-0170.

Comment 8

"The study fails to reveal whether or not the 'No Threshold/Linear Hypothesis' is utilized in assessing the impact on public health. Any amount of man-made radiation is damaging and is an added harm over and above the harm done by natural radiation."

Staff Response - Use of the "Linear Hypothesis" in the Study is clearly stated in Chapter 5, which says:

> "...we do not intend to give the impression that we believe thresholds exist for the onset of radiation effects. Both for the accident case and under normal operational conditions, it is presumed that radiation damage varies linearly with exposure."

Comment 9

"The study fails to prepare a number of models which would be relevant to special areas. Many vicinities will be receiving radiation exposure from a number of sources: nuclear power plants, waste handling facilities, weapons operations, etc."

Staff Response - Environmental impacts from radioactive material in any particular location are the sum of those from this study and those from specific facilities in the vicinity. Although the risk from exposure to persons living in specific areas has not been evaluated, the total cumulative dose to persons from all transportation activities has been evaluated.

Comment 10

"The study fails to take into account the varying qualities of rail points in existence on the various routes proposed."

Staff Response - This Generic Study looks at the average impacts of rail transports. It does not aim at evaluating specific routes.

Comment 11

"The defects in calculating and assessing the effects of radiation exposure due to the transport of radioactive materials make the existing report practically useless. Environmentalists, Inc., is most concerned about transportation activities associated with the various

Barnwell facilities. The Barnwell area will be the terminal of many transportation routes. The population will be exposed to radiation not only from numerous shipments, but will be exposed to accidental and normal releases from the Savannah River Plant, BNFP, converging transportation routes, Chem Nuclear waste handling, nuclear submarine base, nuclear power plants --- including leaks to the drinking water. NUREG-0170 will be of small value in assessing the environmental impact of the Barnwell operations."

Staff Response - Environmental impacts from transportation associated with particular facilities are covered in the Environmental Statements associated with those facilities.

Comment 12

"We question the use of taxpayers' money for a report which appears to have little if any use. The report does not follow the provisions of NEPA. The alternative section does not include discussion of the possibility of not transporting nuclear materials nor the alternative of halting the use of nuclear energy. The cost-benefit analysis fails to quantify many of the transportation costs and some are not even listed."

Staff Response - This environmental impact assessment and statement was prepared to be a basis for deciding on the adequacy of existing regulations governing the transportation of radioactive materials. In this country there are medical, industrial, and commercial activities involving the transportation of radioactive materials. The statement treats alternative modes for such shipments but does not consider the alternative of stopping the shipment of radioactive materials entirely. That alternative could only be considered in the far broader context of evaluating whether any medical, industrial, or commercial use of radioactive material should be permitted. That vastly broader consideration is completely outside the scope and purpose of this statement and beyond the NRC's expressed intent to review its regulations to determine what changes, if any, should be made.

Comment 13

"Environmentalists, Inc., regrets not having had the opportunity to make initial comments on NUREG-0034. However, since NUREG-0170 appears to have such little merit, we anticipate a redundant study for the purposes of licensing the Barnwell facilities."

Staff Response - The licensing of the Barnwell facilities requires a separate Environmental Statement. This study was not intended to replace or remove the need for such a specific statement.

Georgia Public Interest Research Group

Comment 1

"G-Pirg's chief concern with the Final Draft Environmental Statement is with the adequacy of treatment accorded coordination between State and Federal Authorities. There are twenty

Federal and State agencies that could be called upon to act in the event of an incident. The instant document does not adequately deal with this problem."

Staff Response - NUREG-0170 assumes that authorities respond to transportation incidents involving radioactive material in the same way they respond to other transport incidents. No special response to radiological incidents was included in the model. There is a totally independent Federal interagency program as well as several State studies on responding to radiological incidents.

Comment 2

"The New York Department of Law asked similar questions in a letter to NRC dated May 17, 1976. The NRC failed to sufficiently address the issue. For example, there are no regulations or plans for communications equipment or frequent contact between local law enforcement agencies along truck routes (see VII-10). Nor does NRC's answer deal with distances, transportation, or communications between airports (see VII-11) or with regulations concerning 'airport security personal' (sic) as stated in VII-11, or airplane security personal (sic)."

Staff Response - The May 17, 1976, letter from the New York State Department of Law has been answered in Chapter 8 of NUREG-0170. Communications requirements for safeguarded shipments are described in Section 8.4 of NUREG-0170, as well as in 10 CFR Part 73.

Comment 3

"G-PIRG also feels that the FES should have focused more attention on the issue of financial responsibility in the event of an incident. Will the costs be borne by the agencies involved or by the carrier? If by the former, how would the liabilities be apportioned?"

Staff Response - Costs that may be involved in accidents have been estimated as environmental costs. Although the apportionment of financial responsibility may have an effect on the way people respond to an environmental impact, the source of the funds is not pertinent to this study. An analysis of financial responsibility is therefore not included in this Statement.

Comment 4

"G-PIRG also feels compelled to ask who is responsible for the planning and approving of routes and times of travel and for the notification of checkpoints. These activities are vital in the effort to reduce the risk of incidents. Again, these questions are not sufficiently dealt with in the FES."

Staff Response - The regulations of neither DOT nor NRC specify routing, times of travel, or (except for safeguards purposes) notification of checkpoints. Although some local restrictions may be imposed on routing and time of travel, these have little overall effect on transportation. Therefore, no discussion of responsibilities for them was considered necessary. Alternatives to current practices are analyzed in Section 6.3, "Alternatives Introducing Operational Constraints on Transport."

Comment 5

"Finally, G-PIRG cites the NRC for not confronting the potential problem of non-compliance. It is naive to assume that the regulations will be followed merely because they exist. We are mindful of the Brown's Ferry incident. G-PIRG also submits that it is extremely unwise to accept 'industry practices' as assurances of compliance."

Staff Response - An analysis of incidents from 1971 to 1975 is included in Section 4.6. This includes incidents caused by defective or improper packaging.

Comment 6

"In conclusion, we feel that the potential dangers of transport of radioactive materials are great enough to warrant an unhurried and careful consideration of all the issues and ramifications. These risks are particularly acute to Atlanta and to Georgia because of their location at the crossroads of America's transport links and because of their proximity to the Barnwell Nuclear Reprocessing Plant. In light of this, G-PIRG urges more thorough attention to the issues addressed in this paper and to the convening of another public meeting in Atlanta concerning NUREG-0170 with proper advance notice to all interested parties."

Staff Response - NUREG-0170 is the most comprehensive analysis of the environmental impacts of transporting radioactive material thus far produced. The public will be invited to participate directly in any decisions on conclusions drawn from this study. A more detailed study of transporting radioactive material in cities is now being prepared by the NRC Staff.

The Georgia Conservancy (Letter of February 1977)

Comment 1

"It is self evident that a generic statement such as this is inadequate to meet the needs of specific areas of the Nation where a concentration of nuclear facilities or a convergence of transportation routes to such facilities create circumstances demanding independent and detailed treatment. This is particularly true of Georgia, where the presence of the Savannah River Plant, Chem-Nuclear low level waste storage facility, Barnwell Nuclear Fuel Reprocessing Plant, together with the proposed Posiedon Base at Kings Bay, nuclear reactors, weapons systems and weapon components within the State, medical radio-pharamaceutical, industry, etc., will funnel a disproportionate shore of hazardous nuclear materials through Georgia's rails, highways, waterways, and airways. A separate Environmental Impact Statement incorporating the aggregate and cumulative effect of such activities is a minimal requirement of the understanding and protection of those asked to accept and support their existence. We need a comprehensive study of precisely what is moving through and to our State now, and a projection for 1985 and beyond."

Staff Response - It was not the intention of this study to investigate impacts to specific areas. NUREG-0170 assesses environmental impacts on the nation as a whole. Each licensed

facility is required to evaluate in a separate NEPA statement the specific environmental impacts it causes.

Comment 2

"The cost for land reclamation of a radiation accident site is stated to "exceed $200 million" in the Summary and Conclusions. However, Table V-14 shows the cost of decontamination being as high as $8.21 billion which is 40 times as much cost. We therefore find it materially misleading to include only the lower figure in the summary statement."

Staff Response - The Summary and Conclusions section has been revised to more accurately reflect the data from the body of the report.

Comment 3

"...the possible costs resulting from a radiation transport accident are enormous. It appears that insufficient attention has been given to the question of who will be responsible for absorbing these costs and their financial ability to pay. It is questionable that the shipper would be able to cover such costs and the State of Georgia should certainly not be required to bear the responsibility for reclamation and decontamination. What provisions have been made for assurances that these costs are paid? Will the Federal Government be prepared to cover such costs? Through what mechanism?"

Staff Response - Although financial indemnity and insurance coverage may affect the way people respond to an environmental impact, they do not directly affect the impact itself. Analyses of these factors is therefore not included in this statement. Information on insurance coverage can be obtained from the following:

> Joint Committee on Atomic Energy-HR-8631, "NRC Staff Study Concerning Financial Protection Against Potential Hazards Caused by Sabotage or Theft of Nuclear Materials," Appendix D, "To Amend and Extend the Price Anderson Act," Part IIB, "Geographic Limitation on Coverage."

Comment 4

"It's apparent that the accident risks and health effects due to a given accident are directly tied to the frequency of shipments and routes of transport. The full impact of radioactive transport on the State of Georgia or communities in the State cannot be fully assessed without adequate information on these factors.

"Is information on the projected frequency and routes of shipments available to the State of Georgia and concerned citizens?

"It is imperative that the State be provided with advance notice of radioactive shipments and that the State be given the option of prescribing acceptable routes and times of transport.

"It is our understanding that the State of Florida is already pursuing this option.

"Is there provision for Georgia to exercise this right?"

Staff Response - This Generic Study analyzes no specific cases. Frequency and routing information about radioactive material shipments is not available from this report. An ongoing study of transportation in urban areas is developing methods to model this information. Under contracts with NRC and DOT, several states have been inspecting the transportation activities within their borders. Also, legislation on preemption of regulations "inconsistent" with DOT regulations has recently been put into effect. Specific questions on the States' role in regulating radioactive material transportation should be addressed to the United States Nuclear Regulatory Commission, Office of State Programs, Washington, D.C. 20555.

Comment 5

"The magnitude of health effects following a radioactive transport accident will obviously depend to a large degree on what immediate action is taken at the accident site to minimize these effects.

"Has an established procedure been developed for handling such an event and have responsibilities for specific activities been fully defined?

"For example, who will be responsible for radioactive monitoring, for evacuation of adjacent areas, for retaining contaminated people at the site, for decontamination of the accident site?

"We question whether there are even adequate medical and personnel decontamination facilities in Georgia to handle victims of such incidents.

Staff Response - This Study considers the average response to incidents, not specific cases. The question of responsibility for accident response is partially answered in NUREG-0179, "Regulatory and Other Responsibilities as Related to Transportation Accidents," June 1977. Specific response actions are the subject of an ongoing NRC study of emergency response to transportation incidents. Also, both the Western Interstate Nuclear Board (WINB) and the Southern Interstate Nuclear Board (SINB) have carried out study programs and developed proposed plans on accident response.

Comment 6

"We question whether all reasonable alternatives have been considered to reduce the environmental effects of radioactive transport. For example, the alternative of limiting the amount of radioactive material transported should be addressed. This would include limiting the number of nuclear power plants in the country to those now in operation or under construction. This would significantly reduce the risk of adverse environmental effects due to transport, and particularly in Georgia, it would help to minimize the amount of nuclear materials transported across the State to and from the Barnwell, South Carolina Reprocessing Plant."

Staff Response - We have examined a cross section of reasonable alternatives in the transportation system. Questions of altering the types or quantities of radioactive materials transported are beyond the scope of this study, which analyzes the impacts of transporting the present types and amounts of material.

Comment 7

"Spent fuel shipments are specifically exempted from physical protection requirements of 10 CFR Part 73. No discussion of special precaution or less rigorous methods of protection proportionate to the risk are discussed. The rupture of a cask is a stated possibility, resulting in a total of 244 predicted deaths (page VII-2). A consequence of this magnitude (or worse, should the cask fall in a water supply for example) merits more serious consideration of escorts or other appropriate types of safety precautions."

Staff Response - The type of rupture referred to in this comment is a hypothetical result of an act of sabotage. Actually, far fewer fatalities would be expected, and they would be delayed and spread over a period of decades. We believe the absence of immediate fatalities make spent fuel shipments a relatively unattractive target for sabotage.

Comment 8

"The final conclusion of Section VII dealing with special nuclear materials, states that 'alternative means of protection --- are neither necessary nor desirable for the protection of privately owned materials.' Apart from the highly debatable merit of this conclusion, a more profound question which should be addressed is 'What are materials such as these (which have the potential for cataclysmic harm to society in a variety of ways) doing in private ownership to begin with?'

"It seems to us that there is a substantial question as to whether bomb grade material should be introduced into the general stream of commercial traffic."

Staff Response - Private ownership of special nuclear material has been authorized by Congress. Weapons grade material is not in the general stream of commercial traffic. Virtually all of it is transported by the U.S. Government. All such material is transported with special safeguards beyond those used in normal commercial transport.

Comment 9

"Table VI - 2 sets forth the economics of rail and truck shipments of spent fuel. Do the 'costs' include the costs to the State for road damage and maintenance (particularly for overweight shipment), bridge strengthening where needed, increased police coverage and special equipment, if necessary? Who bears these costs? Sec. 168 of the AEC Act of 1954, as amended, and Sec. 91 of the Atomic Energy Community Act, of 1955, as amended, provide a specific statutory mechanism for the evaluation and determination of the need for financial assistance to local entities which may be affected by ERDA activities.

"Would these or similar costs imposed by any of the various modes of transport comtemplated by this statement qualify for relief under these provisions?"

Staff Response - Cost-per-shipment data in NUREG-0170 include State and local licensing fees, which go to support maintenance and road repairs. Provisions for reimbursement of costs as described are not within the purview of this study.

Comment 10

"On Page XXV of the Detailed Summary as one of the long term positive results from the shipment of radioactive materials the assertion is made that the use of nuclear fuels in reactors allows production of electricity for society with lower costs than is possible by more conventional methods of generating electricity.

"Statements like the above have for far too long accompanied cost benefit assessments. To state it now, without qualification or supporting data, in the light of increasing numbers of critical analyses which arrive at contrary conclusions, is simply inexcusable.

"This is particularly true when it is characterized as a 'long term' benefit, implying either (1) an adequate supply of uranium for the indefinite future, (2) the acceptability of plutonium recycle, (3) and/or the economic and environmental viability of a breeder reactor, none of which has or can be demonstrated at the present time."

Staff Response - This statement is based on the best available information.

The Georgia Conservancy (Letter of March 4, 1977)

Comment 1

"Among the final matters dealt with by the Committee was the question of what consequences might reasonably be expected as a result of a successful 'diversion of special nuclear materials,' a question wholly omitted in the Statement itself.

"The ultimate consequence of a successful theft of bomb grade materials, or any major credible catastrophe which might occur anywhere in the commercial fuel cycle [is not covered]. Such an assessment should address not just the immediate economic or biological effects of such an occurence as this statement does, but the predictable events which are likely to ensue, including the possible shutdown of the industry and the attendant disruption in our economy and other major effects (on our foreign policy for example). Alternatively, if the plants are not closed, what effect on public and worker morale? And to production costs if more stringent safety features were demanded?"

Staff Response - NRC efforts are directed at preventing the success of any attempted diversion of special nuclear material, rather than at controlling the consequences of the act. Therefore, an evaluation of the consequences of a diversion is felt to be unnecessary. A brief

description of the potential impacts was included in the Draft Statement, NUREG-0034, as Appendix F.

Comment 2

"A clarification of language using plain english rather than terminology which tends to obscure fact or meaning.

"First we would suggest that euphemistic terms like 'special nuclear materials' and 'diversion' be deleted entirely from any communication which is intended to enlighten or edify. 'Special nuclear material' means bomb grade material and 'diversion' means theft. It does not change the nature of a substance or an act to call it something else. The literature of this industry and the agencies governing it is replete with similar efforts to obscure reality. Please stop it. Learn to tell the truth in a fashion that can be understood and dealt with."

Staff Response - Congress originated the term "special nuclear material" in the Atomic Energy Act of 1954, including not only weapons grade material, but also nonfissionable plutonium, enriched uranium, and other materials enriched in plutonium or certain uranium isotopes. Most special nuclear material is not weapons grade material; to label it as such would be incorrect and misleading. The term "diversion" is used rather than "theft" because "diversion" is a more general term that more accurately covers the possible occurrences. Theft connotes an unauthorized removal of another's property, while diversion can be any unauthorized use of the material. Thus the two terms are not quite synonymous.

Comment 3

"In the NRC spokesman's formal presentation on the threat of 'diversion,' in the following sequence we understood him to say first that 'it is impossible to quantify the threat' and later on to state that 'any mode of transportation can be protected against any level of threat.' Those two statements are totally inconsistent. More importantly, they reveal an attitude, a 'way of thinking' as the Chairman expressed it, which in our opinion has characterized the Government's role in the nuclear industry from its inception, and accounts in large part for the growing mistrust and resistance on the part of the public to continued or increased reliance on nuclear power as the sine qua non of our economic existence."

Staff Response - We believe sufficient resources can be assembled to protect a shipment against any level of threat. Quantification of the threat in terms of expected attacks per year, or assigning probabilities to shipment attacks is not necessary for preventing their success. A review of the transcript of the February 1977 ACRS briefing on NUREG-0170 did not reveal the statement "...it is impossible to quantify the threat." However, a qualitative assessment of the safeguards necessary to protect a shipment does not require assigning a numerical value to the threat.

Comment 4

"The specific question addressed briefly in this proceeding were the probabilities and consequences of theft of bomb grade material. We suggest for your consideration that history

supports the view that any human endeavor whose success depends upon achieving 'zero defects' is doomed to failure. Recent examples in the realm of technology are the Apollo and SNAPS programs. A similar failure in the field of 'anthropology' is exemplified by the actions of Mr. Nixon's staff."

Staff Response - Security in the transportation of radioactive materials is not dependent on "zero defects." Protection lies in the small chance of success in an attempted diversion and in the very small probability of an attempt.

Comment 5

"We further suggest that any serious effort to achieve zero probability of failure, whether technological or anthropological, will, in itself, incur unprecedented costs to our society. Financially, power companies are already chafing under the escalating capital costs of nuclear facilities which knowledgeable critics proclaim to be still not safe enough. Societally, you gentlemen calmly discussed the introduction of guards armed with automatic weapons to traverse Amercia's expressways - a profound 'environmental impact' upon our society, we should say. We urge you to reflect upon it.

"The price already paid or incurred to generate electricity in this way is far greater than that which appears in any cost-benefit analysis. The more we seek to attain zero defects the more the price will rise.

"And we have no choice but to seek it, for the consequences of a major failure, whether it be a transportation accident, a successful theft, or any other mode, though not infinite would surely be intolerable. With costs in the billions, and fear of repetition rampant, regardless of who pays what to whom, what do you think would happen? Do you think it would end there? Would a new Rasmussen study placate the public?

"And suppose it happens when 20% - 40% of the electrical power of the United States is generated by nuclear fission and you are the President? What do you do?

"It seems to us, as it has for a long time now, that, in dealing with the nuclear questions we will remain torn between intolerable risk and intolerable cost."

Staff Response - We agree that to achieve a zero probability of failure would be very difficult. But the target is achieving a very high probability that there will be no successful diversion of special nuclear material. The safeguards program exists because of the chance of an attempted diversion and the magnitude of the possible consequences. Questions on probable U.S. policy in the event of an accident are beyond the scope of this Study.

Comment 6

"Nuclear power generation has already distorted our judicial system in a variety of ways. Most notably, the ancient doctrine of tort law creating liability to innocent third parties for

harm done them by a negligent act has been laid aside to accommodate the growth of this particular industry and for none other.

"Less obviously, but perhaps even more importantly, scientific dissent is quelled, not encouraged, as it properly should be in the search for truth. William Rowe, a ranking official of the Environmental Protection Agency, recently responded to a question on this topic by stating that no effort was made to discourage dissent 'except, of course, when it is contrary to departmental policy.'

"This EIS is inadequate in failing to consider the above questions. They are being discussed in other forums. As a presidential candidate addressing the Washington Press Club, Mr. Carter predicted that a major reactor accident would mean the end of the nuclear power industry. Dr. Lynn Weaver head of Georgia Tech's Nuclear Engineering Department has expressed the same opinion. Countless others share this view. Clearly, it is a credible consequence of any major nuclear disaster, including theft or transportation accident, and should be included in any responsible overall assessment of acceptablility. Adequate notice and availability of subject matter to all interested parties in timely fashion."

Staff Response - Neither the effect of nuclear power on our judicial system nor the quelling of scientific dissent are within the scope of this statement. Demise of the nuclear power industry is not considered to be a credible consequence of an attempted theft of special nuclear material or a transportation accident.

Comment 7

"Civilian guards armed with automatic weapons. What effects, subtle or overt, on travelers sharing the expressways and the general public? What specific instruction to the guards as to their response in a wide range of potential encounters, both real, or as they may be perceived by the guards in a sudden and unexpected confrontation: What quality of individual is contemplated to be recruited and trusted to bear these weapons? What program of indemnification and financial responsibility on whose part for error in selection, training, supervision or performance?"

Staff Response - NUREG-0170 neither assumes nor advocates automatic weapons for civilian guards. For many years ERDA shipments of special nuclear material have been made on public highways with armed escorts, with no discernible effect on the general public. Thus the civilian safeguards program, based on this ERDA experience, is expected to have no significant effect on the public. Specific responses and indemnity questions are not among the topics analyzed by this Study.

Comment 8

"What surveillance systems are specified and in place to identify and monitor potential threats to transportation of nuclear materials? The statement was made that there are no known groups who have the motivation and capability to successfully divert bomb grade materials. Who

made that determination? The FBI? The CIA? The NRC? Is the dollar cost of acquiring and maintaining such information charged to the public generally, or is it internalized and accounted for in the cost-benefit analysis? Apart from financial cost, what loss of freedoms is likely to occur to individual citizens? Will there be increased numbers of phone taps and similar encroachments on privacy deemed necessary to adequately protect these materials? Will the need to protect them result in the successful passage of legislation such as that proposed in the State of Virginia to grant to the Virginia Electric and Power Co. a variety of police powers?"

Staff Response - Information about possible threats to special nuclear material shipments is furnished to the NRC by all U.S. intelligence agencies that gather such information. Among the agencies that have worked with the NRC on the safeguards program are ERDA, the FBI, the CIA, the Department of Defense, and the Department of State. Financial and social impacts of intelligence gathering are not within the purview of the Environmental Study.

Comment 9

"What additional effects can be expected in our judicial and political systems to protect and encourage nuclear power generation? We have identified the abandonment of tort liability, the repression of dissenting opinion, and the extension of police powers to private firms. Will the states be preempted by the Federal Government from a voice in nuclear plant siting and the regulation of nuclear materials transported within their borders? Is that good or bad? Who decides? These are not frivolous questions and they are not adequately considered (if addressed at all) in the Final Environmental Impact Statement. We think they should be."

Staff Response - These topics are beyond the scope of this Study.

State of New York - Department of Law

Comment 1

"Pursuant to the Notice of Availability of the above-referenced Draft Environmental Impact Statement ('DES') published at 41 Fed. Reg. 12937 and the solicitation of comments on that DES as contained in the Notice of Availability, the New York State Attorney General submitted a series of comments on the DES. It was noted in the Attorney General's filing of May 17, 1976 that the DES did not address the issues set forth in the materials previously submitted by the office to the NRC in the course of this administrative proceeding on transportation of nuclear materials as originally noticed in the Federal Register. 40 Fed. Reg. 23768 (June 2, 1975). More specifically the DES did not address the materials submitted by way of this office's letter, dated July 2, 1975, which letter and materials are apparently on file in the Commission's public docket room.

"It has been brought to our attention that, as with the DES, the unreleased final environmental impact statement ('FES') ignores the above described materials and, in part, subsequent filings."

Staff Response - The comments in this and previous letters concerning the June 2, 1975, "Advance Notice of Rule Making Proceeding" will be considered in the course of that proceeding. Neither the DES (NUREG-0034) nor the FES (NUREG-0170) treats those topics.

Comments received on the DES were considered in the preparation of the FES.

Comment 2

"In addition, we have been informed that certain comments are dismissed as being based on 'unconfirmed analysis.' Such a response to the comments, calculations and estimates of this office is meaningless and displays a failure by staff to resolve factual disputes. All the comments and supporting materials filed by this office must be responded to in a thorough manner in order for the Commission to comply with the Guidelines of the Council on Environmental Quality under the National Environmental Policy Act, 42 U.S.C. K 4321 et seq. It is particularly appropriate for the Commission to attend to this matter now in view of its recent decision to have the FES redrafted."

Staff Response - The dismissal of comments about the "hot particle" and "enhanced risk to smokers" models for plutonium health effects is based on their lack of acceptance by the medical and health physics communities and on the conclusions of an extensive NRC staff study.

APPENDIX J

COMMENTS ON THE DRAFT ENVIRONMENTAL STATEMENT

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DOCKET NUMBER
PROPOSED RULE PR-71.73 (40 FR 23768) (72)
Transportation of Radioactive Mtl by Air
(Revised)

STATE OF NEW MEXICO

Environmental Improvement Agency

P.O. Box 2348 - Room 215
Santa Fe, New Mexico 87503

Guy A. Arlotto, Director
Division of Engineering Standards
Office of Standards Development
United States Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Arlotto:

We have reviewed the Draft Environmental Statement on the transportation of radioactive material by air and other modes, and we see no conflict in the conclusions.

Thank you for the opportunity to comment.

Yours truly,

Charles A. Marquez

Charles A. Marquez
Environmental Planner

DOCKETED USNRC
MAY 10 1976
Office of the Secretary Docketing & Service Section
ors

DOCKET NUMBER
PROPOSED RULE PR-71.73 (40 FR 23768)
Transportation of Radioactive Mtl by Air (Revised)

HEALTH SAFETY WELLBEING COMFORT

STATE OF NEW MEXICO

Environmental Improvement Agency

PERA Building - Rm. #215
P.O. Box 2348
Santa Fe, New Mexico 87503

SPECIAL PROJECTS SECTION

April 21, 1976

DOCKETED USNRC
MAY 10 1976
Office of the Secretary
Docketing & Service
OR

Mr. Guy A. Arlotto, Director
Division of Engineering Standards
Office of Standards Development
United States Nuclear Regulatory
Commission
Washington, D.C. 20555

Dear Mr. Arlotto:

We have reviewed the Draft Environmental Statement on transportation of radioactive material by air and other modes. We have no additional comments to offer.

In our opinion this draft complies with the spirit and intent of the National Environmental Policy Act of 1969.

Sincerely yours,

Dick Burgard
Environmental Program Manager

DB/mtm

DOCKET NUMBER
PROPOSED RULE PR-71,73 (40 FR 23768) (14)
Transportation of Radioactive Mtl by Air (Revised)

FEDERAL ENERGY ADMINISTRATION
WASHINGTON, D.C. 20461

APR 30 1976

OFFICE OF THE ASSISTANT ADMINISTRATOR

FEA 76-86

DOCKETED USNRC
MAY 10 1976
Office of the Secretary Docketing & Service Section

Mr. Guy A. Arlotto, Director
Division of Engineering Standards
Office of Standards Development
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Arlotto:

In response to your request for review of the draft environmental impact statement (EIS) on the Transportation of Radioactive Material by Air and Other Modes (NUREG-0034), we are providing the following comments.

The "Standard Shipments" used in assessing potential environmental impacts include plutonium, but do not include enriched uranium. Although the concern expressed during the past year by public officials and others about the air shipment of special nuclear material has emphasized plutonium, uranium has not been excluded. If the NRC is able to certify to the Joint Committee on Atomic Energy (JCAE) that a safe container for plutonium has been developed and tested which will withstand the crash of a high-flying aircraft, the public concern over air shipments could shift to enriched uranium. Accordingly, we suggest that low enriched uranium typically used in light water power reactors be included in the "Standard Shipments" analyzed in NUREG-0034.

On page B-12, the median lethal dose of plutonium is compared with the lethal dose of other toxic materials. We suggest that this paragraph also point out that the projected death from the referenced dose of plutonium would result from cancer at some undetermined time after a latent period of approximately 15 years, but that death from the other toxins would occur within a short period of time.

We hope that these comments are useful to you in preparation of the final EIS.

Sincerely,

Roger W. Sant
Assistant Administrator
Energy Conservation and Environment

MAY 17 1976
Office of the Secretary
Docketing & Service
Section

DOCKET NUMBER
PROPOSED RULE PR-71.73 (40 FR 23768)
Transportation of Radioactive Mtl by Air (Revised)

FRIENDS OF THE EARTH 72 JANE STREET • NEW YORK, NEW YORK 10014 • (212) 675-5911

Friends of the Earth would like to submit the following comments on the Draft Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes (NUREG-0034, U.S.Nuclear Regulatory Commission Office of Standards Development, March 1976)

- - -

Summary & Conclusions, p.v, para.3

The draft environmental statement refers here to air transport as an "effective means of protection"against theft and sabotage of radioactive materials. We strongly disagree. Sabotage of aircraft could lead to a crash and fire and possible dispersal of radioactive materials. Air transport is therefore not an alternative to ground modes of transport since it offers additional potential for such dispersal, in fact triple potential, through aircraft malfunction, pilot error, or sabotage. In our opinion, air transport is the least acceptable and by far the most risky of all transportation modes. Rather than offering an "effective means of protection", it offers instead a wider variety of possible events that could result in dispersal of radioactive materials.

Detailed Summary, p. xix, para.2

We take issue here, as elsewhere, with the reprehensible practice of averaging radiation exposure over large populations and thus submerging individual health effects. This averaging is misleading in that it infers lower radiation releases than actually occur; it also ignores the very real health effects, short- and long-term, on the individual who is unfortunate enough to contract cancer or leukemia, suffer genetic mutations, or give birth to a deformed infant. For this individual the risk is one, e.g. certainty.

One could compare this habit of averaging to the argument used by nuclear proponents in trying to refute public concern over plutonium toxicity. These individuals denigrate public concern by saying that perfectly uniform dispersal and ingestion of plutonium oxide is highly unlikely and therefore we should not worry about plutonium releases. Here, however, it is the NRC that is guilty of assuming - for their own purposes of underplaying the seriousness of radiation releases - that radiation resulting from an accident will be uniformly dispersed and uniformly received by vast populations numbering in the hundreds of thousands, even millions. Nuclear opponents and critics have never assumed such perfect dispersal, and we therefore insist that the NRC not make a similar assumption, and discontinue its use of the term man-rem.

p.xx, para. 2

We refer the NRC to the affidavits of Drs. John Gofman, Marvin Resnikoff and Karl Z. Morgan, prepared for the New York State Attorney General in his lawsuit against the U.S. government to halt air shipments of plutonium. The above are leading scientists with expertise in plutonium toxicity and dosimetry; the NRC figures of one fatality and dixteen latent fatalities are unsubstantiated by any expert studies or data and therefore indefensible.

(more)

FRIENDS OF THE EARTH 72 JANE STREET • NEW YORK, NEW YORK 10014 • (212) 675-5911

p.xxiv

We take strong exception to the statement in paragraph d that nuclear fuels produce lower levels of gaseous and solid pollutants - not because the statement is false but because it compares apples and oranges, .eg. fails to note that nuclear fuels do in fact produce pollutants that are qualitatively different and much more lethal, namely radioactive fission products, in normal operation, through waste accumulation, activation products, and in unplanned releases. Furthermore, the potential for large radiation releases is always present in all parts of the nuclear fuel cycle, normal operational releases aside.

Chapter I, p. I-15

Paragraph 1 has an unfortunate error: the substitution of the word safeguards for the word security. Or is the NRC implying that highly radioactive spent fuel will never be the object of attempted diversion or sabotage because of its innate hazards? Or does the NRC mean that irradiated fuel needs no safeguards, period?

Chapter I, pp.I-22,24,28

If the subject of possible accidents in transport of radioactive materials were not so serious, one could be amused by the NRC's use of the geometric mean of the extremes in curies per package for shipments. The statement "The geometric mean was chosen to avoid attaching undue significance to the relatively few large quantity shipments" could be re-phrased to read:..."to avoid undue attention to the potential hazards from radioactive releases of those shipments exceeding the geometric mean".

One hardly needs to point out that accidents do not space themselves out for our convenience so as to select only small-quantity shipments. An accident is as likely to occur to a large package as to a small one. Does the NRC mean to infer that the health effects from dispersal of a 100-kilogram plutonium shipment (such as those that took place at Kennedy Airport up until last year) are negligible? That the likelihood of large quantities being dispersed is smaller than that for small quantities? In this particular stochastic game, the NRC has fallen flat on its face. One hopes that we do not need an accident involving plutonium to pull them to their feet.

Chapter III, para. H, p. III-15

We question the reliance on the WASH-1400 health effects model. The Union of Concerned Scientists-Sierra Club critique of the Rasmussen reactor safety study has criticized the assumptions of low numbers of health effects posited by WASH-1400 on the grounds that the study assumed near-perfect evacuation of the metropolitan New York area within several hours, while simultaneously assuming that most of the population would be indoors or underground and therefore shielded from radiation. More recently, Dr. J. Martin Brown, Assistant Professor of Radiology at Stanford University School of Medicine has criticized WASH-1400 for neglecting to assess long-term cancer deaths from a reactor core meltdown (Rasmussen uses only immediate deaths of people in the immediate vicinity). Nor does Rasmussen calculate genetic disorders, thyroid disease, etc.

Chapter V, pp.V-2,3

We dissent from the statement that "The most severe accidents are generally the least likely to occur" as yet another departure from logic and from knowledge of stochastic events. If the NRC wishes to persist in this type of argument, they should provide us with the mathematical model supporting this position. Similarly, they refer to "The complete logic model" of accident sequences leading to an environmental impact. A complete logic model is by definition impossible, since if all accident causes and sequences could be articulated, in theory all accidents could be foreseen and avoided. What disturbs us are those sequences that will be left out of the logic model and therefore are unknown.

p. V-13

Paragraph one states that "only 10% of the land area of the United States could be considered as 'unyielding surfaces' such as rock, concrete, or rock covered by soil. However, it should be pointed out that if air transportation is utilized to any great degree in the future (something we strongly oppose), this will mean a larger number of shipments departing from and arriving by air over concrete air strips. Thus, a larger per cent of shipments would be at risk.

p. V-14

Paragraph three states that accidents of severity VII or VIII are expected to occur randomly. If so, then how does the NRC justify its statement (see above, Chapter V, pp.V-2,3) that the most severe accidents are the least likely to occur? And how does the NRC justify non-random dispersal of radioactive materials?

p. V-24

NRC states that present shipping containers exceed required standards, apparently in reference to the Sandia Laboratories tests comparing severity of the thirty-foot drop onto an unyielding surface to a 2,000-foot drop onto hard prairie. The parameter excluded here is the 2,000-foot drop onto a hard surface, e.g. the surface of airports, which by the NRC's own standards, would therefore exceed both of the aforementioned tests.

p. V-29

We disagree with the statement that "Consequences to the aquatic environment are less well understood than for the land". At least one thing is known about living organisms in aquatic environments, namely that they concentrate radionuclides in their flesh(and bones, if they are bony fish), and that these concentrations can easily end up in the food chain that terminates with man. It is also quite obvious that radioactive spills in water are irreversible and cannot be cleaned up, unlike contamination of buildings, solid materials, etc. Consequently, radioactive contamination of bodies of water and of aquatic organisms is likely to be highly detrimental to non-human species of plants and animals, whereas radioactivity released into air can be more injurious to human beings through ingestion or high whole-body doses from gamma radiation.

FRIENDS OF THE EARTH 72 JANE STREET • NEW YORK, NEW YORK 10014 • (212) 675-5911

Chapter V, p.V-30

In paragraph three, the NRC states certain population densities as their method of calculating person-rems from accidents involving radioactive materials, and then states that 98% of the U.S. area has a population density lower than any of these densities. However, they have overlooked the fact that insofar as air transportation is involved, most airports are located in metropolitan areas, particularly those of the heavily populated northeast where a good proportion of existing nuclear facilities are now located. Since only 25 states have no commercial nuclear reactors, it hardly matters what their population densities are. It is the population density in the areas near nuclear facilities that count.

p.V-51

NRC inexplicably says that the risk of plutonium accidents goes down in the 1985 projections. We would like to inquire: why? How can this statement be justified, in view of the government's determination to proceed with experimental, and later commercial, plutonium recycle and the fast breeder plutonium economy? It is not unreasonable to assume that greater use and transport of plutonium increases the risk of accidents due to plutonium release (or diversion).

Chapter VI, p.VI-19

In discussing the alternative of shifting all radioactive cargo to passenger aircraft, the report states that although this would increase passenger exposure, it would decrease the exposure (presumably to the public at large) by reducing the total miles travelled in secondary modes. We take issue with the practice of separating passengers - or cargo handlers - or nuclear industry workers - from the public at large, specifically as it relates to the genetic effects of radiation. NRC can hardly take issue with the fact that there is gene flow via reproduction between workers and non-workers, or between passengers and non-passengers. This indefensible distinction becomes particularly odious when one becomes aware of recent studies indicating that ingested plutonium may concentrate in the gonads.

Table VI-31, p. VI-53

In this table of alternative transportation modes, two modes that could reduce radioactive exposure are inexplicably left out: avoiding cities (by barging materials where possible, as with Brookhaven National Laboratories, and the Shoreham and Jamesport reactors on Long Island); and barges themselves as an alternate or for part of a trip. Cities could be avoided by the use of not only barge but of trucks and railroads; surely the avoidance of populated areas - a general government policy where hazardous materials are involved - could substantially reduce potential effects from accidents or releases. Why is this not considered? Why were barges not considered?

Chapter VII, p. VII-2

The report goes to great lengths to assert its desire to protect civil liberties while maximizing safeguards. Yet the Special Safeguards Study has

FRIENDS OF THE EARTH 72 JANE STREET • NEW YORK, NEW YORK 10014 • (212) 675-5911

already suggested considering such anti-civil liberties measures as wiretapping, surveillance, and infiltration of groups that the government considers potentially subversive or violent.

p. VII-4

The footnote referring to an NRC ban against plutonium air shipments is in error. NRC should be reminded that they refused to implement such a ban, and that only a Congressional amendment introduced by Congressman James Scheuer put such a ban into effect. The ban unfortunately does not apply to ERDA shipments.

-Lorna Salzman
Mid-Atlantic Representative
Friends of the Earth
May 11. 1976

DOCKET NUMBER PROPOSED RULE PR-71,73 (40 FR 23768)
Transportation of Radioactive Mtl by Air

Babcock & Wilcox

Nuclear Materials Division

609 North Warren Avenue, Apollo, Pa 15613
Telephone. (412) 842 0111

May 12, 1976

U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Attention: Director, Office of Standards Development

Dear Sir:

On March 29, 1976, the NRC announced the publishing of NUREG-0034, "Draft Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes". Enclosed herein is one comment.

The DES assumed that dose rates were proportional to the transport index. While this is true for non-fissile material, it is not so in the case of plutonium, where the transport index is derived from criticality considerations. It is felt that the exposure rate is the correct number to use, and it is not clear that this number was used in the DES. (See Page IV-42, for example). Experience has shown the exposure to be about 1 mr/hr at one meter from a container of PuO_2. Thus, the transport index of 5 that was applied to shipments of PuO_2 in the DES is too large by a factor of five.

In closing, I would like to express appreciation at the opportunity to comment.

Sincerely,

J. C. DelSignore (raa)

J. C. DelSignore,
Regulatory Projects Manager

JCD/raa

DOCKETED USNRC
MAY 18 1976
Office of the Secretary Docketing & Service Section

The City of New York

LAW DEPARTMENT
MUNICIPAL BUILDING
NEW YORK, N. Y. 10007

W. BERNARD RICHLAND,
Corporation Counsel

DOCKET NUMBER
PROPOSED RULE PR-71,73 (40 FR 23768)
Transportation of Radioactive Mtl by Air

May 14, 1976

Secretary
Nuclear Regulatory Commission
Washington, D.C. 20545

Dear Sir:

The City of New York will be mailing out its comments on the Draft Environmental Impact Statement on the Transportation of Radioactive Material by Air and other Modes on May 17, 1976.

The Commission should receive its copy on Tuesday, May 18, 1976.

Very truly yours,

William R Coleman

WILLIAM R, COLEMAN
Assistant Corporation Counsel

POSTED DATE
MAY 18 1976

The City of New York
LAW DEPARTMENT
MUNICIPAL BUILDING
NEW YORK, N. Y. 10007
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W. BERNARD RICHLAND,
Corporation Counsel

DOCKET NUMBER
PROPOSED RULE PR-71,73 (40 FR 27368)
Trans of Radioactive Mtl. by Air

USNRC
MAY 1 . 1976
Section

May 17, 1976

Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C. 20545

Dear Sir:

Enclosed please find an original and 20 copies of the Comments of the City of New York on the Draft Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes. If additional copies are required, please contact the undersigned and they will be provided.

Very truly yours,

William R. Coleman

Enc.

WILLIAM R. COLEMAN
Assistant Corporation Counsel
N.Y.C. Law Department
1625 Municipal Building
New York, New York 10007

MAY 1 1978

UNITED STATE OF AMERICA
NUCLEAR REGULATORY COMMISSION

The Transportation of Radioactive Materials by Air and Other Modes

Docket No. PR-71,73
(40 FR 23768)

COMMENTS OF THE CITY OF NEW YORK

The City of New York here submits its comments on the Draft Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes, Docket No. PR-71,73 (40 FR 23768). It is our view that the DES is fatally inadequate and thus cannot serve as a basis for determining the effectiveness of NRC's present rules governing the air transportation of radioactive materials and of possible alternatives to those rules.

I

The rule-making proceeding to which this DES is addressed arises from a nationwide expansion of the nuclear material transportation program. However, even if

the DES at issue were adequate (as it is not) as a generic environmental statement, if the rules purport to apply to transportation within and through New York City, there must be an additional DES prepared for shipments in and through New York City. See Sierra Club v. Morton, 514 F. 2d 856, 872 (D.C. Cir. 1975); Scientists' Institute for Public Information v. AEC, 481 F.2d 1079, 1086-87 (D.C. Cir. 1973); Nelson v. Butz, 377 F. Supp. 819 (D. Minn. 1974). To an even increasing extent New York City has been sought as a conduit for the transportation of nuclear materials. The DES upon which we are commenting utterly fails to deal with New York City's unique problems, which include its density of population, the exceptionally high number of nuclear shipments which shippers have sought to make in and through the City, and the combined impact of these two factors. See Nelson v. Butz, supra.

II

The DES is made virtually worthless by its unexplained exclusion, as "outside the scope of this document" (I-19), of all government shipments. The degree of such shipments is unstated, but they are undoubtedly substantial in number and in degree of ratioactivity. The cumulative impact on the environment of all shipments to and from an area must be assessed in a proper ES. Scientists' Institute for Public Information v. AEC, 481 F. 2d 1079, 1086 - 1087 (D.C. Cir. 1973); Jones v. Lynn, 477 F. 2d 885, 891 (1st Cir. 1973). Clearly, no meaningful assessment of cumulative impact, either nationwide or in a given area, can be made if a substantial portion of the shipments are arbitrarily excluded and treated, in effect, as if they make no adverse contribution to the environment. There is thus a failure to make the required comprehensive and integrated assessment of the environmental risks associated with the transportation of nuclear materials. In addition, exclusion of any discussion of government shipments contravenes one of the main purposes of the EIS requirement,

namely, the coordination of different federal agencies in environmental policy matters. Portland Cement Association v. Ruckelshaus, 486 F. 2d 375 (D.C. Cir. 1973), cert. den. 417 U.S. 921, 94 S. Ct. 2628, upp. after remand 513 F. 2d 506, cert. den __ U.S. __. 96 S. Ct. 469 (1975). Henry v. F.P.C., 513 F. 2d 395, 406 (D.C. Cir. 1975).

III

There is a failure to make a rigorous and objective evaluation of all reasonably available alternatives. To take but one egregious example, barging is described as creating a "negligible" population exposure (IV-34), and barging has been recognized by USEPA as a desirable alternative to land transportation, yet no assessment of it is made in "Chapter VI - Alternatives" or in the "risk assessment section of Chapter IV." Thus, the DES fails to "...set forth those alternatives 'sufficient to permit a reasoned choice,'" Life of the Land v. Brinegar, 485 F. 2d 460, 472 (9th Cir. 1973); NRDC v. Callaway, 524 F. 2d 79, 92-93 (2nd Cir., 1975); NRDC v. Morton, 458 F. 2d 827, 836 (D.C.Cir. 1972); Sierra Club v. Froehlke, 359 F. Supp. 1289, 1343-44 (S.D. Tex 1973) mod. on other grounds, 499 F. 2d

982 (5th Cir. 1974); EDF v. Corps of Engineers, 348 F. Supp. 916, 931 (ND.Miss. 1972) (The discussion of barging in the Safeguards section (VII 13-14) lists some difficulties with escorting barges carrying nuclear wastes. It is stated that the level of security of escorted trucks is not attainable with barges. We would suggest that the Coast Guard be consulted on this conclusion and would refer the writers of the DES to the Coast Guard's "procedures for the Movement of LNG/LPG", Captain of the Port, New York. 1. October 1975, for a discussion of the types of safety measures that can be taken for hazardous marine cargoes.)

Not only is there a failure to adequately analyze alternative modes of transportation, there is a virtually total lack of discussion of the impact of alternative routing of nuclear transportation shipments. The DES acknowledges the importance of population density in determining the significance of an accident (V-48), but nonetheless fails to discuss routing alternatives which would take difference in population density into account. (It may also be noted that the population assumptions used in the DES risk assessment section (V-14,30) bear no

relationship to the City of New York, which has a density of population grossly in excess of that assumed by the DES for a high population area.)

IV

The DES purports to review a 30 year program but fails to include increases in nuclear shipments beyond 1985. Nor is there adequate basis for the DES's forecast of a 250% increase of shipments. For example, in New York State in 1974 the only nuclear plants in operation were Indian Point I and II (990 mw) and Nine Mile Point I (610 mw). By the end of 1985, eight additional plants or upgrading of existing plants for a total of 8552 mw, may be in operation. Six more plants are projected by 19991 with a total additional capacity of 7640 mw.

V

While the DES purports to be evaluating certain existing regulations, there is no attempt to deal with the critical issue of compliance with, and enforcement of those regulations. The NRC, in the course of its purportedly close supervision over shipments of nuclear materials, appears to have no accurate idea of how many shipments are made per year, where they go, by what route they go and to what extent their transport is in accord with applicable law. We submit that no proper assessment of the environmental impact of the nuclear transportation program can be made in the absence of both accurate data and an evaluation of the extent to which existing rules and regulations in fact achieve their purpose.

In addition, in order for the public and Congress to be able to evaluate a DES, it is essential for the DES to explain the assumptions made therein. The DES at issue is replete with unexplained assumptions and references to what unspecified "expermental work" or "private communication"

has shown (See, for example, pp. II-9, II-10, V-14, V-24). It is also replete with reliance on undocumented and apparently unrequired and unenforced industry "practice" (See, for example, pp. II-8 and II-30). Such reliance hardly provides assurance to the public that the NRC has adequately evaluated the environmental impact of the nuclear transportation program.

VI

Chapter V of the DES, "Effect of Transport under Accident Conditions" is fatally defective. We will briefly note only a few errors which, in themselves, totally undermine the validity of the DES's conclusions.

1. Computed estimates of alleged risk are singularly deficient in statistical confidence limits. For example, the risk assessment relies upon a progression of modelling stages; the cummulative effect of the degree of precision lost at each stage makes the study of little or no value.

2. At pages V-8 through V-15, there, the probability of spillage model which purports to calculate accident statistics, takes accident data not from actual aircraft accidents but from Clark's model, based upon laboratory simulations of crashes on unyielding surfaces. Clark's results are then modified by an unexplained process of "engineering judgment" (at page V-13 an explanation is included which provides no proofs nor any basis for the assumptions made). No attempt is made in this analysis to use actual aircraft collision data in a study similar to that performed by Bovet, "Preliminary Analysis of Tanker Collisions" D.M. Bovet. Reported by U.S. Coast Guard Office of Research and Development, November 30, 1970, or Monorsky, "An Analysis of Ship Collisions with Reference to Protection of Nuclear Power Plants, " Journal of Ship Research, October 1959.

3. The accident classification scheme improperly relates severit of an accident to fire duration and speed of impact. It fails to evaluate crush and puncture damage.

And it fails to consider population density as a contributing factor to accident severity.

VII

The discussion of reported incidents involving transportation of nuclear materials is grossly inadequate. Appendix C, does not even contain an explanation of its codes. Nor is there any discussion of possible unreported incidents. Based on the DES's own figures, incidents in 1975 may well have doubled those reported in the four-year period 1971-1974 (IV-38), yet the risk assessment, which used the number of shipments projected for 1985 apparently relied on 1974 accident data.

VIII

Scenarios involving sabatage or diversion of spent fuel or fissionable materials by terrorists or

criminal elements are mentioned tangentially but are incompletely evaluated.

Respectfully submitted,

W. BERNARD RICHLAND
Corporation Counsel of the
City of New York

By Nina Gershon Goldstein
NINA GERSHON GOLDSTEIN
Assistant Corporation Counsel
New York City Law Department
1628 Municipal Building
New York, New York 10007
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William R. Coleman
Of Counsel

May 17, 1976

Commonwealth Edison
One First National Plaza, Chicago, Illinois
Address Reply to: Post Office Box 767
Chicago, Illinois 60690

DOCKET NUMBER
PROPOSED RULE PR-71, 73 (40FR 23768) (78) May 17, 1976
Transportation of Radioactive Mat'l by Air

Mr. Guy A. Arlotto, Director
Division of Engineering Standards
Office of Standards Development
U.S. Nuclear Regulatory Commission
Washington, D. C. 20555

Subject: Comments on The Draft Environmental Statement on The Transportation of Radioactive Material by Air and Other Modes

Dear Mr. Arlotto:

Thank you for the opportunity to provide comments on the subject statement.

We have reviewed the Draft Environmental Statement and have no comments. However, we would appreciate reviewing future documents as they become available.

Very truly yours,

R. L. Bolger
Assistant Vice President

Acknowledged by card 5/26/76

MAY 25 1976

DEPARTMENT OF TRANSPORTATION
UNITED STATES COAST GUARD

MAILING ADDRESS (G-WS/73
U S COAST GUARD
400 SEVENTH STREET SW
WASHINGTON, D.C. 20590
PHONE (202)426-2262

PROPOSED RULE PR 71,73 (40 FR 23768)

15 MAY 1976

Trans. of Radioactive Mtl by Air

Mr. Guy A. Arlotto
Director
Division of Engineering Standards
Office of Standards Development
Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Arlotto:

This is in response to your letter of 24 March 1976 addressed to Mrs. Judith Conner concerning a draft environmental statement dealing with the transportation of radioactive material by air and other modes.

The concerned operating administrations and staff of the Department of Transportation have reviewed the material submitted. We have no comments to offer nor do we have any objection to this project.

The opportunity to review this draft statement is appreciated.

Sincerely,

Chief, Office of Marine Environment and Systems

USNRC
MAY 25 1976
Office of the Secretary
Docketing & Service
Section

Acknowledged by card 5/26/76 JB

-71,75 (40FR23768)

GEORGIA INSTITUTE OF TECHNOLOGY
ATLANTA GEORGIA 30332

SCHOOL OF
NUCLEAR ENGINEERING

May 17, 1976

MAY 25 1976

Mr. Guy A. Arlotto
Division of Engineering Standards
Office of Standards Development
Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Arlotto:

This communication is being sent on May 17, 1976, the date on which comments "must be received by your office"—thus I cannot meet your deadline.

First I would like to emphasize that I am sending a few hurried comments, not as a paid consultant but as a private citizen or university professor interested in these matters. Perhaps on this basis alone I am disqualified. In any case, the short time I have had a copy of NUREG-0034 for review (since May 10, 1976) assures I can only make a rather cursory examination of its contents and check a few of its assumptions. Needless to say, since I am oing this entirely on my own time, other things associated with my employment at Georgia Tech must take precedence. However, I cannot restrain my desire to make a few observations about report NUREG-0034 since I am a member of the Special Panel to Study Transport of Nuclear Materials reporting to the Joint Committee on Atomic Energy of Congress and I am passing on to you some evaluations which are in line with comments and opinions I volunteered earlier in reference to what I considered a bad practice of permitting plutonium and other actinide elements to be transported into and out of densely populated areas.

A quick perusual of the report fails to indicate you have made an adequate comparison of all possible modes of transportation. Some studies have indicated the population exposure (man·rem) from the shipment of radioactive materials decreases in the order of shipments by truck, rail and barge. I realize nuclear power plants, reprocessing plants, fuel fabrication plants, etc, have not in most cases been located where direct barge shipment is possible, but I regret to say I can only conclude this has been by design and refusal of the AEC and now NRC to take this mode of transportation into proper account in the environmental impact statements and in the lisencing of new nuclear operations. For example, discussion of radioactive shipments by barge was not permitted at the Barnwell hearings or the St. Lucie hearings in which I took part.

In general, I am disappointed with the report because of so many half truths and unsubstantiated statements. It presumes to take a conservative stance and to treat the "worst case" but in many cases just the opposite seems to be the case. I am <u>for</u> nuclear energy and for 34 years I have tried to show

Acknowledged by card 5/26/76

we can make and keep this one of the safest of all modern industries, but I fear reports like this may shake the confidence of some of us in those we hold responsible for making and keeping this industry acceptably safe.

In order to be as brief as possible and because of my growing concern about the shipment of Pu and the other actinide elements, I will limit this discussion mostly to the treatment of the risks of shipping plutonium. In what follows I give a few random examples of why I am concerned about this report.

1. Page V-39 Here I read "The Contribution to the Total Dose from Cloudshine, Groundshine, and Resuspension can be obtained by the application of established factors to the results shown in Fig. V-11. For ^{239}Pu and other isotopes of interest, these radiation effects are negligible...."

I believe one has to be a bit naive to assume resuspension makes a negligible contribution to the human Pu dose. For example, several papers at the IAEA San Francisco meeting (November 1975) indicated the importance of resuspension. Here Romney (University of California) indicated that small particles of Pu are rapidly blown away from the source, and when resuspended they are deposited on plants that are eaten by animals and man. Most of the Pu found in vegetation got there by resuspension of dust. Jakublick (of Germany) indicated this PuO_2 on the soil migrates 100 times faster than soluble Pu (e.g. nitrate). Bondietti (of ORNL) indicated the Pu in soil forms complexes that are much more available for uptake by plants and animals. Becker (of EPA) suggested that the action of microorganisms in the soil may render this Pu available for uptake. McLendon (Savannah R. Plant) found a high concentration of Pu in plants (~1/10 that of core camples). This all suggests we cannot disregard the Pu in the soil where, in time, it may be transformed such that its fractional uptake by the human body may increase from 10^{-6} to 10^{-2}.

2. Tables V-7, V-12 and V-13 are good examples of an attempt to give the impression of a very conservative consideration of the problem and an evaluation of the "worst case accident" and yet your worst case assumes a shipment of only 20 kg of Pu when it is an established fact that larger Pu shipments have passed through some of our airports. When the reader notes such tactics used to depreciate the risks, he is inclined to question the credibility of the rest of report.

3. Table III-8 is given without explanation and I have reason to question its reliability. I was chairman from the beginning until 1972 of the Internal Dose Committee of ICRR that made such calculations and set the standards for all these radionuclides (and I was chairman of the NCRP internal dose committee for 20 years). Since 1972, I have been busy with research and teaching at Georgia Tech, so I am not completely up-to-date with the latest ICRP calculations. However, the following Table shows discrepancies I found in your table for Pu radionuclides in comparison with ICRP Committee 2 values as of 1974, and I doubt there have been substantial changes since then.

Values of Rem/Ci Given by NUREG-0034 and by ICRP

Plutonium Radionuclide	Table III-8 Values			Values Given by ICRP (1974)				
	Lung	Bone	Marrow	Lung	Bone*	Marrow	Liver	Ovaries
Pu-238	$3.1x10^8$	$7.6x10^8$	$1.3x10^6$	$3.1x10^8$	$4.0x10^9$	$6.7x10^3$	$3.6x10^8$	$1.7x10^8$
Pu-239	$2.0x10^8$	$8.7x10^8$	$1.5x10^6$	$2.9x10^8$	$4.6x10^9$	$4.4x10^3$	$4.1x10^8$	$2.0x10^8$
Pu-240	$2.0x10^8$	$8.7x10^8$	$1.5x10^6$	$3.0x10^8$	$4.7x10^9$	$7.6x10^3$	$4.1x10^8$	$2.0x10^8$
Pu-241	$5.8x10^5$	$1.7x10^7$	$3.2x10^4$	$5.5x10^5$	$9.8x10^7$	$1.3x10^3$	$8.3x10^6$	$4.4x10^6$

*This value is for trabecular bone. I do not know for what type of bone the Table III-8 is representative.

From the above it is seen there are some significant discrepancies. For example, the bone risk (where most of the malignancies develop from Pu) is underestimated by a factor of 5. The risk to the liver and ovaries may be as great as that to the lungs, but they are not even considered. Surely some consideration should be given to the genetic risk!

Table B-1 There seem to be large discrepancies between this table and the values given in the GESMO report, WASH-1327, which I reviewed earlier. These discrepancies are shown below:

Radionuclide	% by weight in Table B-1	% by weight in WASH-1327	Ci calculated WASH-1327	g in WASH-1327
Pu-238	1.9	3.49	$3.47x10^5$	$0.20x10^5$
Pu-239	63.0	43.63	$5.30x10^3$	$2.50x10^5$
Pu-240	19.0	26.00	$3.37x10^4$	$1.49x10^5$
Pu-241	12.0	15.65	$1.00x10^7$	$0.90x10^5$
Pu-242	3.8	11.21	239	$0.64x10^5$
Am-241	0.6		$2.52x10^4$	$7.78x10^3$
Am-243			$6.78x10^3$	$3.66x10^4$
Cm-244			$1.70x10^6$	$2.04x10^4$

When each new NRC report uses a new set of assumptions about the SGR-GESMO-120 day spent fuel inventories, how can we be expected to believe any of the numbers or evaluate the data? Which NRC report are we to believe?

I have added also my calculations of Curies using the WASH-1327 data. Here we note that most of the risk is not from ^{239}Pu but from ^{238}Pu, ^{241}Pu, ^{244}Cm and ^{241}Am. Also, I have shown (HPJ 10, 151, 1964) that ^{238}Pu is 150 times more hazardous (Curie-for-Curie) than ^{239}Pu, ^{241}Pu is 3 times more hazardous, ^{244}Cm is 32 times more hazardous, and ^{241}Am is 16 times more hazardous. In addition, this 2.04×10^4 g of ^{244}Cm comprises 2.2 Ci of neutrons for which extra precautions must be taken.

5. Pages XIX and I-24 I am forced to conclude that this Draft Environmental Statement (NUREG-0034) like other NRC Draft Reports (e.g. WASH-1327) was hurriedly and perhaps carelessly written. I believe there are acceptable ways of shipping radioactive materials (as there are acceptable ways of recycling Pu), but I am convinced that more carefully prepared and properly reviewed draft reports, before they are issued for almost instantaneous review and comment by members of the public, would go a long way toward easing the tasks of some of us who are trying to develop a reasonably safe nuclear power industry that is worthy of strong support of the public.

On page XIX we find the statement, "It is estimated that the total annual population exposure resulting from normal transport is about 9600 person·rem." Such a statement is completely meaningless and valueless because the year is not indicated and there is no indication of whether this man·rem is to the total body, thyroid, trabecular bone, deep lung compartment, etc.

On page I-24 we have another useless statement because of insufficient qualifications. I refer to, "The total amount of Pu shipped annually is estimated to be 2000 kg." Presumably, this was for 1974? From WASH-1327 we find that for a BWR-1.15 SGR fuel discharge after 120 days decay we have 574 kg of Pu. Thus the 2000 kg corresponds to only 2000/574 = 3.5 reactor discharges per year assuming 1000 MWe per reactor.

I could go on and on pointing out weaknesses in this report, but in order to mail this on your deadline date I will close with a few general comments as follows:

a. I believe the severity of aircrash accidents assumed in this report comes far short of the worst case.
b. There are too many rather arbitrary and unsubstantiated assumptions.
c. There are serious inconsistencies between this and previous NRC reports and statements of NRC officials.
d. Average cases and the standard or reference man data are used in estimating cancer risk. Don't the children, the persons with respiratory diseases, etc, count? It seems we should protect them as well as the healthy adult worker to whom the standard man data apply.
e. The ICRP lung model is used improperly. If the 750 ml lung tidal volume curve had been used (for the child) instead of the 2150 ml curve, it would be noted that about 28% and not 14% of the particles of 3 microns mean size distribution are retained in the lower pulminary compartment of the lungs, and in either case (for the child or the adult) the larger Pu dust particles should not be neglected in the calculations of risk.

f. The man-rem dose for normal and accident situations should be integrated over the entire population for all age groups and for all dose rates. Arbitrary cut-offs, and boundary assumptions lead to serious underestimates of the risk.

g. Although the dose to the pulmonary lymph nodes is 100 or more times that to other lung tissue, this dose has ignored in the risk evaluations. I realize the ICRP has depreciated this risk because the ERDA studies of Thompson et al at BNW have failed to produce cancers in this part of the reticulo endothelial system in animal studies. However, I am uneasy in applying these data to man who lives 70 years instead of 20 years (dog's life span) and Thompson has in fact observed some malignancies in tissues adjacent to the lymphatic tissue which suggest that blood vessels leading into these organs or tissue just beyond the alpha-particle complete kill within the lymph nodes may be the tissue at greatest risk in the case of man.

I hope you will find these hurried comments helpful and constructive in the redraft of report NUREG-0034.

Sincerely,

Karl Z. Morgan
Neely Professor

KZM:tm

UNITED AIRLINES

JUN 7 1976

May 17, 1976

Mr. Guy A. Arlotto, Director
Division of Engineering Standards
Office of Standards Development
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Arlotto:

Further to your letter of April 26, the following are our brief comments on the Draft Environmental Statement prepared by your department in support of the Nuclear Regulatory Commission's advance notice of rule-making action:

Chapter I - Page I

This reference page states that the purpose of the publication is to assess the impact upon the environment from the transportation of radioactive materials, primarily by aircraft, etc.

This would appear to indicate that an effort has been made to justify an increase in the allowable limits for air movement. We will need to be extra careful in reviewing future rule making actions.

Capter VI - Page 36 - Paragraph B. 2-2.1

To prohibit shipments of radioactive material during adverse weather would be impractical because it changes so quickly in widely separated geographic areas.

Chapter VI - Page 38 - Paragraph B. 2-2.2

To restrict movement to daytime flights would eliminate most freighter flights. This would be very undesirable.

Chapter VI - Page 39 - Paragraph B. 2-2.3

It would not be practical to restrict movement by air to airports in low population areas, since service by air is so limited at such locations. A better alternative, if this is a valid concern, would be to prohibit transport by air.

Chapter VII - Page 15

Air transport should not be required for the movement of radioactive shipments based on security considerations. The much more important consideration relates to the exposure of people, equipment and facilities to radiation and it is these concerns that should determine whether radioactive shipments can and should be carried by air.

The transport of radioactive material by air should be limited to only that which is absolutely necessary. In our opinion, this is primarily material related to medical applications including research, diagnosis and treatment.

We trust this information may be of some assistance.

Sincerely,

E. Stohr/wh

Edmund Stohr
Vice President
Industry Affairs

DOCKET NUMBER
PROPOSED RULE P-71 (PR-71)

TRANSNUCLEAR, INC.

May 24, 1976

JUN 7 1976

Mr. Donald R. Hopkins
Office of Standards Development
U.S. Nuclear Regulatory Commission
Washington, D.C. 20545

Subject: Draft Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes Docket No PR-71,73; NUREG-0034

Dear Mr. Hopkins:

Transnuclear, Inc. is a fuel cycle services company specializing in all aspects of the transportation of radioactive materials. We are responsible for arranging transportation of much of the nuclear fuel cycle materials which move etween the U.S. and Europe each year. Modes of shipment used include air, ocean, road and rail.

We own and utilize several different types of packagings for unirradiated nuclear fuel material. We will also have licensed spent fuel casks available for service in mid-1977. These casks are suitable for transport by rail or road and will hold 3 PWR assemblies or 7 BWR assemblies and are currently being used in Europe on a routine basis.

The purpose of this letter is to comment on the DES and request that the final statement include the use of these intermediate size casks as another alternative to the rail casks and small truck casks.

There appear to be some typographical and/or mathematical errors in the tables and discussion relating to spent fuel transportation.

Table I-2 on page I-20 shows a total of 370 spent fuel packages per year in 1975 with a truck/rail split of 14.2/85.8 percent. However, the Baseline Shipment Information as shown on Table IV-1, page IV-11, shows 54 shipments by truck and 326 by rail for a total of 380. The percentage split in Table I-2 is compatible with the number of shipments in Table IV-1, so perhaps the 370 total packages per year is incorrect.

Acknowledged by card 6/7/76

ONE NORTH BROADWAY • WHITE PLAINS, NEW YORK 10601

In Chapter VI the discussion in Section B.1-6 indicates that seven times as many shipments will be required by truck as compared to rail. However, in Table VI-17, there are 380 shipments per year by truck and none by rail. This value should be 54 + 7(326) = 2336 if all 326 rail shipments are to be transferred to truck. If the radiological impacts as reported in Table VI-18 are based on Table VI-17, there may be significant errors in the results.

We also question the economics of spent fuel transport as reported in Section B.1-6.2. A recent study by the Edison Electic Institute on Nuclear Fuels Supply reported in Appendix V:

" The cost of transporting a normal spent fuel annual discharge for a 1200-1300 MWe reactor over a distance of 1000 miles to a reprocessing plant is about $680,000 using a legal weight truck, $275,000 using an overweight truck, $460,000-$530,000 for a non unit train, and $750,000-$860,000 or a unit train."

We suggest that the alternative for spent fuel transport be presented as follows:

Mode	Legal weight truck	Special permit truck	Rail
PWR elements/cask	1	3	7
Trip distance miles	1,000	1,000	1,000
Trips per year (1975)[1]	2,336	780	334
Cost per assembly[2]	11,300	4,600	7,600-14,300

[1] Assumes only one mode used

[2] Based on costs in EEI report and 60 assemblies per year for an 1100 MWe PWR

The radiological impacts should be calculated using the above values.

We would appreciate an opportunity to discuss this with you at your convenience. We will be glad to review the results to be published in the FES prior to publication. Please contact us if you have any questions.

Very truly yours,

Bill R. Teer
Vice President

Ne 'ork State Department of Environmental Conservation
50 Wolf Road, Albany, New York 12233

Peter A.F. Berle
Commissioner

DOCKET NUMBER
PROPOSED RULE PR-71,75 (40 FR 23768)
Trans. Radioactive Mtl. by Air

June 3, 1976

RECEIVED USNRC JUN 11 1976 Section

Mr. Robert B. Minogue, Director
Office of Standards Development
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Minogue:

The State of New York has completed its review of the U.S. Nuclear Regulatory Commission "Draft Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes", issued in March, 1976. In preparing the enclosed comments, we have taken into consideration the views of interested State Agencies including those represented on the NYS Atomic Energy Council.

The draft statement (NUREG-0034) indicates that consequences of an accident involving shipments of plutonium vastly outweigh the consequences of transporting all other radionuclides.

Therefore, the State of New York urges the Commission to consider the environmental impacts, and the alternative modes of transporting Plutonium and the security implications thereof separately from all other radioisotopes. Only in this way can the environmental consequences, benefits to society, and costs of alternative modes of transport and packaging requirements be adequately assessed.

The draft statement should also discuss idemnification for any damages that may result from transportation of radioactive shipments made under Federal regulations including human exposure, contamination limits, etc.

Thank you for providing the State the opportunity to comment on this environmental statement.

Sincerely yours,

Theodore L. Hullar, Ph.D.
Deputy Commissioner for
Programs and Research

Enclosure

Comments of the

STATE OF NEW YORK

ON THE

U.S. NUCLEAR REGULATORY COMMISSION

"DRAFT ENVIRONMENTAL STATEMENT ON

THE TRANSPORTATION OF RADIOACTIVE MATERIAL BY

AIR AND OTHER MODES" (NUREG-0034) ISSUED

MARCH 1976

NRC DOCKET NO. PR-71,73

May 28, 1976

1. General Comment

The Draft Environmental Statement indicates that radiation exposure from no 1 transportation averaged over the number of people exposed is small. It would result in a statistical increase of one latent cancer fatality in the U.S. per year.

While the use of average exposure is reasonable to predict the effects resulting from normal transportation, the use of the estimated average accident risks can be misleading. The low average accident risk results from taking the very low accident risks associated with the large number (some 70% of total shipment) of radiopharmaceutical shipments and distorts the risks associated with the transportation of plutonium.

Table V-14 notes that the plutonium oxide accident risk analysis results for 1975 shipments indicate a risk total of 6.5 latent cancer fatalities. This same table notes that accidents involving the release of plutonium oxide would account for 99.8% of the total accident risks.

Tables VI-31 and VI-32 - these tables list alternative actions ranked in order of the impact in decreasing transportation risks. The first two alternatives, i.e., developing more stringent packaging standards for plutonium and establishing a 1% respirable plutonium criteria for shipment, should be given high priority and established as regulatory criteria. In addition, the third most significant alternative in reducing transportation risks, shipment of plutonium by rail, should by fully evaluated (including security implications) prior to authorizing resumption of shipment of plutonium by air.

The Draft Environmental Statement notes that the accident risks of latent cancer fatalities and early fatalities arise principally as a result of a very unlikely event of a major release of plutonium associated with the nuclear fuel cycle. The statement acknowledges that the consequences of such an accident, a ough very unlikely, could be severe for a few individuals. Accidents in a densely populated area were estimated to produce one fatality within 365 days and approximately 16 exposures sufficient to produce death from cardiopulmonary

insufficiency in some cases. In addition, the Draft Environmental Statement notes th latent cancer fatalities associated with this major release are estimated at twenty per year over a 30-year period, or 600 cancer fatalities. The Draft Environmental Statement then indicates the probability of such an occurrence is estimated to be 10^{-9} per year in 1974.

In spite of the low probability of a major release of plutonium the severe consequences of the accident merits attention to the further analysis of the alternative transportation and packaging modes and security implications thereof in order to further reduce the probability of plutonium release in an accident. Therefore, New York State suggests that the alternative modes of transporting plutonium be considered separately from other radionuclides. In such a separate review, the need for developing an "air-safe" container for plutonium shipment must be considered as part of the requisite overall analysis of the environmental consequences (in normal and accident situations) of alternative modes of plutonium transportation and packaging and the security requirements associated therewith.

2. General Comment

The concern for the severe consequences of the release of plutonium should not be used to require a major modification of packaging and shipping requirements of small quantities of radiopharmaceuticals, for example. However, the Draft Environmental Statement notes that packages being used for transportation of radioactive materials perform significantly better than the present packaging standards and that the present shipping procedures result in shipments well below the packaging and transportation index standards. It is, therefore, recommended that the present standards for packaging and shipping be made more stringent to reflect present practices. The report notes that this can be done without changing shipping practices and with no change in present overall risks. This would, however, prevent the increase in exposure that would result from increased use of packages and shipping practices that would just meet the existing standards.

3. General Comment

The various modes of Transportation including options within each mode should be subjected to systematic analysis wherein all of the risks, (i.e., normal transportation; accidents and security consideration), are interrelated so that both the impact and a Transportation strategy could be developed. The Draft Environmental Statement fails to perform this function and, therefore, does not provide a meaningful comparison of the benefits and risks of alternative transportation modes.

4. General Comment

The draft statement should reference and thoroughly discuss the safety analyses performed for the development of spent fuel shipping containers and the accident parameters used to develop safety analyses.

5. General Comment

It is noted by the NYS Dept. of Commerce that the suggestions offered by the New York State Atomic Energy Council to the NRC on August 1, 1975 were generally addressed in the subject document. Although specific assumptions and input data may be subject to question, the methodology used in the DES is technically sound. The DES recognizes that the transportation of radioactive materials is a necessary and beneficial action, and that the associated risk is extremely small - several orders of magnitude less than other commonly accepted societal risks.

6. PI-24 Section I.D. - The last sentence of the middle paragraph states:

"The annual numbers of spent fuel shipments for 1975 and for 1985 are estimated to be 370 and 3600 respectively."

The NYS Department of Transportation notes that the number of 370 shipments for 1975 appears to be too low for the following reasons.

a. NYS Department of Transportation has conducted a survey by mail of the nuclear power plants and government reactors that could be shipping spent fuel across New York State and to date have determined that 199 shipments of spent fuel were made from just two nuclear power plants and two federal reactors in 1975 across New York State.

b. Supplement 1 to WASH-1238 (NUREG 75/038) - "Environmental Survey of Transportation of Radioactive Materials To and From Nuclear Power Plants" includes on Pages 4, 5 and 6, a Table S-1, entitled Summary of Transportation Data for Nuclear Power Reactors. Table S-1 is the result of individual analyses by the Commission during the period January 1972 through March 1973 of the environmental impact of such transportation for 84 individual nuclear power reactors at 53 different sites.

Using the data for irradiated fuel shipments from Table S-1 and excluding movement by rail where optional methods of transportation were shown New York State Department of Transportation arrived at the following totals.

Irradiated Fuel	
Number of Truck Shipments	2516
Number of Rail Shipments	283
Total Shipments	2799

7. General Comment

The New York State Department of Health notes that the annual population dose during normal transportation is low and that shipments of radiopharmaceuticals, Mo-99 and radioiodines, represent a greater source of exposure than the shipment of spent nuclear fuel and plutonium oxide.

8. General Comment

Information should be added to the Draft Statement that clearly establishes the level of enforcement action being undertaken by the U.S. Department of Transportation, the Nuclear Regulatory Commission and various states in connection with the transportation of radioactive materials. This information should include tabular material about the number of inspections relating to

radioactive materials that have been undertaken and the type and number of enforcement actions that have been taken in connection with radioactive materials during the last five years. There should also be an indication of the number of inspections that are scheduled during the coming year.

9. Pi-Summary and Conclusions - In the event that NRC proposes a significant change in the regulations for Transportation of radioactive material, an environmental impact statement must be prepared pursuant to NEPA for such a proposed federal action. NUREG-0034 will obviously be an excellent reference for such a study.

10. Piv, No. 7 - The Draft Statement indicates (P. iv) that a few individual transport workers whose radiation exposures exceed the limits established for members of the general public should be, and in most cases are monitored and otherwise treated as radiation workers. There does not seem to be clear indication of when such transportation workers are to be treated as radiation workers. It is necessary that workers required by their job to work with radioactive materials and radiation, whether in a laboratory or on a loading platform, are dealt with in a consistent manner. Therefore, it is important that the class of transportation workers and work situations involving significant shipments of radioactive materials should be identified so appropriate radiation protection measures can be taken. The regulations should be amended so that transportation workers likely to receive a dose in any calendar quarter in excess of 25 percent of the applicable value in paragraph (a) of 10 FER 20.101 are provided with appropriate personnel monitoring equipment

11. PI - 3 Section A - The Draft Statement indicates (P. I-3) that updated shipment information will be available in time for use in the fina version of the Statement. We urge that such shipping data be incorporated fully into the final Statement. The newer data, in other words, should be used not only to revise Tables I-2 and I-3 but also to recompute transport impacts and to reevaluate alternative transport modes in the event that the newer data warrents such effort. If this information significantly alters the results of the draft environmental statement, than NRC should issue another draft statement for comment prior to the issuance of a Final Environmental Statement.

12. PI 4 Section I.B. This section should present quantitatively the various applications for which radioactive materials are used and the benefits to society from these applications.

13. Pages I-4 and I -19

The DES uses a figure of 600,000 packages of radioactive material shipped annually. This differs from other estimates previously used, including an estimate of 800,000 packaged cited by the U.S. Atomic Energy Commission on page 61 of WASH-1238, dated December 1972. The reason for using the 600,000 figure should be indicated.

14. Page I-20

Table I-2 indicates that 85.8% of the estimated 370 spent fuel shipments transported in 1975 were shipped by rail and that the other 14.2% were moved by truck. This information does not agree with information provided to "The State" regarding 186 motor truck shipments of spent fuel

to the West Valley, New York reprocessing plant in 1975. These shipments, which came from only two nuclear power stations would alone account for over 50% of the estimated 370 shipments.

15. Page I-25:

The first sentence of the second paragraph refers to "Figure I-2". It appears that it should refer to "Figure I-3".

16. Section V.B.

The basis is not provided for the distribution of accidents among the various population densities for each of the transportation modes considered. Although some description of the basis for the fractions used for aircraft accidents is provided, almost no basis is provided for expecting the low severity truck accidents to occur mainly in urban areas. If these assumptions are based on a statistical analysis, that analysis should be identified.

17. Section V.B. 2

This section indicates that in the case of accidents involving motor carriers the dominant factors in the determination of accident severity are crush and fire. Currently, packaging standards do not include crush specifications. It is recommended that the responsible regulatory agencies consider implementation of a crush standard.

18. Tables V-12 and V-13

These tables should include the consequences of accidents involving spent fuel.

19. Table V-13

For the 20 kg Pu Case, the number of persons receiving doses greater than 15 rem, 10^4 rem, and 10^5 rem are listed.

Since the number of persons receiving a dose greater than 15 rem is several orders of magnitude greater than those receiving a dose greater than 10^4 rem, the number of persons receiving doeses at intermediate levels should be provided.

20. Pages V-24:

The first sentence of the last paragraph refers to "Table V-2". It appears that it should refer to "Table V-6".

21. Page V-44:

Table V-11 does not identify the first radionuclide on the list. It appears that it should specify Plutonium.

22. Page V-54:

The last sentence of the first paragraph refers to a number of injuries and fatalities "per reactor year". It appears from what is presented previously in the paragraph that it should refer to the number of these events "per year".

23. Pg. V-57:

Justification should be given for assuming that the population at risk is 75 million persons.

24. General Comment

It is recommended that the environmental statement be expanded to include

24. General Comment - (continued)

Federal monies expended, (1) in the development of regulations and (2) in the enforcement of regulations followed by a discussion as to the optimal amount of money that should be expended to effectively minimize the hazard to the Public from the transportation radioactive materials.

DOCKET NUMBER
PROPOSED RULE

DEPARTMENT OF HEALTH, EDUCATION, AND WELFARE
OFFICE OF THE SECRETARY
WASHINGTON D.C. 20201

MAY 26 1976

JUN 7 1976

Mr. Guy A. Arlotto
Director, Division of Engineering
Standards
Office of Standards Development
Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Arlotto:

We have reviewed the draft Environmental Impact Statement concerning the transportation of radioactive material by air and other modes. On the basis of our review, we offer the following comments:

1. We note that the June 1975 public comments on the proposed rulemaking concerning air transportation of radioactive materials are not included in the draft document.

2. Detailed Summary: As presently contained in the document, the detailed summary does not present the reader with a thorough examination of the probable effects expected to occur from a shipping accident involving radioactive materials. Information should be included in the final document on the individual effects of each of the various types of accidents that could happen, modes of shipment, and the identity and quantity of materials involved. These should be described with and without ameliorating actions and/or safeguards. Comparing the overall exposure to populations from accidents involving radioactive material to the overall exposure from other sources does not address the consequences of a shipment accident in absolute terms.

3. Page I-15: It is noted that the shipments listed and their modes of transport are representative of the radioisotope industry (Table I-1). There are no estimates for postal shipments, which probably use any and all modes of transportation. Although these are of small individual quantity, they may be large in volume.

4. Page I-19: Weapons shipments and all shipments in government-owned vehicles are not considered. These omissions may have seriously affected the calculations presented in the statement.

5. Page III-8: It is stated that the Biological Effects Ionizing Radiations (BEIR) report was used in the Health Effects Model. Actually, the Health Effects Model used is that found in Appendix VI of the Reactor Safety Study (WASH-1400). WASH-1400 significantly modified the risk estimates contained in the BEIR report by introducing "Dose Effectiveness Factors" (Table VI, 9-70, Appendix VI, WASH-1400). These factors do not access a straight linear extrapolation, (as does the BEIR report), making these risk estimates of low doses and dose rates used in the draft statement lower by a factor of five than those found in the BEIR report. It is erroneous to give the impression that the health effects calculated in this draft document would be equivalent to those that would be arrived at by using the BEIR report.

Also, references are made to studies which seem to indicate that rodents exposed to radiation have longer life spans. It has been theorized that radiation creates a more sterile environment, thus reducing the probability of respiratory infection in rodents, increasing their life span in a radiation environment. We are of the opinion that the draft statement should clearly state the reasons for an increased life-span among the rodents, as well as mention the above cited hypothesis.

6. Page III-9: The source should be cited for the statement that declares that EPA has adopted the dose limits proposed by the National Council on Radiation Protection (NCRP). We are of the impression that EPA is in the process of reviewing these radiation standards but has not agreed to the limits proposed by NCRP.

7. Page III-13: We suggest that line 12 in paragraph 2 read as follows: "Technetium -99 can be given in rather large quantities with little radiation dose." As presently used in the draft document, the word "dose" refers to pharmaceutical dose (which in this instance is not the case). Also a discussion of the short half-life of Technetium-99 should be included in the final document as a means to support the above statement.

8. Page III-13/14: It should be noted that the use of pertechnetate for brain scanning is relatively low, amounting to 1.5 million administrations during 1972. The impact of other technetium compounds and kits as well as ^{67}Ga, ^{75}Se, and ^{133}Xe should also be considered.

9. Page III-15: It is important that the basis for simplifying assumptions be documented, even if only briefly, since they can significantly influence the risk estimates.

10. Page III-17: We do not agree with the statement made in paragraph one. Soluble Plutonium is listed in Table III-7 and represents a material that can enter the food chain. Since I_{131} constitutes an inhalation hazard, it also represents a potential health threat to the food chain in the event that a dairy or truck farming area were to become contaminated.

11. Page IV. Item 7 indicates that a few individual transportation workers might possibly be exposed to radiation limits which exceed those established for the public. The draft document devotes little attention to the problems of identifying, monitoring, and controlling the exposure to "truckers", "handlers" and others.

12. Page IV-49, Statement 6: The average individual dose from transportation is stated as 0.5 mrem/year. This is a factor of 2, not 20 less than the average per capita dose from radiopharmaceuticals (Table III-3).

13. Page V-29, line (1): This represents two cycles incorporated into one and is usually referred to as "grass-cow-milk-man" and "grass-cow-man" cycles.

14. The statement does not project the latent cancer fatalities (LCF) or early fatalities (EF) to the year 1985. Although exposure is projected to increase by a factor of approximately 3 from 9589 (1975) to 28,590 (1985), this suggests the LCF could increase from 1.2 in 1975 to 3.6 in 1985 as a result of normal transport only. Assuming the increase of a factor of 3 and an essentially equivalent population exposure, one may project the fatality date on pg. xx to be as follows:

	1975	1985
Early Fatality	1	3
Other deaths	16	48
Latent cancer deaths (30 yr. period)	600	1800

The alternative analysis is based on current shipment impact, pg. VI-1, and does not appear to be projected in terms of conditions which might be expected in 1985. Essentially, the

alternatives are compared on a basis of cost benefit vs. radiological effects(s), pgs. VI-1 and VI-3. If one accepts the figure of 8.22×10^6 per LCF or any other death, an investment benefit in terms of citizen protection may be calculated.

It is therefore suggested that as a minimum alternative B.3-1, Restriction of Physical and/or Chemical Form, of B.4-1, Revision of Packaging Standards, be required for radioactive material shipments.

Thank you for the opportunity to review the document.

Sincerely,

Charles Custard

Charles Custard
Director
Office of Environmental Affairs

United States Department of the Interior

OFFICE OF THE SECRETARY
WASHINGTON, D.C. 20240

ER-76/290 DOCKET NUMBER PROPOSED RULE PR-71 73 (40FR23768) JUN 8 1976

Trans. Radioactive Mtl. by Air

USNRC JUN 15 1976 Office of the Secretary Docketing & Service Section

Dear Mr. Arlotto:

Thank you for your letter of March 24, 1976, requesting our comments on the draft environmental statement on the Transportation of Radioactive Material by Air and Other Modes (Docket No. PR-71, 73, dated March, 1976).

Our comments are submitted according to the format of the statement or by subject.

Detailed Summary

It would be helpful to summarize the proposed action more clearly at the outset of the environmental statement. We conclude that it is proposed to continue regulating the transport of radioactive materials under present Federal regulations, pending completion of further studies of the costs and effectiveness of alternate transportation systems. While these studies are referred to generally (i.e., page v, paragraph 3), we find no summary of the specific studies in progress or of their expected date of completion.

The non-radiological consequences of accidents involving vehicles used solely for transport of radioactive materials are variously given as "two injuries and less than one fatality each four years" (for example, page iii, page xx, page xxiii). It would be advisable to use the same terminology throughout. In addition, some indication should be given of what percentage of transport is by vehicles used solely for transport of radioactive materials; otherwise, the figures on non-radiological consequences of accidents have little or no meaning or relevance to an evaluation of overall risk to individuals.

Acknowledged by card 6/16/76

CONSERVE AMERICA'S ENERGY

Save Energy and You Serve America!

Since hydropower is a significant conventional energy source, we suggest revision of the ninth line of page xxiv, by adding the words "such as by fossil-fuel plants" at the end of the sentence.

Introduction

Throughout the statement there is little information on the adequacy of regulations as applied to the transport of large-curie radiation sources that are stated to contain as much as hundreds of thousands of curies, for use in large-scale sterilization operations (page I-9). These are described as consisting chiefly of the radioisotopes cobalt-60 and cesium-137. Large curie sources of up to 10,000 curies are also said to be shipped to cancer treatment centers both in the United States and abroad, with overseas transport by ship and domestic transport by truck or rail (page I-9, paragraph 2). However, we found little or no information on the size or weight of the casks, or particularly on the adequacy of protection afforded the transport of the large-curie radiation sources under existing regulations.

Tabular data in Chapter I, that appears to provide comprehensive information for most classes of radioactive materials shipments, provides little or no information on the large-curie radiation sources, which appear to be among the potentially most hazardous materials shipped. For example, Table I-2 (page I-20) shows no shipment class having an average of more than 5,000 curies per package. We feel that comparable information, including the number of packages shipped annually in 1975 and 1985, should be provided for the teletherapy sources containing up to 10,000 curies of radioactivity and for the radiation sources that contain as much as hundreds of thousands of curies of activity, particularly in view of the fact that some of these large-curie sources are said to be shipped to locations abroad and by means of truck, rail, and ship. These shipments appear particularly important for inclusion in this evaluation because it is noted that 6,600 industrial 100-curie sources were estimated to be shipped in 1975 (Table I-2), but a single shipment of a radiation source containing hundreds of thousands of curies of radioactivity appears to be potentially as hazardous as thousands of the 100-curie-source shipments.

Transport Impacts Under Normal Conditions

Several statements suggest that the study is based on surprisingly incomplete information in some important areas pertinent to transport of radioactive materials. For example, it is stated: "While no specific information is at hand to suggest that radioactive materials are not shipped on passenger trains, no evidence of such use was discovered in an informal survey of the industry" (page IV-31, paragraph 1). This suggests that the facts now available to the staff provide no information on whether or not radioactive materials are shipped on passenger trains. It is also stated that "it is suspected that barge may be a method for transport of new and spent fuel to reactors and reprocessors located on appropriate waterways" (page IV-34, paragraph D.4-1). This lack of certainty on the part of the Nuclear Regulatory Commission regarding even the basic mode of transport in use for such materials does not provide reassurance that transport of radioactive materials is being carefully regulated in all cases.

Security and Safeguards

Chapter VII, concerning security and safeguards, raises further concerns relative to the transport of the large-curie radiation sources discussed previously. It is noted that one of the two groups of nuclear material that may require safeguarding consists of "a few radioisotopes such as cobalt-60," the other group being Special Nuclear Materials (SNM), and it is stated further that "isotopes such as cobalt-60 could be used by a terrorist in the form of a dispersal weapon" (page VIII-1, last paragraph). However, only the safeguarding of the SNM appears to have been considered in depth. Specific mention of the adequacy of present regulations to assure the safety and security of the large-curie sources containing cobalt-60, particularly when shipped overseas, should be presented in the final statement.

It has been stated that "other materials, such as cobalt-60, which are in special form, might be stolen and then dispersed in a highly populated area" (page VIII-7, paragraph 3). In spite of acknowledgment of the hazard, there is no specific discussion of risks in shipment of the high-curie sources or of adequacy of safeguards provided by existing regulations, even though these could contain several hundred thousand curies, evidently largely of cobalt-60. It is stated that "adequate safeguard measures are available if it is determined that some isotopes need added protection" (page VII-12, paragraph 1), but the need has evidently not yet been fully evaluated with respect to shipments of large quantities of cobalt-60.

The report does not specifically analyze consequences of accidents resulting in significant quantities of radioactive materials entering surface waters. While the probability of such occurrences would no doubt be very low, such an analysis might still be desirable to determine if conditions could arise requiring emergency measures to protect public water supplies.

Sincerely yours,

Stanley R. Bovemus

Deputy Assistant Secretary of the Interior

Mr. Guy A. Arlotto, Director
Division of Engineering Standards
Office of Standards Development
Nuclear Regulatory Commission
Washington, D. C. 20555

DOCKET NUMBER
PROPOSED RULE PR-71,73 (FR 23768)
Trans. Radioactive Mtl. by Air

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LOUIS J. LEFKOWITZ
ATTORNEY GENERAL

PHILIP WEINBERG
ASSISTANT ATTORNEY GENERAL
IN CHARGE OF
ENVIRONMENTAL PROTECTION
BUREAU

May 17, 1976

JUN 1 0 1976

Director
Office of Standards Development
United States Nuclear Regulatory
Commission
Washington, D.C. 20555

Re: Comments on the Nuclear Regulatory Commission's Draft Environmental Impact Statement on the Transportation of Radioactive Materials (NUREG-0034)

Dear Sir:

Pursuant to Notice of Availability of the above-referenced Draft Environmental Impact Statement ("DES") published at 41 Fed. Reg. 12937 and the solicitation of comments on that DES as contained in the Notice of Availability, the New York State Attorney General submits herewith comments on certain portions of the Draft Environmental Impact ("DES") from this office. Comments on other portions of the DES are in final preparation and will be submitted shortly hereafter. These additional comments will, in part, relate to the analysis in the DES of toxicity of materials, containerization, and overall risk analysis.

The DES if adopted as a Final Environmental Impact Statement ("FES") without major revision by the NRC will constitute a legally inadequate EIS under the National Environmental Policy Act, ("NEPA") 42 U.S.C. § 4321 et seq. The DES does not address many of those issues set forth in materials previously submitted by this office to the NRC in the course of this administrative proceeding as originally

noticed in the Federal Register. 40 Fed. Reg. 23768. Moreover, the DES does not address those issues discussed in the affidavits of Theodore T. Mason and Robert R. Leamer dated November 30, 1975 and January 20, 1976 previously submitted to the United States District Court for the Southern District of New York in the case of the State of New York v. The Nuclear Regulatory Commission (75 Civ 2121 [WCC]), copies of which are enclosed. These affidavits should be treated as sealed documents. Similarly the NRC should address those problems cited by John F. Shea, III, in the affidavits submitted in that court action, dated December 11, 1975 and January 20, 1976 and Captain James A. Eckols, dated November 28, 1975. Copies of all of these affidavits are enclosed.

In addition to the comments previously and now submitted to the NRC on this transportation issue and apart from those soon to be filed by this office with the NRC, several other more general comments are pertinent to a discussion of the DES and ultimate impact statement adequacy:

1) The DES fails to discuss in any way shipments of special nuclear materials ("SNM") and other radioactive substances by the Energy Research and Development Administration ("ERDA"). These shipments should be described in detail as to substance, quantity, and number. Of course a risk analysis of these shipments should be made.

2) More detailed discussion of the substance, quantities and numbers of shipments by NRC licensees should be included in the DES.

3) One of the most glaring inadequacies of the DES is the failure to give a meaningful assessment of the hazards of shipments by the water mode. Two pages of cursory discussion in the DES is given to this major alternative (pp. IV-34-35).

4) The DES safeguards discussion bases portions of its analysis on the as yet incomplete and unreleased analysis of safeguards in the Generic Environmental Statement on the Use of Recycle Plutonium in Mixed Oxide Fuel in LWR's. WASH 1327 ("GESMO"). General references to uncompleted studies in other proceedings render the DES legally inadequate.

The NRC must recognize, of course, that the execution of a generic review of this transportation issue and the drafting of a generic environmental impact statement will not satisfy the NRC's full obligation under NEPA. In this regard see the points raised in the affidavit of John F. Shea, III, dated January 20, 1976, as to the scope of the NEPA review process necessitated by this transportation issue.

Very truly yours,

LOUIS J. LEFKOWITZ
Attorney General
By

John F. Shea III
by JJZ

JOHN F. SHEA, III
Assistant Attorney General

JFS:rab
Enc.

JUN 16 1976

USNRC
JUN 16 1976
Office of the Secretary
Docketing & Service
Section

Mr. Louis J. Lefkowitz, Attorney General
State of New York Department of Law
Two World Trade Center
New York, New York 10047

Dear Mr. Lefkowitz:

Thank you for your letter dated May 17, 1976 commenting on the Nuclear Regulatory Commission's Draft Environmental Statement on the Transportation of Radioactive Materials (NUREG-0034)

Your letter requested that two of its enclosures be treated as "sealed documents". We have considered this to be a request for withholding those two enclosures from public disclosure, a request subject to the provisions of Part 2, "Rules of Practice", and Part 9, "Public Records", of Title 10, Code of Federal Regulations, copies of which are enclosed. Since your request contained no reasons recognized in those regulations for nondisclosure of the two documents, your request is denied without prejudice to your future resubmittal. The two enclosures to your letter dated May 17, 1976, identified as affidavits of Theodore T. Mason and Robert R. Leamer dated November 30, 1975 and January 20, 1976 are hereby returned to you, and will not be considered as comments on the Commission's Draft Environmental Statement NUREG-0034

Sincerely,

ORIGINAL SIGNED BY [illegible]

Robert B. Minogue, Director
Office of Standards Development

Enclosures (original only):
1. 10 CFR Part 2, "Rules of Practice"
2. 10 CFR Part 9, "Public Records"
3. Affidavit dated November 30, 1975
4. Affidavit dated January 20, 1976

TP513.1

bcc: Public Document Room (FR 71, 73 40 FR 23768)

USNRC
JUN 16 1976
Office of the Secretary
Docketing & Service
Section

COMMENTS OF THE NEW YORK STATE ATTORNEY GENERAL ON THE DISCUSSION OF SAFEGUARDS IN THE NUCLEAR REGULATORY COMMISSION'S DRAFT ENVIRONMENTAL IMPACT STATEMENT ON THE TRANSPORTATION OF RADIOACTIVE MATERIAL BY AIR AND OTHER MODES
NUREG 0034

By

THEODORE T. MASON

ROBERT R. LEAMER

Introduction

1. Three affidavits were submitted by Robert R. Leamer and Theodore T. Mason, dated 16 June, 1975, 30 November, 1975 and 20 January, 1976 to the United States District Court for the Southern District of New York in the case of the State of New York v. The Nuclear Regulatory Commission, et al. Copies of these affidavits have been provided to the Nuclear Regulatory Commission ("NRC") in the course of this proceeding dealing with the transportation of radioactive materials as originally noticed in the Federal Register. 40 Fed. Reg. 23768. References to the "plaintiff" in these comments on the Draft Environmental Impact Statement ("DES") are, of course, to the State of New York. Occasionally references are made to the "defendants" and "defendants' affidavits"; these references are to the NRC and its sister agencies which are involved with the transportation of radioactive materials and the affidavits which this agency and its sister agenices have filed in the litigation initiated by the State of New York.

The prior Mason/Leamer affidavits were submitted to:

a. demonstrate that there is a substantial likelihood a highly motivated group of terrorists could be successful in destroying or seizing for destructive use special nuclear materials (SNM) in the course of commercial air transport, or related connecting transport, notwithstanding existing safeguard regulations and/or actual practice;

b. indicate that the military has the current safeguard capability to move SNM by surface transport which is significantly less vulnerable to terrorists than commercial air transport and related connecting transport;

c. specifically evaluate the air transport of uranium (as opposed to plutonium) and demonstrate that any one of five (5) military assisted transportation system alternatives is significantly more secure against terrorist action than commercial air transport, because of:

(1) rigorous control of future shipment movement information;
(2) more secure in-transit communications;
(3) reliable and highly motivated personnel with security training and clearances;
(4) appropriate selection of weapons and vehicles;
(5) superior reaction capability;
(6) physical remoteness of airfields and facilities;
(7) psychological deterrent of a U.S. military protection force.

d. indicate that points contained in J. Edlow's affidavit submitted by defendants and in the MITRE Report prepared for the Nuclear Regulatory Commission (MITRE Technical Report 7022, September, 1975, The Threat to Nuclear Facilities), corroborate the findings of Mr. Leamer and myself regarding the vulnerability of commercial air and related connecting transport sys-

tems, including the following points:

(1) "Expediting" as practiced under current Part 73 Regulations and described by Mr. Edlow may provide notice after a shipment of SNM has been misrouted or diverted and may help prevent casual theft. However, it will not prevent determined terrorist attacks or organized theft. Shipment preplanning integral to "expediting," without stringent information control, could substantially aid a terrorist in seizing or destroying SNM in transit.

(2) There have been no less than 26 commercial aviation-related terrorist acts in the last 6 years; carriage of SNM in commercial aircraft provides terrorists with an additional incentive; the MITRE Report observed that terrorism has become commonplace in the Western World and weapons of large caliber and full-automatic fire can be easily procured;

(3) The transportation industry is heavily infiltrated with criminals, corruption, employee collusion, and has been characterized by Sam Edlow as untrustworthy, incompetent, and operating in an environment of criminality; the MITRE Report has observed that a veritable army of criminals and hoodlums in this country is waiting and willing to undertake any activity, including murder, if profit justifies it.

Purpose of this Affidavit

2. The purpose of this affidavit is to evaluate, as well as possible within the brief time available, the Draft Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes, March, 1976 ("DES"), as a response to the previous affidavits of Mr. Leamer and myself.

Military Assisted Transportation Alternatives For Uranium

3. The only discussion of military assisted air transport alternatives in the DES is limited to approximately one-half of a page (p. VII-12). What little discussion there is emphasizes only the military airfield aspect of these alternatives. It is apparent that the 5 military assisted options for uranium transport detailed in our affidavit of 30 November, 1975 (pp. 4-7) were not considered.

4. The DES does admit that the use of military airfields and/or aircraft "appears technically feasible." However, in a footnote, the DES suggests that the use of military airfields and aircraft may be prohibited and cites a law said to provide that: "Except as otherwise provided by law, sums appropriated for the various branches of expenditure in the public service shall be applied solely to the objects for which they are respectively made." 31 U.S.C. 628. In light of the obvious danger to the national security inherent in commercial air transport and related connecting transport of SNM, the failure of the DES to demonstrate that there are no sums appropriated which might properly be applied to the use of military airfields and aircraft for transport of uranium is significant.

5. The statement that "adequate protection can be afforded at civilian airfields" (VII-12) is not supported by substantive discussion and misses the point that a military airfield has numerous advantages including inherent security, control of movement information, cleared, motivated and trained personnel, reaction capability, and location outside of highly populated areas.

6. Even though the DES makes no specific mention of military helicopters, it does make brief reference to helicopters generally (VII-13). This reference to helicopters, and STOL aircraft, together with their range and payload parameters, is without any quantification and hence without substance. After all this time, only conclusory speculation is offered. It is generally

known, however, that a wide range of helicopters is used in the military and in industry with considerable flexibility in range and payload. In fact, a quick check reveals, for example, the following:

Helicopter Manufacturer/Type	Range	Payload (lbs.)
Boeing Vertol model 234	240 nm. 320 nm.	20,000 4,000
Bell model 222 (undergoing certification)	425 nm.	1350 (Estimated)

Military Assisted Transportation Alternatives for Plutonium

7. The DES makes no reference whatever to the military surface transport alternatives for shipment of plutonium set forth in our Affidavit of 16 June 1975, pages 20 through 22.

Terrorist Use of SNM

8. In our Affidavit of 16 June 1975, pages 14-16, we cite a number of authorities in support of the following propositions:

a. that the information necessary for the design of a nuclear device is publicly available; and

b. that a technically competent group of terrorists could fabricate an effective, even if crude, nuclear device notwithstanding the fact that it had no prior experience in fabricating such a device.

Notwithstanding some discussion regarding the benefits of prior experience in the fabrication of such a device, the DES admits that persons without such experience could produce a device with a low tonnage yield, apparently a yield of one kiloton or less, or even a device with a substantial yield (F 1-3). Moreover, the DES admits that "the potential consequences arising from any nuclear explosive are so serious as to warrant the utmost vigilance, however low the probabilities may be." (F-2). The DES places great emphasis on the supposed difficulty of "emplacement" of a nuclear device because law enforcement agencies would be watchful (p. F-4). However, this is not very comforting when one considers the almost

infinite opportunities for emplacement in a large city.

9. On page VII-7, 8 the DES admits that plutonium oxide can be used as a dispersant in weapon form or by dispersing plutonium in transit by bursting its container and that such use would have serious consequences. However, in Appendix F, page F-4, the consequences of using plutonium oxide are said to be uncertain and such use is said to be inconsistent with observed behavior of terrorists. Peter Skinner's Affidavit of 2 May, 1975 indicates that the consequences of use of plutonium oxide as a dispersant are not uncertain. While it may true that terrorists have not yet used poisonous agents, that does not mean that they will fail to use them in the future. Moreover, terrorists might find particular appeal in a radioactive poison, not only because of its greater psychological value (over more conventional poisons), but also because of its extremely long life, assured effectiveness and its particular macabre method of destroying human tissue.

DES Discussion of Current Policy, Regulation and Practice

10. The DES makes a significant admission regarding the NRC's overall policy on safeguards. The DES states (VII-2) that, while safeguards must be capable of preventing acts which could result in a "major civil disaster," safeguards need only provide a "high degree of protection" against acts that could result in "serious civil damage." No justification or analysis is presented to support such a policy and no definitions are provided for any of the salient concepts employed. One would think that, given the immense danger posed to the public by terrorist use of SNM, safeguards should be capable of preventing any such use.

11. Plaintiff pointed out in the Mason/Leamer Affidavit of 20 January, 1976 that the provisions of 10 CFR 73 apply only to licensees shipping certain amounts of SNM computed by formula, which include 5,000 grams or more of U235 enriched to 20 per cent or more, or 2,000 grams or more of plutonium. Failure to subject smaller quantities to such regulations subjects the public to significant dangers specified in the above-mentioned Mason/Leamer

Affidavit. The DES does not respond to this point.

12. Plaintiff has demonstrated in three affidavits that the current requirements and practice regarding safeguards are inadequate to cope with the terrorist threat. The DES does not address itself in any meaningful way to the inadequacies previously specified by plaintiff. Indeed, the DES admits (VII-3) that "present requirements are designed to protect against theft, diversion, or sabotage by one or two employees with access to the plant and material, by a small armed force attacking a plant or vehicle, or by both acting in combination." "[S]mall force" is not defined in the DES. But, as to nuclear facilities, the Atomic Energy Commission ruled that licensees were only responsible for providing adequate security to repel not more than one or two individuals acting in concert (Nuclear Fuel Services Inc. - NRC Docket #50-201, Atomic Safety Licensing Board Decision, November 29, 1974, p. 11). However, it is almost certain terrorists would employ 4, 5 or more persons. Moreover, the AEC ruled that licensees were not required to protect nuclear facilities against a well armed band of saboteurs whatever the size of the band; licensees need only concern themselves with "an amateur group" (Id. p. 15).

13. Given the purpose for which the safeguard requirements (10 CFR 73) were designed it is not surprising that the requirements and practice are grossly inadequate to cope with terrorism.

14. The DES fails to respond to plaintiff's previously specified criticisms of various aspects associated with the use private guards: inadequate training, lack of security clearances, low pay, and lack of military type motivation. When the DES discusses the number of guards employed it is misleading. At one point (VII-10), it states that in truck transport "the number of guards would be varied to suit the particular shipment and preceived [sic] threat;" the regulations do not require this. At another point (VII-4), the DES states that, when cargo aircraft are used, enroute transfers must be observed by more than one armed person; the regulations do not necessarily so require.

15. Plaintiff has previously pointed out that the weapons and vehicles employed by private guards are inadequate for coping with the terrorist threat. The DES offers no meaningful response.

16. Nevertheless, the DES (VII-6) makes the bold assertion: "Licensee guards are expected at all times to (1) interpose themselves between SNM and any adversary attempting entry and (2) intercept anyone exiting with such material. A sufficient degree of force should be applied to counter that degree of force directed at them, including the use of deadly force . . . Considering the number of personnel and the weapons selection likely on both sides in a confrontation with terrorists, it would be tantamount to suicide for licensee guards to act in the manner suggested by defendant.

17. Plaintiff has previously demonstrated the wide dissemination of information regarding future SNM shipments (Affidavit of Peter Skinner, 2 May 1975) and emphasized the danger which this presents. The DES makes no response. Plaintiff has also pointed out the inadequacy of current communication systems used in commercial SNM transport. Again, the DES fails to respond.

18. The DES (VII-10) asserts that local law enforcement agencies located along a truck route would supply a secondary response. This is all well and good but for the fact that the regulations do not require communication equipment or frequency of contact which assures that such persons would be alerted when required. In connection with truck transport from airports to facilities, the DES (VII-11) states that convoys will have the additional protection of the facility's security force to act as a response capability, but fails to deal with the practical aspects involving distance, transport, communications, and on site responsibilities. The DES statement (VII-11) that "airplane security personnel" would be present during airport SNM transfers in addition to the guards accompanying the truck is not supported by the regulations. The regulations do not provide for armed airplane security personnel.

19. With regard to deterring an attack the DES places great emphasis on psychology (VII-8); this is ironic in light of the reluctance of the DES to give any meaningful consideration to use of military capabilities.

20. The statement in the DES that hardware and techiques are currently available to allow an effective recovery effort is inexplicable in light of the admission that recovery cannot be relied upon as the strong link in the security system. (VII-9)

21. With regard to monitoring and inspection of safeguard systems, the statements in the DES (VII-5) appear to be wishful thinking. Not even the DES claims this monitoring and inspection of SNM transport actually occurs.

Conclusion

22. The fact that the DES fails to respond to the plaintiff's previous affidavits is not surprising when one notes that the DES admits that an "in depth analysis of safeguards" is currently being undertaken (VII-9) and that studies are being completed to determine "the cost and effectiveness of alternative systems" to safeguard SNM (VII-15). Thus, at this late date, NRC admits that it has not yet analyzed and studied the safeguards issue involved in the air and related connecting transport.

Dated: New York, New York
April 9,1976

Docketed USNRC
JUN 16 1976
Office of the Secretary Docketing & Service Section

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

----------X

THE STATE OF NEW YORK,

Plaintiff,

-against-

THE NUCLEAR REGULATORY COMMISSION, et al.,

Defendants.

----------X

AFFIDAVIT IN FURTHER SUPPORT OF PLAINTIFF'S MOTIONS

STATE OF NEW YORK)
: SS.:
COUNTY OF NEW YORK)

JOHN F. SHEA, III, being duly sworn, deposes and says:

1. I am an Assistant Attorney General in the office of LOUIS J. LEFKOWITZ, Attorney General of the State of New York, and I make this affidavit in further support of plaintiff's motions for a preliminary injunction and summary judgment.

2. The January, 1976 affidavit of Robert F. Barker of the Nuclear Regulatory Commission ("NRC") states that the preparation of an Environmental Impact Statement on the Transportation of Radioactive Materials By Air ("EIS") "is intended to satisfy the procedural and substantive requirements of the National Environmental Policy Act of 1969." (p. 1) It is still not clear, however, whether this "study" will include an assessment of several items such as ERDA shipments by air of special nuclear materials ("SNM"). Compliance with NEPA is, of course, an impossibility if ERDA actions are not subjected to scrutiny under the Act.

3. The NRC may or may not issue further environmental

impact statements, in addition to the generic EIS, in an attempt to satisfy the NEPA mandate. Compliance with NEPA would be an impossibility if all that was conducted was a generic review of these federal actions. Many issues not amenable to generic treatment are involved in the air transport of SNM. For example, the site-specific problems of such transport through the individual metropolitan regions of New York, Los Angeles, Detroit or Minneapolis-St. Paul, do not lend themselves to treatment in a single generic EIS. Similarly, for example, the issuance of at least some licenses by NRC, and at least some ERDA shipments, will demand NEPA assessment in individual EIS's. It must be remembered that plaintiff maintains that individual federal actions of licensing, approving, allowing or executing, directly or indirectly, the air transport of special nuclear materials constitute separate major federal actions significantly affecting the environment and requiring environmental impact statements.

4. Finally, procedural compliance with NEPA will only be possible when environmental review procedures implemented, including EIS preparation, are truly adequate under the Act. This issue may not be prejudged.

5. The Jackson Amendment restricting certain air shipments of plutonium by ERDA was signed into law on December 31, 1975.

6. In defendant's memoranda of law in opposition to plaintiff's earlier motion for a preliminary injunction, air transport of SNM was seen as being vital to the U.S. role of being a "dependable supplier" of SNM abroad. "Our role as a principal supplier of nuclear materials permits the United States to further its foreign policy objective of curtailing the proliferation of nuclear weapons." (Def. Mem. of Law, June 6, 1975, p. 5).

It is significant that, on Monday, January 19, 1976, the first chairman of the former Atomic Energy Commission, David E. Lilienthal, said that the United States must immediately and unilaterally "Order a complete embargo to the export of all nuclear devices and all nuclear material" to avoid the "impending disaster" of the rapid international spread of nuclear bombs. (New York Times, January 20, 1976, p. 2, cols. 4-6, copy attached as Exhibit "A").

7. It is respectfully requested that the affidavit of Messrs. Mason and Leamer, dated 20 January, 1976, be sealed.

JOHN F. SHEA, III

Sworn to before me this
20th day of January, 1976

Assistant Attorney General
of the State of New York

NEW YORK TIMES, JANUARY 20, 1976, p.2, cols.4-6.

U.S. Export Ban on Nuclear Equipment Urged by Former Atomic Energy Chief

By DAVID BURNHAM
Special to The New York Times

WASHINGTON, Jan. 19—The first chairman of the Atomic Energy Commission said today that the "impending disaster" of the rapid international spread of nuclear bombs required that the United States immediately and unilaterally end the shipment of nuclear equipment to all foreign countries.

The call was made at a Senate hearing by David E. Lilienthal, chairman of the commission from 1947 to 1950.

Two fellow panelists at the hearing, Dr. Hans A. Bethe and Dr. Herbert F. York, said they would support a temporary embargo of nuclear shipments, now estimated to earn the United States more than $1 billion a year, if it was the first step in a major diplomatic effort to develop an effective international system to control the spread of nuclear weapons.

Dr. Bethe, a Nobel Prize winner, director of theoretical physics for the Manhattan Project in World War II and professor of physics at Cornell University, has been an outspoken advocate of nuclear power as a source of energy. Dr. York, director of the Lawrence Radiation Laboratory at Livermore, Calif., during the development of the H-bomb, is a professor of physics at the University of California, San Diego.

"If a great number of countries come to have an arsenal of nuclear weapons, then I'm glad I'm not a young man and I'm sorry for my grandchildren," Mr. Lilienthal, now the head of an international consulting firm, said at the Senate Government Operations Committee hearing.

Six countries are known to have developed atomic weapons—the United States, the Soviet Union, Britain, France, China and India. But within four years, 28 countries are expected to be operating nuclear power reactors and developing within their borders a growing familiarity with nuclear technology.

"The tragic fact is that the atomic arms race is today proceeding at a more furious and more insane pace than ever," Mr. Lilienthal said. "Proliferation of capabilities to produce nuclear weapons of mass destruction is reaching terrifying proportions."

"We have to decide now what we can do, now, within our own capabilities, to prevent a very bad situation from becoming a disastrous and inevitable one," he said.

"I therefore propose as a private citizen that this committee, with its great prestige, call upon the Congress and the President to order a complete embargo to the export of all nuclear devices and all nuclear material, that it be done now, and done unilaterally," Mr. Lilienthal continued.

"Further, unilaterally, the United States should without delay proceed by lawful means to revoke existing American licenses and put an end to the future or pending licensing to foreign firms and governments of American know-how and facilities paid for and created by American taxpayers' funds and American brains."

Asked about the proposed embargo, Dr. Bethe said: "When I first heard about it and read it, I didn't like it. But I now like it when Mr. Lilienthal said the embargo was temporary until we worked out real controls. But we have to make clear that the embargo is temporary until a treaty can be concluded between nuclear countries that really assures control over proliferation."

Dr. York, in response to the same question, said, "My views are similar to Dr. Bethe's. As the first part of a major initiative to try to do something, it seems good."

Mr. Lilienthal said that if the United States, the world's major nuclear supplier, unilaterally embargoed the export of nuclear equipment, the other countries that have gradually begun selling reactors and other nuclear equipment to less developed nations such as Brazil would also cease their exports.

The two other panelists also offered suggestions about the steps the United States should take to curtail the spread of weapons. Dr. York recommended that it cut off all nuclear shipments to the scores of nations such as France and Japan that have not ratified the 1968 treaty on the nonproliferation of nuclear weapons.

Dr. Bethe recommended that Congress immediately pass a law forbidding the export of the so-called "breeder reactor." This reactor, now under development by the United States, is designed to create more plutonium than it burns. In addition to serving as reactor fuel, plutonium can be fashioned into atomic bombs.

Senator Abraham A. Ribicoff, the Connecticut Democrat who heads the committee, called for a detailed study of the present weapons controls. "If the system is inadequate—and there are several experts who insist it is—then we must acknowledge these inadequacies and organize our Government to deal with them effectively and fast," he said. "Otherwise our nation and the world are in peril."

EXHIBIT "A"
J-86-18

DOCKETED USNRC
JUN 16 1976
Office of the Secretary Docketing & Service Section

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

----------X

THE STATE OF NEW YORK,

Plaintiff,

-against-

THE NUCLEAR REGULATORY COMMISSION, et al.,

Defendants

----------X

AFFIDAVIT IN SUPPORT OF MOTION FOR PRELIMINARY INJUNCTION AND SUMMARY JUDGMENT

75 Civ. 2121 (WCC)

STATE OF NEW YORK)
: SS.:
COUNTY OF NEW YORK)

JOHN T. SHEA, III, being duly sworn, deposes and says:

1. I am an Assistant Attorney General in the Environmental Protection Bureau of the New York State Department of Law and am assigned to this action. I make this affidavit in support of plaintiff's motion for a preliminary injunction and for summary judgment.

2. The State of New York is making the instant motion for a preliminary injunction notwithstanding the Court's previous denial of a motion for a preliminary injunction by an order dated September 9, 1975. In making the motion, we rely on all previous affidavits, letters and memoranda submitted to the Court in the action, as well as an additional affidavit by Theodore T. Mason and Robert R. Leamer, sworn to November 30, 1975, which we respectfully ask to be sealed, an affidavit by Captain James A. Eckols, sworn to November 28, 1975, and this affidavit. In this motion we seek to clearly set forth a distinction between the

preliminary injunctive relief [illegible] we seek with regard to plutonium and that which we seek with regard to uranium, other than uranium enriched in the isotope U-233. U-233 is not a subject of the preliminary injunction motion because at present we are unaware of any immediate plans to transport such material by air.

3. Plaintiff continues to seek the cessation of all air transport and related connecting transport of plutonium, because the danger of dispersion of this highly toxic material in an aircraft-accident poses a grave threat to human life quite apart from the threats of terrorism. As for the threat of terrorism regarding plutonium, the Mason/Leamer affidavit sworn to July 16, 1975, pointed out that military assisted surface transportation is significantly less vulnerable to terrorist acts than the present commercial air transport system.

4. With regard to uranium (other than uranium enriched in the isotope U-233), plaintiff seeks a lesser remedy, i.e., the cessation of all commercial air transport and related connecting transport. This lesser remedy is sought because such uranium materials do not present the same toxic threat as plutonium. Nevertheless, as indicated in the Mason/Leamer affidavit sworn to June 16, 1975, and the affidavit of Peter N. Skinner sworn to July 31, 1975, uranium, like plutonium, could be fashioned into a practical nuclear explosive by terrorists. As also indicated in that Mason/Leamer affidavit, the commercial air transport system is highly vulnerable to terrorist interception of uranium. Finally, as indicated in the Mason/Leamer affidavit sworn to November 30, 1975, submitted herewith, military assisted transportation alternatives are far less vulnerable to such terrorist interception. Plaintiff particularly urges that alternative (1) suggested by Messrs. Mason and Leamer for the transport of uranium, i.e., the

use of military airplanes flying between military airfields with short hauls by military helicopter, is appropriate (Mason/Leamer Affidavit, sworn to November 30, 1975, pp. 4-5).

5. In addition to clearly setting forth a distinction between the preliminary injunctive relief sought with regard to plutonium and that sought with regard to uranium, we submit in this motion additional facts, set forth in the Mason/Leamer and Eckols affidavits submitted herewith, which demonstrate the irreparable harm which may result from failure to grant the requested relief as to plutonium and uranium.

6. I should also point out that the Congressional bill which the Court described at page 10 of its opinion of September 9, 1975, as restricting air shipments of plutonium by the Energy Research and Development Administration ("ERDA") has not become law. On December 3, 1975, I spoke with John Bell, Legislative Aide to Congressman James H. Scheuer. Mr. Bell informed me that the ERDA legislation, to which the Jackson Amendment regarding ERDA's shipment of plutonium by air transport was added, had been held up in a Senate-House Conference Committee since early fall. The delay in that Committee, Mr. Bell noted, was not due to the Jackson Amendment, but rather due to other Senate amendments. On December 2, 1975, the Committee reached final agreement on all issues but the Report had not reached the House and Senate. The Report retains verbatim the language of the Jackson Amendment.

7. The State of New York is also making a motion for summary judgment which declares that defendants' actions in licensing, approving, allowing and executing, directly or indirectly, the transportation by air and related connecting transport of special nuclear materials without having prepared, circulated for comment and filed adequate Environmental Impact Statements concerning the transport of all special nuclear

materials to, from, in, or over the City and State of New York and the United States and its territories are in violation of the National Environmental Policy Act, 42 U.S.C. § 4321, et seq. ("NEPA"), and the Council on Environmental Quality Guidelines, 40 C.F.R. § 1500, et seq. ("CEQ Guidelines"). It is significant that, notwithstanding the defendants' statement in their memorandum of law of June 6, 1975, page 16, that they did not concede that an Environmental Impact Statement is required by NEPA, defendants failed to adduce one argument in the 47 page memorandum which is directed toward that issue. The memorandum as a whole, in effect, did concede that defendants violated the law and concentrated solely on whether the preliminary injunctive relief ought to be denied for other reasons. Only defendants Civil Aeronautics Board and U.S. Customs Service later moved to dismiss the complaint and in their supporting memorandum of law (undated) asserted that they had not violated NEPA. At page 5 of that memorandum, however, they conceded that no facts were at issue. As demonstrated in plaintiff's opposing memorandum of law of September 5, 1975, on the facts admitted by defendant and on the law, these two defendants have also violated NEPA and the CEQ Guidelines. The motion to dismiss has not yet been decided.

8. The State of New York further moves that the summary judgment direct that defendants make available a draft generic Environmental Impact Statement concerning the transport of all special nuclear materials to, from, in or over the City and State of New York and the United States and its territories on or before December 31, 1975, that defendants hold hearings thereon during March 1976 in various parts of the country, including New York City, and accept comments thereon through March 31, 1976, and that defendants file an adequate final generic Environmental Impact Statement concerning the transport of all special nuclear materials to, from, in or over the Ci

and State of New York and the United States and its territories on or before June 21, 1976. Such a direction by the Court is required in order to ensure that the law will be complied with by a date certain. The date selected for making available a draft statement and for filing a final statement should not be burdensome to the defendants, since the Court noted at footnote 4 of its memorandum of September 9, 1975, that it had been represented to the Court that the draft would be available by the end of this year and the final by the summer of next year. The inclusion of dates for making available the draft and for hearings and the submission of comments by interested parties thereon is designed to assure that the date for filing the final statement will not be used as an excuse to curtail the extensive study and comment which a draft statement on this important topic will require.

9. On November 7, 1975, plaintiff filed a notice of appeal from the Court's order of September 9, 1975. The record on appeal is presently scheduled to be filed in the Court of Appeals on or before December 16, 1975. If the relief requested in the instant notice of motion is granted, prosecution of the appeal from the earlier order may not be necessary. If the relief requested in the instant notice of motion is denied and plaintiff appeals from that denial, it may be desirable to prosecute the two appeals simultaneously. Accordingly, plaintiff respectfully requests that the Court extend the time for transmitting the record on appeal to the Court of Appeals to and including February 5, 1976, pursuant to Rule 11(d) of the Federal Rules of Appellate Procedure.

JOHN F. SHEA, III

Sworn to before me this
11th day of December, 1975

Assistant Attorney General
of the State of New York

J-86-23

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

DOCKETED USNRC JUN 16 1976 Office of the Secretary Docketing & Service Section

THE STATE OF NEW YORK, Plaintiff,	:	
-against-	:	AFFIDAVIT
THE NUCLEAR REGULATORY COMMISSION, et al., Defendants.	:	75 Civ. 2121 (WCC)

STATE OF MISSOURI)
:SS.:
COUNTY OF ST. CHARLES)

CAPTAIN JAMES A. ECKOLS, being duly sworn, deposes and says:

1. I am a pilot with an American flag commercial air carrier and am Chairman of the Hazardous Materials Committee of the Air Line Pilots Association (ALPA) which represents the professional interests of 32,000 airline pilots on 34 airlines. ALPA is a member of the International Federation of Air Line Pilots Associations which represents pilots from 60 nations. I make this affidavit in support of the State of New York's motion for a preliminary injunction and motion for summary judgment.

2. I will, in the ensuing pages, set forth the reasons why airline pilots believe that there exists an imminent and severe danger of catastrophic harm from the continued shipment of special nuclear materials ("SNM") by commercial air transport. My discussion will center on two areas of inadequacy of this method of shipment: I. Safeguards, II. Containment, Control, and Handling.

I. Safeguards

3. Critical to the safety of commercial air transport of SNM is the severely inadequate security within the air cargo industry. Presently, regardless of cargo, multi-million dollar aircraft and pilots are subject to selection at any time as a "target of opportunity" by skyjackers, extortionists, terrorists or saboteurs. We received a clear lesson as to the very real terrorist threat as 3 Boeing 747's burned to ashes on a patch of Jordanian desert while crew and passengers were held hostage under the muzzles of terrorist sub-machine guns. We have seen as well:

- -mid air sabotage
- -grenade attacks on land
- -attacks on terminals
- -abductions
- -diversions
- -over 370 global acts of terror endangering 16,000 people.

As I have stated, the lesson is clear, SNM must be removed from commercial air transport.

4. As it stands now, without waivers from the FAA certain materials would be strictly forbidden from carriage aboard any aircraft other than those under the direct jurisdiction of the Department of Defense. Often information as to the presence of SNM is not properly disseminated to crew members actually flying the aircraft and, in some cases, their exposure to danger is shocking, moreover, the related danger to the cargo itself is appalling. The crew members involved in this transportation have not volunteered for this extremely hazardous duty for the benefit of industrial shippers.

5. If these materials must be moved by air transportation, they should be moved by military personnel, in military aircraft from military airports that do not constitute a hazard to the public.

6. Data found in studies prepared by the former Atomic Energy Commission ("AEC") support the contention of the State of New York that the hazards involved with the commerical air transport of SNM, due to such transport's vulnerability to theft, organized crime, terrorism and cargo loss, warrant immediate suspension of such transport of SNM. Sam Edlow, President of Edlow International Company, which company shares a virtual monopoly of the SNM shipping business with the Transnuclear Company, was contracted by the AEC to prepare A Factual Study of Special Nuclear Material Patterns of United States Commercial Organizations and Of Unclassified Exports By The AEC and Its Contractors. ("Edlow Rept."). The report, prepared by that major industry spokesman, contains several specific findings:

> -The commercial airline industry is stuck with the fact that enroute terminal use and attendant security risks cannot be avoided.
>
> -Commercial airlines do not find it feasible to disqualify high risk individuals.
>
> -Commercial airlines do not find it feasible to equip vehicles with simple alarms or more sophisticated anti-hijack devices. (In this connection, two well-known national companies providing armed car services were interviewed. Neither company saw "any purpose to be served by equipping armored cars with alarms or other anti-hijack equipment."
>
> -Similarly, commercial airlines do not find it feasible to provide special locks for vehicles.

-Nor do they find it feasible to provide constant communication.

-The airlines do not seal off "driver's" compartments on any vehicles. (Edlow Rept. pp. 24, 25, 42)

7. It has been stated by defendants in their affidavits that the reasons for shipment of SNM by air, "as with any material involves factors of economics, reliability, convenience and speed in delivery" (D. Aff. of Leland Rouse, p. 4). This glosses over real reasons for air shipment as determined by Mr. Edlow. According to him, cost is the most important consideration to shippers in the selection of shipping method. (Edlow Rept. p. 13)

8. The defendants further state that "containers are less likely to be delayed or misrouted when transported by air than by surface transport, particularly when long distances are involved" (D. Aff., Leland Rouse, p. 4). This statement is utterl without basis, and is contrary to the facts of which defendant DOT is fully aware. Sam Edlow authoritatively related the details of several incidents which show such statements by the defendants to be gross distortions of what really goes on in the SNM cargo industry.

> "Have you heard about the three famous UF^6 shipments of March, 1969? One was mine. 33 kgs. U enriched to 90%, aboard an international flight to New York to Frankfurt, had been loaded on a mixed London-Frankfurt pallet. At London, the pallet was removed from the aircraft, and the London cargo was removed. The balance of the pallet just sat there while the aircraft took off and continued to simply sit at London. We were notified by consignee that the flight arrived without the shipment, and we swung into action. The airline quickly found the cargo, still sitting in London. No airline personnel at London or elsewhere had initiated any action. We had to tell the airline that the cargo was missing. Incredible -- you can bet your bottom dollar.

"Second famous shipment of March, 1969. Three containers of strategic material, gross weight 850 lbs., left Goodyear on Wednesday, reached Columbus, were taken to Dayton, where they were loaded aboard air freighter for St. Louis for onforwarding to consignee by special truck. Two containers were delivered on Thursday. The third container appeared to be irretrievably lost, but was eventually found nine days later in Boston under a load of shoes. And how was it found -- a shoe store was tracing a lost consignment of shoes and Thank God -- they found the shoes -- with the strategic material underneath. Incompetence -- what else?

"Third March shipment. Four containers of strategic material were loaded aboard air freighter at Dayton for St. Louis on Friday. Saturday -- two of the four were delivered to consignee. No one with the air line could figure out what happened to the other two containers. Tracing followed, and the missing containers were located on Monday at St. Louis Airport, right where they were supposed to be. Incompetence -- nothing else.

"To sum up -- the environment of the transportation industry is one of incompetence, criminality, and unreliability." (Plutonium Diversion, Geesaman, Donald P.; Report before California Legislative's Assembly Science and Technology Council's Energy Panel, June 15, 1972, pp. 15, 16).

9. Incompetence and inefficiency are obviously not the only problems associated with the commercial air cargo industry. William Brobst former Deputy Director of the Office of Hazardous Material, DOT, now with the Energy Research and Development Administration ("ERDA"), in commenting on the then AEC's set of procedures to be followed in protecting special nuclear materials in transportation, stated:

"Although these procedures might be somewhat effective in discouraging the diversion of nuclear material by some bystander who is curious as to the contents of the package, I do not believe that they have any meaningful degree of effectiveness in even discouraging an intentional diversion by any person whose motives are subversive or economic." (Ibid. p. 11).

10. In this regard, Sam Edlow has confirmed Mr. Brobst's opinion on the effectiveness of safeguards procedures and "signature service" and has described the condition of the transportation industry into whose hands SNM were being committed. As he points out, the procedures are only as effective as they are wanted to be by those in the industry who implement them.

> "I was part of an informal meeting some few months ago attended by government personnel, representatives of major truckers, railroads, one airline, insurers, and freight claim agents. It was agreed that the transportation industry is so thoroughly infiltrated by the Cosa Nostra that any cargo which organized crime determines to obtain will be obtained. To put it another way no material is safe during transportation if organized crime decides to lay its hands on the material.....
>
> "How very often we read of thefts of bullion, jewelry, watches from secure rooms at air cargo terminals. The hijacking of aircraft is now a weekly occurrence. Today aircraft are hijacked to provide escape means to Cuba. Who here dare say that aircraft will not by hijacked for the nature of the cargo aboard - because of its high value or its strategic nature?
>
> "Gentlemen, the transportation industry is infiltrated by organized crime and must be adjudged incapable of providing reasonable protection for valuable or strategic cargo. The transportation industry is untrustworthy....
>
> "The high level of incompetency which has been achieved by surface and air carriers staggers the imagination. The inability of the air carrier industry to properly handle the cargo handed to it for air carriage now approaches a national scandal...
>
> "Signature service cannot and will not prevent loss, diversion, or mishandling of cargo. Further, signature service will not give early notice that shipment is lost, unaccounted for, or diverted. At most, it will single out a shipment as being something other than routine. That the regulation provides any more in the way of security, I question." (Ibid, pp. 13, 14, 17).

11. It is widely recognized in the industry and among defendants that a nuclear black market, if not already in existence, is bound to develop as SNM is successfully stolen in small or larger quantities. Commissioner Larsen, when still with the former AEC, publically conceded the point. (Atomic Energy Commission's Symposium on Ssafeguards, Research and Development, October 1969).

12. May 1970, the Institute of Nuclear Materials Management published a report on safeguards in transportation. The abstract of that report stated in part:

> "the transportation industry is characterized by its own press as... 'rotting at its core'...., law enforcement agencies advise that $1 billion dollars of merchandise is being hijacked or pilfered during transportation each year in the United States, and federal agencies acknowledge that organized crime has a strangle hold on the United States transportation industry. Into this milieu, professional managers of nuclear materials are currently shipping sufficient quantities of nuclear materials to produce nuclear weapons or to direct toward possible nuclear blackmail. The INMM Safeguards Committee explores these issues in this document and concludes that the postulated problem is real, current, at the alarm level now, and increasing in scope and risk."

13. Dr. Theodore Taylor, one of the foremost experts in the area of clandestine nuclear weapons use has noted professional criminals can be motivated, simply by the prospects of large profits, to steal fissionable material, for sale to high bidders. "Practically every highly valuable material has been traded in illegal national and international markets. It is hard to see why inadequately protected fissionable materials should be any exception" (December, 1971 AANS Symposium on the Energy Crisis).

14. The irony of the present situation, particularly with reference to ERDA shipment of SNM, is pointedly addressed by former AEC Director Crowson, Division of Nuclear Materials Security. One of the anachronisms of the NRC policy is that strategic nuclear materials which are to be used for military purposes are shipped under military rules. But, if the same materials are to be used for civilian purposes - although they too could fuel a bomb - they are usually shipped in the words of Crowson "like a special delivery letter" (Science, April 9, 1971, p. 145).

II. Containment, Control & Handling

15. ALPA's independent investigation of the air cargo industry and the present scheme for radioactive materials handling has resulted in a number of findings all of which have been indisputably confirmed by Congressional investigations. Eight of these ALPA findings are as follows:

1) Most hazardous material shipments are carried in violation of federal safety precautions.

2) Shippers, freight forwarders and carriers routinely ignore or misinterpret the law and do not even have a copy of the applicable regulations available where they were needed.

3) The regulations themselves are outmoded, confusing and allow the carriage of materials which do not belong on passenger or cargo aircraft.

4) Inadequate fire-fighting equipment on airlines and the inaccessibility of hazardous

cargo make many potential in-flight emergencies impossible to deal with.

5) The entire regulatory scheme is threatened by the pervasive issuance of exemptions from the regulations, without any notice to the public or opportunity to protest unsafe operations.

6) The overlapping jurisdiction of government agencies hampers effective regulation.

7) The Federal Aviation Administration's inspection program in the field is virtually non-existent.

8) FAA's laxity in enforcement leaves hazardous materials regulation violators totally undeterred.

16. This situation is severely aggravated by the fact that the FAA, the agency that purports to be the safety regulation agency for the industry, only regulates safety on a spot-check basis between the official business hours of 8:30 a.m. to 5:30 p.m. Yet most of the major air freight activity, for example at John F. Kennedy International Airport, takes place between midnight and 6:00 a.m. The Washington office of ALPA can document numerous instances of inaction by the FAA after specific requests for attention to certain shipments had been made to appropriate FAA personnel.

17. On January 5, 1975, the Deputy Secretary of DOT established a Task Force to review the movement of such hazardous materials in air commence. Its report, filed on March 19, 1975 contained a number of significant findings:

1. Based on inspection of carrier

facilities and carrier personnel, many of the receiving agents, who in most cases are the first persons to physically examine these materials, have received only a minimum amount of training and their acceptance of freight was determined by consulting CAB tariffs or IATA regulations, not the DOT regulations as required by federal law. As a matter of fact, of seven air carrier facilities visited at JFK and Philadelphia airports, only three had copies of the DOT regulations.

2. Although notification to the pilot in command has been required for more than 25 years, there is no uniform notification form and many of the notificiation forms checked contained discrepancies which were in violation of the requirements of 14 CFR 103.25.

3. The Task Force reported that it examined training programs which varied in duration from 30 minutes to 16 hours. However, many of the longer programs required that the student to do a lot of the work on a home study basis and included that time in the total. The Task Force found that, although the awareness of air carrier personnel has improved, the person receiving the least training time was the agent on the receiving line who, by the very nature of his job function, comes into first contact with the hazardous materials. This same criticism has been noted in every

study made on the hazardous materials problem since the Pan Am crash of 1973. The training requirements have been in effect since December 6, 1973 and all programs must be approved by the FAA; yet this problem has not been rectified.

18. The practices, attitudes and performance records of the industry and the federal regulatory agencies only increase the hazards inherent in the commercial air transport of such cargo As recently as June 19, 1975 Assistant Secretary of the DOT bemoaned at a speech in San Francisco the continued poor compliance record of hazardous materials shippers. General Benjamin O. Davis Jr. said that DOT had found ". . .that about 75 percent of all shipments checked on air terminals and elsewhere were in violation. . .of applicable safety rules."

19. As a final note, with regards to the repeated statements by defendants that radioactive materials shipment has gone on for 25 years with complete safety, this is another distortion of the real facts by NRC and others. As to SNM, there have been, to my knowledge, no catastrophic releases of plutomium other than the Thule and Palomares spills (See Affidavit of John F. Shea, III, June 16, 1975). However, we have experienced disasters involving the air shipment of other radioactive materials where human error defied all computations as to the probabilities of such events. Attached is a report concerning just one of such instances where radioactive materials, caused a serious emergency involving contamination of hundreds of persons and valuable property in several cities. Specifically the report describes the Delta incident of December 31, 1971 which resulted in the radiation exposure of 917 passengers who had been on board a plane carrying limited radioactive materials. As the report notes, "an unfortunate chance combination of human errors

resulted in this incident" (Exhibit "A", p. 48).

20. The defendants argue a dangerous line. We are to wait for the purportedly "remote" event of an accident or diversion of SNM in commercial air transport rather than preclude the event by removing SNM from such commercial mode now. I personally and professionally believe that to continue to follow such a scheme would be an irresponsible course of action on the part of defendants and, accordingly, support the State of New York's request for injunctive relief and summary judgment.

Capt J A Eckols
CAPTAIN JAMES A. ECKOLS

Sworn to before me this
28 day of November, 1975
St. Charles Mo
Arthur Bunch
My Comm expires 7/31/77

NATIONAL TRANSPORTATION SAFETY BOARD
Washington, D. C.

EXHIBIT A

REPORT OF AIRCRAFT RADIOACTIVE
CONTAMINATION INCIDENT, DELTA AIR LINES, INC.,
DECEMBER 31, 1971

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Appendix A

REPORT OF AIRCRAFT RADIOACTIVE CONTAMINATION INCIDENT DELTA AIR LINES, INC., DECEMBER 31, 1971

I. SYNOPSIS

A small quantity of radioactive material leaked from a bulk shipment onboard Delta Air Lines Passenger Flight 925 of December 31, 1971, while the shipment was en route from the manufacturer in Tuxedo, New York, to the consignee in Houston, Texas. The aircraft, Convair 880, N8801E, was contaminated and 917 passengers had traveled aboard it before discovery of the leakage and removal of the aircraft from service at Chicago, Illinois, O'Hare International Airport on January 2, 1972. The aircraft was ferried to Atlanta, Georgia, where it was decontaminated under the supervision of the Georgia Department of Public Health and the United States Atomic Energy Commission (AEC). By telephone contacts and press releases, passengers who had flown on this aircraft between the time of aircraft contamination and its removal from service were afforded an opportunity to determine the extent of exposure to themselves and to their baggage.

II. INVESTIGATION

A. BACKGROUND

The investigation of this incident was conducted in a sequential manner beginning with the manufacturer's packaging through shipment, discovering of excessive radioactivity, subsequent action, to corrective measures as a result of this incident.

B. FIELD INVESTIGATION

1. Manufacturer/Shipper

The Union Carbide Corporation (UCC), Sterling Forest Research Center, Post Office Box 234, Tuxedo, New York, is licensed by the AEC to operate a nuclear reactor in the State of New York. The AEC retains licensing authority over reactor operations. New York is an Agreement State under Section 274 of the Atomic Energy Act of 1954, as amended, and can, therefore, regulate possession and use of nuclear materials within the state.

Radioactive Material

UCC advised that the subject shipment was a routine bulk shipment of molybdenum 99 (Mo 99) in 3 normal sodium hydroxide solution, which had a 66.5 hour half-life. This had been a standard Friday afternoon shipment to Bio-Nuclear Laboratories in Houston, Texas, on a weekly basis for the past 12 to 18 months for consignee pickup at the airport.

Processing

The material was processed in the UCC reactor and moved from there under water (shielding) to hot cell #2 where it was placed into two 500 ml. (or 1 pint) polyethylene screwcap bottles.

Bottling
(Primary Container)

The bottles were approximately 7 inches high and 3 inches in diameter with a 7/8-inch inner diameter and 1 3/8-inch outer diameter neck. The bottling operation in the hot cell was performed behind a 4-foot-thick window, using a pair of mechanical manipulators each of which has two wide opposing metal fingers. The manipulators exert a force similar to that applied by the operator as they provide no mechanical advantage.

To cap the bottles, the neck of a bottle was held by one manipulator while the screwcap was closed down as tightly as possible, "finger tight," with the other manipulator. The plastic cap was 1 3/8 inches high and 1 5/8 inches in diameter.

Packaging
(Secondary Container)

The bottles were placed on a conveyor cart and transported to the conveyor station at the back of the hot cell complex, where each bottle was placed, with the aid of a single manipulator, into a secondary, shielding container. This was a stainless steel/lead lined container called a "pig." The outer dimensions of the pig were 12 inches high and 8 1/2 inches in diameter. The inside space was 3 1/4 inches in diameter with a 1 7/8-inch deep inner ledge at the top. The pig had been decontaminated thoroughly and was placed in the receiving station, which was just below the conveyor station, before the bottles were moved from hot cell #2.

A shielding plug top with a neoprene type gasket was then put in place and the pig was lowered onto a dolly. The heavy shield door was opened and the shipment was wheeled out of the conveyor station to the packaging area. The plug top was bolted down onto the pig with four ½-inch bolts. Smears (paper swipes) were taken to verify that there was no contamination on the outside of the pig.

Outside Wooden Protective Jacket

The pig was then lowered into a wooden overcoat or jacket, the top of which was bolted down onto six 1/2-inch steel bolts. The outer jacket was a 4-inch-thick layered plywood container, the dimensions of which were 23 inches high by 23 inches in diameter. It was secured to a 5-inch-high, 28-inch square pallet to facilitate handling by forklift. Readings were then taken of the radioactivity on the surface (200 mR/hr) and at 1 meter distance (8 mR/hr). The packages were labeled, sealed with a lead seal, and moved onto the loading dock where they were smeared once more before being loaded by crane onto a company truck for forwarding. An illustration of the containers appears in Attachment A-1.

UCC had no written procedures for the maintenance of reuseable Type B pigs and wooden jackets. When these containers were returned by motor freight, they were checked for any

contamination, decontaminated if necessary, and examined by personnel from the packaging area to assure that these containers appeared to be in satisfactory condition for reuse.

Contents

Each of the two polyethylene bottles in this shipment contained 283.5 ml. of Mo 99 in liquid form and the calibrated isotope specification for each was 65,200 mCi (millicuries). When packaged for shipment, each completed piece weighed 430 pounds and had a Transport Index (TI) of 8. The total shipment was two pieces at 860 pounds with a TI of 16.

The labeling of the packages was as follows:

a. Metal tag secured to outside of jacket (reproduced below)

RADIOACTIVE MATERIAL		
U.S.A.	D.O.T.	S.P. 5800
Type -B		Wt. 90 kg
UNION CARBIDE CORPORATION TUXEDO, NEW YORK		

b. Two Radioactive Yellow–III labels on opposite sides of each jacket, (see Attachment A-2a).

c. One address label glued to jacket, (see Attachment A-2b).

d. "Packing" slip envelope (white with red print) glued and taped to jacket (containing UCC Order - Invoice 28856 and a copy Airbill Number 006 JFK 432 4103, prepared by the shipper) (see Attachment A-3).

e. Manila envelope taped to jacket, rubber stamped in red, "Department of Transportation Special Permit No. 5800," containing copy of the permit, (see Attachment A-4).

Transport

At 2:10 p.m., Friday, December 31, UCC delivered the subject shipment to the Delta Air Lines air freight dock at John F. Kennedy International Airport, Jamaica, New York (JFK) in their own Chevrolet Carryall, a 3/4-ton truck.

Other UCC shipments were also delivered to Delta Air Lines in the same movement. These shipments included 4 cartons of radioactive material weighing 515 pounds which were consigned to Hastings [illegible] JFK 4327 4114. One piece was a pig slightly smaller than, but similar to, that consigned to Bio-Nuclear Laboratories.

The larger radioactive shipments were moved by forklift from the truck and placed onto an airline cargo cart with dropsides.

2. Carrier

Delta Air Lines, Inc., Atlanta Airport, Atlanta, Georgia, 30320, is a Delaware corporation with headquarters [illegible] in Atlanta, Georgia. The company operates as a scheduled air carrier under a

currently effective certificate of public convenience and necessity issued by the Civil Aeronautic Board, and an operating certificate issued by the Federal Aviation Administration (FAA).

Delta personnel received the Bio-Nuclear shipment at their air freight terminal at JFK an signed for it in good order with no exceptions noted.

Receipt

The shipment was received on the Delta ramp and moved from the delivery truck onto a Delt Wollard Baggage Cart, Model BC-450, where it remained until it was taken out to the flight lir for loading into the aircraft. It was not taken into the warehouse.

Load Planning

The load agent, in working the load, found he had more than 50 TI's, which is the maximar allowable on one aircraft. Therefore, he held one shipment of radioactive material destined tc Houston until Delta's next departure, passenger-carrying Flight 981 of December 31, which wa scheduled to depart only 2½ hours after Flight 925. This shipment was shown on airbill JFK 4327 4136. It weighed 33 pounds and had a TI of 8. Flight 981 loadpapers are Attachment A-5

Dispatch

Flight 925 was dispatched with a total TI of 48, consisting of two shipments to Houston ir Cargo Bin 3:

No. of Pieces	Weight (lbs.)	Airbill No.	Transport Index
2	575	JFK 4327-4114	17
2	860	JFK 4327-4103	16*
		*to Bio-Nuclear	
and one shipment to New Orleans in Cargo Bin 4:			
6	228	JFK 4377-3811	15

The captain was so advised by the Restricted Articles Notice form attached to his clearanc release (see Attachment A-6). Other freight, air mail, and first class mail were also loaded in bin 3 (see Flight 925 dispatch records which are Attachment A-7).

Cargo Bins

The Convair 880 has two cargo bin areas below the passenger compartment floor, one forwar of the wing and the other behind the main landing gear and hydraulic compartments. (s Attachment A-8). They are each 19 feet long by 3 1/2 feet high and each has one 38-inch w access door in the middle of the bin on the right side of the aircraft. However, the push-in d cargo net, and fuselage limit the height of the entrance to 20 inches (see Attachment A 9). convenience, Delta numbers their cargo bins #1 through #4. The forward section of the fus

bin is #1; the aft section of the forward bin #2; #3 is the forward section of the aft bin; and the aft section of the aft bin is #4.

Passenger Load

On departures from New York and New Orleans, the aircraft was occupied as shown in the following chart:

Crew: 3 Flightcrew (cockpit)
3 Stewardesses (cabins)

From New York	1st Class (Forward Cabin)	Coach (Aft Cabin)
No. of seats available	24	96
Passengers to New Orleans	1	30
Houston	0 + 1 (Nonrevenue)	19 + 1 (Nonrevenue)
Total	2	50
From New Orleans to Houston	0 + 2 (Nonrevenue)	22 + 1 (Nonrevenue)
Total	2	23

Cargo Loading

The Ramp Agent and two Ramp Service Agents who loaded the three heavy Bio-Nuclear and Hastings radioactive pieces of freight reported that the loading procedures for bin 3 were as follows:

The International Scout Conveyor - Model TC-476 was placed at the cargo bin door (see Attachment A-10). The sides of the baggage cart (in this case freight cart #12) were dropped to make it more nearly a flat bed and it was maneuvered to a position directly under the low end of the conveyor belt (see Attachment A-11). From there the first 430-pound piece was tipped on its side and lifted by two men until it started up the belt, at which time it was rolled over onto its flat top because the pallet on which it was secured extended 2 1/2 inches beyond the wooden jacket and hampered the operation by digging into the belt. It was balanced by one man as it progressed up the belt to the cargo bin door. The conveyor height was adjusted lower so that the pig could then be rolled over onto its side and worked into the cargo bin from

where it was pushed all the way forward in the bin. There was no apparent damage done to th shipments during loading, and handling was held to a minimum because of the weight. Afte the heavy pieces were placed, the following Houston cargo was loaded into bin 3:

No. of Pieces	Weight (lbs.)	Class
12	214	Air Mail bags
5	132	First Class Mail
9	207	Air Freight

Intermediate Stop

The compartment was opened in New Orleans; however, there was no freight or mail to b off-loaded from the forward section, bin 3, so New Orleans personnel were not involved with an of the contamination.

Radioactive Material Training

The Delta Air Lines training supervisor at JFK was not interviewed personally because he wa out of town on a business trip, but he prepared a statement which reads as follows:

"My training schedule at JFK follows prescribed company schedules and material. All ne employees with Delta who have contact with radioactive materials are given training in the first week of employment. In addition all employees are given recurrent training once eac year on radioactive materials.

"Our source of material for training are:

1. Hazards of Radiation in Shipping Radioactive Cargo, (Book).
2. Radioactive Materials (Standard Practice 805).
3. Air Cargo Restricted Articles (Standard Practice 891).

"Included in this training our employees are shown the shipping labels used, the total amoun of Transport Index allowed on our aircraft, and the bins we allow radioactive materials in.

"Also I instruct employees in handling, distances, and dangers should package becom damaged.

"Our Load Agents, Ramp Agents and Supervisors are instructed on the above, however, the receive additional training such as notification of Pilots of all restricted articles onbo proper entries on our load message (teletype), and those agencies to notify in case of damaged shipment."

Cargo Off-Loading

At Houston, the four Ramp Service Agents who off-loaded the Houston cargo reported th luggage from bins 1 and 2 was off-loaded first, then the freight cargo from bins 3 and 4. [illegible] reported that the three heavy containers of radioactive materials in bin 3 were lying on their [illegible] and were not standing in upright positions. "Nothing unusual was thought of this as they [illegible] be turned sideways, tilted, etc., to get them in and out of Convair 880 plane cargo [illegible] There also was moisture noted on bin floor, but this is not uncommon as many times a [illegible]

loaded in the rain or bad weather and moisture is carried into a bin area on cargo." The two men at the foot of the conveyor belt slid the containers off the belt onto a cart. "Since these articles are very heavy, 430 lbs. each, we had to slide them off the belt and in doing so they have a tendency to fall on their side." As each container was off-loaded the men got up on the cart, set them upright, and positioned them on the cart.

Warehouse Storage

The three heavy containers of radioactive material and several small boxes containing radioactive material were then taken to the freight warehouse where they were left on the cart overnight, separated from any other airfreight. A shift change followed this activity, but the next morning, January 1, the Bio Nuclear shipment was unloaded from the cart in the warehouse by the same man who later helped load it on the consignee's pickup truck the following morning, January 2.

Aftermath

The handler who worked inside cargo bin 3 during the off-loading at Houston was contacted at 4:30 p.m. on Sunday, January 2, and advised of the contamination problem. His work clothing was found to be contaminated, and he was given a medical examination which revealed no apparent injury. He subsequently reported a burn area on one leg which had been exposed to the contamination. An examination of this condition revealed that it was "...a chemical reaction from the solution the radioactive material was in."

3. Consignee

Bio-Nuclear, Inc., 6006 Schroeder Road, Houston, Texas, 77021, is a subsidary corporation of the American Biomedical Corporation, Dallas, Texas. It is a Texas State licensed radioactive materials processor. At the time of the incident, Bio-Nuclear did not have a Health Physicist on its staff.

They have been receiving from UCC weekly bulk shipments of liquid Mo 99 for over a year and use it to process Technetium (Tc 99), a daughter of Mo 99 with a 6-hour half-life. Tc 99 is a radioisotope used by the medical profession for diagnostic purposes. Routinely, the shipment is sent on Fridays. The consignee's plant is closed on Saturdays. The shipment is picked up early on Sundays, for Sunday night processing and early Monday distribution to customer hospitals and doctors.

About 7 a.m. Sunday, January 2, the Bio-Nuclear shipment was picked up by their driver from the Delta freight dock at Houston Intercontinental Airport. Hastings Radiochemical had previously discovered that its consignment was contaminated, and that company notified Bio-Nuclear of the possibility that the Bio-Nuclear consignment was also contaminated. The Bio-Nuclear packages were surveyed with a Ludlum Geiger counter (2000 mR range), and the reading was off the top of the scale. Traces of white powder also were found on the rim of the pig. The liquid remaining in the two plastic bottles was transferred to the extractors as quickly as possible to minimize radiation exposure. No measurements were made of the amounts actually in the bottles, but it was noted that the liquid level in one bottle was lower than those of previous shipments, and the inside of the pig was wet. The packaging containers and absorbent papers used for handling were removed to a remotely located warehouse.

Bio-Nuclear called Delta Air Lines, informed them of the findings, advised them to check the employees who handled the shipment, and gave interim instructions on decontamination procedures. After moving the contaminated containers to the warehouse, Bio-Nuclear notified the Texas State Health Department.

4. Activities After Discovery of Contamination

a. Notification

There are specific requirements for the carrier to make immediate notification to the nearest FAA facility by telephone in certain cases of dangerous article incidents. Breakage of a shipment calls for immediate notification to the shipper and the Department of Transportation (DOT) and a report within 15 days to the DOT, Hazardous Materials Regulations Board. It is required that a copy also be sent to the FAA facility which was first contacted (14 CFR Part 103.23, Part 103.28 and 48 CFR Part 171.16).

Since the shipment appeared to be in good condition at the time of consignee pickup, and the carrier was not immediately alerted to the possibility of contamination, it was several hours before all concerned parties were notified of this incident. Official records of the first few original notifications are either nonexistent or very sparse. Consequently, the attached notification chart (Attachment A-12) is a reconstruction of the approximate sequence of events since almost all times shown are estimates.

b. Postincident Activity

(1) Aircraft Movement Until Taken Out of Service

Delta Air Lines did not know that their plane, Convair 880, N8801E, was contaminated when it arrived in Houston before midnight on December 31, 1971. Consequently, the aircraft was continued in regularly scheduled passenger service until it landed at O'Hare International Airport, Chicago, Illinois, about 8 p.m., January 2. Following is a chart which shows the flight numbers and cities involved during this period of operation while the aircraft was contaminated:

Flight/Date	Origination	Intermediate Stops	Termination
#925 Dec. 31, '71	New York, N.Y.	New Orleans, La.	Houston, Texas
#998 Jan. 1, '72	Houston, Tex.	Atlanta, Ga. Dayton, Ohio Columbus, Ohio	Miami, Fla.
#952 Jan. 1, '72	Miami, Fla.	West Palm Beach	Chicago, Ill.
#939 Jan. 1, '72	Chicago, Ill.	Louisville, Ky. Atlanta, Ga.	Tampa, Fla.

Flight/Date	Origination	Intermediate Stops	Termination
#992 Jan. 1, '72	Tampa, Fla		Atlanta, Ga.
#1951 Jan. 2, '72	Atlanta, Ga.		Miami, Fla.
#1942 Jan. 2, '72	Miami, Fla.		Atlanta, Ga.
#955 Jan. 2, '72	Atlanta, Ga.		West Palm Beach, Fla..
#954 Jan. 2, '72	West Palm Beach, Fla.	Tampa, Fla.	Chicago, Ill.

The aircraft arrived in Chicago, Ill., at 6:30 p.m., was surveyed, and taken out of service.

Ferry Jan. 2	Chicago, Ill.		Atlanta, Ga.

(2) Aircraft Contamination

The aircraft was initially surveyed by the AEC at Chicago, O'Hare International Airport after 7:00 p.m. on Sunday Jan. 2.

Instrument: Juno Model #7 survey meter
Readings:
- at rear cargo door - 50 mR/hr.
- In center of cargo bin 3 - 500 mR/hr. to 3R/hr.
- In aft passenger cabin at seats 34 & 35 - 200 mR/hr.

The scheduled flight was cancelled and the aircraft was moved to the hangar area until it could be ferried to Atlanta.

On arrival of the ferry flight at Atlanta, the Georgia Department of Public Health, and the AEC, assisting in the emergency, again surveyed the aircraft.

Instrument: [illegible] (Geiger-Muehler scanner) with 30 mg/cm² probe.
Readings:
- Contact reading on floor under seat 34-140 mR/hr.
- Highest reading on bottom of seat 35-60 to 70 mR/hr.

Instrument: Eberline E-120 (maximum range of 50 mR/hr).
Readings:
- Forward end of cargo bin (without handprobe) - 3 to 4 R/hr. (estimate based on state of reading).
- Smear at forward end of cargo bin - 2R/hr.
- Smears on spots generally in middle of cargo bin - 4 mR/hr. to 10 mR/hr. (contaminant could be wiped out).

- Air inlets (at side of cabin just below hatracks) above seats 34 & 35 - low level traces of smearable contaminant.
- Air exit vents (outboard of and below the seats) at seats 34 and 35 - little more than a trace (see Attachment A-13 for seat locations).

Seat and floor readings were the result of direct radiation from the leaked radioactive liquid source. Smearable contamination resulted from airborne radioactive particulate (e.g., dust).

There was no contamination found at the adjustable ventilators installed over the individual passenger seats. (See Attachment A-14 for details of Convair 880, Air Distribution System.)

The only access route for air movement between the cargo compartment and the aircraft ventilating system was a 2 3/4-inch breather hole provided in the sidewall above the cargo door to permit pressure equalization between the passenger compartment and the cargo area. On depressurization, air from the cargo compartment exhausts into the outflow side of the system to the outflow valve. Air in the cargo compartment is generally static except during cabin pressure changes. (See Attachment A-9 for location of breather hole.)

(3) Aircraft Decontamination

The Georgia Department of Public Health, Radiological Health Service in Atlanta, took charge of and actually decontaminated the aircraft and was assisted by Delta Air Lines personnel. The AEC Regional Compliance Office in Atlanta, although primarily a regulatory organization, served as coordinating office. They worked with DOT, FAA, and the carrier. AEC Operations Division personnel furnished Radiological Assistance Team support where necessary.

After determining that the cargo bin was constructed with a fiberglass liner taped to the structure and a metal floor, it was decided to remove the liner from bin 3 and strip out the old tape.

Personnel who were to enter the cargo bin were dressed in full length cover-alls, rubber boots, rubber gloves and were equipped with a Martindale respirator, two dosimeters (instruments for measuring doses of radioactivity) and a film badge. The first man into the bin was allowed a maximum exposure time of 15 minutes. His dosimeters read 38 mR. Consequently, the next man in was allowed 45 minutes to work and his exposure was [illegible] mR. The man in charge of the operation who was in the midst of the activity the entire time had a 100 mR reading on his self-dosimeter.

The fiberglass floor liner, when removed, showed 2-plus R/hr., as did two panels of the metal underfloor and cargo tiedown rings, which were also removed. Air tools were used and insulating material was vacuumed out. The inside was then scrubbed with liquid soap and rinsed, but was not flushed, to avoid possible spreading of the contaminant. On Monday, January 3, 1972, at 3:30 p.m., the aircraft was released. When surveyed, the readings on the aircraft structure (excluding the cargo bin liner, which was removed) had ranged from 160 mR/hr. to 2-plus R/hr. On completion of the decontamination, the maximum contact reading was only 50 mR/hr. under the aircraft belly.

On January 6, one week after the incident and more than 3 days after decontamination, the aircraft made its first landing in Tampa, Florida, where it was checked for radioactivity and was found to be contaminated. Accordingly, the aircraft was sent back to Atlanta for further checking and decontamination, as necessary. There were two spots in the cargo bin

where contact readings could be found. The tape was stripped out and no removable contamination was present. The aircraft was again returned to service.

This incident provided an example of the differences in response to tests for radioactive contamination resulting from different scanning equipment utilized, proximity to the source, and the interpretation given to the various readings.

(4) Employee and Passenger Involvement

The first consignee (Hastings Radiochemical) to receive a shipment from the subject flight, discovered the contamination by normal scanning. They checked the employees and equipment before the contamination had time to spread in their facility. By the time Bio-Nuclear was notified the following day of the possibility of contamination, their driver had picked up the shipment at the airport. However, on receipt of the shipment at the plant, they handled it as a "hot" shipment. Consequently, there was no contamination spread throughout that facility.

The first word of this incident received by the manufacturer was followed by a check of their facilities which revealed no contamination on their equipment or employees.

By the time the carrier was notified, the contaminated aircraft had been through airports in 10 cities; many employees had serviced it with numerous pieces of airline equipment; and much freight, express, and mail had been moved in its cargo compartments. Most of these could be traced, but the mail was the exception. However, the major problem confronting the airline was the 917 passengers who had flown onboard the aircraft and had their baggage in one of the cargo compartments.

The AEC established scanning stations in the various cities involved and established a set of guidelines for Delta to implement (see Attachment A-15). Meanwhile, Delta personnel started with the ticket flight envelopes and started backtracing the people who were shown to have been onboard the aircraft. More than two-thirds of the total number were contacted personally by telephone, and the press was used in certain off-route areas to advise passengers of the problem and offer professional assistance to scan them and/or their baggage.

Survey check stations were set up in the ten cities at which the contaminated aircraft had stopped. The personnel from these check stations also surveyed eight homes on request. Passengers were advised by phone and the news media that they could either come to the check stations or contact their state health agencies. Arrangements were made for the employees who had actually worked the shipment to have total body scans performed at other places, such as local hospitals or medical schools which had the facilities to perform this task.

The results of the passenger survey indicated that neither passengers nor employees had been subjected to a personal health hazard although some had been exposed to more radioactivity then is acceptable under the concept of the lowest practical exposure of people to radiation. This information was also reported in the press.

(5) Baggage Involvement

One hundred twenty-four passengers brought 271 various articles plus two dogs to the survey check stations for examination. Numerous bags were found with a small amount of contamination, and there were some with comparatively high levels of contamination.

Subject of observation.	Unit identified as #40	Unit identified as #16
Polyethylene bottle (primary container).	Reportedly, water had replaced radioactive liquid to the top of bottle and top had been secured finger tight: Bottle resting down in beaker with some liquid in the bottom. When the bottle was squeezed between fingers, liquid escaped.	

Thirty-eight days after the shipping incident, the containers were viewed again after they had been returned to UCC. They were in the plant, but isolated in a roped-off quarantine area. The container parts were still too radioactive to be handled.

During this visit to the plant, a demonstration of the polyethylene bottle filling process was conducted by the hot cell operator who had filled the bottle for the subject shipment. For this demonstration, however, water was used instead of a radioactive material. The process followed that which was described earlier in this report. After the demonstration bottle was removed from the hot cell and checked for any contamination, it was picked up with gloves, and when tipped upside down, the water leaked rather freely. Then the "tightness" of the screw-cap was checked. Although it had appeared to be on securely, it was only "manipulator-finger" tight. It released and unscrewed with only very light fingertip pressure. Subsequently, the top was tightened with fingers and the thumb around the cap and the seal then contained the liquid inside.

III. CORRECTIVE ACTION

Subsequent to the incident, there was a concerted effort toward eliminating the potential for another incident involving a radioactive material leak which could contaminate cargo and baggage areas in aircraft and/or endanger passengers or the public at large.

The manufacturer, UCC, took several actions that included:

- Meeting with the Atomic Industrial Forum, which is an industrial trade association comprised of radioisotopes manufacturers, shippers, processors, etc. The Radioisotope Committee agreed to develop new, effective, and workable container leak-tests that could be adopted by the American Standards Association.
- Discontinued use of the old polyethylene filler bottle for a new one with a different sealing arrangement.
- Evaluation of an induction-welded sealing cap for the primary container.
- Primary container for liquid shipments are now leak checked to 25 inches of mercury before they leave the hot cell.
- Changed from handmade neoprene gasket for the pig to manufactured natural gum rubber

gasket for better seal.

- Consideration of a change to a plug type gasket that would fill the remaining space around t top of the polyethylene bottle.
- Pigs with gaskets to be leak checked once and then rechecked again each time a gasket changed.
- Consideration of a leak-check for the bottle and secondary container pig for each liquid, Ty B and Iodine shipment.
- Initiating a preventive maintenance program with records kept, using newly assigned se numbers to pigs.
- Instituted an administrative change which requires two people (packer and man who work hot cell) to check the packaging of each shipment.

The carrier proposed to the Civil Aeronautics Board that shippers of radioactive material in Ty B packages be required to conduct a leak-test at the point of origin; and state in writing that t consignee will perform a wipe-test within 3 hours of shipment arrival at destination. This will ass that packages are safe to carry on aircraft and determine if leakage has occurred during flight. T tariff became effective March 12, 1972 and is to expire June 12, 1972. CAB Order No. 72-3- dismissed the complaint against it.

IV. ANALYSIS

Of primary concern in this analysis are the conditions leading to the leakage of a bulk radioacti shipment in liquid form which contaminated equipment and exposed the public to higher levels radiation than the generally acceptable minimum. Reports of all the authorities concerned with t incident assured those people who were involved that the exposures encountered did not constitu health hazard. It did, however, create many harrowing hours of activity and concern for the passeng on the flights; for employees who handled the contaminated package and subsequently used t contaminated equipment: and for the personnel responsible for decontaminating of equipment a scanning people and baggage for radioactivity.

There is no shortage of regulations governing the manufacture, transportation, and use radioactive materials. Admittedly, the regulations are rather complex and spread throughout seve different volumes, but they are specific in the requirement that the radioactive material must contained.

The manufacturer was thoroughly familiar with the product, how to handle it safely, and the Ty B packaging being used, because this had been, for more than a year, a routine weekly bulk radioact shipment to the same consignee.

The manufacturer's employees reportedly had operated a nuclear reactor and packaged the prod for shipment over the year without injury or incident. The redundant (primary and second container) Special Permit authorized packaging was designed to survive major accidents transportation without releasing the contents. These requirements covered impact, as wel subsequent fire.

Possibly the aforementioned familiarity with the reusable Type B containers led to a relax approach in the maintenance of the stainless steel/lead-lined pigs. There was no written compl procedure for assuring that each pig met the standards for reuse. The plastic inner bottles apparently served well, and there seemed to be no reason to especially mistrust them or their secur Even for the demonstration filling of a typical plastic bottle; the liquid (water) was not contained the screw cap as it was installed by the operator/manipulator combination. However, it was noted the top could easily be screwed down tightly enough with bare hands to have satisfactorily contai the liquid. Apparently, the final main bottle seal had not been tested [illegible].

"This Side Up" labels were not required on the outside of the packages. If the containers are satisfactory, there should be no need for this addition. However, the outside wooden protective jacket is shaped with a pallet/platform bottom which would tend to indicate which way it should be carried, if for no other reason than to spread the load over a larger section of the cargo bin floor.

The bulk of the individual 430-pound package necessitated normal upright handling by forklift and crane. However, it did create problems when it came to loading the 28-inch-high package into a 20-inch-high access door of a CV-880 cargo bin. There was room, once inside, for the package to have been turned upright onto its pallet base. If this had been done, the bottle would have had only about 10 minutes to leak rather than approximately 4 hours. Accordingly, the radioactive liquid probably would not have leaked outside the secondary container. This would also have prevented subjecting the bottle to air pressure changes while it was upside down.

The carrier indicated that it had a training program wherein the employees were instructed in handling radioactive shipments. The AEC in Atlanta reported that they had given instruction on this subject to the carrier's management personnel for relaying to the cargo handler (Ramp Service Agent) level. Some of the Ramp Service Agents interviewed had received such instructions, but others of the cargo handling personnel indicated that the instruction had not been given to them.

Although it was preplanned, the delay by the consignee in picking up the shipment added to the magnitude of the problem, as did the loose notification procedures and the lack of a specific emergency procedures plan. These aspects delayed a timely discovery and immediate initiation of remedial measures.

Subsequent to the original interview of the Georgia Department of Public Health personnel, the Radiological Health Service representative, who was in charge of the aircraft decontamination in Atlanta, was contacted for some additional information and for clarification of some reports. During discussion of the "traces" of contamination reportedly found in the passenger cabin air inlets and air exit vents, it was determined that air vent contamination was not a problem since the trace readings were insignificant, and the origin of the contaminant was questionable. It was explained that the smears/wipes of the upper and lower grids of the ventilating system were made and placed in envelopes, then into a bag. Following this activity, the smear/wipes were made in the highly contaminated cargo compartment. These were then placed in envelopes and *all* envelopes were taken to the laboratory.

At the laboratory, the contents of the 20 to 30 envelopes, some of which were "extremely hot," were then placed inside glassine envelopes. The multichannel analyzer with a 5-inch sodium iodide crystal indicated only traces, approximately 300 counts/min. or less. This is considered to be an insignificant amount, and it is suspected that this trace amount was the result of cross-contamination of the specimens, especially since the entire air flow is into the cabin through the inlet, out of the cabin by the exit vent, past the cargo bin breather, to the outflow valve.

V. FINDINGS

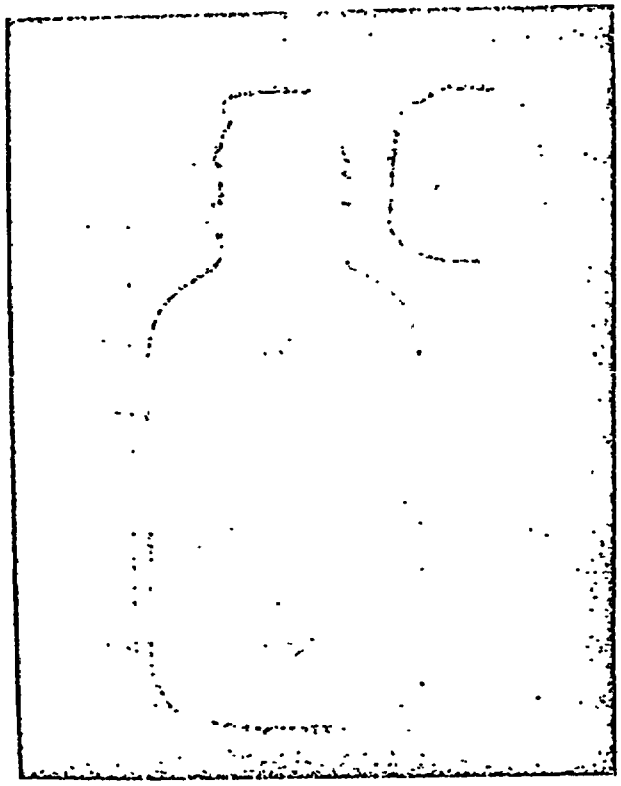
- The reusable Type 2 packaging used for transporting the subject radioactive bulk shipment in liquid form did not fulfill the containment requirements of the regulations.
- The manufacturer did not have a standard maintenance procedure for overseeing the condition of the returned Type B pigs before reuse.
- An unfortunate chance combination of human errors resulted in this incident, i.e., plastic bottle top too loose, pig gasket in unsatisfactory condition, package rolled onto and left on its side during transport. The removal of any one of these steps from the sequence would have prevented this incident.

- The carrier's training program for handling radioactive materials had not reached all cargo handling personnel.
- A routine delay in pickup of the shipment by the consignee and the lack of a specific emergency plan for incidents such as this prevented timely discovery of the situation and initiation of immediate remedial action. This resulted in increasing the magnitude of the problem.
- Trace indications of radioactive contamination in the passenger cabin ventilating system were the result of cross-contamination of the specimens as they were taken to the laboratory.
- Reportedly, there was no health hazard to passengers or employees involved in this incident.

VI. CONCLUSION

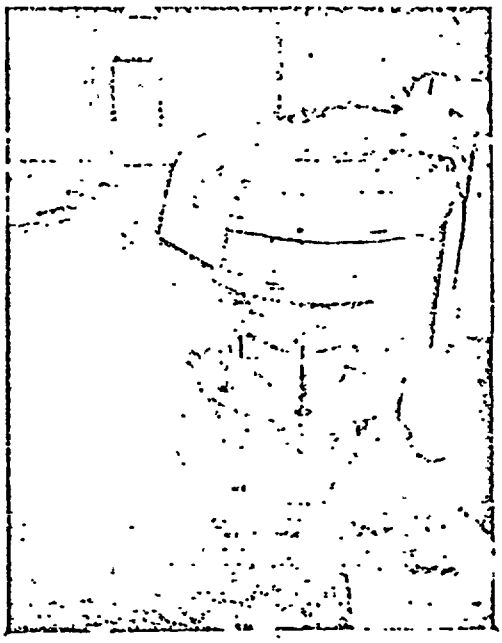
It is concluded that this incident occurred because of the improper packaging of a bulk liquid radioactive shipment in a poorly maintained reusable Type B container. A contributing factor was the transport by air with the package lying on its side.

ATTACHMENT A-1

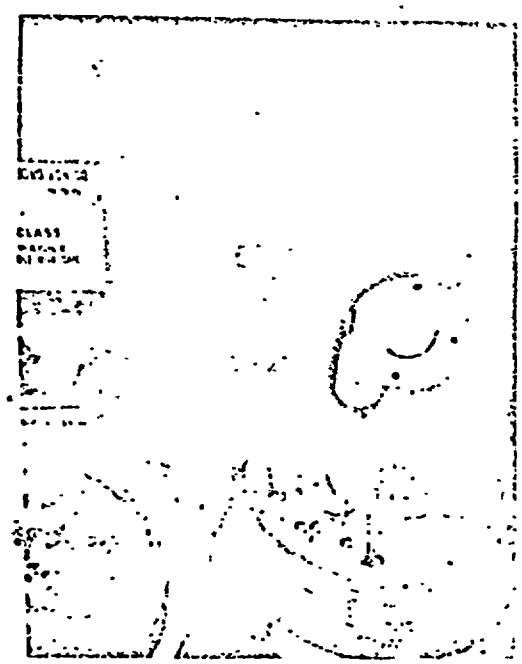


Typical PRIMARY CONTAINER
Polyethylene bottle

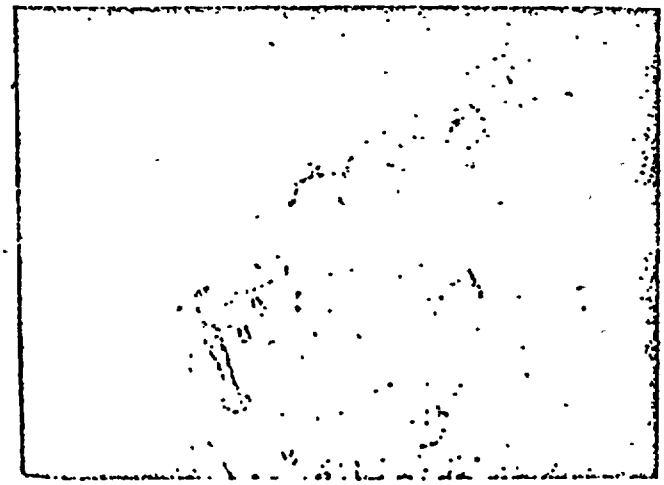
SECONDARY CONTAINER "PIG"
Stainless steel/[illegible] lined
Bio-Nuclear package # 40



Typical - DOT SP-5800
SHIPPING CONTAINER
Wooden protective jacket



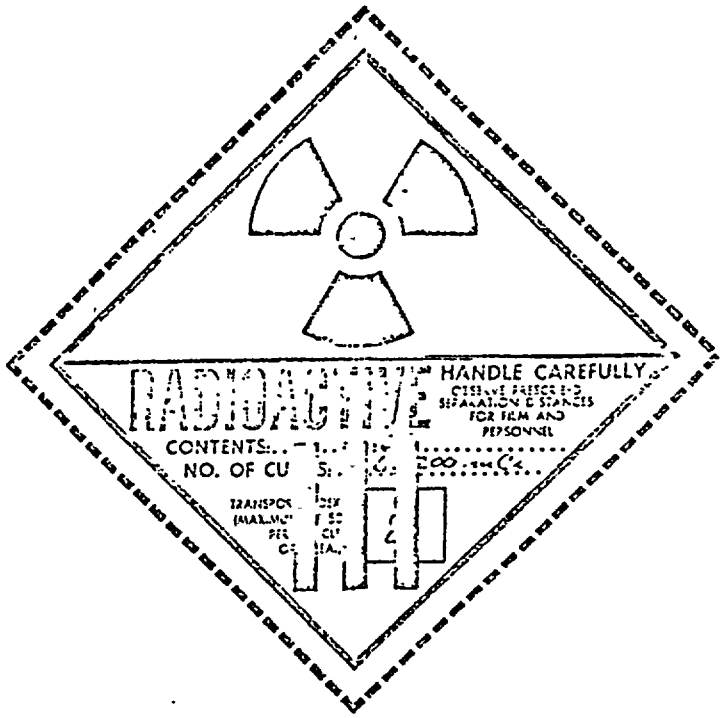
CONTAINER #16 - Bio-Nuclear
Neoprene gasket missing



CONTAINER #40 - Bio-Nuclear
Section of neophrene gasket missing

ATTACHMENT A - 2

a.



Package Label
RADIOACTIVE - YELLOW III

Bright yellow upper half
White lower half

b.

FROM
UNION CARBIDE CORPORATION
STERLING FOREST RESEARCH CENTER
P. O. BOX 324, TUXEDO, NEW YORK 10987

To:

BIO-NUCLEAR LABORATORIES

HOLD AT AIRPORT

HOUSTON, TEXAS

Address Label

RESPIRABLE CONTAINERS ARE NOT ACCEPTED FOR TRANSPORTATION PREPAID TO UNION CARBIDE [illegible] OF RECEIPT A CHARGE OF $10.00 PER WEEK WILL BE MADE FOR CONTAINERS HELD MORE THAN 7 DAYS

UNION CARBIDE

UNION CARBIDE CORPORATION
STERLING FOREST RESEARCH CENTER
P. O. BOX 324, TUXEDO, N. Y. 10987

ORDER - INVOICE
28856

INVOICE TO
Dismuclear Laboratories
Box 2034
Houston, Texas 77027

SHIP TO (IF DIFFERENT FROM INVOICED TO)
Houston

CUSTOMER SALES ORDER NO			TERMS	DATE PRODUCED
00321-5	1203	2	NET 30 DAYS	12/21/71
CUSTOMER PURCHASE ORDER NO				
7227	8-3720			22/12/71

BATCH NO	PRODUCT CODE	PRODUCT DESCRIPTION	QUANTITY SHIPPED	QUANTITY ORDERED & BILLED	UNIT PRICE	AMOUNT
M Mb	MO-99-P-3	Molybdenum-99	130,000 mCi	82,000 mCi		

CONCENTRATION 230 mCi/ml
VOLUME 567 ml in 2 bottles, 285 ml each
SPECIFIC ACTIVITY 1.0 mCi/mg
CHEMICAL FORM Na_2MoO_4 in 3N NaOH
STABILIZER —
CARRIER —

ISOTOPE SPECIFICATIONS 1800 HRS 12/21/71
CALIBRATION TIME

SPECIAL INSTRUCTIONS
Calibrate to 1800 Sunday
Ship in 2 bottles of equal quantity

PACKAGING AND SHIPPING INFORMATION

DESCRIPTION
☐ RADIOACTIVE MATERIALS
☐ RADIOACTIVE MATERIALS SPECIAL FORM
TRANSPORT GROUP
ACTIVITY
LABEL
☐ [illegible]
☐ RADIOACTIVE YELLOW III
☐ NO LABEL REQUIRED

☐ THIS SHIPMENT [illegible] DEPARTMENT OF TRANSPORTATION AND TO THE [illegible] REGULATIONS

☐ THIS SHIPMENT [illegible] CARRY [illegible]

SHIPMENT APPROVAL
RECEIVED BY
DATE

Cyn 24 hrs.
TRAFFIC: Notify customer of waybill info

Shipped in [illegible] Packages
SURVEY OF SHIPPING CONTAINER S)
[illegible] MR HR AT SURFACE
MAX PER [illegible]
TOTAL UNITS PER PACKAGE
[illegible] AT ONE METER
☐ NO SIGNIFICANT REMOVABLE CONTAMINATION

GROSS WEIGHT
[illegible]
Transport Index
Removable
Plus

5.1

UNIFORM AIRBILL NON-NEGOTIABLE

Subject to Conditions of Contract on the Plan of Transport

AIRBILL NUMBER

CARRIER	ORIGIN	SERIAL NUMBER
006	JFK	4327 4103

THE CARRIER'S LIABILITY IS LIMITED PER ITEM 3 ON REVERSE SIDE UNLESS A HIGHER VALUE IS DECLARED. SHOW DECLARED VALUE TO NEAREST WHOLE DOLLAR

DECLARED VALUE: NVD

ROUTING: All the routing applies unless shipper inserts specific routing here

DL Flt. 925 Lv. 6:55 PM

☒ PREPAID ☐ COLLECT

DELTA AIR LINES, INC.
ATLANTA GEORGIA 30320

TO	VIA	TO	VIA	TO	VIA	TO	VIA
IAH	DL						

CONSIGNEE'S ACCOUNT NUMBER: CONSIGNEE

NAME: Biomuclear Laboratories

STREET ADDRESS: HOLD AT AIRPORT

CITY: Houston, Texas — STATE — ZIP CODE

SPECIAL INSTRUCTIONS INCLUDING CUSTOMER REFERENCE NUMBER: NOTIFY ON ARRIVAL TEL 713-747-4274

SHIPPER'S ACCOUNT NUMBER: SHIPPER

NAME: Union Carbide Corp. 591

STREET ADDRESS: PO Box 324, Tuxedo

CITY: Tuxedo, New York 10987 — STATE — ZIP CODE

PIECE OR ZONE | ORIG ADVANCE CHGS | DESCRIPTION OF ORIGIN ADVANCE CHARGES | DEST ADVANCE CHGS | DESCRIPTION OF DESTINATION ADVANCE CHARGES

OTHER CHARGES | DESCRIPTION OF OTHER CHARGES | G B L NUMBER

CARRIER USE ONLY

RATE	CHARGES
	WEIGHT CHARGES $
	PICK UP
	DELIVERY
	EXCESS VALUE
	ADVANCES
	OTHER
	SHIPPER'S C.O.D.
	C.O.D. FEE
	TAX
	TOTAL CHARGES $

NO PCS	WEIGHT	DESCRIPTION OF PIECES AND CONTENTS PACKING, MARKS NUMBER
2	860	Radioactive Material
		16 Units
		(RESTRICTED ARTICLES NOTICE ATTACHED)

THIS IS NOT AN INVOICE

EXECUTED AT BY: JFK Mujn — DATE: 12/31/71 — TIME: 1410

CARRIER: 006 — ORIGIN: JFK — SERIAL NUMBER: 4327 4103

ATTACHMENT A - 4

DEPARTMENT OF TRANSPORTATION
HAZARDOUS MATERIALS REGULATIONS BOARD
WASHINGTON, D.C. 20590

SPECIAL PERMIT NO. 5800

This special copy permit is issued pursuant to 46 CFR 146.05-4 of the U. S. Coast Guard (USCG) Dangerous Cargo Regulations and 49 CFR 170.13 of the Department of Transportation (DOT) Hazardous Materials Regulations, as amended.

1. The U. S. ATOMIC ENERGY COMMISSION (USAEC) and its contractors and licensees, the DEPARTMENT OF DEFENSE and its contractors, and licensees of "agreement states" as approved by the USAEC, are hereby authorized to ship Type B quantities of any non-fissile radioactive material in either normal or special form, as provided for herein.

2. Each user of this permit must register his identity with this Board prior to his first shipment under the permit.

3. The authorized packaging consists of an interim DOT Specification 20WC wooden protective jacket, as described in Appendix A hereto, when used with any single one of the following types of inner containment vessels which must fit snugly within the jacket:

a. A DOT SPECIFICATION 55 (or equivalent) metal-encased shielded inner containment vessel;

b. A DOT Specification 2R (or equivalent) metal inner containment vessel; or

c. A DOT Specification 7A inner packaging which has a metal outer wall (not authorized for normal form radioactive materials).

4. The packaging design is based upon the ambient conditions as prescribed in Marginal C-2.4.3 of the Regulations for the Safe Transport of Radioactive Materials, 1967 Edition, International Atomic Energy Regulation (IAEA).

5. The authorized package meets the criteria of the International Atomic Energy Agency for Type B packages [illegible]

6. Prior to each shipment authorized by this permit, the shipper shall notify the consignee and, if export shipments, the competent authority of any country into or through which the package will pass, of the dates of shipment and expected arrival. The shipper shall notify each consignee of any special loading/unloading instructions prior to his first shipment.

7. The outside of each package must be plainly and durably marked "USA DOT SP 5800" and "TYPE B", in connection with and in addition to the other markings and labels prescribed by the DOT regulations. Each shipping paper issued in connection with shipments made under this permit must [illegible] "USA DOT SPECIAL PERMIT NO. 5800", [illegible] with the description thereon

J-86-59

8. Each package of gross weight in excess of 50 kilograms (110 pounds) must have its gross weight in kilograms plainly and durably marked on the outside of the package.

9. Shipments are authorized only by vessel, cargo-only aircraft, passenger-carrying aircraft, rail, and motor vehicle.

10. No special operational transport controls are necessary during carriage except as specified herein, and no special arrangements have been made under Marginal C-6.5 of the IAEA Regulations.

11. For shipments by water, the shipper or agent shall notify the USCG Captain of the Port in the port area through which the shipment is to be made, of the name of the vessel on which the shipment is to be made, and of the time, date, and place of loading. When the initial notification is given in a port area through which the shipment is to be made of the name of the vessel on which the shipment of the Port.

12. Any incident involving loss of contents must be promptly reported to this Board.

13. This permit does not relieve the shipper or carrier from compliance with any requirement of the DOT regulations, including 46 CFR Parts 146 to 149 of the USCG Regulations, except as specifically provided for herein, or the regulations of any foreign government, into or through which the package will be carried.

14. This permit expires January 15, 1971.

Issued at Washington, D.C., this 3rd day of January 1969.

/s/E. G. Grundy, Capt.
For the Commandant
U. S. Coast Guard

/s/S. Schneider
For the Administrator
Federal Aviation Administration

/s/D. W. Morrison
For W. R. Fiste
For the Administrator
Federal Highway Administration

/s/Austin H. Banks
For Mac E. Rogers
For the Administrator
Federal Railroad Administration

Address all inquiries to: Secretary, Hazardous Materials Regulations Board, U.S. Department of Transportation, Washington, D.C. 20590. Attention: Special Permits.

cc:
U. S. Coast Guard
Bureau of Explosives, AAR
Federal Highway Administration
Federal Railroad Administration
Federal Aviation Administration
Atomic Energy Control Board, Canada
U. S. Atomic Energy Commission, Mr. Kaye
Department of Defense, Mr. Edwin T. Loss

DEPARTMENT OF TRANSPORTATION
HAZARDOUS MATERIALS REGULATIONS BOARD
WASHINGTON, D.C. 20590

SPECIAL PERMIT NO. 5800
FIRST REVISION

Pursuant to 46 CFR 146.02-25 of the U. S. Coast Guard (USCG) Dangerous Cargo Regulations and 49 CFR 170.15 of the Department of Transportation (DOT) Hazardous Materials Regulations, as amended, and on the basis of the October 14, 1970, petition by the Idaho Nuclear Corporation, Idaho Falls, Idaho and the November 5, 1970, petition by Westinghouse Electric Company, Pittsburgh, Pa.:

Special Permit No. 5800 is hereby amended by revising paragraphs (1), (5), and (14) and by adding new subparagraphs (1a), (9a), and (11a), to read as follows:

"1. Shipments of Type B quantities (S 173.389 (L)) of any radioactive material, in normal or special form, are hereby authorized, as further provided for herein. This packaging, when constructed and assembled as prescribed herein, with the contents as authorized herein, meets the standards prescribed in the DOT regulations, Sections 173.394(b) (3), 173.395(b)(2), and 173.396(c)(3), and 173.398(c). The fissile radioactive material content of each package may not exceed those quantities and material types as limited and prescribed in subparagraphs (a)(2)(ii), (a)(2)(iii), and (b)(2) of S 10 CFR 71.6 of the USAEC Regulations, with such packages to be shipped as either Fissile Class II or III, in accordance with the package transport index limitations or shipment limitations prescribed therein.

"1a. Each shipper, under this permit, other than the petitioners named above, and the other previously identified petitioners, shall register his identity with this Board prior to his first shipment, and shall have a copy of this permit in his possession before making any shipment.

"5. The authorized package described herein is hereby certified as meeting the specific requirements of the International Atomic Energy Agency's (IAEA) "Regulations for the Safe Transport of Radioactive Material", Safety Series No. 6, 1967 edition, as follows:

a. Marginal C-6.2.2 - The package design meets the requirements for Type B packaging for radioactive materials.

b. Marginal [illegible] as limited by paragraph (1) meets the requirements for Fissile Class II or III shipments.

"9a. For shipments by air, a copy of this permit must be carried aboard any aircraft transporting radioactive materials under the terms of this permit. Fissile Class III shipments by cargo-only aircraft must conform to S173.396(g)(1). Fissile Class III shipments by passenger-carrying aircraft are not authorized.

"11a. For shipments by water, a copy of this permit must be carried aboard any vessel transporting radioactive materials under the terms of this permit.

Continuation of 1st Rev SP 5800

"14. This permit expires January 15, 1973."

All other terms of this permit, as revised, remain unchanged. The complete permit currently in effec consists of the original issue and the First Revision.

Issued at Washington, D.C.:

/s/ R. G. Schwing, Capt. R. G. Schwing, Capt. For the Commandant U. S. Coast Guard	25 November, 1970 (DATE)
/s/ S. Schneider For the Administrator Federal Aviation Administration	18 DEC 1970 (DATE)
/s/ D. W. Morrison for W. R. Fiste For the Administrator Federal Highway Administration	2 December 1970 (DATE)
/s/ Quentin H. Banks for Mac E. Rogers For the Administrator Federal Railroad Administration	9 December 197 (DATE)

Address all inquiries to: Secretary, Hazardous Materials Regulations Board, U.S. Department Transportation, Washington, D.C. 20590. Attention: Special Permits.

Dist: a, b, c, d, e, h, i
Keleket/CGR Corporation, Waltham, Mass..
Rutgers University, New Brunswich, N.J.
Department of the Army, Washington, D.C.
General Electric Co., Pleasanton, Calif.
The Ohmart Corporation, Cincinnati, Ohio

Union Carbide Corporation, Tuxedo, New York
Radiation Products Division, Burlington, Mass.
Naval Research Laboratory, Washington, D. C.
J. L. Shepherd & Associates, Glendale, Calif.
Siemens Medical of America, Inc., Union, N.J.
Nuclear Engineering Co., Inc., Morehead, Ky.
Battelle Memorial Institute, Columbus, Ohio
Todd Shipyards Corporation, Galveston, Texas
Materials Evaluation Group, Phoenixville, Pa.
General Electric Co., St. Petersburg, Florida
Westinghouse Electric Corporation, Cheverly, Md.
Westinghouse Electric Corporation, Pittsburgh, Pa.
Cumberland Research Corporation, Port Norris, N.J.
Industrial Reactor Laboratories, Inc., Plainsboro, N.J.
Newport News Shipbuilding & Dry Dock Co., Newport News, Va.

January 1, 1969

Interim DOT Specification 20WC

§ 178.194 Specification 20 WC wooden protective jacket

§ 178.194-1 General Requirements

(a) Each jacket must meet the applicable requirements of § 173.24 of this chapter.

(b) Maximum gross weight of the jacket plus the contents may not exceed the following:

(1) Spec. 20WC-1: 500 pounds

(2) Spec. 20WC-2: 500 pounds

(3) Spec. 20WC-3: 1000 pounds

(4) Spec 20WC-4: 2000 pounds

(5) Spec 20WC-5: 4000 pounds

§ 178.194-2 Materials of construction

(a) The general configuration of the wooden protective jacket is a hollow cylindrical shell constucted of one-piece discs and rings of plywood or solid hardwood reinforced with steel rods.

(b) Plywood must be exterior-grade, void-free, douglas fir (or equivalent) not more than one inch thick. Solid hardwood is authorized for Spec. 20WC-2 only.

(c) Discs and rings must be glued together with a strong, shock-resistant adhesive, such as either of the following:

(1) A resorcinol-formaldehyde adhesive, which has been bonded under heat *and* pressure: or

(2) A polyvinyl-acetate emulsion, which has been reinforced with cementcoated nails. The nails must be randomly spaced and must be at least 2-1/2 times as long as the minimum thickness of the plywood discs or rings.

(d) Full-length steel rods are required for reinforcement and lid closure. For Specs. 20WC-1 and 20WC-2, a minimum of six rods at least 0.25 inches in diameter are required. For Spec. 20WC-3, a minimum of 12 rods, at least 0.375 inches in diameter are required. For Spec. 20WC-4, a minimum of 16 rods at least 0.375 inches in diameter are required, and for Spec. 20WC-5, a minimum of 16 rods at least 0.5 inches in diameter are required. For Specs. 20WC-1 and 20WC-2, steel rods must be equally

spaced around the circumference of the rings and discs, midway between the O.D. and I.D. of the rings. For Specs. 20WC-3 and 20WC-4, bolts may be staggered alternately in two rows, at ±0.5 inches from the line midway between the O.D. and I.D. of the rings. For Spec. 20WC-5, bolts may be staggered alternately in two rows at ± one inch from the line midway between the O.D. and I.D. of the rings. Rod ends must be threaded and secured with lock nuts and steel washers, or equivalent device, to provide at least a one inch diameter bearing surface on each end. Ends of the rods must terminate 0.75 inches below the surface of the plywood for Specs. 20WC-1 and 20WC-2. For Specs. 20WC-3, 20WC-4, and 20WC-5, the ends of the rods must terminate 1.5 inches below the surface of the plywood, and that portion of each end disc which extends beyond the rod ends must be further held in place with lag screws at least four inches long.

(e) Thickness of wooden shell:

(1) Spec. 20WC-1: At least four inches thick.

(2) Spec. 20WC-2: At least three inches thick. The jacket must be completely encased by a steel shell at least 18-gauge thickness, such as a Spec. 17H steel drum. The steel shell must be vented by at least four 0.25 inch diameter holes, which must be covered with a durable weatherproof tape.

(3) Spec. 20WC-3: At least five inches thick for the jacket wall, and at least six inches thick for the end discs. In addition, at least three plywood chines, two inches wide and protruding two inches beyond the outer surfaces, must be located at each end and midway along the length of the jacket.

(4) Spec. 20WC-4: At least six inches thick for the jacket wall, and at least six inches thick for the end discs. In addition, at least three plywood chines, two inches wide and protruding two inches beyond the outer surfaces, must be located at each end and midway along the length of the jacket.

(5) Spec. 20WC-5: At least six inches thick for the jacket wall, and at least eight inches thick for the end discs. In addition, at least five plywood chines, two inches wide and protruding two inches beyond the outer surfaces, must be located at each end and equally spaced along the length of the jacket.

(f) Figures 1 and 2 illustrate representative designs.

§ 178.194-3 Closure

(a) Closure for the wooden protective jacket is provided by the steel reinforcing rods. The end cap (lid) must fit tightly to the body of the jacket to prevent a heat path to the inside of the jacket. The lid joint for Specs. 20WC-3, 20WC-4, and 20WC-5 may not be co-planar with the end of the inner containment vessel.

(b) Spec. 20WC-2. Locking ring closure, if used, must conform to § 178.104-4. Flanged closure, if used, must have at least eight steel bolts (at least 0.25 inch diameter) and lock nuts (or equivalent device), spaced not more than five inches between centers.

§ 178.194-4 Tests

(a) Each jacket must be visually inspected for defects such as improper bonding, cracking, corrosion of steel rods, an improperly fitting closure lid, or other manufacturing defects. Particular attention must be given to any separation of the plywood discs and rings which would provide a heat path to the inside of the jacket.

§ 178.194-5 Painting

(a) Each jacket must be completely painted with a high quality exterior weather resistant paint.

§ 178.194-6 Marking

(a) Each jacket must be marked on the external surface as follows: "USA DOT 20WC-( ) TYPE B" and "RADIOACTIVE MATERIAL". The appropriate numeral must be inserted in the marking to indicate the appropriate Spec. 20WC category; e.g., "USA DOT 20WC-2".

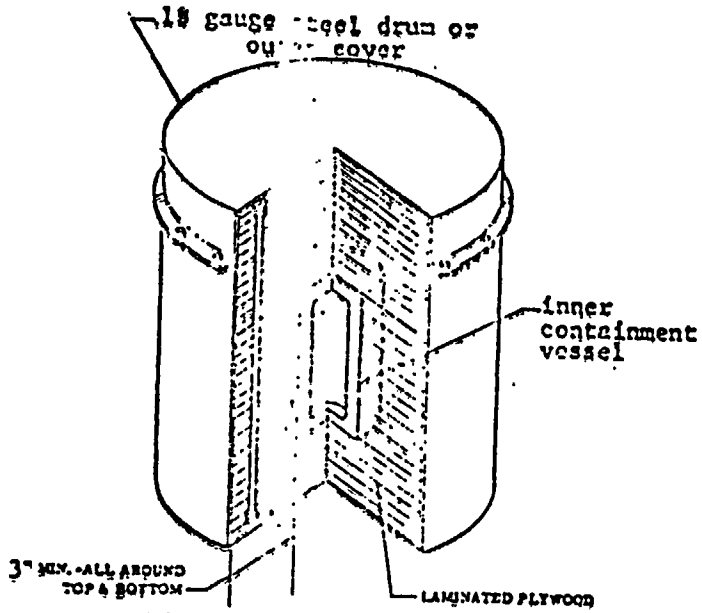


Figure 1. Spec 20WC-2

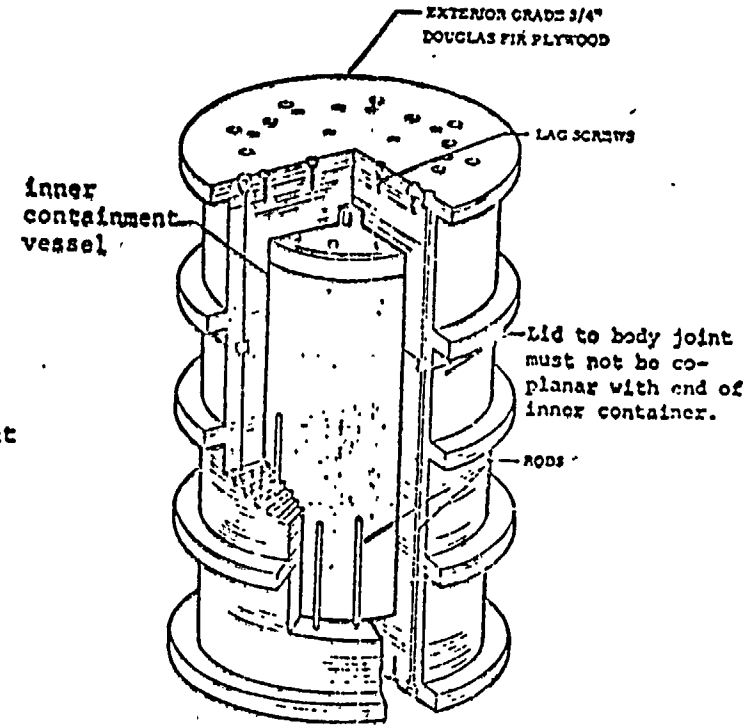


Figure 2. Spec 20WC-5

MSY CODE
IAH CODE
DATE 75/1/21
NO. 906

FLIGHT RECORD
LM AND CX
TRANSMIT INFORMATION IN THE UNSHADED BLOCKS ONLY

				CARGO BOARD	BIN 1	BIN 2	BIN 3	BIN 4	BIN 5	BIN 6	BAGS		MAIL		EXPRE				
CUT		34		2554	2392		162				38	893	40	640	4	4			
CUT	2	26	1-0	1245		1146		99			53	1246	15	360					
CUT	2	50	1-0	4279	2392	1146	162	99			91	2139	55	1000	4	49	31	1111	

1 MSY BGS - M - X - FLT
2 IAH Bgs - M - FLT
3 MSY FLT 4/162 R/A - MSY
4 IAH FLT 2/99 R/A - IAH
1 DOG + 1 CAT - IAH BIN 2 1 DOG AS BAG - MSY BIN 1

RAMP

J-86-69

ATTACHMENT A-5

ATTACHMENT A - 5 - 2

Station JFK
FLT _____ Date 12/31/71
Agent _____

DELTA AIR LINES FREIGHT

Page 15 of _____ Pages

Ont #41 3762

DEST IAH PCS	WT	AIRBILL OR SHIPPING TICKET NUMBER	DEST PCS	WT	AIRBILL OR SHIPPING TICKET NUMBER	DEST MSY PCS	WT	AIRBILL OR SHIPPING TICKET NUMBER
1	33	JFK 4327 4136		9	R.A. UNITS			
2	66	JFK 4327 4125		16	R.A. UNITS			
2	40	JFK 2505 0256						
						13	407	JFK 2905 [illegible]
						2	58	JFK 4[illegible] [illegible]
						6	321	JFK 4454 6155
5/139			/			21/786		TOTAL
/			/			/		TOTAL /

J-86-70

FORM 0412 8016C
NOTICE 2-70

RESTRICTED ARTICLES/ARMED GOVERNMENT OFFICIALS NOTICE

DELTA AIR LINES

TO CAPTAIN 951, 31
FLIGHT DATE

FROM: LOAD PLANNER L. Cummings (SIGNATURE) CITY TAN

THE FOLLOWING ACCEPTABLE RESTRICTED ARTICLES ARE ON BOARD:

CLASSIFICATION: RADIO ACTIVE MATERIAL AMOUNT 24 UNITS BIN 3 DEST. IAH

CLASSIFICATION: RADIO ACTIVE MATERIAL AMOUNT 10 UNITS BIN 3 DEST MSY

THE FOLLOWING GOVERNMENT OFFICIALS ARE ON BOARD AND HAVE BEEN CLEARED TO CARRY CONCEALED WEAPONS:

NAME _____ GOVT. AGENCY _____ DEST _____

NAME _____ GOVT. AGENCY _____ DEST. _____

Prepare In Duplicate
1. Captain
2. Station File (For Two Years)

Form 0412 K0166
NOTICE 7-70

RESTRICTED ARTICLES/ARMED GOVERNMENT OFFICIALS NOTICE

DELTA

TO: CAPTAIN 425 / 31
FLIGHT DATE

FROM LOAD PLANNER L. Cummings (SIGNATURE) CITY TPA

THE FOLLOWING ACCEPTABLE RESTRICTED ARTICLES ARE ON BOARD:

CLASSIFICATION: Radio Active Material AMOUNT 15 units BIN 4 DEST. PHX

CLASSIFICATION Radio Active Material AMOUNT 33 units BIN 3 DEST. IAH

THE FOLLOWING GOVERNMENT OFFICIALS ARE ON BOARD AND HAVE BEEN CLEARED TO CARRY CONCEALED WEAPONS:

NAME _____ GOVT. AGENCY _____ DEST. _____

NAME _____ GOVT. AGENCY _____ DEST. _____

Prepare in Duplicate
1. Captain
2. Station File (For Two Years)

ATTACHMENT A-6

FLIGHT RECORD

LM AND CK

TRANSMIT INFORMATION IN THE UNSHADED BLOCKS ONLY

DELTA AIR LINES

MSY . OCLL

725 / 31

901

					BIN 1	BIN 2	BIN 3	BIN 4	BIN 5	BIN 6	BAGS		MAIL		EXPRESS		FREIGHT		COMAT		FIRST CLASS MAIL	
1	30			54	2511	956		487			43	1011	8	175			26	587	30	1500	12	351
	17	1-L		10	682	36	1892				29	682	12	214			15	1552			5	132
1	49	1-1		64	3193	992	1892	487			72	1693	20	359			41	2469	30	1500	17	513

1 MSY BAGS - C C B BALL HST IAH BCC

2 MSY M-A-FLT IAH DOS 1/86 HS FLT

3 IAH FLT M-A

4 MSY FLT

[illegible] R/H MSY [illegible] 6/1335 R/H IAH [illegible]

RAMP

ATTACHMENT A - 7 - 2

FREIGHT AND COMAT MANIFEST

Station JFK

FLT _____ Date 12/31

Agent _____

Page _____ of _____ Pages

Cart 12

FREIGHT

RH PCS	RH WT	AIRBILL OR SHIPPING TICKET NUMBER	DEST PCS	DEST WT	AIRBILL OR SHIPPING TICKET NUMBER	DEST PCS	DEST WT	AIRBILL OR SHIPPING TICKET NUMBER
[illegible]		[illegible]			[illegible] NO SIDE			
2	860	JFK 4327 4123			RA units 16			
4	515	JFK 4327 4114			RA units 17			
					83			
					15			
					48			
6	1375		/			/		TOTAL /

'74 DEC 31 PM 4:10

Bin 3

COMAT

/			/			/		/

FREIGHT AND COMAT MANIFEST

ATTACHMENT A - 7

Station JFK

FLT _____ Date 13/31/71

Agent _____

Page _____ of _____ Pages

Cont # 05

FREIGHT

DIST MSY PCS	WT	AIRBILL OR SHIPPING TICKET NUMBER	DIST PCS	WT	AIRBILL OR SHIPPING TICKET NUMBER	DIST AH PCS	WT	AIRBILL OR SHIPPING TICKET NUMBER
6	228	JFK-11377-911			15 R.A. UNITS			
1	38	JFK 32954 564			C.A.G.P.T.			
1	2	002/8574 5505						
8	41	JFK-4422 5363						
11	78	JFK-4422 5273			DAC			
						2	64	JFK-2097 [illegible]
					SJD	2	25	024/11-07-[illegible]
					LIVE DOG ELP	1	36	015/[illegible]
						4	82	JFK-4423 5[illegible]
21/487			/			9/207		TOTAL

Bin 4

Bin 2

Bin 3

COMAT

/		/			/			TOTAL /

DEC 6 PM 6:07

J-86-75

FREIGHT AND COMAT MANIFEST

ATTACHMENT A-7

Station JFK

FLT _____ Date 12/21/71

Agent _____

DELTA AIR LINES FREIGHT

Page _____ of _____ Pages

Cont # 45

DEST MSY PCS	WT	AIRBILL OR SHIPPING TICKET NUMBER	DEST PCS	WT	AIRBILL OR SHIPPING TICKET NUMBER	DEST IAH PCS	WT	AIRBILL OR SHIPPING TICKET NUMBER
6	228	JFK 4377 2311			15 R.A. UNITS			
1	38	JFK 32954 3641			C.A.G.P.T.			
1	2	062/5574 5505						
2	41	JFK 4423 5306						
11	78	JFK 4423 5273			DAL			
						2	64	JFK 5097 [illegible]
					SJD	2	25	026/1409 [illegible]
					LIVE DOG ELP	1	36	015/8835 [illegible]
						4	82	JFK 4423 [illegible]
21	487		/			9	207	TOTAL

Bin 4

Bin 2

Bin 3

COMAT

/			/			/		TOTAL /

'71 DEC 31 PM 6:07

J-86-76

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 V
ATLDDDL MSYOODL IAHDODL
.JFKOODL
GX
S25/31 901 FC3000/ORIC-1900/AGD[illegible]/C3/21
1-49-1-1/G564/1-30/3954/LEMING/MASON


ØV
CRDDDDL MSYOODL
.JFKOODL
LM
S25/31 901
MSY F1 Y30 L3954 1-2511 2-956 4-407 D43 MC/175 FR26/C37 C30/1500
A13/301
IAH Y19 NR1-1 L2610 1-602 2-36 3-1002 D29 M12/214 FR15/1502 A5/132
TOY F1 Y49 NR1-1 L6564 1-3193 2-992 3-1002 4-407 D72 M20/300 FR41/2469
C30/1500 A17/513
DIMLX
1- MSY DOS C C IS BALLAST  IAH DOS
2- MSY M A FR IAH DOG  1/36 AS FRT
3- IAH FR M A
4- MSY FR
6/228 R/A MSY BIN FOUR  6/1375 R/A IAH BIN THREE 33 UNITS


ØV
SABRMDL NYCRADL
.JFKOODL
PFS
S25/31DEC JFK
MSY 1/30
IAH 0/19
$


 ØV
SABXXDL
.JFKOODL
PS
C525/31DEC 901 90 A JFK 1900 21 C05
E 01 01 24 C02 F C49 C49 072
$
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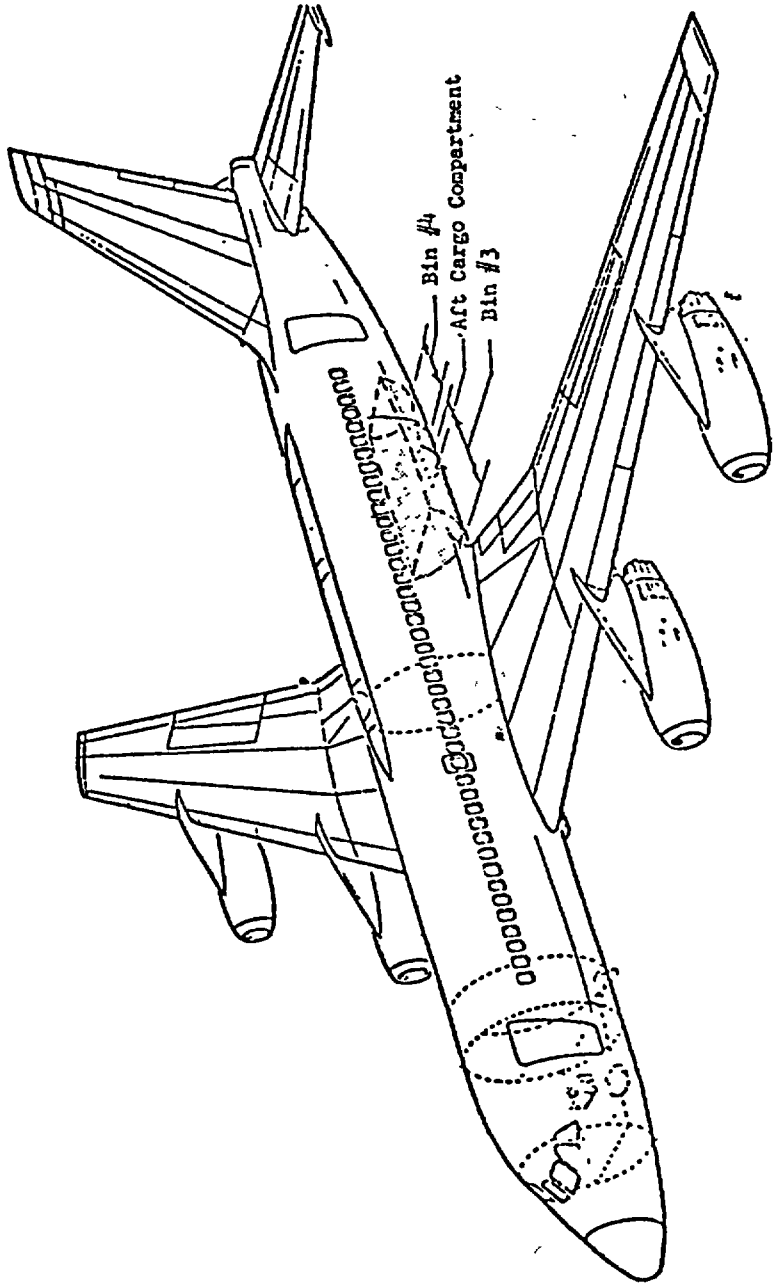
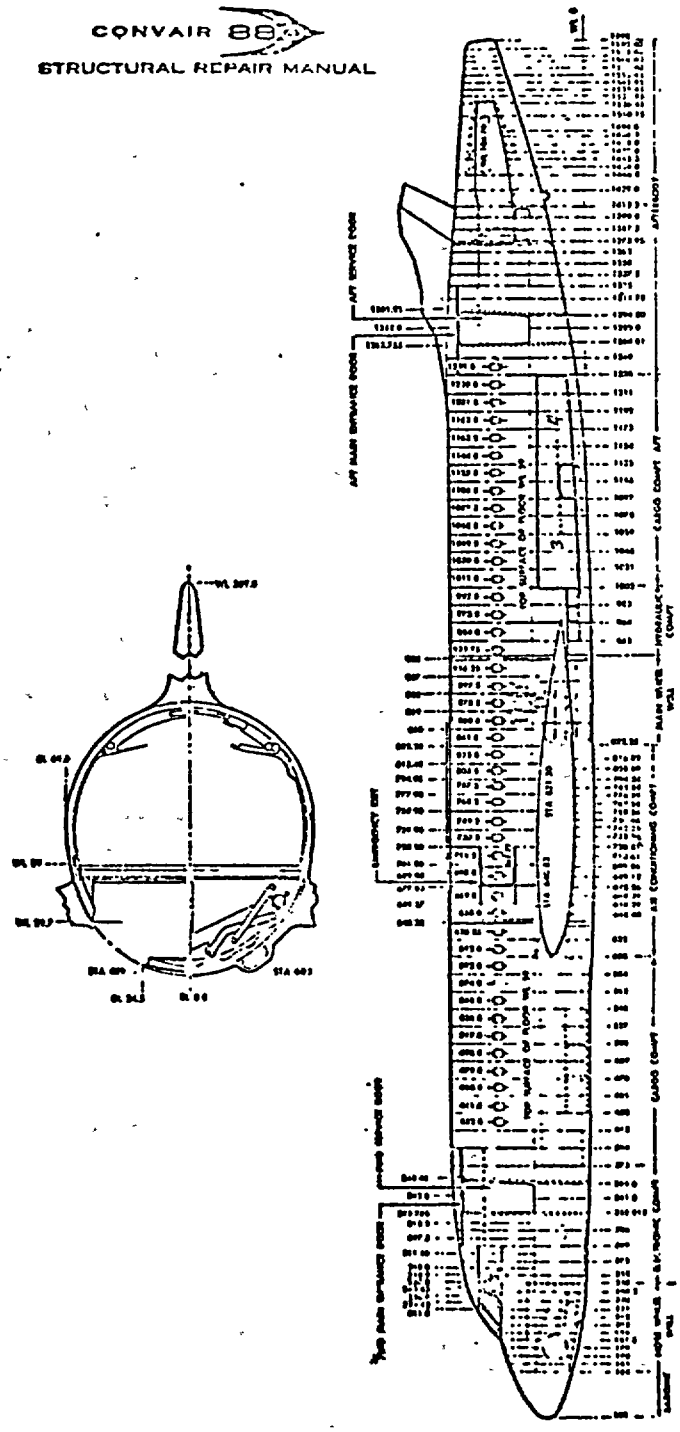
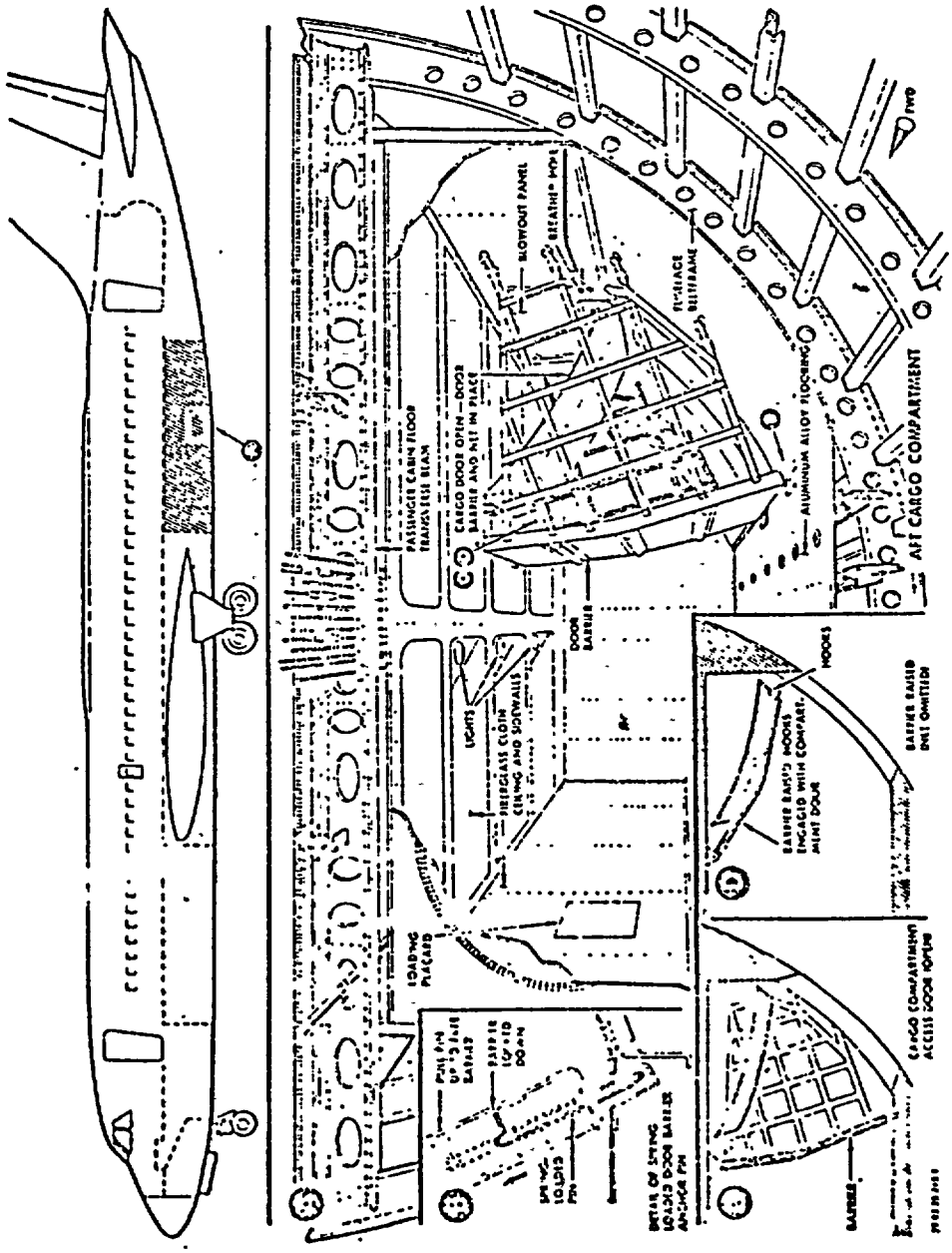
CONVAIR 880
MAINTENANCE MANUAL



CONVAIR 880

STRUCTURAL REPAIR MANUAL





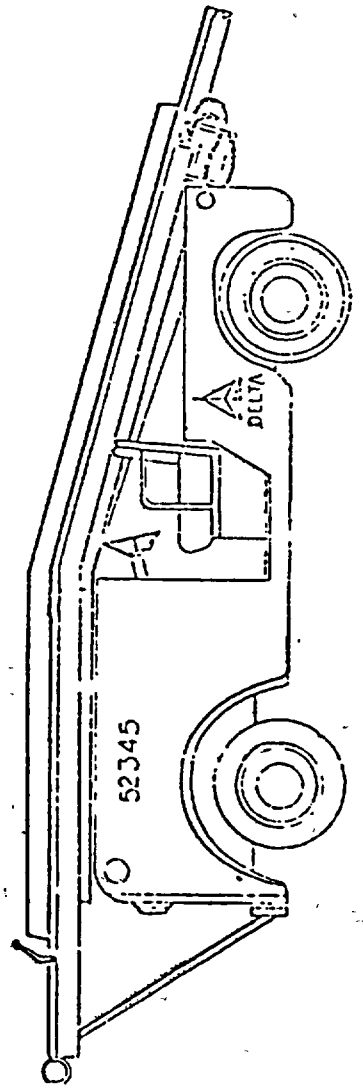
Cargo Compartments, Typical

DELTA AIR LINES, INC.

STANDARD PRACTICE

CONVEYORS

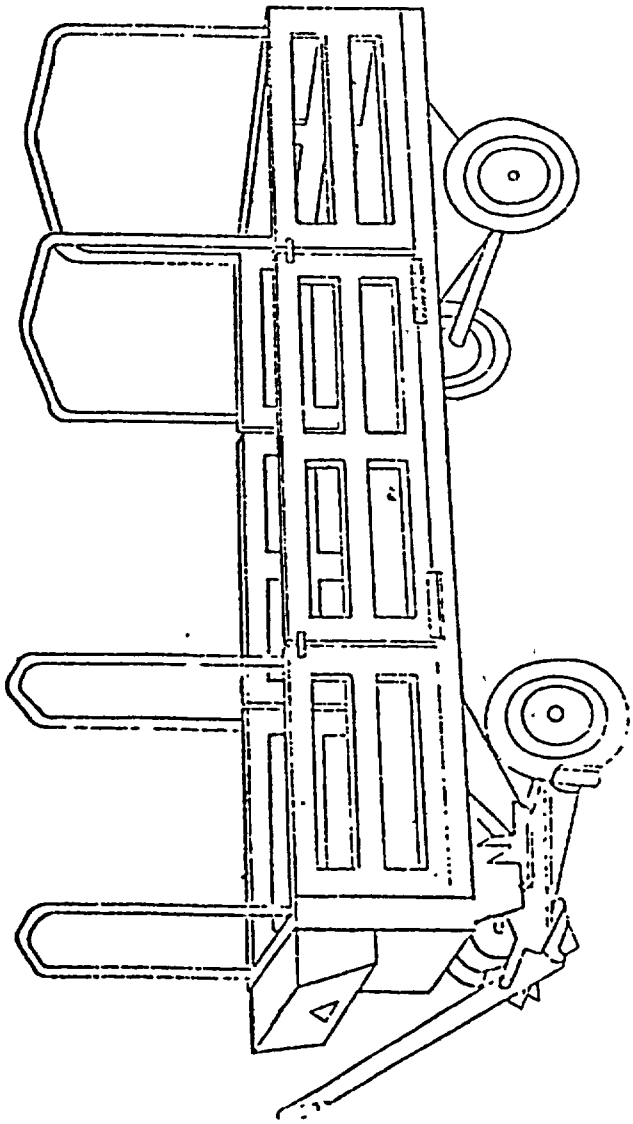
International Scout Conveyor - Model TC-476



DELTA AIR LINES, INC.

STANDARD PRACTICE

Wollard Baggage Cart - Model BC-450



RECONSTRUCTION OF SEQUENCE OF INCIDENT NOTIFICATIONS

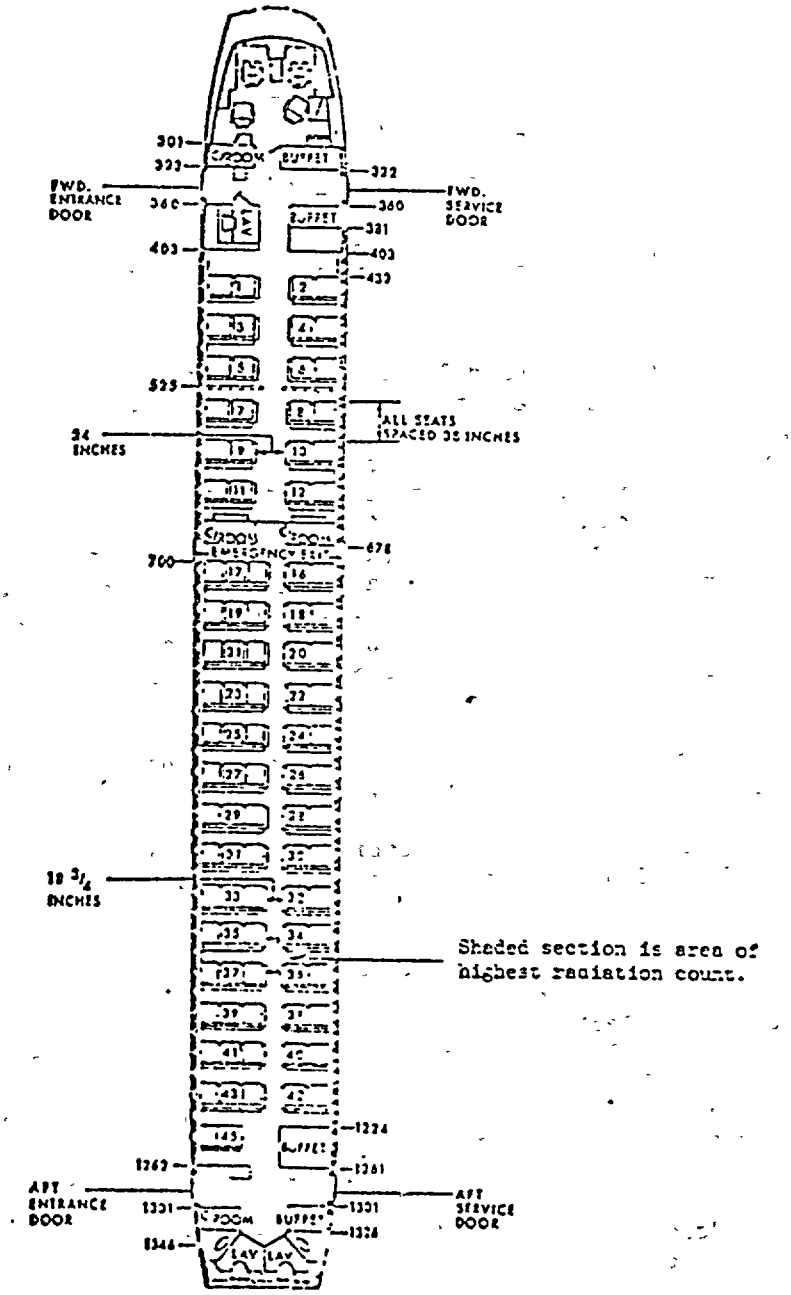
REF.	DAY/DATE	TIME	CALLER	CALL RECEIVED BY	INFORMATION EXCHANGED
C	SAT./JAN.1	0800-0900			Hastings Radiochemical picked up shipment from airport. On return driver detected contamination during routine processing.
C	SAT./JAN.1	1330	Hastings	Hastings' Consultant HP-Radiation Safety Officer (RSO)	Advised him of probable contamination. (He came in, surveyed packages, and confirmed contamination.)
C	SAT./JAN.1	1430	Hastings-RSO	Texas State Health Dept.	Advised of external contamination
C	SAT./JAN.1	1445	Hastings-RSO	American Biomedical Corp Dallas (Bio-Nuclear parent company)	Advised of contamination and alerted to possibility of BioNuclear shipment contamination.
C	SAT./JAN.1	afternoon	American Biomedical	BioNuclear	Advised of Hastings receipt of contaminated shipment in same consignment as theirs.
C	SAT./JAN.1	1500-1600	Hastings (Made UNSUCCESSFUL attempt to call)	Union Carbide Corp.	Apparently call got through to UCC boiler room. Caller would not identify problem or relay any information.
B	SUN./JAN.2	0700-0800			BioNuclear driver went directly to airport to pick up shipment. (Neither driver nor Delta knew of contamination at this time.) BioNuclear subsequently verified contamination and transfered remaining contents from containers.
A	SUN./JAN.2	morning			Texas State Health Dept. official traveled from Austin to Houston, visited Hastings, and confirmed contamination on packages.
B	SUN./JAN.2	morning	BioNuclear	Delta Air Lines (Freight)	Advised of findings of contamination, to check employees who handled shipment, and how to wash off contamination. (BioNuclear moved containers to quarantine in warehouse.)

*REF. - A - Time reference stated by individual company or agency representative.

B - Time reference approximated by company or agency representative.

C - Time reference approximated and reported by another party.

REF.	DAY/DATE	TIME	CALLER	CALL RECEIVED BY	INFORMATION RECEIVED
C	SUN./JAN.2	morning	Delta	Aviation Dept. Airport Security and Fire Dept.	Requested evaluation of condition at Airport Freight Facilities. (Fire Dept. decontaminated.)
A	SUN./JAN.2	1330	Hastings and Texas State Health Dept.	Union Carbide Corp.	To advise of contamination. UCC requested they call BioNuclear
A	SUN./JAN.2	1400	BioNuclear	Union Carbide	To advise package received contaminated.
	SUN./JAN.2	afternoon	BioNuclear	Texas State Dept.	To advise of contamination. (Representative, already at Houston, arrived soon after at BioNuclear.)
A	SUN./JAN.2		Texas State Health Dept. (called from BioNuclear)	Houston City Health Dept.	To advise of contamination. (Both proceeded to airport for survey which revealed additional areas of contamination.)
A	SUN./JAN.2	1500	Delta-Atlanta	Delta-Chicago	To advise of possible aircraft contamination. Requested AEC and Illinois Board of Health be contacted to inspect aircraft which was due to arrive at 1530. (AEC surveyed aircraft and found it contaminated. Aircraft was taken out of service and ferried to Atlanta for decontamination.)
B	SUN./JAN.2	2330	Delta-Atlanta	Union Carbide	Requested UCC call Delta VP to answer questions.
B	MON./JAN.3	0015	Union Carbide	Delta-Atlanta	In response to 2330 request.
B	MON./JAN.3	0400	Union Carbide	Delta, FAA & Georgia State Health Dept. (confer. call)	To determine course of action to pursue.
B	MON./JAN.3	0400	Union Carbide	BioNuclear (at home)	To learn details regarding package as received.
B	MON./JAN.3	0810	Union Carbide	N.Y. State Dept. of Health Dept. of Transportation Atomic Energy Comm., Regn.I Compliance	To advise known details of incident to date.
B	MON./JAN.3	0900	Union Carbide	Another Houston Consignee	To assure his packages were not contaminated. They had been routinely checked and found to be clean.



GENERAL ARRANGEMENT-PASSENGER AREA
(96 PASSENGER CONFIGURATION)

CONVAIR 880

MAINTENANCE MANUAL

AIR DISTRIBUTION SYSTEM - DESCRIPTION AND OPERATION

1. General

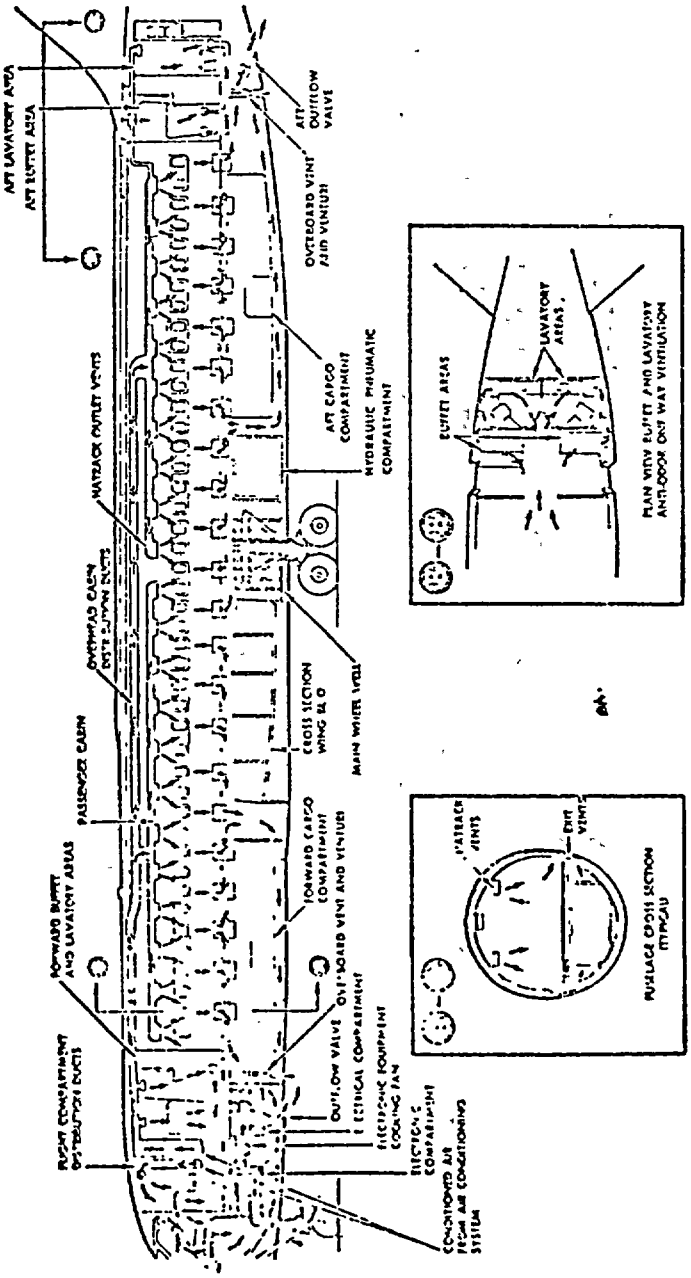
The air distribution system delivers conditioned air from the air conditioning packages to the crew and passenger compartments. A schematic of the air flow is shown on Figure 1. The air distribution system is illustrated on Figure 2. Aluminum and fiberglass ducting is used to deliver the conditioned air to air inlets along the sides of the cabin just below the hat-racks. The location and design of the inlets permit an even distribution of conditioned air throughout the passenger compartment with no drafts at any passenger location. The ducts and inlet vents minimize sound generation by the conditioned air as it moves through the ducts and out of the vents. Additional adjustable air inlets (ventilators) are installed above each passengers seat next to the reading light on lower surface of the hat racks. Conditioned air for the flight compartment is delivered by aluminum and fiberglas ducting and discharged above the flight crew's heads and at their leg level. Adjustable ventilators are installed above and forward of each crew seat (except observer).

Conditioned air in the passenger cabin is exhausted from the cabin through exit vents installed outboard and below the seats. These vents direct the exhaust air into the area below the floor. The flight compartment air is also exhausted to the area below the floor. The air exhausted below the floor in the forward area of the cabin is directed through the electronics compartment for cooling and ventilation of the electronics equipment and then through the electrical compartment and overboard through the forward cabin pressure regulator and out-flow valve, or the electronic equipment cooling valve. The air exhausted below the floor in the aft area of the cabin is directed aft, around and below the baggage compartments to stabilize temperatures in the baggage compartments, and then further aft to the aft pressure regulator and outflow valve where the air is ported overboard.

To prevent odors from entering the passenger areas, all lavatories and buffets are ventilated by a one-way ventilation system. The conditioned air directed to these areas is vented directly overboard through tubing, a venturi to limit flow, and overboard vents.

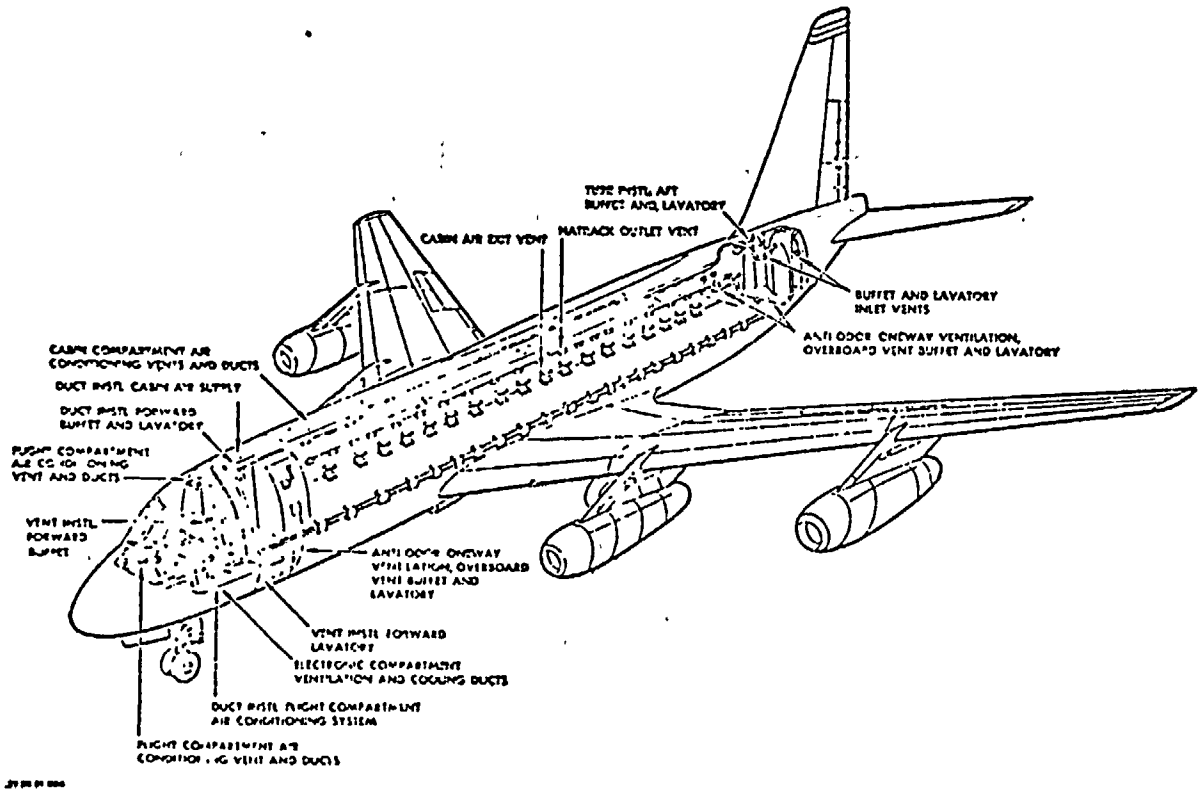
CONVAIR 880

MAINTENANCE MANUAL



Air Flow and Pressurization Schematic

82



Air Distribution System

INSTRUCTIONS FOR OPERATION OF THE AIRPORT SURVEY POINTS

THE ACTIONS OF THE SURVEY POINT TEAM ARE TO ASSIST DELTA AIR LINES (DAL) AND SHOULD BE AIMED AT ASSURING THE PASSENGERS OF THE AGENCY CONCERN FOR THE PASSENGER. JUDGEMENT MUST BE EXERCISED SO AS NOT TO UNDULY EXCITE THESE INDIVIDUALS. IT SHOULD BE BORNE IN MIND THAT THESE INDIVIDUALS ARE NOT INFORMED ON RADIATION CONTROL. CONSEQUENTLY, INSTRUMENT RESPONSE ON VERY SENSITIVE SCALES MAY CAUSE UNNECESSARY CONCERN IF OBSERVED BY THE INDIVIDUAL. ALSO, THE TEAM MEMBERS SHOULD BE AWARE THAT THEIR REMARKS AND CONVERSATIONS AS HEARD BY THE PASSENGERS ARE SUBJECT TO PASSENGER INTERPRETATION. REMARKS MADE IN JEST AND USE OF WORDS SUCH AS "HOT" OR EXPRESSIONS DENOTING SURPRISE OR UNDUE CONCERN BY TEAM MEMBERS MUST BE AVOIDED.

A DAL REPRESENTATIVE WILL BE THE PUBLIC CONTACT POINT FOR THE SURVEYS PERFORMED BOTH AT THE AIRPORT AND AT HOMES. IT SHOULD BE REMEMBERED THAT SURVEY TEAMS ARE SERVING IN AN ADVISORY CAPACITY TO DAL. ANY RECOMMENDATIONS TO PASSENGERS SHOULD BE MADE BY DAL. DAL WILL PROVIDE TRANSPORTATION OF TEAM REPRESENTATIVES TO HOMES FOR HOME SURVEYS.

1. Points are to be manned from 10:00 AM to 10:00 PM by qualified individuals daily beginning January 6, 1972, for 5 days or until no further requests are received and the survey point is shut down by the Delta Station Manager. The number of individuals making up this Survey Point Team should take into consideration, that Home Survey Teams may be drawn from the Survey Point Team.

2. Delta Air Lines Station Managers will provide space and will assure that passengers are directed to the survey point.

3. The area used for survey should have the floor covered with protective paper or plastic sheeting as a precaution.

4. Instruments, with appropriate check sources, capable of measuring from one mr/hr to 500 mr/hr, beta-gamma, are to be available.

5. Decontamination supplies consisting of absorbent pads, paper towels, rubber gloves, detergent solution, plastic bags, tags, marking pencils, and radiation tags are to be available.

6. A record, with copy to the Division of Compliance, AEC, will be made of the survey of each individual and article on the form attached.

7. Instrument surveys should be made of all articles returned by passengers on the affected flights. If articles are contaminated the passenger also should be surveyed.

8. The action point is a contact reading of 2 mr/hr, beta-gamma.

a. If no reading is detected above 2 mr/hr, the passenger is informed that there is no significant contamination and he is allowed to depart.

b. If a reading is detected in excess of 2 mr/hr, the team will:

(1) Attempt to decontaminate without destruction or damage to the item.

(2) If decontamination is successful to 2 mr/hr, the passenger will be so informed. He will be advised that some contamination was detected and removed and an offer will be made to have his home surveyed. Judgment *must* be exercised in the expression of this offer based on the level and extent of contamination found.

(3) If decontamination to 2 mr/hr is *not* successful, the passenger will be informed that contamination was found which was not easily removed and that fixed contamination is present. The contaminated article should be tagged with the release date that decay would result in a 2 mr/hr level. The passenger should be informed of this and the fact that the article should be stored and not used until the date. Delta Air Lines will store the article if the passenger so desires. An offer should be made to have his home surveyed. Judgment *must* be exercised in the expression of this offer based on the level and extent of contamination found.

9. Home Surveys

a. The home survey should be performed promptly. The passenger should be qualitatively informed of survey results by the Delta representative. Passenger property should NOT be destroyed nor confiscated. Rather, the passenger should be informed of acceptable cleaning practices, the fact that the radioactivity will disappear naturally to acceptable levels within a specified time, and some statement of hazard. The date on which decay will result in a 2 mr/hr level should be made known to the passenger.

b. Adequate records should be maintained of the home surveys. Delta Air Lines should be informed of the results and should serve as the contact point and make all arrangements for the survey.

c. Upon completion of a home survey, the member of the team that performed the survey should inform the AEC, Division of Compliance, HQ, telephonically of the result (301) 973-1900. The caller should ask for Mr. J. R. Metzger or Mr. G. W. Roy. Calls may be made collect.

d. If a team anticipates that a requested home survey cannot be accomplished within 48 hours, additional assistance should be requested by the AEC Radiological Assistance Team member through Radiological Assistance Team channels.

TENNESSEE VALLEY AUTHORITY
CHATTANOOGA, TENNESSEE 37401

June 2[illegible], 1976

Mr. Guy A. Arlotto, Director
Division of Engineering Standards
Office of Standards Development
Nuclear Regulatory Commission
Washington, D.C. 20555

DOCKET NUMBER
PROPOSED RULE PR-71,73 (40FR23678)
Trans. Radioactive Mtl. by air

Dear Mr. Arlotto:

This is in response to your letter of April 26, 1976, to Dr. Lewis B. Nelson, regarding the Draft Environmental Statement on The Transportation of Radioactive Material by Air and Other Modes.

Pursuant to Section 5 of the Tennessee Valley Authority Act of 1933, [48 Stat. 58, as amended, 16 U.S.C. Sec. 831d (1970), Supp. IV, 1974], TVA is authorized to develop new fertilizer products and cooperate in the experimental research, development, and use of such products. In this connection, TVA's National Fertilizer Development Center has since 1967, under license from the U.S. Nuclear Regulatory Commission, prepared small amounts of fertilizer materials tagged with the radioactive isotopes of ^{32}P, ^{33}P, ^{35}S, or ^{45}Ca for research and experimental use and shipped them to many locations in the United States and foreign countries. The fertilizer materials used and shipped for this purpose usually are: (1) ordinary and concentrated superphosphates, (2) monoammonium and diammonium phosphates, and (3) calcium sulfate. Only solid materials are shipped. They have a low order of corrosivity, are nontoxic (except possibly when ingested), are nonexplosive, nonflammable, and not subject to spontaneous combustion. In fact, ammonium phosphates are used as fire retardants.

Our usual range of shipping weights, specific activity, surface radiation level, and transport index are tabulated below.

No. of containers/ shipment	Material wt./shipping container, g	Specific activity (mCi/g of material)	Surface radiation of package (mR/hr)	Transport index (mR/hr at 3-ft distance)
1-3	100-2500	0.5	0.5-25	0.05-1

Acknowledged by card 6/25/76 LJ

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Mr. Guy A. Arlotto June 2 1975

We expect that most of our future shipments will remain in this range, and we could commit ourselves to not exceeding these limits, if necessary. Although TVA is licensed by the Nuclear Regulatory Commission to handle and ship to authorized recipients materials containing as much as 3000 millicuries of ^{32}P, or 1000 millicuries of ^{33}P, or 1500 millicuries of ^{35}S, or 100 millicuries of ^{45}Ca, our usual shipments contain far lower amounts.

Our packaging, labeling, and inspection procedures are based on those outlined in the document, A Review of the Department of Transportation (DOT) Regulations for Transport of Radioactive Materials, printed December 1972 by the Department of Transportation.

We believe it is essential that regulations continue to allow shipment of these materials by passenger-carrying aircraft because air cargo transport is neither available from the local airport where the materials are developed nor at the location of many of the recipients of the materials. Additionally, brief transit time for these materials is necessary because decay of the radioactive elements is rapid, and it is important that the time between preparation and use be short. If the tagged materials are shipped by much slower surface transportation, it would be necessary to tag them at significantly higher levels, which would have the effect of increasing their hazard potential.

The short half-lives of these materials require very tightly coordinated transportation schedules, and in some cases, verification of progress. Larger shipments could not be as readily scheduled or traced in their progress.

We appreciate the opportunity to comment, and ask your very thorough consideration of the comments provided.

Sincerely,

Peter A. Krenkel, Ph.D., P.E.
Director of Environmental Planning

DOCKET NUMBER
PROPOSED RULE PR-71,73(40FR23768)
Trans. Radioactive
Mtl. by Air

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JUN 2 1976

Director
Office of Standards Development
United States Nuclear Regulatory Commission
Washington, D.C. 20555

Re: Comments on the Nuclear Regulatory Commission's Draft Environmental Impact Statement on the Transportation of Radioactive Materials (NUREG-0034)

Dear Sir:

On May 17, 1976 the New York State Attorney General submitted comments to you on certain portions of the above-referenced document. At that time we informed you that additional comments were being prepared on other portions of the Draft Environmental Impact Statement ("DES") and would be submitted in the future. These comments are now complete and are enclosed herewith for docketing in the proceedings on the DES. Thank you for your cooperation.

Acknowledged by card 6/22/76

Very truly yours,

LOUIS J. LEFKOWITZ
Attorney General
by:

JOHN F. SHEA III
Assistant Attorney General

Comments by

John W. Gofman, M.D., Ph.D.

on

Draft Environmental Statement on The Transportation of Radioactive Materials by Air and Other Modes, Docket No. 71-73 (40 FR 23768), March 1976, U.S. Nuclear Regulatory Commission, Office of Standards Development

Submitted on behalf of
The Attorney General of the State of New York

John W. Gofman is Professor Emeritus, Medical Physics, University of California, Berkeley, California, 94720. Home address is 1045 Clayton Street, San Francisco, California, 94117

Prepared May 16, 1976

These comments will be limited to the subject of plutonium and its health hazards, in the context of the DES. The DES is totally unacceptable in its evaluation of the inhalation hazard of plutonium, since the errors in treatment of this subject are numerous and large. Consequently all the evaluations of the consequences of plutonium dispersal in the event of container failures are not only irrelevant to the true problem, but they do a severe disservice in grossly underestimating the true medical cost of such dispersals.

Point 1. The lung dose per curie inhaled is given as $2x10^8$ rems in Table III-7 (for insoluble PuO_2.) This value is manifestly incorrect. Gofman (1) and Cohen (2) agree that the dose is $2x10^9$ rems per curie deposited. Correcting this , from deposited to inhaled, we should reduce the value four-fold. Therefore, the correct value is $5x\ 10^8$, which is 2½ times as great a dose as presented in the DES. But this is only the beginning of the serious underestimate of dose from plutonium in the DES. All calculations of the DES are based upon the ICRP Model (Figure B-2 in Appendix B). That Model makes the erroneous assumption that no plutonium is retained for long-term delivery of dose to the bronchial region, an assumption based upon no evidence whatever and totally in contradiction with evidence concerning the impairment of bronchial ciliary function in cigarette smokers and in non-smokers . (See Gofman (1). When this is taken into account and when the small mass of the cancer-relevant bronchial tissue is taken into account, (one gram instead of the 570 grams of the whole lung) we end up with the following correction factors that must be applied to the DES estimates of dosage:

For cigarette smokers, dose must be multiplied by 103 times,
For non-smokers, the dose must be multiplied by 8.2 times.

Therefore, overall, incorporating these factors and the 2½ factor above, the DES underestimates the dose for plutonium inhalation by 257.5 times for cigarette smokers and by 20.5 times for non-smokers. These errors, alone, are sufficient to invalidate all the consequences of dispersion estimated in the DES But these are not the only serious errors concerning effects estimation.

Point 2 . In Table III-9 the DES estimates latent cancer fatalities as 22.2 deaths per 10^6 person-rems of exposure to the population. The data of reference 1 point to a more correct value of 762 deaths per 10^6 person-rems on the same calculation basis. Therefore, the DES estimate is some 34.3 times too low in its cancer estimate. If this underestimate of effe. is combined with the underestimates of dose, we arrive finally at the following error estimates for the DES evaluation:

For Cigarette smokers, effects must be 3533 times larger than DES estimates,
For non-smokers, the effects must be multiplied by 281.3 times to correct the DES estimates.

The final result of such corrections is to make the DES estimates totally meaningless as they stand in the report.

Point 3: In Appendix B , page B-12 the DES refers to " ... the median lethal dose of plutonium as 260 micrograms" This statement is not only

meaningless, it is grossly erroneous. The dose that guarantees a lung cancer fatality is 0.058 micrograms of Pu^{239} for cigarette smokers and it is 7.3 micrograms for non-smokers. Thus, for cigarette smokers, a dose 4483 times smaller than the DES will kill all humans, whereas the DES estimates their dose will kill ½ those exposed. Thus the DES is much more than 4483 times too low on plutonium toxicity. For non-smokers the amount required to guarantee fatality is 35.6 times lower than the dose DES calculates will only kill one half of the exposed. Unless the Nuclc Regulatory Commission learns something of the true toxicity of plutonium it is likely to continue to make such absurd statements as that on page B-12 that "Although plutonium is certainly a potentially dangerous mater ial, it is not orders of magnitude more potent than numerous other existing materials".

Point 4. On page B-10, the DES states, " Cancers have been induced in laboratory animals, although no cancers attributable to plutonium have been observed in humans." This statement is not only meaningless, it is dangerous. What the DES should state is " No meaningful study has been undertaken to determine how many lung cancer fatalities have been caused by plutonium handling." For the population-at-large, the best estimate currently available is that plutonium fallout has condemned 1 million persons in the Northern Hemisphere to lung cancer deaths.(Gorman,(3).

Summary

The DES has so seriously underestimated both the dose and the effects for plutonium exposure that all of its comments on dispersal of plutonium must be regarded as worthless.

References:

(1) Gofman, John W., "The Cancer Hazard from Inhaled Plutonium May 14, 1975. CNR Report 1965-1R , Committee for Nuclear Responsibility, Yachats, Oregon.

(2) Cohen, B.L. "The Hazards in Plutonium Dispersal" Report of the Institute for Energy Analysis, Oak Ridge Associated Universities, March , 1975, Oak Ridge , Tennessee.

(3) Gofman, John W. "Estimated Production of Human Lung Cancer by Plutonium from Worldwide Fallout" , July 10, 1975, CNR Report 1975-2, Committee for Nuclear Responsibility, Yachats, Oregon.

COMMENTS OF THE NEW YORK STATE ATTORNEY GENERAL ON THE DISCUSSION OF TOXICITY OF MATERIALS, CONTAINERIZATION, RELEASE OF MATERIALS AND GENERAL RISK ANALYSIS IN THE NUCLEAR REGULATORY COMMISSION'S DRAFT ENVIRONMENTAL IMPACT STATEMENT ON THE TRANSPORTATION OF RADIOACTIVE MATERIALS BY AIR AND OTHER MODES

NUREG 0034

BY

DR. MARVIN RESNIKOFF
PETER N. SKINNER, P.E.

Introduction

1. Previously numerous affidavits were submitted by the State of New York to the United States District Court for the Southern District of New York in the Case of the State of New York v. The Nuclear Regulatory Commission, et al. Copies of these affidavits have been provided to the Nuclear Regulatory Commission ("NRC") in the course of this proceeding dealing with the transportation of radioactive materials as originally noticed in the Federal Register. 40 Fed. Reg. 23768. References to the "plaintiff" in these comments on the Draft Environmental Impact Statement ("DES") are, of course, to the State of New York. Occasionally references are made to the "defendants" and "defendants' affidavits"; these references are to the NRC and its sister agencies which are involved with the transportation of radioactive materials and the affidavits which this agency and its sister agencies have filed in the litigation initiated by the State of New York.

2. We have examined certain parts of the DES dealing with toxicity of materials, containerization, dispersion, crash environments and risk analyses of various modes of transport and it is our conclusion that the DES is a fatally defective document and, as such, cannot be relied upon as an accurate or adequate document by the Congress or the public.

Shipment Size

3. For the purposes of the DES the authors assumed an air shipment of plutonium with a size of four packages containing five kilograms each for a total of 20 kgs. (Tables V-13, V-12, V-7). Actual practice seems to indicate that larger sized shipments are more realistic. For instance, two JFK PuO_2 shipments on July 29, 1974 and February 24, 1975 weighed 48.3 kilograms and 45.1 kilograms respectively, each more than twice the size assumed by the DES. This assumption undercuts the credibility of the "worst case" scenario.

Containerization

4. Whether or not plutonium powder will escape its container during an air accident is dependent on two factors, the strength of the container and the severity of the accident environment. Considering the first of these, the DES makes only a passing reference to the wealth of material available as a result of the work done by Sandia Laboratories, and others, as well as a great deal of data supplied by the many experts appearing in the case of State of New York v. Nuclear Regulatory Commission, et al., United States District Court for the Southern District of New York (75 Civ. 2121 [WCC]). No data whatsoever can be found in the DES to dispute the criticism in the affidavits previously filed by the State in that case and in the Nuclear Regulatory Commission ("NRC") proceeding on transportation noticed at 40 Fed. Reg. 23768.

5. It has been determined under performance test conditions that the integrity of these containers are breached by levels of test crash environment intensity which are significantly less severe than actual air crash environments (Def. Aff., Nussbaumer, Exh. D; Pl. Aff., Pinkel, p. 6; Resnikoff, [6/12/75], p. 3). In fact, during test drops done for NRC at speeds of only 130 feet per second, even the inner pressure vessels were caused to leak (Pl. Aff., Resnikoff [6/12/75], p. 3; Def. Aff., Nussbaumer, Exh. D.). The Sandia Laboratory Report, "Special Tests for Plutonium Shipping Containers", annexed to the

Nussbaumer affidavit as Exhibit D, candidly admits that, if impact speeds were raised to 150 feet per second, spillage of nuclear material is likely (Pl. Aff., Pinkel, p. 6; Def. Aff., Nussbaumer, Exh. D). Yet the DES classification scheme for accident severity categories assumes that no material will leak from cannisters in such accidents. Hence, these assumptions in the DES directly contradict the earlier affidavits of defendants submitted to the Federal District Court and the NRC.

6. No thought has been given to the potential of penetration damage due to shrapnel-like fragments of disintegrating airplane components resulting from an air accident (Pl. Aff., Pinkel, p. 7). Dr. Chapman, formerly of the Cornell Aeronautical Laboratory, is in agreement with Mr. Pinkel and Dr. Resnikoff when he concludes that, given the present containers, there is little assurance of containment of materials in air crash environments, which are clearly more severe, more complex and of greater impact than accidents in other modes of transport (Pl. Aff., Chapman, pp. 2-3; see also Pinkel, Resnikoff) The containers now in use by the NRC, their agents and licensees are clearly not designed from a complete knowledge of the air crash environment and continued use of such containers in air transport jeopardizes human life (Pl. Aff., Pinkel, p. 10).

7. Cannister strength is lightly treated by the DES on pages V-24, 25, and 26 and VI-48 and 49. At this late date the NRC admits that "only a limited number of containers [have been] tested." The DES assumes that "Model I" packaging (that is cannisters meeting current regulations) would fail (p. V-12). As to cannister "Model II", which is deemed by the NRC to be a conservative approximation of "real containers in an accident environment" (VI-26), and hence the critical link for NRC's allegations as to safety of containerization, the authors rely on unspecified "personal communications" for substantiation of their various assumptions. This totally undermines the validity of this analysis for the purposes of this DES. The authors arbitrarily define fractions of plutonium powder shipments which will

released in the event of an air accident of a given severity class. Of the two references presented to support these arbitrary assumptions, one, (9) (p. V-24) is a private communication "private communication" is also refered to earlier on page V-1. in regard to population densities across the country. "Private communications" are a highly suspect source for a very important parameter for study of this area. No specific data is ever identified as stemming from this "personal communication"; and hence, no basis is given for the authors assumptions as to accident severity classes and release model fractions. These models are unverifiable and, as a result, highly questionable, to say the least.

Accident Environments

8. The DES presents an abbreviated analysis for the complex and controversial area of accident environments. The authors of the DES consider only that damage inflicted on the containers by assumed fire and speed of impact factors and do not consider crush and puncture damage, the very damage mechanisms deemed to be so significant in the earlier Sandia report which was placed on the record of the State's case by the defendants themselves (Def. Aff. Nussbaumer, Exh. C, D and F).

9. Nothing in the text of the DES indicates how the authors established accident type classifications on the basis of papers by "Clark et al." (p. V-60). Since the NRC has made the work of Clark et al. central to the determination of these "type classes", specific discussion of all relevant portions of that material must be provided if this part of the DES is to have any validity.

Release

10. It is significant that the earlier analyses by Resnikoff (Pl. Aff. April 25 and June 12, 1975), which only assumed 1/16 of the DES "worst case" release, resulted in the tens of thousands of Latent Cancer Fatalities ("LCF's"). Had he used a

20 kilogram release instead, hundreds of thousands of people would have become LCF's in all three cases of meteorological stability. (See Pl. Aff. Resnikoff, April 25, 1975, Appendix D).

Dispersion and Resuspension

11. The degree to which the public would become exposed to plutonium powder in the event of an air accident is dependent on the parameters discussed earlier and on several others as well; dispersion is one of them. The DES presents an almost incomprehensible complex of figures and explanations on this topic. A number of factors necessary for the reader's reproduction of the conclusions as to dispersion are omitted or inadequately described. The basic input term of deposition velocity, necessary for standard Gaussian analyses, is completely missing. Apparently Figure V-11, "Specific Dose vs. Area", is important to the DES's determination of areas which would be covered by plutonium powder after an accident. The term, Specific Dose (rem/gm), is depicted as varying with the area enclosing such a dose. This is an internally inconsistent concept (rems/gram of plutonium does not vary -- it is a constant). Yet the concept becomes, by the use of other vague factors, the basis for figures V-12 and V-13, which set forth the number of people affected. Because of the inconsistencies and lack of descriptive information contained in the DES on this issue, we have been precluded from further comment on this analysis.

12. Both Robert Barker of the NRC (Def. Aff. sworn May 30, 1975) and Dr. Marvin Resnikoff (Pl. Aff. sworn April 25, 1975 and June 12, 1975) (one of the deponents herein) utilized Gaussian models with full explanation of the input parameters and sensitivity thereto. The DES, inconsistent with the analysis of the NRC's own expert, Barker, does not even explain these differences in approach between the DES and the Gaussian analyses. The discussion of contradictions later in these comments shows that the DES predicts 617 Latent Cancer Fatalities, Barker 15,000, and Resnikoff 107,000. Since the DES arrives at conclusions different than either of those models, some

explanation is required before the DES can possibly be relied on as having any validity.

13. Dispersion is also dependent on the meteorological conditions assumed. Calm weather increases the amount of individual dosages and turbulent conditions decrease dosages. In the DES the authors state: "A year or more of data record (sic) for these parameters is used in the model which was obtained at two different locations" (p. V-29-30). Neither the data recorded nor the locations studied were presented; yet these factors quite obviously have tremendous impact on the conclusions presented in figure V-10. Such data were presented by Barker (Def. Aff. p. 17 and exhibits) and Resnikoff (Pl. Aff. April 25, 1975 Table 2). Once again this omission precludes reproduction of the DES's conclusions by the reader. The DES's use of only average conditions from the "year or more of data" recorded does not present scenarios capable of producing "worst-case accident consequences" found in figures V-11 and V-12.

14. Resuspension of the powder once it has settled out of the atmosphere onto buildings, vehicles, roads, etc. will plague decontamination and evacuation efforts and increase exposures to the public. The DES states only that "the contribution to the total dose from cloud shine, ground shine, and resuspension can be obtained by the application of established factors to the results shown in figure V-11 . . ." (p. V-39). No use or actual application of these highly important "factors" is to be found in the DES.

Respirability

15. Plutonium powder comes in various size gradations, depending on the source, some being more likely to settle in the lung than others. The more plutonium which settles in the lung, the greater the degree of risk of lung cancer. The authors of the DES assume 20% will be a candidate for deposition on the basis of particle size gradation of Fast Flux Test Facility ("FFTF") feed material (p. V-40), stated by the DES to be 20%

respirable. However, plutonium oxide shipments through JFK in 1974 and 1975 (p. V-43) were admitted by the NRC to be 40% respirable. Indeed even the DES assumption of 40% respirability for JFK shipments is far too low as the authors have based that figure on a statistical construct of a 3.3 micron mean size of particles in those shipments. However, uncontested information in the record of the State's case against the NRC indicates that the range of particle size (.92 - 1.12 microns) did not include 3.3 micron particles at all, much less a mean particle size of 3.3 microns (Pl. Aff. Skinner, Appendix B). Since particles below 3.3 microns are " . . . considered to be respirable and candidates for deposition in the pulmonary tissue . . . " (p. V-40), it is accurate to say that 100% of the JFK shipments were candidates for lung deposition. Use of a 20% respirability figure represents a significant underestimate of plutonium's dangers. Again the DES proves to be a document replete with invalid assumptions.

Population Concentrations

16. The DES assumes 10,000 people/square mile to be a "High Population Density" (p. V-30). Examination, however, of the Tri-State Regional Planning Commission 1970 Census population distribution shows that there are only a few square miles within a zone of maximum impact in New York City with 10,000 persons or less (Pl. Aff. Skinner-Wang sworn June 13, 1975, exhibit 7). The Skinner-Wang affidavit utilizes 40,000 persons/square mile as a more representative value for a "worst case" accident at JFK. According to that affidavit a four-fold increase in population density would result in a four-fold increase in the impact presented in figures V-12 and V-13 of the DES.

Biological Half-life

17. Radioactive material has a normal decay half-life of the material itself. In addition, when a radioactive material is taken up by the body, natural biological processes can expel a part of that uptake. The rate at which the expulsion takes place is known as the biological half-life. For the purposes

of the DES the authors chose 500 days (page III-16). This assumption appears to be a significant underestimate. In the appendix to the DES (page B-7), the authors admit the " . . . lung clearance half-time" is 200-1,000 days. In order to obtain the worst-case scenario as described in figures V-12 and V-13, the authors should have used 1,000 days, not 500. There is significant authority for the use of such a value. The U.S. Environmental Protection Agency ("EPA") reports in its publication, "Environmental Analysis of the Uranium Fuel Cycle, Part III - Nuclear Fuel Reprocessing, 520/19-73003-D, that the new International Commission on Radiation Protection ("ICRP") lung model assumes a 1,000 day half-life as does the NRC's WASH-1535 "LMFBR Program Environmental Statement" in that document's Table II.G-9.

Biological Effectiveness

18. Another area of disagreement lies in the biological effectiveness (i.e., effect on tissue) of given gram of plutonium. The DES uses a figure of 2.0×10^8 rems/curies. The NRC's WASH 1535 at Table II.G-10 presents a figure of 8.6×10^8 rems/curie. According to the USEPA (Id.), ICRP now uses 16.5×10^8 rems/curie for Pu-239. Since the DES relies on the Pu-239 value of 2.0×10^8 for its conversion calculation of the biological effectiveness of reactor type Pu (that shipped through a JFK) (Page B-4), it is clear that the danger of plutonium inhalation may be understated by the DES by over 8 times. At any rate, the resulting impact calculated from the 2.0×11^8 number cannot be considered a "worst case" impact.

19. Recycle of plutonium in today's light water reactor fuels will increase the concentrations of certain isotopes of plutonium in any shipments by air as shown below.

Plutonium Constituents

Constitutent	DES (B-5)	JFK*	WASH. 1327**
Pu-238	1.9%	0.6%	4%
Pu-239	63.0%	72.0%	43%
Pu-240	19.0%	18.7%	26%
Pu-241	12.0%	7.0%	15%
Pu-242	3.8%	1.6%	11%
Am-241	0.6%		1%
Rems/curie	10.6×10^6	39×10^6	83×10^6

(See April 25, 1975 Resnikoff affidavit - table 2 for calculations of Rems/curie)

These increases mean that the latent cancer danger of plutonium powder will increase by about 100% when plutonium recycle matures. This effect has not been taken into account in tables V-16 and V-17 of the DES.

Latent Cancer Fatalities

20. Latent Cancer Fatalities ("LCF") is an epidemiological factor. When a population receives a dose of radioactive material, the LCF factor can be used to predict the number of fatalities due to this dosage above the average one can expect from other causes. The authors of the DES chose 22.2 LCF/10^6 person-rems for lung cancer on the basis of the BEIR report (p. III-23). This number is smaller than a that in a number of other reports. USEPA has assumed 50 LCF/10^6 person rem. Dr. John Gofman reports that Cohen has used 39 LCF/10^6 person rem and assumes 762 LCF/10^6 person rem himself (Pl. Aff. Gofman, Exhibit B, p. 6). From these data it can be clearly shown that the DES has understated the danger of plutonium inhalation by as much as 34 times. The specific origin of the Latent Cancer Fatalities figure (20 per year for 30 years) (p.ii), which allegedly could be produced from the DES's plutonium

*Pl. Aff. Skirner-Wang affidavit, sworn June 13, 1975, Exhibit 7

**"Draft Generic Environmental Statement on Mixed Oxide Fuel", p. IV C-62.

accident scenario, cannot be found anywhere. Throughout the numerical presentations the reader is forced to do detective work to find the computational framework (often apparently guesswork) utilized by the authors, often without success.

21. Of interest as well is the DES's use of cutoff points for the production of LCF's from population exposure. Standard epidemiological analysis utilizes the formulas described above (LCFs/10^6 person-rems) based on the whole population exposed. This method is necessary to integrate the natural variability of people's response to carcinogens. Although the DES uses the above epidemiological tool, it applies that tool only to a part of the population, that part which has sustained more than a given dose, thereby eliminating a significant number of exposed persons (or person-rems) from consideration. Table V-13 employs a cutoff of 15 rem. That part of the exposed population, perhaps millions of people who, receiving less than 15 rem, are excluded from epidemiological consideration - i.e. they are deemed by the DES as not being potential cancer victims. Such a method is contrary to standard epidemiological practice (as utilized in the Skinner-Wang affidavit of June 13, 1975, Exhibit 1). The method employed by the DES significantly reduces the impact of a dispersion accident.

22. A similar cutoff or threshold was applied to calculations underlying figure V-10. The cutoff of .8 rem was used for depicting the area enclosing populations dosed at that level. Since this figure is based on a one kilogram release and the DES worst case scenario was based on a 20 kg release, one can readily see that the actual cutoff is not .8 but actually (1) 20 x (.8) or 16 rems or (.5) (20) x (.8) or 8 rems depending on the fraction of a shipment released (p. V-25).

23. Another significant underestimate in impact consequences can be found in Table V-13's use of the "Integrated 1 year dose" factor. Instead of presenting the number of people who would have suffered irradiation over their 50 year adult lifetime, the DES presents a smaller number on the basis of only a 1 year dose. The text of the DES does not describe how this integration was done, which precludes adequate analysis by ourselves at this time.

Sensitivity Analysis

24. The sensitivity analysis presented in Appendix G of the DES covers a number of factors which can be varied for an examination of the range of effects on calculated impact. The "theoretical basis" for this analysis is in equation (2) $\Delta I \cong \frac{dI}{dX} \Delta X$. This is an elaborate way of saying that, if the dependent variable (X) is changed by a certain amount (ΔX), ΔI will change on the basis of dI/dX. For the few variables analysed in this manner, none of the dI/dX conponents are presented and the methods and assumptions utilized to get them are missing as well.

25. Although many variables have been mentioned herein as being underestimates, only one of these, population density, is analyzed in the DES for sensitivity in the accident scenarios. As mentioned before (Pl. Aff. Skinner-Wang, sworn June 13, 1975, Table A) we maintain that 40,000 people/square mile is a more representative population density for the New York City region imperiled by plutonium air shipments. This represents a 400% increase over the baseline population density (10,000/mile^2) NOT 10% as the DES assumes.

26. Assuming a linear dI/dX term the 5.1% increase in baseline value (Figure G-2) would ge increased by a factor of some 204%. Therefore LCF numbers would be doubled due to the four times greater density of population in the region at risk. The sensitivity of this parameter in the DES is contradicted by

an uncontested affidavit filed by the State in its case against the NRC (Skinner and Wang, sworn to June 13, 1975). That affidavit shows that a 400% increase in population density would occasion a 400% increase in lung cancer fatalities (see Tables 1-9). The analysis of Annual Early Fatality Probability increases (DES Figure G-3) does not consider population density in such a way as to be meaningful in terms of figure V-13.

27. This section in the DES on sensitivity analysis is totally inadequate, having failed to analyze those variables we have discussed herein and having further failed to consider other variables essential to a valid final impact assessment (e.g. shipments by barge, putting plutonium in "bulk" form).

28. The term "lung cancer fatalities" utilized in the Skinner-Wang affidavit sworn June 13, 1976 can be used interchangeably with the DES's term, latent cancer fatalities. Lung cancer fatalities utilized in the Skinner-Wang affidavit above also include the DES's fatality sub-group, annual early fatalities. This overlap between the DES and Skinner-Wang analyses is really academic because the fatality occurs either way.

Contradictions and Discrepancies in NRC Analyses of Impact

A. Barker's Affidavit

29. The DES presents accident impact conclusions which, in part because of the nature of the assumptions used, were smaller than those previously claimed by the NRC in the NRC affidavit by Barker (p. 5-12). Unfortunately lack of clarity and documentation in the DES precludes complete comprehension of all the origins of these discrepancies. Therefore preliminary analyses were made using known dispersion models with the major known impact assumptions used in the DES.

30. Utilizing the model presented by Barker in his affidavit (Memo dated 5/14/75 by J.H. Cusack from Brookhaven National Laboratory ["BNL"]), an impact consequence for a DES

"worst-case" release yielded more than 53,000 LCFs (see calculations attached).

31. We used Table No. 6 of that memo because it appears to be a "worst-case" analysis and DES purports to have "worst-case" analysis as its primary purpose.

32. Because of the lack of clarity and specifics in the DES model, we were unable to use that model and we utilized the Barker model instead, changing only the amount of plutonium oxide released. The Barker model originally used a release of approximately 1.25 Kgs. (page 1 BNL memo). We changed this amount to the amount utilized in the DES, 10 Kgs. All other inputs were kept the same. This changed the value of latent cancer fatalities of 15,000 people which the Barker model predicted in Table No. 6 of the BNL memo (Pl. Aff. Skinner-Wang, sworn to June 13, 1975, Table A) to an astounding total of 53,000 people. The DES on the other hand, on page ii, predicted only 617 fatalities. The only possible explanation for this conflict lies in the many assumptions used by the DES which remain secret and unavailable for scrutiny by Congress or the public.

B. The NRC's Model in the Generic Environmental Statement on Mixed Fuel ("GESMO") WASH 1327

33. On pages V-48 and V-49 of the GESMO, assessing plutonium recycle, an abbreviated model is presented which describes the dispersion of plutonium based on a 2 Kg. release. Although the model fails to calculate contaminated areas and the number of persons affected, one can utilize it to determine these impact parameters with the help of the Resnikoff methods in the Resnikoff affidavit (April 25, 1975), which are very similar to the GESMO method.

Assumptions

1.	Distance form point of release (GESMO, p. V-48).	40 miles
2.	Amount respirable (Skinner Affidavt sworn April 29, 1975, Exh. 7)	100%
3.	Amount expelled by lungs (DES V-42)	70%
4.	χ at 40 miles (GESMO, p. V-48)	8.1×10^{-4} gm-sec/m^3
5.	Release Height (DES p. V-31 and Barker BNL memo, p. 1)	Elevated
6.	Release Quantity, PuO_2 (DES p. V-25, Model II)	10 kg.
7.	Specific Dose Pu-239 (DES p. III-19)	2×10^8 rem/ci
8.	Specific Activity Pu-239 (DES p. B-5)	.06 ci/gram
9.	Reactor Pu Conversion factor (DES p. B-4)	11.2
10.	Standard man's breathing rate (Rad. Health Handbook)	3.3×10^{-4} m^3/sec

34. When we properly arranged the assumptions, the calculations yeilded the conclusion that the DES severely understates the impact consequences for a plutonium dispersion accident. Our calculations are as follows:

(1.0 - .7 = .3) [fraction remaining in lung] times

8.1×10^{-4} gm-sec/m^3 [χ] times

3.3×10^4 m^3/sec [Volume Breathed] equals

8.1×10^{-8} grams in the lung.

Then,

8.1×10^{-8} [grams in the lung] times

2.0×10^{-8} rem/curie [exposure] times

.06 curie/gram [specific activity] times

11.2 [conversion factor] times

10 kg [DES release] divided by

2 kg [GESMO release] equals

54 rems to a person @ 40 miles from the release site

35. Substitution of the χ value for a distance 1,800 feet yields the value of 115,000 rems exposure to a person located there.

36. Assuming GESMO utilized the worst-case conditions, stability Class F (Case B in Pl. Aff. Resnikoff, Table 2), over 1.4 million people would be exposed in the dispersion arc to 54 rems or more. On the other hand, the DES states in table V-13 that only 280,600 persons are being exposed to 15 rems or more. This massive inconsistency between the DES and other NRC documents totally undercuts the validity of the health effects model of the DES for air transport of plutonium.

Miscellaneous Questions and Comments

37. The alternative of transporting materials by water is given only minimal consideration in Chapt. IV, Section D.4 Page IV-34. No information is given about the present volume of material shipped by water. It seems clear that in certain localities, water transport may indeed be an alternative to conventional inter-city ground transport modes, and might result in significant reductions in exposure in both normal and accident situations. Although plutonium is the major contributor to accident latent cancer fatalities, it has a long half-life. Thus the shipment of plutonium by water may be economically feasible as well.

38. There is a major difficulty in determining the areas of sensitivity when the various parameters in the risk equation for accident scenarios, pg. V-8 are changed in alternative situations. We are provided with a set of figures for the baseline and alternative situations, but nowhere are there any intermediate or exemplary calculations which would show what, specifically, contributed to the change between the baseline and alternative figures. For example, in Table VI-3, page 41-7, we are given the set of figures for all air shipments being instead transported by truck. But it is impossible to tell from these new figure alone, just what contributed to the alternative results -- a difference in vehicle miles/year, probability of accidents, accidents of

different severity classes, etc. Without the benefit of intermediate calculations, it is impossible to determine why the proposed alternatives result in the changes given in the summaries.

39. The methods of obtaining figures for normal and accident L.C.F. in both baseline and alternative transport situations are quite unclear. There is no derivation given for the equation from which the baseline risk figures are obtained. (The equation itself is very difficult to find, especially in light of its exclusive use in determining the final figures). The variables used in this general equation are also hard to locate and several of them (e.g. vehicle miles/year for each type of shipment, probability/vehicle mile of a specific severity class accident) can only be obtained through a series of separate calculations. Calculations of the alternative results are made by changing a specific parameter in the original equation and following this through; this is obviously done with a computer program, but no program is provided, making it very difficult to reproduce these results. In addition, inconsistencies with the language used to show the changes between baseline and alternative situations make the results confusing and occasionally misleading. While most of the changes are represented in percentages, the very large reductions are not, e.g. a "factor of 16 decrease", which seems fairly small, actually represents a 94% decrease in the baseline figure, a very significant change. Particularly puzzling are the rankings of truck, rail, and passenger air transport (VI 53-55).

40. How are cancer fatality figures for normal and accident transport situations calculated? (Table VI-1, pg. VI-2)

41. What is the basis for figures in Table I-1 on annual person-rems in normal transport for each type of radionucleotide? How are the annual person-rem figures calculated in the alternative section (e.g. Table VI-4, pg. VI-10)?

42. How are mileage, exposure time and population dose figures detemined for alternative transportation modes? (e.g., switching from all passenger to all cargo air paragraphs 1 and 2, pg. VI-16).

43. For a diffusion model used to assess the consequences of release of radioactive materials, figure V-10, page V-31, what release height figures are used; and why are these chosen for each mode?

44. In the summaries of results for each transport mode, how are figures for "probabilities of ≥ 1 early fatalities/year" derived, e.g., Table VI-4, page VI-10.

45. Why are certain alternatives evaluated only with regard to cost, while discounting seemingly significant decreases in accident latent cancer fatality figures, e.g., Table VI-28, page VI-44.

46. In the release consequences analysis (chapter V, section E, page V-43), how do worst-case release heights vary from one mode of transportation to another (e.g., truck or helicopter accidents)?

47. On page VI-41, Section B.2 - 3.1, what procedure is used to determine reduction in truck accident rates due to the 3 alternatives given?

DEPARTMENT OF TRANSPORTATION
MATERIALS TRANSPORTATION BUREAU
WASHINGTON, D.C. 20590

DOCKET NUMBER
PROPOSED RULE PR-71,73(40FR23678)
Trans. Radioactive Mtls by Air

JUN 14 1976

Mr. Robert B. Minogue, Director
Office of Standards Development
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Minogue:

This refers to your April 1, 1976 letter, enclosing a copy of the Draft Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes (NUREG-0034). As you know, our staff has been kept informed of the progress of this effort during the past year and, in fact, met with your staff, along with the Federal Aviation Administration's representatives prior to the initiation of the associated rulemaking proceeding in June 1975. The document appears to be a very comprehensive treatment of the subject addressed. The radiological data presented are consistent with currently available information and the references cited are generally accepted within the scientific community. The statistical data on risk assessment, accident probabilities, exposures to transport workers, etc., are drawn from the various studies recently conducted jointly by NRC and DOT. Our review has not revealed any anomalies or inaccuracies. The conclusions drawn by your staff and the recommendations offered are, in some cases, subjective and do not readily lend themselves to critical review, however, they do appear to be justified on the basis of the study and the assumptions made.

Specifically, we were pleased to note that your staff had concluded that the radiation exposure of individuals from normal transportation is within recommended limits for members of the general public. As you know, the subject of transportation workers' exposure to radiation during normal handling of radioactive packages has been the subject of intensive review by our agencies for the past several years. This study should be very useful in supporting the continuation of the present system whereby transport workers are not considered to be radiation workers in the course of handling radioactive materials shipments.

The conclusions drawn from this study with regard to the environmental impacts associated with both normal transportation and accidents involving radioactive materials, are especially noteworthy. The infinitely small impact from normal transport, as well as the very small risk from

Acknowledged by card 6/25/76 J.P.

accidents, should be especially helpful in our continuing efforts to allay the fears of the public as to the adequacy of the existing regulatory framework for transportation of radioactive materials. The information and conclusions from factual studies such as this provide a sound basis for rational public judgment. We appreciate the opportunity to review this document and will be glad to provide you with any information you consider necessary to proceed with its final publication.

Sincerely,

Alan I. Roberts
Director
Office of Hazardous Materials Operations

(89)

JUN 25 1976

1281 Emory St
San Jose, Calif. 95126
June 14, 1976

Subject: NURG-0034
Draft Environmental Statement
on
Transportation of Radioactive Material
By Air and Other Modes

DOCKET NUMBER
PROPOSED RULE PR-71, 73
(40 FR 23678)

Attention: Mr. Donald Hopkins
Task leader for this statement.

Dear Sir:

A letter from Mr. Anlotte dated May 18 gave me an extension of time to submit comment on this draft which I appreciate. I am one of the few private citizens who received copies of the draft and have given it serious study, desiring to make a responsible comment. Since I don't type and do not have access to a typist please forgive the informal appearance of this letter. I am deeply concerned

about a particular matter and will make myself as clear as possible.

In the detailed summary, p. xxvii it is stated that the impetus for the review includes, "a need to respond to current national discussions of safety and security aspects of nuclear fuel cycle materials." This statement suggests to me that your statistical conclusions include data concerning transportation of spent fuel from power plants. Ch. 1 pgs 10–15 & 6 discuss the nuclear power industry. Fig. I-1 p. I-2 shows spent fuel moving to & from reprocessing plants. Fig I-1 beginning on p. I-16 also refers to materials traveling to and from reprocessing plants.

Yet in Table I-3 p. I-21 you have <u>excluded</u> fuel cycle shipments – stating in a footnote that "this data is expected to be updated by a more extensive survey now in progress." In other words you are <u>not</u> including fuel cycle shipments in this study because you do not have necessary data.

Then on page I-24 you point out that the studies of nuclear fuel cycle shipments from which you do take information has not considered <u>air</u> transport.

Then, still on page I-24 you state flatly, (2nd par.)

"Since there are currently no HLRW shipments and few, if any, are anticipated by 1985, they are not explicitly treated in the model."

So, your statistical conclusions reported in the Summary + Conclusions at beginning of the book do not include data about shipment of irradiated fuel from nuclear power plants. And your stated stated purpose of answering public concern about nuclear fuel cycle material is not answered.

My concern is that you lead the reader to expect something which does not happen. And, what is worse, a perfunctory look at the early part of the book leads one to believe that the statistical conclusions cover all radioactive material shipments

To correct this situation, I suggest that you change the title

It seems to me your statement is actually concerned only with shipments which are or could be made by air + have compared the relative value of shipping these by other modes. Suggested title might be Comparison of environmental impact from shipment of radioactive materials by air + other modes.

Then in your early statements tell which materials are considered and why.

My next concern is that this book was published at great expense prematurely. I find 2 particular examples of this: Page I-3 tells of questionnaires sent out requesting data — the results of which were not in when this book was made up. and the already mentioned footnote on page I-21 expecting

updated data. You are badly in need, it seems to me, of more current data. I ran an average of the dates for all references listed at ends of chapters. The average age of your data is 4 years. Some of your references date back to 1955. Yet you went ahead & published your draft without fresh material. It's just a rehash of old studies.

In correspondence with the state agencies who were sent copies I learned that very few would be studying it and making any comment. They tell me they are understaffed and deluged with material of this kind.

With a little dedication & imagination as well as concern for the <u>reader</u> of your material you could write something much shorter & clearer. This book suggests that you intend to put people to sleep so they won't study & find out what you are trying to say.

I will be interested in hearing from you about further developement of this statement

Very truly yours,

(Mrs) Virginia Karstedt

P.S. I note that table I-3 pI-21 is based on a speech presented in 1974 concerning Transportation of hazardous material in Air Commerce. Yet in the table you do not make this clear. It looks like those are all pkgs shipped by any mode!

V.K.

DOCKET NUMBER
PROPOSED RULE PR-71,73 (41 FR 23768)
Transportation of DNM By Air

ASSOCIATION OF
AMERICAN RAILROADS
LAW DEPARTMENT
AMERICAN RAILROADS BUILDING · WASHINGTON, D.C. 20036 · 202/293-4096-97

HARRY J BREITHAUPT, JR.
Vice President and General Counsel

June 25, 1976

DOCKETED USNRC
JUN 28 1976
Office of the Secretary Docketing & Service Section

Mr. Samuel J. Chilk
Secretary
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Chilk:

This refers to NUREG-0034, Draft Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes, and particularly to statements on pages VI-44, 45 regarding the use of special trains for irradiated fuel shipments.

That draft appears to be the product of a rule-making proceeding that was initiated by notice in the Federal Register on June 2, 1975, Vol. 40, No. 106, p. 23768. At that time the Statement was to be directed to air transportation. The Association of American Railroads (AAR) was not aware of this Statement until recently during proceedings before the Interstate Commerce Commission in ICC Docket No. 36325, Radioactive Materials, Special Train Service, Nationwide.

In view of some of the statements contained in the draft concerning special train operations, it appears most unlikely that anyone with actual railroad experience was consulted. In particular, the statements on the pages referred to above appear to be based on a complete misunderstanding of the nature of special train service. There is a conclusion in the draft that ". . . the use of dedicated trains does not appear to be cost-effective." Such a conclusion is based on an assumption that the shipments would be in regular trains "dedicated" solely to radioactive material, and does not indicate a familiarity with the special service that is provided by the railroads as outlined in the attached excerpts from a special train tariff.

[illegible] 6-28-76, [illegible]

The draft states:

> "Almost 90% of all derailment accidents occurred at speeds less than 40 m.p.h. Thus, it is difficult to see how the use of special trains at reduced speeds (35-40 mph) could substantially reduce derailment accidents." (VI-44)

That conclusion was based on the erroneous assumption that there is no difference between special train service at 35 m.p.h. and regular train service at that speed. The fact is that the special handling and supervision given to special trains moving under the Special Train Service Tariff virtually eliminates accidents. The attached verified statements, which were filed by railroads in the ICC proceeding referrred to above, will provide additional information regarding the nature of special train service and show why, regardless of the mathematical theories applied on pages VI-44-45, in actual operations there is a great difference between regular train service and special train service as far as safety is concerned. As shown by these statements, a survey of five major railroads failed to disclose any indication that there had ever been an accident of any sort involving a special train operation, with the single exception of a heavy off-balanced load which derailed because of its off-balance nature, resulting in minor track and equipment damage, but with no damage to the lading and no injuries.

The conclusions on pages VI-44-45 were predicated on regular train service and a number of accidents (most of which were assumed not to be of a serious nature), but should have been predicated upon special train service with no accidents.

We would appreciate the Draft Environmental Statement being corrected accordingly.

Very truly yours,

cc: Ms. Janice K. Corr, Attorney
Office of the General Counsel
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555
w/o attachments

Subject to increases in rates and charges as provided in Item 7-290, 7-301

V.C.C. S-430
(Cancels V.C.C. S-382)

I.C.C. S-1155
(Cancels I.C.C. S-1057)

SOUTHERN FREIGHT TARIFF BUREAU

(Southern Freight Association, Agent)

FREIGHT TARIFF S-842-N

(Cancels Freight Tariff S-842-M)

RULES AND CHARGES
GOVERNING
SPECIAL TRAIN SERVICE

BETWEEN POINTS IN

ALABAMA	ILLINOIS(Southern portion)	LOUISIANA(East of Mississippi River)	OHIO(Cincinnati, Portsmouth and vicinity)
ARKANSAS(Helena and West Helena)	INDIANA(Southern portion)	MISSISSIPPI	SOUTH CAROLINA
DISTRICT OF COLUMBIA	KENTUCKY	MISSOURI(St.Louis and vicinity)	TENNESSEE
FLORIDA		NORTH CAROLINA	VIRGINIA
GEORGIA			WEST VIRGINIA

This tariff applies on intrastate traffic only in the States of Alabama, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee and Virginia.

SPECIAL TRAIN SERVICE TARIFF

ISSUED FEBRUARY 27, 1974

EFFECTIVE APRIL 8, 1974

ISSUED BY
Z. C. BERRY,
Tariff Publishing Officer
151 ELLIS STREET, N.E.,
ATLANTA, GA. 30303

(The provisions published herein will, if effective, not result in an effect on the quality of the human environment.)

RULES AND OTHER GOVERNING PROVISIONS

GENERAL RULES AND REGULATIONS

ITEM	SUBJECT	APPLICATION
20	References embrace changes by supplement	Where reference is made in this tariff-- To an item, page rule or other provisions, such reference will also embrace reissues or amendments of said item, page, rule or other provisions. To "this tariff" or "herein", such reference will also embrace supplements thereto, unless otherwise specifically indicated. To another tariff, such reference will also embrace supplements to or successive issues of such other tariff, unless otherwise specifically indicated.
75	Method of cancelling items	As this tariff is supplemented, numbered items with letter suffixes cancel correspondingly numbered items in the original tariff or in a prior supplement. Letter suffixes will be used in alphabetical sequence starting with A. Example: Item 445-A cancels Item 445 and Item 365-B cancels Item 365-A in a prior supplement, which in turn canceled Item 365.
100	Method of denoting reissued matter in supplements.	Matter brought forward without change from one supplement to another will be designated as "Reissued" by a reference mark in the form of a square enclosing a number (or letter, or number and letter, in the case of intrastate supplements), the number (or letter, or number and letter) being that of the supplement in which the reissued matter first appeared in its currently effective form. To determine its original effective date, consult the supplement in which the reissued matter first became effective.

RULES AND CHARGES GOVERNING SPECIAL FREIGHT TRAIN SERVICE OR SPECIAL MIXED FREIGHT AND PASSENGER TRAIN SERVICE.

ITEM	SUBJECT	APPLICATION
120	Furnishing of Special Freight Train Service or Special Mixed Freight and Passenger Train Service.	Carriers parties to this tariff will, upon request as provided in Item 130 and at their convenience, furnish Special Freight Train Service or Special Mixed Freight and Passenger Train Service between any two points on their respective lines, locally (one carrier hauls) or jointly (two or more carrier hauls), subject to the charges and conditions hereinafter specified.
130	Definition of "Special Freight Train Service" or "Special Mixed Freight and Passenger Train Service".	Special Freight Train Service or Special Mixed Freight and Passenger Train Service, as used in this tariff, means a train which is operated on an expedited schedule at a charge in addition to the applicable class or commodity rates or fares, or a train which is assembled in accordance with instructions given to a rail carrier by a consignor, consignee, or any agent of a consignor or consignee. When a Special Freight Train or Special Mixed Freight and Passenger Train movement is requested, or the operation of Special Freight Train or a Special Mixed Freight and Passenger Train is necessary in order to comply with service or other transportation requirements specified, the charges shown in Item 140 will be applicable, subject to Note 1, this item. Note 1 - Consignor, consignee, or the agent of consignor or consignee must request Special Train Service (in writing, or by telephone confirmed by telegram or letter) as to each Special Train movement to be made under this tariff giving the involved carrier (or carriers) all necessary information as to such Special Train movement, including consist, date and time of movement, routing, and any other information and instructions pertinent to such movement, allowing sufficient time to enable said carrier (or carriers) to consummate whatever arrangements may be necessary to facilitate the movement of such train, including the assembly of equipment, personnel and other incidental requirements.

DOCKET NUMBER
PROPOSED RULE PR-7173 (41 FR 23768) NBP Ex. 5

See pp. 4-5

BEFORE THE

INTERSTATE COMMERCE COMMISSION

RECEIVED USICC JUN 28 1976 Office of the Secretary Section

DOCKET NO. 36325

RADIOACTIVE MATERIALS, SPECIAL
TRAIN SERVICE, NATIONWIDE

VERIFIED STATEMENT OF

JOHN G. GERMAN (V.P. Engineering, Mo-Pac)

ON BEHALF OF RESPONDENT RAILROADS

DUE DATE: MAY 27, 1976

RECEIVED JUN 4 1976 LAW - COMMERCE

Verified Statement
of
John G. German

My name is John G. German. I am Vice President-Engineering for the Missouri Pacific Railroad Company headquartered at 210 N. 13th Street, St. Louis, Mo. 63103. I hold a B.S. degree in Mechanical Engineering from Case Institute of Technology. From December, 1943 through August, 1961, I was employed in the Mechanical Department of the Great Northern Railway at various locations as Assistant to Master Mechanic, Traveling Engineer, Master Mechanic, Assistant to Chief Mechanical Officer and Superintendent of Motive Power. Since September, 1961, I have been employed by the Missouri Pacific Railroad at St. Louis, Missouri as Chief Mechanical Officer, Assistant Vice President-Engineering and more recently as Vice President-Engineering.

In my present position I have responsibility for the design, construction and general condition of locomotives and cars, track and structures and signal and communications, including compliance with all governmental regulations relating thereto. In this position and throughout my entire career I have been in close contact with the operations of the railroad. I have been involved in the instructions concerning the handling of radioactive spent nuclear fuel cores since the Missouri Pacific first became involved with these movements between St. Louis and Kansas City in 1965.. Within the past year we have handled movements between New Orleans and Kansas City. All of these movements have involved DODX flat cars carrying special AEC (now ERDA) approved casks. All have moved in regular freight train service, but with special provisos

as follows:

Originally the AEC specified that these cars be handled on the rear of a freight train at a speed not to exceed 35 mph with the guard car immediately behind the shipment and just ahead of the caboose.

At the present time ERDA, who has replaced AEC, stamps on the waybill the following instructions: "Must not be humped. Do not switch with locomotive detached. Protection must be provided after classifications. Cars must be placed on rear of train next to caboose. Road conductor must periodically contact escort enroute. Speed restricted to 35 mph. This shipment must be placed in the clear of rail switch points when in a yard or siding."

German indicated to Aid Ditfem that these are many shipments only.

In addition to these requirements Missouri Pacific added the requirements that the freight train not exceed 100 cars, that it would always be accompanied by an Operating officer, and that when meeting or passing other trains one of the trains must be stopped.

Obviously both agencies have recognized that from the standpoint of safety trains carrying the cask must not exceed 35 mph. These instructions are in accord with our own experiences gained through many years of handling large masses traveling at speeds up to 80 mph. Historically we have found it necessary to reduce speeds of shipments where the risk of high loss can be greatly reduced by lowering the speed. Even at 10 to 15 mph the impact of a heavy freight train against a standing freight train is so great that it causes complete destruction of locomotive units

and many cars, therefore we have seen no engineering reasons to increase this speed for any style of cask produced today.

I am aware of the tests that have been used to develop approved casks and I understand that spent fuel cores from commercial plants will be much hotter from a radiation standpoint than those from the navy ships and that the high level waste shipments will be extremely radioactive. In my opinion those involved in the proposed movement of spent nuclear cores from power plants and high level waste from reprocessing facilities have not fully addressed the problems that can arise in railroad transit, and in particular there are three questions that need to be resolved.

No. He has this reversed

1. In multiple track territory there is always the possibility of derailment of another train going in the opposite direction on an adjacent track. In the event of such accident should a tank car of LPG or some other such petrochemical rupture and torch against the cask, what temperature and time combination could the cask sustain without failure? In my opinion the fire test in a pool of oil at 1475°F. for ten or thirty minutes (according to type material) is a poor substitute for the torching condition which I know can occur at much higher temperatures in a very concentrated area for many hours.
2. We understand that should a cask rupture for any reason and the material goes on to the ground or perhaps even worse yet into a water supply, the area could be contaminated for many years.

Having seen the results of large masses colliding at speeds less than 35 mph, it is my opinion that the puncture test is still not a true measure of what could happen during the collision between another train and the cask car, be it a rear end, head on collision, or an oblique collision at railroad grade crossing.

3. Trains generally follow and cross many lakes and streams during their journey and of course these waterways generally serve as a source of drinking water for the general public. Considering the large amount of kinetic energy to be absorbed at time of collision what criteria have been established to allow the car and cask attachment to absorb this energy with a minimum chance of losing a ruptured cask from the car into a waterway.

After considering all factors involved in the movement of irradiated spent nuclear fuel cores from commercial power plants to reprocessing stations, and shipments of high level waste from the latter facilities, including the three above very questionable areas, we have reached the conclusion that for the best interest of the Missouri Pacific Railroad and our good neighbors located adjacent to our right-of-way that we should handle all movements of these materials in special train.

Missouri Pacific handles some 80 special trains per year and I do not recall a single incident or accident attributable to such handling. These movements for the most part involve loads

of either excess clearances or excess weight or both and are generally operated at speeds up to 35 mph.

Our decision to handle spent nuclear fuel cores and high level nuclear waste in special train movements is based upon the fact that experience clearly indicates this is the wisest way to handle the movement. Switching of the cask cars would be greatly minimized and the entire movement can be controlled much more safely than at the end of a 100 car train. By greatly reducing the mass of the entire train the locomotive engineer can carefully control speeds entering and leaving sidings, yard tracks, slow orders, etc. Also by virtue of the fact that there is no switching involved and the special train can accelerate and decelerate to and from the 35 mph limit much better than a long heavy freight train, the overall transit time is considerably reduced. Furthermore this relieves delay to all other cars in revenue train service and greatly reduces chance of the operating crews having to be relieved due to the Hours of Service Act (not to exceed 12 hours.)

In the event that there should be a derailment for any reason it has been my experience that speeds not exceeding 35 mph permit stopping the movement before the car gets too far from the track and sustains too much damage. Here again, the ability to closely monitor and control speed in a special train movement is very important. Most of these cars have three axles per truck which in itself is rather difficult to rerail should one or more wheel derail. In addition, the mass of these cars equals and in some cases exceeds that of our larger locomotives. Rerailing such heavy cars takes special railroad cranes of large capacity,

of which we only have two, and special off-track cranes which must be transported long distances to the scene of the derailment.

Obviously at the time of derailment it is necessary to immediately evacuate the area at least within a 1500 ft. radius and get assistance from ERDA and the shipper to monitor the area for any radioactivity spill. Presently the escort on DODX cars can monitor the area and therefore it is imperative that to quickly detect escape of radioactive material all spent nuclear fuel cars should be accompanied by an escort.

In the event of fire or rupture involving the cask it would be necessary to evacuate the area for several miles, especially on the leeward side and stop use of all potable water sources down stream until the scope of the contamination could be determined. In such event we could expect that our roadway in the immediate area would be out of service for a very long period of time. Rerouting of traffic could become very costly.

In no event could we commence wrecking operations until the area had been declared safe for the workmen and further that in case of minor contamination that the workmen had been given special clothing and instructions.

It is my opinion that the movement of both loaded and empty cars involved in handling irradiated spent nuclear cores from power stations and high level nuclear waste from reprocessing plants under the following conditions:

1. Must not be humped.
2. Must not be switched with locomotive detached.
3. Must be protected from undue impact after classification.

4. Must have one buffer car between locomotive and cask car.

5. Must have guard car with escort qualified to monitor for irradiation between cask car and caboose.

6. Road conductor must periodically contact escort enroute.

7. Shipment must be placed in clear of fouling point of all turnouts.

8. When meeting or passing other trains one train must be stopped and the other should proceed at not to exceed 35 mph.

9. Maximum speed restricted to 35 mph.

V E R I F I C A T I O N

State of Missouri)
) ss
County of St. Louis)

John G. German, being duly sworn, deposes and says that he has read the foregoing statement, knows the contents thereof, and that the same is true as stated.

John G. German

Subscribed and sworn to before me this 26th day of May, 1976.

R. C. Mason
Notary Public

My Commission Expires Sept 28 1978.

R. C. MASON, NOTARY PUBLIC
County of St. Louis, State of Missouri
My Commission Expires September 28, 1978
This act performed in the City of St. Louis, which adjoins the County of St. Louis in which I was commissioned.

DOCKET NUMBER
PROPOSED RULE PR-71.73 (41 FR 23768) (90)

DOCKETED
USNRC
JUN 23 1976
Secretary
Service
Branch

MOVEMENT OF NUCLEAR FUEL CORES IN CASKS ON HEAVY-DUTY
SPECIALLY-EQUIPPED FLAT CARS
I.C.C. DOCKET NO. 36325

My Name is George R. Hanson, Manager Operations Planning in the Operating Department of the Chicago and North Western Transportation Company ("North Western"), with offices at 500 West Madison Street, Chicago, Illinois, 60606. My railroad service commenced in 1951 with the Chicago and North Western as a Trainman. Until April, 1959, I served as a Brakeman, Switchman and Conductor, working in major Terminals and on road trains. Since April 1, 1959, I have been Assistant Trainmaster, Trainmaster, Assistant Superintendent, Superintendent, and Division Manager. In 1974 I was appointed to my present position. In this position I am responsible for the identification of operations planning needs, both short and long-range, for the Operating Department, including the scheduling and blocking of freight trains on the North Western System. I am also Chairman of our railroad's Hazardous Commodity Committee, whose responsibility is to advise and recommend to our management procedures in connection with the safe and efficient handling and transportation of potentially hazardous materials.

It is the decision of the management of Chicago and North Western to move nuclear fuel cores in casks on heavy-duty specially-equipped flat cars in special train service.

The North Western operates approximately 110 road trains per day on its 9,996 miles of railroad in the states of Illinois, Iowa, Nebraska, North Dakota, South Dakota, Minnesota, Wisconsin, Wyoming, Kansas, Missouri, and Michigan. These road trains contain between 100 and 150 cars and operate at a speed of approximately 40-50 MPH. Maximum timetable speed on lines equipped with Automatic Block Signals or Automatic Train Control is 60 MPH; on other lines operated by use of Train Orders and Timetables the maximum speed is 49 MPH. North Western operates approximately 70 terminals where trains or cars are marshalled into road trains or interchange receipts and deliveries.

The North Western's main objectives in handling the heavy nuclear cores in special train service are as follows:

Safety to the public and North Western's employees.

A car or cars to be moved in a special train would receive a minimum amount of handling in our terminals. Upon receipt of a car or cars containing nuclear fuel cores from a connecting railroad, North Western would place a caboose and engine to such car(s) and immediately depart from the terminal. Except for a minimal number of crew change points, this special train would operate in straightaway main track service.

Example (actual): On January 18, 1976, North Western received three cars containing nuclear cores from the P-C Railroad at Proviso, Illinois, Yard. Having already received advanced information of the these cars, a crew was on duty upon arrival to handle the special train forward. The train departed Proviso at 11:08 P.M. enroute to Council Bluffs, Iowa, where it was delivered to the UP Railroad. The total lapsed time these three cars were on our railroad, that is, from receipt to delivery, was less than 16 hours. Conversely, if the same three cars were handled in regular train service, we would have received them from the P-C Railroad on their regular interchange transfer assignment. Prior to the delivery, these three cars would have received approximately 16-24 hours' terminal detention in the P-C Yard. This transfer would be delivered to us in our Receiving Yard (9), wherein our Car Department carefully inspects each car to determine the condition of the running gear of each car. Depending on traffic conditions in the yard, this transfer will be slated to be humped; that is, to be shoved over our automated hump into our Classification Yard (5). Due to the extreme weight and "Dangerous" placarding of the nuclear cores prior to the humping of this transfer, a switch engine would be dispatched to Yard 9 and switch them out and handle them specially

3 crew changes

around the hump to Holding Yard (4) or Yard (1), where they would be held for a train destined to Council Bluffs. Normally traffic received at Proviso receives over 24 hours' delay until it actually departs. This time is needed to inspect, hump and actually place in an outbound train. The special handling described could cause additional delay of up to another 24 hours. During the time the nuclear cars are at Proviso, they would be handled five or more times -- 1) by the delivering road, 2) by the switch crew assigned to switch them out of Transfer Yard 9, 3) by a special transfer crew to a holding yard, 4) to the train yard, or 5) to block into the designated train. Each time cars are handled in the terminal, the possibility of a derailment or accident exists. The probability of such occurrences increases with the number of times cars are handled. That is, the vast number of train and engine movements within the confines of the yard increase the potential of an accident such as collisions or sideswipes. We presently handle at Proviso over 7,000 cars, about 50 trains per day, and have 45 to 50 switch engine assignments. Again, the extreme weight of the nuclear cask cars increases the potential of a derailment due to the breaking under weight of a track or switch. I estimate normal delay at Proviso would be 30 to 48 hours. We presently have two trains per day to Council Bluffs -- No. 253 and No. 255. Inasmuch as No. 255 is a

high-speed manifest train handling TOFC, autos, etc., nuclear casks would have to be handled on No. 253. With the scheduled work enroute at various stations and terminals, No. 253's schedule from Proviso to Council Bluffs is 36 hours, 16 hours of which the train is at Boone, Iowa, a terminal where the train is reswitched and receives additional traffic from various trains throughout Iowa. Arrival at Council Bluffs to delivery to the UP would be approximately 8-10 hours. The same three nuclear casks which were handled in special train service in less than 16 hours on January 18 from Chicago to Council Bluffs, if handled in regular train service, would exceed 70 hours, based on a 24-hour or less delay at Proviso. The possibility of an accident again is increased due to operating in and out of various yards and switching operations. Another very important point in handling these cars in regular train service is that the more cars in a given train being pulled the more the involved cars are exposed to train dynamics, that is, the intertrain reaction which is caused by grade changes, the slowing down, stopping or accelerating of the train. Quite simply stated is the running in or out of the slack between the engine and caboose or the rocking side to side of certain cars over irregular tracks. This is not a new phenomena, however; the increase in train lengths, car sizes and loadings has caused railroads to become more alert to the increased

problems caused by dynamic train action. We have attributed many derailments to train dynamics. Obviously, train dynamics occurring in a two or three-car train is almost non-existent. Another equally important point in handling nuclear casks in special train service is the surveillance of the involved cars as they move across the railroad. During the entire trip our onboard train crews are able to devote their entire time observing the car(s) for mechanical defects which could develop enroute or other conditions which could jeopardize the safe movement of the train. In regular train service the above type of surveillance is not possible when one considers a train of 100 to 150 cars is over 1½ miles long and in-train mechanical failures are not readily noticeable to the head or rear end crew, particularly when they occur near the middle of the train. I have personally known many accidents where a derailed car in a train will be pulled for several miles undetected by the crew due to curves, weather or distance from the engine or caboose. In my opinion the nuclear casks handled in special train significantly increases the crew's ability to monitor the actual movement and thus detect any defects. In my 25 years of service in the Operating Department of the Chicago and North Western, I cannot recall one incident wherein a reportable accident has occurred when handling a car in special train service. This is very significant when we consider there

are almost 50 reportable train accidents per month on our railroad. Special trains are operated on the North Western quite frequently, not only in the case of the nuclear casks, but also in handling high value dimensional loads, certain explosives and poison gases, precision equipment and loads wherein the shipper requests special handling. Expensive containers such as the nuclear casks and specially designed rail cars are moved over the railroad many times faster when handled in special trains, sharply reducing the number required to perform the service. Turnaround time of special equipment and cars is generally a savings to the shipper.

As I have previously stated, the North Western does have accidents. Train derailments or wrecks involve any number of cars from one to fifty or more. Determining factors in the number of cars involved in an accident include speed of train, train consist (number of cars in train), track structure at point of derailment such as main track switches, and also the ability of the train crew to promptly note and take action to stop the train at the time the derailment occurs. Major derailments immediately place a route of our railroad out of service until the involved cars can be rerailed or cleared from the main track or tracks and the damaged track and roadbed rebuilt. This must be accomplished as promptly as possible,

as every lost hour a main track is obstructed results in several thousand dollars loss to our company -- similar to shutting down an assembly line in a large factory. Our work crews work around the clock until service is restored. If a car or cars of nuclear casks were involved in a major derailment, particularly if tipped over and disengaged from the rail car and/or other cars on top of the casks in a pile up, clearing operations could not commence until all procedures have been followed in connection with nuclear material involved in an accident. These procedures are found in the A.A.R. Bureau of Explosives Pamphlet No. 1. Briefly, the procedures state "Until the extent of the hazard can be determined, keep all persons the greatest practicable distance away." "Persons not properly protected against radiation shall not be permitted to approach the vicinity of any place where radioactive material is suspected to have been spilled." Protection of personnel will vary depending on circumstances and may consist solely of radiation monitoring. The North Western is not equipped, nor do we have trained personnel to monitor radioactivity. We would be required to leave our main line obstructed until assistance or further advice has been obtained from a competent authority. This authority most likely would be received from the nearest Atomic Energy Commission office, and it is quite evident that clearing operations could not commence until

"Orange Book"

qualified persons arrived on the scene, which I have been told could be as long as 48 hours. Fires often time accompany railroad wrecks. These fires stem from the many flammable materials we handle in train or from a burning wheel on a freight car. I personally know of fires that have burned for more than 24 hours in a pile up of wrecked cars, the burning flammable material igniting other cars in the area. If nuclear casks were involved, particularly if underneath a burning pile of railroad cars, serious complications could occur. In reviewing the design of the special flat cars used to transport LMFBR Spent Fuel Shipping Cask, I note the fixed refrigeration units attached to the car. These units are used to control the heat generated within the core of the spent fuel. In a major derailment involving one of these cars it is very likely that the refrigeration units would become unserviceable. The core would be without this protection until a replacement car could be found and the cask transferred. I estimate the time required to perform this work would be at least five days, or as long as 10 days, depending on the availability of a replacement car and its location; also, special transfer equipment. If the special car merely becomes derailed, the railroad involved is required to change out the wheels which were derailed; this is due to the roller bearing assemblies on each wheel. This would result in a minimum delay of three to five days.

Donelan moved to strike as hearsay (Jone)

almost impossible to transfer at the scene

Railroads are constantly brought to criticism from the news media and public anytime an accident occurs in spite of the millions of miles of safe miles we operate daily. We work constantly to improve our safety records, particularly in the transportation of hazardous materials. Needless to say, if a derailment involving nuclear casks happens and is noted by the public or news media, the railroad involved would be subject to the public perception of the dangers in that particular situation, with the railroad probably receiving much unfavorable publicity and being the subject of much inquiry. Legislators, both in the Federal and State Governments, are daily adding new regulations and laws in connection with the transportation and handling of hazardous materials. As I stated at the beginning of this testimony, the North Western is insistent on handling nuclear cores in casks in special train service, thus doing everything possible to reduce the probabilities of an accident involving nuclear material.

GEORGE R. HANSON

STATE OF ILLINOIS)
) SS
COUNTY OF COOK)

GEORGE R. HANSON being duly sworn, deposes and says that he has read the foregoing statement, knows the contents thereof, and that the same are true as stated.

GEORGE R. HANSON

Subscribed and sworn to before me this 18 day of May, 1976.

Notary Public

My Commission Expires MY COMMISSION EXPIRES OCTOBER 17, 1976

DOCKET NUMBER
PROPOSED RULE PR-71,73 (41 FR 23768)

BEFORE THE

INTERSTATE COMMERCE COMMISSION

Lee p

No. 36325

RADIOACTIVE MATERIALS, SPECIAL TRAIN SERVICE, NATIONWIDE

DOCKETED USNRC JUN 26 1978 Office of the Secretary Docketing & Service Section

AFFIDAVIT OF
H. L. LEWIS

My name is H. L. Lewis. I am employed by The Atchison, Topeka and Santa Fe Railway Company ("Santa Fe") as Superintendent of Transportation. My office address is Suite 902, 80 East Jackson Boulevard, Chicago, Illinois 60604.

I was first employed by Santa Fe at Chanute, Kansas in the year of 1940 in the position of mail clerk. Since then, I have held the positions of Transportation Inspector, Trainmaster, Assistant Superintendent and Superintendent before becoming Superintendent of Transportation in 1974.

Because of my vast operating experience over the past 36 years, I am intimately familiar with both regular train service and special train service as provided by the Santa Fe Railway and have set forth below several differences between the two types of service which relate to the safety of handling radioactive materials.

In my experience with the railroad, I have been aware of many train accidents involving trains in regular service. In my entire experience, however, I am not aware of any incident involving a derailment or damage to a car being handled by Santa Fe in special freight service. There are several reasons for this.

Even though our operating personnel do everything economically feasible to prevent accidents and to ensure the safety of the lading and personnel involved in regular train service, there is no way of guaranteeing that an accident will not occur. Accidents causing damage to railroad cars and the lading usually involve derailments or switching mishaps. Some factors which contribute to the rate of incidents or severity of any given incident are the train length, the amount of switching required, the speed of the train, the mixture of the lading contained in the train and the mixture of types of equipment in the train. Regarding each of these factors, there is an inherent safety advantage in special train service.

No authority need be cited for the proposition that higher speeds will result in more severe damage to train cars and lading if involved in an accident. In this respect, special train service has an advantage over regular train

service, since special trains handling nuclear materials would be limited to speeds of 35 m.p.h. while the speed of regular train service is dictated by the schedule and track conditions. Most of Santa Fe's main trunkline trackage is designed and maintained to handle freight train traffic at 70 m.p.h.

Train length also plays an important part both in the frequency of rail mishaps and the severity of such mishaps. For Santa Fe in the years of 1974 and 1975, the average length of its freight trains was approximately 52 and 56 cars respectively. In special train service, the length of trains would be substantially shorter, thereby reducing the length and weight factors which effect the frequency and severity of train derailments. As pointed out above, other important factors in comparing the safety of regular train service to special train service are the types of equipment in the train and the mixture of the lading.

Insofar as regular trains are concerned, they are assembled and handled in everyday operations. With few exceptions, cars handled in regular train service are assembled and handled from industries or interchanged from trains from other railroad lines and placed in our regular trains without

regard to location so far as the commodity is concerned. Generally, cars are gathered from various trains and switched onto other tracks by destination designation, then gathered by blocks and placed on a track where they are given mechanical inspections. Except for Class A explosives and open-top or flatcar loads, the shipper loads the car and closes the door, and therefore railroad personnel have no opportunity to inspect the lading or the method of loading. The consist of a regular train includes various lading commodities in different types of cars, some of which are railroad owned, some privately owned and some shipper owned.

The special trains handling nuclear casks, on the other hand, would consist of a few cars specifically selected and conditioned for that lading. Special handling means special attention being given to the movement and observation of the train by all personnel involved. In addition to being a much shorter train, there would not be mixed ladings and there would not be a variety of types of cars which could contribute to the frequency of accidents. Due to the train handling only the nuclear cask cars, there would be no switching or other yard handling in route, whereas with the normal or regular train it would be necessary to go into various yards to set out or pick up cars. These yard

operations would expose the cars to additional switching operations.

Special trains would also be subjected to fewer switching operations at destination or at an interline junction. If the destination is served by the road-haul carrier, all that would be done would be to set the buffer cars aside and shove the cask cars to the consignee. This would not involve switching as would be the case with a regular train and the car could be delivered with a minimum of handling. If the car were to go to an interline junction railroad, it would be set at the interchange and picked up from the interchange without a mix of other traffic. The effect of minimizing handling of the cars would be to increase safety of the movement.

Another factor contributing to the increased safety involved in handling cars in special train service is that all the cars on the train can be observed by both the head end and rear end crews at practically all times and at practically all locations. This is often not possible, however, with longer, regular trains because of curves, weather conditions and vegetation.

As an operating officer with more than 20 years' experience as a trainmaster and superintendent, I am extremely

concerned about the possible effect of a derailment involving a train handling radioactive material. I can foresee the panic that would exist if townspeople were advised that a nuclear incident had occurred in their vicinity. The repercussions created by an overzealous news media could stir the populous of a city or town to such an extent that operations in the future would be very questionable.

For these reasons, it is my firm belief that if we were to handle the material as potentially dangerous as nuclear casks of either initial material or spent material, we must do so in the safest possible manner. This should involve special train service which, in summary, provides the following safety advantages over regular train service:

a. Slower speeds

b. Fewer switching operations

c. Shorter and lighter trains

d. Similar commodities

e. Similar equipment

FURTHER AFFIANT SAYETH NOT.

VERIFICATION

STATE OF ILLINOIS)
) SS.
COUNTY OF COOK)

H. L. Lewis, being first duly sworn, on oath deposes and says that he has read the foregoing statement, knows the contents thereof, and that the same are true as stated.

H. L. Lewis

SUBSCRIBED and SWORN to before me this 25th day of May, 1976.

C. D. Crest
Notary Public
MY COMMISSION EXPIRES JANUARY 14, 1977

CERTIFICATE OF SERVICE

I, Gary L. Crosby, hereby certify that I served a copy of the above Affidavit of H. L. Lewis on all parties of record in this proceeding by depositing a copy thereof in the United States Mail Box at 80 East Jackson Boulevard, Chicago, Illinois, proper postage prepaid, before 6:00 p.m. on the 25th day of May, 1976.

DOCKETED USNRC
JUN 28 1976
Office of the Secretary Docketing & Service Section

DOCKET NUMBER PROPOSED RULE PR-71.73 (41 FR 23768) (90) Ex. 12

VERIFIED STATEMENT

OF

FRED BEALER, JR.

My name is Fred Bealer, Jr., and I am Director of Transportation Operations for Union Pacific Railroad Company, headquartered at 1416 Dodge Street, Omaha, Nebraska, 68179. I have been employed by Union Pacific since 1959. My earlier positions with Union Pacific included Assistant Northwest District Car Distributor, Secretary to Northwest District General Manager, Secretary to Vice President Operations, Safety Agent-Nebraska Division, Trainmaster-Idaho Division, Assistant Superintendent-Kansas Division and Manager-DF Car Utilization.

In my present position as Director Transportation Operations, I have responsibility for general direction of train movement and equipment distribution as well as compliance with governmental regulations concerning equipment movement.

Four years of my railroad career involved traveling the entire Union Pacific system as Secretary to Vice President Operations. My duties included reviewing all accident reports. At no time was there ever an accident involving a special train. During my 17 years with the Union Pacific I have never seen nor heard of an accident involving a special train on my line. I requested that the Union Pacific accident reports in the Office of the Vice President-Operations be checked. There were no

reports of accidents involving special trains in those records which go back 13 years.

A special train usually consists of a locomotive, caboose and one or more cars requiring special handling. The speed allowed may vary and depends upon the nature of the handling required.

Special train service does not necessarily mean slower than regular service. In fact, it often provides faster service than regular train service. The reason for this is that special trains, because of their size, move through terminals faster than the longer trains. When they take sidings to meet other trains they can use many sidings which may be too short for regular trains. This feature reduces delays. Trains in special service can also reduce and pick up speed faster than regular trains. I know of instances where special train service was requested when faster than regular service was desired.

In my opinion, special train service is safer than regular train service. For one thing, if a defect in the equipment occurs, such as a hot box, it is more readily apparent to the crew because of the nearness. Also, a short train can stop more quickly than a longer train.

When a special train meets or is passed by a regular train, its speed is usually restricted or it is required to stop. The speed of the opposite or passing train may also be

restricted. This greatly reduces the severity of a potential accident.

A regular train usually travels over 50 MPH. Many select regular trains on the Union Pacific are operated at 70 MPH. The number of cars handled in a regular train will vary from 50 to 150 and the length of the trains will be anywhere from one mile to two miles long. The weight of these trains will average between 3000 and 10,000 tons. When a train of 100 cars traveling at 70 miles an hour derails, the combination of the speed and the weight of the train often results in upwards of 30 cars being derailed. The force exerted in the derailment is such that many of the cars frequently are totally demolished and the contents destroyed.

On the Union Pacific between Omaha, Nebraska, and Salt Lake City, Utah, there are two main tracks running side by side. Trains moving eastward use one main track and trains moving westward use the other. We have had accidents involving trains going in opposite directions, both of which were regular trains traveling at a high rate of speed and the results were particularly catastrophic.

As an operating officer, I have been at the scene of many train accidents. I have directed the clearing of wrecks and assisted at others. Some of these incidents have involved hazardous materials such as LPG gas, ammonia and phosphorous. Under these circumstances, it is required that the FRA, AAR,

the Bureau of Explosives, Environmental Protection Agency and the appropriate state and local officials be notified. Sometimes the FRA and the AAR will send experts to the wreck to direct.

If cars handling irradiated material were involved in a wreck and were derailed, or damaged, it would present a uniquely difficult problem for the railroad. I, personally, have had no experience in this field, nor do I know any operating railroaders who have. The weight of the empty cask in which the irradiated fuel elements are shipped on DODX cars moving into Scoville, Idaho, is more than 200,000 pounds, and holds 18,000 pounds of irradiated fuel elements. If such a car were derailed, it could present a formidable task in rerailing. I have seen LPG gas cars rolled down an embankment. If this occurred with a DODX car containing irradiated fuel, or even with the empty cask containing residual radioactivity, (why?) it would be a time consuming and dangerous situation to clear. There is also the possibility the car could be drailed into a river or lake. Through the State of Nebraska, Highway 30 generally parallels Union Pacific's main line and many portions of the interstate as well as other highways and roads are adjacent to the railroad. At other locations, Union Pacific's tracks run adjacent to tracks of other railroads and sometimes cross them. Union Pacific tracks also are in the proximity of airports such as Stapleton in Denver, and McCarran

Field in Las Vegas. An accident involving a car containing radioactive material at any of these locations could conceivably cause considerable interference with interstate commerce. If the cask should leak as a result of the derailment, there would be the problem of contamination, hazard of deaths and personal injury. I have been at derailments where the forces exerted have caused rails to be torn from the track and thrust through railroad cars. There is always the possibility of a rail impaling an irradiated fuel container. Even if there were no emission of radioactive products, there would be considerable delay in clearing the railroad or highways for operation because of various environmental and regulatory features. Why?

I do not know what the full impact would be if there were leakage from a car containing irradiated fuel, or an empty car containing residual radioactivity, but apparently there would be long-term repercussion. For example, Westinghouse receives shipments of irradiated fuel and radioactive waste material at Scoville, Idaho, and is in frequent contact with our Freight Agent nearby at Arco. On August 22, 1975, our Freight Agent received a telephone call from a Westinghouse representative, Mr. Herb Paulson, who advised that a DODX car in the Scoville plant had become contaminated by leakage. He further advised that the car would be unavailable for further use since it was going to be buried.

Described as hearsay by ALJ, first left in

The DODX car was a heavy-duty depressed-center flat car with a permanently attached cask for transportation of spent nuclear fuel cores. The cask and car combined had an empty weight of about 335,000 pounds. The cask alone, when empty, weighed about 225,000 pounds.

The Arco Agent on March 5, 1976, contacted Mr. Paulson to inquire into the cause of this incident but was only informed that the cask and bed of car had been contaminated but that the wheels had not. Mr. Paulson stated that after Westinghouse had received some "inquiries from the East" on the previous day he had been told not to discuss the incident or give out any further information.

In my opinion, handling cars containing irradiated fuel elements, or empty casks which have residual radioactivity, in special train service, would reduce the possibility of an accident, as well as the severity of an accident, if any occurred.

VERIFICATION

STATE OF NEBRASKA)
) SS
COUNTY OF DOUGLAS)

FRED BEALER, JR., being duly sworn, deposes and says that he has read the foregoing statement, knows the contents thereof, and that the same are true as stated.

Fred Bealer Jr.
FRED BEALER, JR.

Subscribed and sworn to before me this 25th day of Ma[illegible]

J. F. Harness
NOTARY PUBLIC

My Commission Expires June 8, 1979.

DOCKET NUMBER
PROPOSED RULE PR-71,73 (41 FR 23768) (90) Ex. 13
See pp. 9-12

DOCKETED
USNRC
JUN 23 1976

I.C.C. DOCKET NO. 36325
VERIFIED STATEMENT OF HARVEY H. BRADLEY

My name is Harvey H. Bradley. I am Vice President Transportation, Southern Railway Company. I graduated from Virginia Military Institute at Lexington, Virginia, in 1949 with a Bachelor of Science degree in Civil Engineering. I have been employed by Southern Railway since August, 1949, except for two years in the Army during the Korean War. During that time I have held the positions of Student Apprentice; Assistant Supervisor; Track Supervisor; Bridge and Building Supervisor; Assistant Trainmaster; Trainmaster (4 locations), Division Superintendent (3 locations) General Manager Transportation; Assistant Vice President-Safety, Assistant Vice President-Transportation, and Vice President-Transportation.

I understand that this proceeding is concerned with the question of whether or not shipments of irradiated fuel elements and radioactive waste material should be confined to special trains. My knowledge of the commodities involved is rather limited and comes mainly from various government publications. I am advised that the shipping casks may

weigh in excess of 100 tons and must be continually cooled. A booklet published by the Energy Research and Development Administration (ERDA), Atoms on the Move: Transporting Nuclear Material (1975) states, on p. 37:

> "If cooling equipment associated with a cask of spent fuel were put out of commission in a highway accident, for instance, the heat of normal radioactive decay would cause the cask's temperature to climb. Calculations show that it might rise to as much as 700°F, in fact, but there would be no danger of melting the cask wall itself."

Another government publication, Environmental Survey of Transportation of Radioactive Materials to and From Nuclear Power Plants. (WASH-1238) prepared by the Atomic Energy Commission in 1972, states, on p. 83:

> "In one design of rail cask now under evaluation (GE, IF-300), complete failure of the external cooling system will cause the cask to overheat over a period of several hours. In that case, under certain adverse but unlikely conditions, the temperature of 50% of the fuel elements would reach 1200°F, which could cause perforation of the cladding on some of the rods if the elements were of the present PWR type."

and on p. 85:

> "Some designs of rail casks have an external mechanical cooling system. An accident may cause moderate damage to the cask such that the mechanical cooling system becomes inoperative. If no corrective action is taken and the ambient temperature is above 100°F, the temperature of the fuel in the cask will increase enough in a few hours to cause an overpressure in the cask cavity, and some of the coolant will be released through the vent system. This also may occur in some cask designs if the cask is involved in a severe fire.
>
> "Venting may occur in a series of releases; one design permits about 5% of the gas in the cask cavity to be released at a time."

In a serious train accident there is frequently compression and telescoping of the train, with a tendency for the cars to pile up and for lighter cars to ride up over heavier cars. In a pileup of mixed freight, a 100 ton cask of irradiated fuel elements would quite likely be at the bottom, with its cooling system out of operation. If the cars on top of it contained inflamable freight, and the cask reached a surface temperature of 700°F (going up toward an interior temperature of 1,200°F) the cask would <u>start</u> a fire.

Since the kindling point of paper is 300°F to 350°F, the placards warning of the radioactive nature of the shipment would burn off before the cask reached a temperature of 700°F.

The concurrent venting of radioactive gases would seriously interfere with efforts to fight the fire and remove the wrecked cars, and it could easily take several days to clear the wreckage, cool down and remove the cask, and clear the railroad right of way.

All this is assuming that no fuel elements were released from the cask in the train wreck. In this regard the AEC publication quoted above states, on page 87:

> "If seven irradiated fuel elements were released from a cask in an unusual accident, the radiation level at 100 feet could be as much as 10^4 r/hr. Assuming the fuel elements remained unshielded for 10 hours, approximately 30,000 persons within a mile radius (based on 10^4 persons/square mile) might receive a cumulative dose of about 1000 man-rem. If a person remained unshielded at an average distance of 100 feet from the fuel elements for 6 minutes, he might receive a dose of as much as 1000 rem. Persons remaining near the exposed fuel for any appreciable length of time may receive large doses of radiation. Someone at a distance of 10 feet from the exposed fuel for about a minute, would receive a dose of 1000 rem. Remote equipment would be required to erect a shield around the fuel elements or to place them in a shielded box or to repackage them.

I am advised that a dose of 500 rem is likely to be fatal.

I have assisted in or supervised clearing the tracks and restoring train service after many accidents, but have never been faced with the conditions that appear likely to result from a serious accident involving a shipment of irradiated fuel elements moving along with other freight of all kinds in general freight train service.

The AEC publication quoted above also stated , on p. 86:

> "The likelihood of a cask remaining unattended after loss of mechanical cooling . . . can be reduced by appropriate administrative controls such as escorts, alarming the mechanical cooling system, inspection of the shipment at regular intervals, and notification of the shipper in case of any failure of mechanical cooling or involvement in an accident."

In this connection the technical description of the General Electric IF-300 irradiated fuel shipping cask states, on page 16:

> "The IF 300 cask is equipped with an audible alarm system. System activation occurs if the cask temperature exceeds a predetermined value. This indicates either the failure of the cooling system or a loss of water from the external water jacket.
>
> "Transportation personnel, railroad or highway, will be given adequate training to respond to this

alarm. A procedures and notification manual will accompany each shipment."

The problem is that, as will be shown hereafter, in a general train of mixed freight no one would ordinarily be available to hear the alarm or to check the cask at regular intervals.

The technical description of the General Electric IF-300 irradiated fuel shipping cask describes four tests that the cask passed. These are the four tests required for all irradiated fuel shipping casks (10 CFR §71.64, Appendix B) and are as follows:

1. A 30-foot free fall onto a flat unyielding surface. This produces a speed on impact of 30 mph. However, in actual train wrecks impact speeds of more than 30 mph are not unusual. In general freight train service speeds of 60 mph are common, and when two 60 mph trains pass, going in opposite directions, the rate of closure is 120 mph. Anything protruding from, or falling off of, one train and striking a cask on the other train would have a speed on impact of 120 mph.

For this reason Southern has operating instructions requiring shipments of irradiated fuel and radioactive waste to be moved at speeds not exceeding 35 mph, and when two trains pass in opposite directions, one train must stop while the other train proceeds at not more than 35 mph. Thus the impact speed in any accident cannot be much greater than the 30 mph for which the casks are tested. However, from an operating standpoint it is not practical to maintain these speed controls unless the shipments are handled in special train service.

2. A 40 inch free fall onto a steel bar 6 inches in diameter. According to the General Electric technical

manual mentioned above, this test is intended to simulate the end of a railroad rail. The intent is good, because accidents in which cars and their freight impale themselves on broken rails are not uncommon. Ordinarily we do not keep separate records of such incidents, but when a broken rail pierces a fuel tank and spills diesel fuel, the resulting pollution problem attracts attention. Therefore I was able to determine that last year we had six fuel spills caused by tanks being punctured by broken rails. However, the 40 inch drop test produces an impact speed of only about 10 mph, and in regular train service a cask of irradiated fuel elements could run up against the end of a broken rail at 50 or 60 mph. A quarter mile long section of rail, spiked in place throughout its length, comes close to being an immovable object.

3. Thirty minutes in a 1,475°F fire. Fires are not uncommon in railroad accidents, and although the temperatures probably seldom exceed 1,475°F, the duration frequently exceeds half an hour. I can recall a three month period during which we had three fires on Southern that lasted more than 24 hours.

4. Immersion under 3 feet of water for 8 hours. If a car carrying a cask of irradiated fuel elements should derail on a bridge or trestle, it is quite likely that the cask would end up under more than 3 feet of water, and considering the weight of the cask and the difficulty of conducting recovery operations from a bridge or a trestle it is most likely that the cask would not be removed from the water within eight hours.

The tests that the casks are required to undergo

would be far exceeded by the actual circumstances of many railroad accidents.

Since 1965, as part of my job, I have received daily reports of all train accidents on Southern Railway System. Movements of special trains are very carefully monitored, and any accident involving such a train would of course attract immediate attention. It is my conclusion that special trains simply do not become involved in serious accidents.

Specifically, during the 5-year period 1970-1974 Southern had an average of 357 reportable accidents (involving $750 or more damage) per year and an average of 2,892 accidents per year that were not reportable under the standards set by the Federal Railroad Administration. For 1975 the standards were changed so that accidents involving less than $1,750 were not reportable, and during that year Southern had 273 reportable accidents and 3,489 minor (non-reportable) accidents.

During this entire period of time Southern had only one accident involving a special train. On October 12, 1975 a special [illegible] by flatcar carrying an unbalanced load climbed the rail on a curve and derailed at 22 miles per

hour, doing minor damage to the track and cars; no damage to the lading and no injuries. This unusual accident was caused by the heavy, unbalanced load, but since it was a special train it was under constant close surveillance and could be stopped quickly.

Regular freight trains are often more than a mile long, so long that on curves a particular car will frequently be out of sight of either the engine or the caboose, and sometimes cars will be out of sight of both. If a car should derail or have some other accident at such a time, no one would know about the accident, or try to stop the train, until some time later. Furthermore, regular freight trains frequently weigh so much that, at a speed of 60 mph, it may take more than half a mile to stop.

On the other hand special trains consist of only a few cars and are so short that every car is under constant surveillance from both the engine and the caboose. This, combined with the slower speeds at which special trains operate and the special care with which they are handled, accounts for the fact that in my experience special trains are never involved in serious accidents and are rarely

involved in any accidents at all. Furthermore, if a special train should derail, the slower speed and shorter length (lower total weight of the entire train) would enable the crew to stop the train almost at once, before the cars could turn over or pile up. This would greatly simplify checking the cars for damage. Clearing the track would not be as much of a problem because there would not be a pile of wreckage to clear away.

The slower speed, shorter stopping distance and shorter length of a special train also greatly reduces the likelihood of a crossing accident.

The use of special trains will also give quicker, more dependable service and quicker turn-around time, allowing better utilization of the special casks and cars. Although the irradiated fuel elements would only move at a maximum speed of 35 mph, in a special train the shipment would move right on through from origin to destination. For example, it would take a shipment less than 10 hours to move from the power plant at Newport, S.C. to the reprocessing plant at Barnwell, S.C.

in special train service, and arrangements could be made for the shipment to leave Newport as soon as it was loaded, without waiting for the next outbound train.

On the other hand if the shipment moved in regular train service, it would leave Newport on train 85 at 6:00 p.m. (which might be 23 hours after the cask was loaded and ready to move) and would arrive at Rock Hill, S.C. at 6:30. Then it would leave Rock Hill on train 185 at 2:00 p.m. the following day and would arrive at Columbia, S.C. at 5:00 p.m. The day after that it would leave Columbia at 7:00 a.m. on train 97 and would arrive at Barnwell at 11:00 a.m. and be interchanged to SCL. SCL's local train would pick the car up at Barnwell at 9:00 a.m. the next day and deliver it to the reprocessing plant at 9:45 a.m. That is, if the car left Newport at 6:00 p.m. on Monday it would be scheduled for delivery at Barnwell at 9:45 on Thursday, in regular train service.

VERIFICATION

DISTRICT OF COLUMBIA) ss:

HARVEY H. BRADLEY, being duly sworn, deposes and says that he has read the foregoing statement, knows the contents thereof, and that the same are true as stated.

HARVEY H. BRADLEY

Subscribed and sworn to before me this 24th day of May, 1976.

LAWRENCE A. HUFF
NOTARY PUBLIC
IN AND FOR THE DISTRICT OF COLUMBIA
MY COMMISSION EXPIRES JUNE 30, 1977

UNITED STATES
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
WASHINGTON, D.C. 20545

JUN 30 1976

Mr. Guy A. Arlotto, Director
Division of Engineering Standards
Office of Standards Development
Nuclear Regulatory Commission
Washington, D. C. 20555

DOCKET NUMBER
PROPOSED RULE PR-71,73 (40 FR 23768)
Trans. Radio. Mtle By Air

Dear Mr. Arlotto:

This is in response to your letter of March 24, 1976, inviting the U.S. Energy Research and Development Administration (ERDA) to review and comment on the Nuclear Regulatory Commission's (NRC) Draft Environmental Statement, NUREG-0034, Transportation of Radioactive Materials by Air and Other Modes (March 1976). We have reviewed the statement and have determined that the proposed administrative action will not conflict with known current or future ERDA programs.

We should like to provide you with some general comments for consideration in the preparation of the final statement. Detailed comments are provided in the enclosed staff comments.

This document contains much pertinent information relative to NRC and the Department of Transportation regulations for the shipment of fissile and other radioactive material and reflects considerable work in summarizing information concerning personnel exposure limits and radiological effects. However, it was difficult to verify results presented due to incomplete discussion of the material in the text. Although we are familiar with the subject and the associated technology, we found the organization of the statement somewhat difficult to understand. We would like to suggest that you may wish to revise the organization of the statement for better continuity.

In chapter II (PII-3) where it is stated that ERDA was created by the Energy Reorganization Act of 1974, it would be desirable at this point to describe the role of ERDA in authorizing packaging for use by contractors.

Acknowledged by card 7/12/76

DOCKETED USNRC
JUL 12 1976
Office of the Secretary Docketing & Service Section

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

Because of the subject matter of this statement, we would suggest that a glossary be added at the beginning of the statement. Some examples are transport index, half-life, effective half-life, latent cancer fatality, competent authority certification, and others. We feel that such an addition would be quite helpful to all readers. Furthermore, NRC might wish to consider the use of photographs in the statement to also assist the reader.

Our staff also strongly recommends that a more thorough evaluation be given to the need for decontamination after an accident involving rupture of containment. The ingestion pathway discussed in appendix A should be carefully evaluated for the radionuclides which may cause special problems.

We agree with the general conclusion of the statement that the risk from radioactive material shipments is low compared to other societal risks. However, we are concerned that the accident risk analysis overestimates the transportation accident risk and is too simplified to make valid comparisons of the relative risks between the various radioactive materials. The danger in this, is that people might scale the accident risk results in an attempt to determine the shipping level at which the accident risk would become unacceptable. When and if the industry approaches this shipping level at some future time, the overestimation could lead to unwarranted concern over the accident risk. This point is discussed in the enclosed staff comments.

Thank you for the opportunity to review this draft statement and we would like to request that NRC send a minimum of twelve copies of all draft statements for review and comment and four copies of final statements.

Sincerely,

W. H. Pennington, Director
Office of NEPA Coordination

Enclosure:
Staff Comments

cc w/enclosure:
CEQ (5)

ERDA STAFF COMMENTS
ON THE
NUCLEAR REGULATORY COMMISSION
DRAFT ENVIRONMENTAL STATEMENT, NUREG-0034

DOC USNRC
JUL 1 2 1976
Office of the Secretary
Docket Control
Section

1. Page i, Paragraph 3

The first paragraph here gives the person rem per year, but does not give the comparative person rem per year in the U.S. from background radiation. We think it would be appropriate to make this explicit as the conclusion on page v notes the small fraction contributed by the transportation phase. We did not find an explicit number anywhere in the text.

We found no comparison of the excess exposure received by aircraft passengers and crew from cosmic radiation at flight elevation vs. the background radiation they would have received had they stayed on the ground. The comparison of this number with that arising from exposure from packages containing radioactive material carried in the aircraft should be constructive.

2. Page ii, Paragraph 3a

States, ". . . an aircraft carrying a bulk shipment of plutonium oxide. There are presently less than 100 bulk shipments of plutonium per year . . ."

The terminology, "bulk" shipments, may be construed to be loose or unpackaged. We are unaware of any such shipments of plutonium. We suggest that these statements be reevaluated since they may convey a connotation different from that intended in respect to shipment of plutonium.

3. Page iii, Paragraph e

It is not clear in the text, page II-25, whether curve A, B, or C is used. If A has been used in the calculations, then it would be appropriate to state in "e" that no medical precautions are taken.

4. Page iii, Paragraph 4

Another alternative which could be considered is requiring the carrier to survey packages prior to acceptance or loading. If this check and balance had been in effect, we might not have experienced some of the notable exposures in aircraft transportation.

5. Page xxii

What is the basis for the statement "A Factor of twenty decrease in accident risk and consequences seems attainable by this technique (change in physical form) for plutonium shipments."? We agree with the principle but question the technical basis of this factor.

6. Page I-12, Paragraphs 1 and 2

We suggest that these be revised to indicate the following: 1) there are no commercial reprocessing plants presently operating; 2) liquid high level wastes must be solidified within five years of production and 3) an acceptable waste disposal method, not just site approval, is needed before a permanent waste repository will be available.

7. Page I-16 through -18, Table I-1

This table lists shipments which include all nuclear fuel cycle material; however, the statement fails to address U-core, U_3O_8, normal and enriched UF_6, fresh and recycled fuel assemblies, and radioactive wastes. We suggest that these should be addressed in the statement.

We also suggest that the category "Low Level Wastes" shipped from "Fuel Fabricator and Reprocessor" to "Commercial Burial Site" by "Truck or Rail" might be added to this table.

8. Page I-20, Table I-2

We suggest that the category "Fresh Fuel and Radioactive Waste Shipments" be added.

9. Page I-24

What is the basis for the statement that spent fuel shipments represent "a significant transportation risk"? We could find nothing in Reference 7 to support this statement.

10. Page I-24

What is the basis for and meaning of the statement that "a similar risk occurs in the transport of high level radioactive wastes"?

11. Page II-4, Last Paragraph

The statement is made that implies the NRC regulations regarding packaging of radioisotopes are included in 49CFR174-177, clarification of this is in order.

12. Page II-14

In the requirements stated for 49CFR173.395(c)(2), we suggest the wording on the U.S. Atomic Energy Commission be updated.

13. Page III-1, Last Paragraph

The sentence reads as though the range of a "one MeV gamma" is 11 cm in tissue. We suggest that NRC might consider expanding the discussion to correct this impression.

14. Page III-3

The statement and the equation following table III-1 are misleading. Theoretically, the equivalent biological effect can be achieved when the relative biological effectiveness (RBE) of the radiation for each exposure consequence is known. The quality factor is used primarily for radiation protection purposes and in our opinion is not adequate for the purposes of comparing exposure risks from the mixture of sources discussed in this paper.

Furthermore, neither quality factor or relative biological effectiveness are defined; they are not equivalent and should not be used interchangeably, particularly when such diverse effects as acute death and lung cancer are considered. We also suggest that NRC might want to consider expanding the discussion of the rem to rad conversion.

15. Page III-4, First Paragraph

Inhaled naturally-occuring alpha emitters include thoron daughters as well as radon daughters.

16. Page III-9, First Paragraph

We suggest that this paragraph be rewritten since it implies that the MPC (air or water) is a unit of exposure rather than being based on the permissable exposure to critical organs.

17. Page III-12, Table III-6

We suggest that the average or mean effect of radioactive transport be added to compare transport dose effect to background and medical dose effect.

18. Page III-15, Last Paragraph

We suggest that the phrase "specific radionuclide" replace the phrase "radioactive specie" which is used throughout. The latter phrase is confusing since it could refer to animals or plants.

19. Page III-16, Table III-7

For PuO_8 we feel that the biological half-life in liver and bone, as well as in lung must be stated and identified.

For Pu, the biological half-life listed is for the deep lung. The value for bone is 36,000 days. Using the isotopic composition and specific activities found in appendix B, p. B-5 and the dose conversion factors from table III-8, we find the following Pu dose conversion values, in rem/curie inhaled.

	Dose commitment over:	
	1 y	50 y
Lung	4.2×10^6 rem/ci	1.1×10^7 rem/ci
Bone	1.2×10^5	4.4×10^7

We cannot agree with the value of 2×10^8 listed in table III-7 for PuO_8. Conversion to rem/g yields 50 year dose commitment conversion factor of:

Lung	1.4×10^8 rem/g (inhaled)
Bone	5.4×10^8

These values are closer but still do not agree with that listed in the table. We suggest that the data presented in the table be reevaluated in light of these comments.

20. Page 17, First Paragraph

Is it not the relative risks that are to be compared and not the person-rem?

21. Page III-23, Table III-9

The table has not been correctly copied and adequately referenced. "Whole body" is actually "Total (excluding Thyroid)". Also the table contains those values used in WASH-1400 for external exposure. What was used in this analysis for internal exposure? The risk number shown for the thyroid is surely not a mortality estimate--morbidity maybe, but not mortality. Finally, if the estimates of

table III-9 are based on the absolute model, it should be so noted.

22. Page III-24, First Paragraph and Figure III-2

This figure was taken from p. 9-7 of WASH-1400 appendix VI. However, the referenced figure does not contain a curve for alpha emitters. Any subsequent argument pertaining to acute effects (death) of alpha emitter inhalation is unsupportable without these data and suggest that NRC might wish to include these data.

23. Page IV-13.

Table IV-2 gives population dose to crew and passengers from packages. We suggest that it also include the differential received by same populations as a result of cosmic radiation at flight altitudes. Such a number would be several times the 1400 for Passengers-1* and many times the Crew-I* numbers.

24. Page IV-20, Table VI-4

There is inconsistency between the PuO_2 shipping distance noted in this table and that noted in table V-10 on p. V-37.

25. Page IV-27

Person rem/yr are calculated on this and following pages. We think it appropriate that background exposure doses also be calculated and presented for comparison. For example, the 5042 person rem/yr is a big number to the layman or the person taking data out of context. However, it becomes small when compared to the population background exposure of 22.5 million person-rem/yr.

26. Page IV-33, Section D.3-2

It is assumed that there will be a two-hour "storage" period associated with time spent in rail yards. Is this a realistic figure, particularly where interline transfer is required, or are these transfers taken into account in arriving at this figure.

27. Page IV-40, Section F.1

We feel that transport index system can be based on dosage from the package or the maximum number of packages considering criticality. Hence, the label does not inform as to which of two potential hazards exists. This could be important in accident recovery.

Likewise, the terms Type A, Type B, or large quantity are meaningless to all but a very few persons. Some improvement might be obtained if the labels provided explicit relevant information. We suggest that NRC may wish to study this suggestion as an "alternative" toward reducing mislabeling and mishandling occurrences.

28. Page IV-41, Section F.3

Since 10% of the incidents that involve release are in the Type A category and that these packagings are relatively inexpensive, it seems reasonable that requiring crush and puncture resistance characteristic of service conditions be explored as an alternative.

29. Page IV-43, Section F.5

Appendix C does not provide a deciphering code. However, some of the more notable incidents have derived from packaging errors. We do not feel that this section discusses this matter in proportion to its importance -- either as to requirements or as to cost-benefit or corrective action. It is implied elsewhere that a preconsignment survey of the package would be beneficial in reducing labeling errors. However, the benefit of a quality assurance over-check as to labeling and proper packaging and closure should be considered as an alternate.

30. Page IV-43, Section G

The subject of this section and that of section D.4 (page IV-34) might well be considered in light of the prospect of using ferry barge shipments to circumnavigate cities or states which embargo nuclear shipments or areas where rail carriers are refusing to haul nuclear shipments. We do not feel that the regulations contemplated the casual public in such proximity to nuclear shipments, particularly spent fuel casks, for the typical time period involved. We feel that this situation lends itself to be analyzed in the draft.

31. Page V-8, Equation (1)

We assume this equation was used to calculate accident risks. We have several questions on the methods used to develop numerical values for input into the equation. A primary concern is the term D_{ij} (estimated release fraction for the type of shipment being considered and for the accident severity class). The method of development of D_{ij} appears to be oversimplified. Release fractions used for each

accident severity class are presented in table V-6 (page V-25). Questions are raised for both the values used and the use of the release fraction in the analysis. The statement is made (page V-24) that "Model 1 would be an accurate model if packaging were no better than required by present standards." We disagree that it would be accurate; experience indicates that not all material will get out and become dispersed when a package is breached. We are not sure of the basis for Model II. It was our understanding that the reference testing was under impact conditions. If so, how does one apply the results to, e.g., puncture conditions?

Does a category VII accident in air transport involve the same forces as a category VII accident in truck transport? If not, we would expect different release fractions for different modes (since the same container could be used in any mode).

We would not, in general, expect the same release fraction from an accident involving a category VII impact and one involving a category V impact and a category III fire. According to figure V-6 (Page V-9) the latter is also a category VII accident. Whether or not a category III fire will contribute to a release depends on specific package characteristics and specific contents characteristics.

It is also not clear how the normalized population dose (K_i in Equation (1)) is obtained. We know it involves figure V-11 but there is no reference as to source of figure V-11 nor how the curve was developed.

32. Page V-11, First Paragraph

A fire temperature of 1875°F is referenced. We wonder if it would not be appropriate to discuss the 1475°F used in container (MC 0529, 10 CFR 71 etc.) and the impact of the difference.

33. Page V-15, Section B.2

Crush forces are load dependent. Therefore, if, for example, a shipment is made in a sole use vehicle which contains only a few small radioactive material packages the crush force severity categories (e.g., category VIII, 5% of accidents involve a crush force greater than 500,000 pounds) are likely to be incorrect.

Also it would be appropriate to define the phrase "crush force"

34. Page V-27, Last Sentence

From this statement and the discussion near the top of page III-17, the reader is left with a confused picture. Is the calculation for ^{131}I and ^{137}Cs release consequences based on the milk path or on the inhalation path only? The statements in chapter III imply that only the inhalation was included in which case the consequences for ^{131}I and ^{137}Cs releases are underestimated. This should be clarified in the final statement.

35. Page V-30, Second Paragraph

There is no discussion or reference to explain the model used to calculate the area enclosed by isopleths. When an area as large 10^4 km^2 is involved (see figure VII), the model used for this calculation is very much of interest since this area exceeds by more than four orders of magnitude the areas plotted in Meteorology and Atomic Energy. Also, such a large area would depend more on regional than on local meteorology. The atmospheric stability and wind speed should be mentioned as well as the method by which values of the dispersion parameters σ_y and σ_z are determined.

36. Page V-31, Figure V-10

Figure V-10 is self-explanatory although the normalization dose value of 0.8 rem seems odd and there is no explanation of it in the text. This figure, however, and figure V-11 on page V-38 are inconsistent. From figure V-10 the 10-meter release height curve yields a value of $4x10^6$ m^2 at the 95 percentile. Thus, the area enclosed by the $8x10^{-4}$ rem per g of ^{239}Pu released is $4x10^6$ m^2. In figure V-11, however, the ordinate corresponding to $4x10^6$ m^2 is $9x10^{-3}$ rem/g of ^{239}Pu released. This discrepancy should be corrected.

37. Page V-34, Second Paragraph

In the last sentence a cloud height of 10 meters was assumed; however, we feel that atmospheric stability and wind speed assumption should be made and stated.

38. Page V-38, Figure V-11

We do not understand the shape of this curve. The dose should be proportional to the atmospheric dilution factor, E/Q or x/Q' and the area as a function of x/Q' as plotted in Meteorology and Atomic Energy has a concave shape to it, whereas this one (figure V-11) is convex. Since no model is described or

referenced, it is impossible to check. As previously noted, we suggest that the source of this figure and how the curve was developed be referenced.

39. Page V-39, Top Line

A computer code is mentioned. Which code is it? Is it documented? There is an ANSI Standard for computer codes which if followed gives the reader some assurance that the code has been reviewed and checked for accuracy. Has this been done for the codes used in this document?

40. Page V-43, Second Paragraph

We do not feel that taking 20% respirable as a median for 10% and 40% is conservative.

41. Page V-43, Third Paragraph

No support or descriptions are given for either of the two components in the "third factor". The statement "For plutonium this fraction is approximately 11/24" is unsupported as is the statement "ratios of irradiation rates and clearance rates... this factor is approximately unity for plutonium". A geometric standard deviation of 3 (footnote) signifies a very wide range of particle sizes, and a most difficult aerosol from which to derive "irradiation rates". This lack of information renders the entire remainder of this section unsubstantiated and therefore of little value. We strongly suggest that additional information be supplied.

Also, we would like to know what is the significance of 11 and 24 in the fraction 11/24 and is there any reference for these figures.

42. Page V-44, Table V-11

Radionuclide name is missing on first line. We assume this should be ^{239}Pu.

43. Page V-48, Fifth Line

Delete the word "physiological" since it is meaningless as used here.

44. Page V-48, Third Paragraph

We suggest that Equation (1) should be given or referenced.

45. Page VI-49, Table VI-30

Accident LCF reduction in table is by a factor of 23, but the text refers to a 23% LCF reduction. This discrepancy should be corrected.

46. Page V-50, Table V-15

The risk reported in this table of accidents in the shipment of PuO_2 is (for the same annual shipment quantity) at least four orders of magnitude greater than that found in a detailed assessment of the risk of shipping plutonium by truck. (T. I. McSweeney, L. J. Hall, et al. An Assessment of the Risk of Transporting Plutonium Oxide and Liquid Plutonium Nitrate by Truck. BNWL-1846, Battelle, Pacific Northwest Laboratories, Richland, Washington, August 1975.)

We feel that this is extreme conservatism in the accident risk analysis.

47. Page VI-1

One section noticeably missing is a detailed history or "Track Record" of fissile and other radioactive materials during the past 15-20 years and the analysis of that data utilizing the parameters used in this study. This omission is not understood since the first sentence in paragraph 2 on page VI-1 states, "The environmental impact of an alternative in radioactive materials shipments is meaningful only when compared to the impact of the current shipping practice." The evaluation of low consequence events of the past could then be compared to projected consequences of future shipments to assess the method used.

No assessment is made of risks resulting from human error or faulty equipment which could result in dropping or puncturing containers during handling (fork-lifting) operations.

In addition, no mention is made of specialized training for personnel involved in the various facets of fissile and radioative materials shipments and the impact it might have in precluding incidents and accidents.

48. Page VI-2, Table VI-1

We suggest that the annual population dose due to accidents be included.

49. Page VI-10, Table VI-4

Table VI-4 and following give baseline and alternative calculated values then a change usually in percent. Giving this change in percent rather than in absolute value tends to be misleading. This is particularly true when evaluating the sum of LCF for normal and accident. For example, on page VI-22 we find a normal transport LCF increase from 1.166 to 1.195 or 0.029 or 2% while accident LCF decreases 21%. Stopping there it sounds like a substantial overall LCF decrease. But looking farther we see the 21% decrease is from 0.000529 to 0.00044 or 0.000089 decrease off-setting 0.029 increase or a net 0.0289 increase. We recommend showing the change in absolute values throughout this section.

Furthermore, we feel that the text could be strengthened by the addition of narrative which place the differentials between alternate modes in perspective relative to the probable accuracy of the result (i.e., relative to the confidence limits in the data). For example, what is the confidence in, or significance of, the computed 21 percent decrease in latent cancer fatalities due to accidents?

50. Page VI-14, Table VI-6

The annual air cost minus truck cost in dollars for plutonium shipment should be 2.8×10^3, not 3.4×10^3, based on the information in this table. Also, the footnote for this table is confusing since it is indicated that the plutonium shipping distance is 1200 miles but the cost is given for a 2000 mile trip.

51. Page VI-19, Last Paragraph

States, "additional secondary mode mileage..." This is in conflict with statement on page VI-17, B.1-3 which says, "shorter distance in secondary mode."

52. Page VI-30, Section B.1-6.2

The discussion fails to acknowledge the aggravated logistics and increase in facilities and labor required at a reprocessing plant receiving about 5 metric tons of fuel per day by truck relative to rail. This is important also in light of the added potential for operator error, and dosage to plant operating personnel.

Some mention of the efficient utilization of transport fuels is probably appropriate. A 1000 MWe light water reactor might originate 60 spent fuel cask shipments by year by truck or 10 cask loads by rail. Fuel consumption is typically 670 BTU per ton mile by rail; 2400 BTU per ton mile by truck. Assuming a 1000 mile trip (each way), rail shipments would save over 64,000 gallons of diesel fuel per reactor year.

53. Page VI-41, Paragraph 3

States "Restricting trucks to good weather driving..." A restriction of this type would precipitate confusion as to the definition of "good weather driving" and would prevent the driver from exercising discretion as to whether road conditions are safe or unsafe (he should be in the best position to make that determination).

54. Page VI-43, Section B.2-3.3

This section discusses restriction on truck travel on weekends. Since truck costs are based on miles covered, denial of weekend travel would severely escalate costs of shipments by this restriction. Long haul operations that are currently on the road for greater than five days would be severely affected.

55. Page VI-44, Section B.2-4

In view of recent railroad actions, we feel this section deserves more emphasis and perhaps some expansion. Specifically, is there any basis in statistical data to suggest that the addition of special train units (extra's) operating over trackage otherwise scheduled, but at less than normal freight train speed would increase accident frequency or consequences relative to normal freight service?

56. Page VI-47, Table VI-29

This table shows a factor of 16% increase for one item and 100% decrease for another. We suggest consistency in these tables. Some comment applies to table VI-30, page VI-49.

57. Page VI-49, Line 23

States "...Since accidents involving plutonium shipments are expected to produce 98.6% of the total risk..." If this statement is true, then the packaging requirements for all quantities

of plutonium shipments should be upgraded. Perhaps consideration should be given to require all transuranics to have a super classification of containers to be used for all modes of transport.

58. Page VII-1, Third Paragraph

This paragraph indicates, according to the text, that nuclear material is subject to security procedures and safeguards intended to preclude the diversion or theft of nuclear material or sabotage of the nuclear facilities in which it is handled.

This statement in regard to the safeguarding of strategic quantites and types of special nuclear material is misleading and should be revised. There is no option to safeguard special nuclear material in this category. NRC regulations prescribe the safeguarding both at fixed facilities and in transit. Additionally, safeguards and security procedures are not limited to "strategic quantities" but to all special nuclear material.

That part of the paragraph which speaks to radioisotopes, such as cobalt-60 should be eliminated. There are no security and safeguards features in the context within which they are discussed, i.e., to preclude diversion or theft or sabotage, applicable to the handling of radioisotopes by NRC. Mentioning cobalt-60 raises numerous related questions regarding other hazardous radioactive materials not subject to NRC safeguards and security type control (e.g., radium).

59. Page VII-2 B(2) and (3)

Meaning of "Contractors" unclear. Contractors to NRC, U.S. Government, nuclear industry or what?

60. Page VII-5, Second Paragraph

The meaning of "supporting safeguards security systems" requires clarification.

61. Page VII-8, Third Paragraph

We see no reason to specify "escort guards" but would refer to "guards" without the qualification since it is unlikely that guards would be used solely for escort purposes. The same sentence apparently intends to refer to "the transportation mode" rather than "the transportation model."

62. Page B-7, First Paragraph

A portion of material deposited in the tracheobronchial region may also pass directly to blood, depending on initial solubility. The term "reticuloendothelial cells of the alveoli" is ambiguous; it is not clear whether this refers to fixed or mobile pulmonary macrophages.

63. Page B-7, Second Paragraph

"Soluble plutonium" is a thoroughly non-specific term. Translocation half-times and fractions can vary several-fold depending on inhaled particle size, specific chemical form, and isotopes of plutonium. Use of the narrow range "150-200" is misleading and may be dangerous in risk estimates; the unit of time is not even given.

64. Page B-9

This figure is taken directly from publications by J. F. Park and W. J. Bair at Battelle Pacific Northwest Laboratories; reference and credit should be given.

65. Page B-10, First Paragraph

This discussion is not complete; the lethal biological effect of progressive pulmonary fibrosis leading to death by respiratory insufficiency is not even mentioned. We suggest that this section be expanded.

66. Page B-10, First and Second Paragraphs

Terms "high", "low", "lower", and "relatively" should be given values or ranges; "relatively high body burdens (.00007 to .09 microcuries)" spans 3 orders of magnitude. We suggest that ".00007 to .09 microcuries" be changed to "0.005 to 0.420 microcuries". (Reference - WASH-1320, page 25).

67. Page B-11, Fourth Paragraph

It should be pointed out that "increases in urinary excretion in some cases by orders of magnitude" may represent only a decrease of a few percent in long-term lung burden of insoluble plutonium.

68. Page B-12

We suggest that NRC staff may wish to reference Dr. J. N. Stannard's paper "Plutonium Toxicology and Other Toxicology" in The Health Effects of Plutonium and Radium (Jee, W. S. S., ed.). J. W. Press, Salt Lake City, Utah (1976) pp. 363-372 rather than the B. L. Cohen reference. ERDA staff feels the suggested reference to be more current.

69. We are listing the following typo errors to improve the draft:

B-7 - Clearance half-time of 150-200 omitted units.

V-9 - There is a VII just above II and a IIII next to II. Should they not both be III?

V-24 - Last paragraph. Should it not be table V-6?

V-54 - First paragraph, last sentence. Should it not be 0.2 fatalities per year?

70. It has been suggested that the report title be shortened to "The Transportation of Radioactive Materials."

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
WASHINGTON, D.C. 20460

DOCKET NUMBER
PROPOSED RULE PR-71,73 (41FR23?

Trans. Radioactive Mtl. by Air

22 JUL 1976

Mr. Robert B. Minogue
Office of Standards Development
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Minogue:

Enclosed are the EPA comments from our review of NUREG-0034, the draft environmental statement on the Transportation of Radioactive Materials by Air and Other Modes.

We are concerned with the implication of Table IV-2. It lists maximum and average doses to individuals on aircraft of 340 mrem/year and 60 mrem/year, respectively, and since there is no accompanying discussion of the subject, it implies that NRC finds these doses acceptable. EPA has issued recommendations to FAA which state that doses to individuals at such levels are unacceptable for aircraft passengers since at least one cost effective method can be used to significantly reduce these doses (i.e., increased shielding). Therefore, we do not consider this exposure situation consistent with current Federal guidance which states: (1) that "there should not be any man-made radiation exposure without the expectation of benefit resulting from such exposure" and (2) that "...every effort should be made to encourage the maintenance of radiation doses as far below this guidance as practicable." We believe actions must be taken to reduce doses of this magnitude to aircraft passengers.

In December 1974, EPA issued its recommendations to the Federal Aviation Administration for a dose rate limit of 0.5 mrem/hour at seat level. EPA estimated that this would yield a dose of 42 mrem/year to individuals in the worst assumed case. In the same recommendations, EPA found that there is at least one cost-effective method readily available to maintain dose levels below 0.5 mrem/hour. Obviously NRC has followed neither the FRC guidance nor the EPA recommendations in calculating the doses given in the statement and, further, has chosen to imply these doses are acceptable by failing to discuss them. With the tremendous number of shipments of radioactive materials per year on passenger aircraft, EPA views this matter with grave concern, and believes NRC and FAA should undertake immediate action to correct this unsatisfactory situation.

Acknowledged by card 7/27/76

DOCKETED USNRC
JUL 27 1976
Office of the Secretary Docketing & Service Section

A second major problem with this statement involves the analysis of transportation accidents. While the approach taken to evaluate transportation accidents appears reasonable, there is a lack of supporting information to confirm the results of the analysis and the conclusions which are drawn. Thus, these results and conclusions are based solely on engineering judgment. We believe this fact should be recognized and pointed out in the final statement.

In light of our review and in accordance with EPA procedure, we have rated the proposal as EU (Environmentally Unsatisfactory) and classified the draft statement as Category 2 (Insufficient Information). If you or your staff have any questions concerning our rating or comments, please do not hesitate to call on us.

Sincerely yours,

for Rebecca W. Hanmer
Director
Office of Federal Activities (A-104)

Enclosure

Comments on NUREG-0034
The Draft Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes

General Comments

1. There is a lack of discussion pertaining to the high individual dose equivalent rates to passengers from normal shipments on aircraft. These dose equivalent rates, which are cited in Table IV-2 as 340 mrem/year maximum and 60 mrem/year average, are large fractions of the Federal Radiation Council guidance and are the most significant impact from normal aircraft shipments. In January 1975, EPA issued recommendations to the Federal Aviation Administration which state that doses to individuals at such levels are unacceptable for aircraft passengers since at least one cost-effective method is readily available to significantly reduce these doses (i.e., increased shielding). The action of shipping radioactive materials as described in this statement is not consistent with current Federal guidance which states: (1) that "there should not be any man-made radiation exposure without the expectation of benefit resulting from such exposure and, (2) that "... every effort should be made to encourage the maintenance of radiation doses as far below this guidance as practicable." We believe actions must be formulated and carried out to reduce doses of the magnitude cited being received by aircraft passengers.

2. In December 1974, EPA issued its recommendations to the Federal Aviation Administration for a dose rate limit of 0.5 mrem/hour at seat level. EPA estimated that this would yield a dose of 42 mrem/year to individuals in the worst assumed case. In the same recommendations, EPA found that there is at least one cost-effective method readily available to maintain dose levels below 0.5 mrem/hour. Obviously, NRC has followed neither the FRC guidance nor the EPA recommendations in calculating the doses given in the statement and, further, has chosen to imply these doses are acceptable by failing to discuss them. With the tremendous number of shipments of radioactive materials per year on passenger aircraft, EPA views this matter with grave concern, and believes NRC and the FAA should undertake immediate action to correct this unsatisfactory situation.

3. We point out that EPA has proposed standards concerned with normal operations in the uranium fuel cycle (40 FR 23420) which include doses received during transportation of radioactive materials. These standards would limit individual doses to 25 mrem to the whole body. EPA believes that this will have little or no effect on the economics or operations of the transportation industry because, as it now exists, the dose equivalent levels appear to be less than 1 mrem

per year, well below 25 mrem per year. The fact that EPA has formally proposed standards which would apply to the transportation of uranium fuel cycle materials and yet is not recognized in the draft statement is an oversight which should be corrected.

4. With regard to transportation accident analysis, the relationship of the shipping package test requirements and the performance of the packaging under various accident categories has not been established to our knowledge. Thus, the information on failure rates and release fractions as presented in Table V and the conclusions drawn are based solely on engineering judgment. This fact should be indicated in the final statement.

5. EPA believes that use of the BEIR report in its unmodified form is the most reasonable model to use to calculate health effects in this statement at this time. Since the debate over the health effects model in WASH-1400 is still continuing, it is premature to base this analysis on WASH-1400 premises.

6. With the exception of weapons-related shipments where the country's security might be compromised, we cannot understand the exclusion of government transportation statistics. Since this group of statistics is surely a large collection, the public release of this information is not only desirable but could certainly aid in the assessment of the environmental impact created by the transportation of radioactive materials.

Specific Comments

1. P. III-2, Last paragraph: It should be noted that the length of time over which energy is absorbed is also critical to creating biological effects.

2. p. III-3: Since there were 5.5 million examinations in 1972 using technetium and the most useful form cited was used a mere 120,000 times, it is not clear what happened with the other 5,380,000 examinations.

3. p. III-9: The statement, "The dose limits proposed by NCRP and adopted by EPA..." is not correct. EPA is currently operating under the 1960 guidelines of the Federal Radiation Council (FRC). The EPA is currently working in an interagency effort to review and update the FRC guidelines; the NCRP dose limits are being consulted in this effort but have not been adopted.

4. p. III-13: We suggest rewriting the sentence beginning "Technetium-99m can be given..." as, "Technetium-99m can be given in relatively large amounts with little radiation exposure." "Relatively" emphasizes comparison with other isotopes and "amounts" eliminates

possible confusion resulting from using the word "dose" which is used in a medical context rather than the radiological context in which it had previously been used.

5. p. IV-12, sec. D. 1-1: It is stated that tiers 6, 7, and 8 in figure IV-3 schematically illustrate the procedure that the FAA employed to arrive at the various dose estimates in their assessment, reference IV-2 in the statement. However, tiers 7 and 8 do not appear in figure IV-3. They should be added in the final statement.

6. p. IV.-34: We feel that the water transport discussion was not thorough enough. The only reason cited for this treatment is a "paucity of information" concerning water transport. However, the discussion in the draft statement on the manufacture of floating nuclear power plants (NUREG 75/113) provides a brief but much more adequate discussion of the subject. If it is believed that a projection to 1985 is too uncertain this is understandable and should be so stated, but a more thorough discussion would be more informative for the public and would not as likely appear to be a sidestepping of the issue. Therefore, further basic discussion of water transport and an explanation for its exclusion in the further analyses is warranted.

7. p. IV-41: In the second paragraph of section F.3, there is no factual basis cited for the statements leading to the 0.5 mrem/year "expected" dose rate. This section needs to be more thoroughly documented to indicate which radionuclides were considered and in what proportions. Further, information on whether certain types of packages are damaged more frequently than others and, if so, which, is certainly of importance to the analysis in this section.

8. pp. IV-42-43: The method of modifying equation 2 to arrive at the given equation is not clear, further elucidation is requested.

If there are records indicating "an average of 5 losses per year over the last 9 years," it seems there might also be records indicating for how long these packages were lost. Such information would eliminate another estimate, i.e., the "7-days lost" figure, to allow a more precise appraisal of possible population doses.

9. p. IV-44: The discussion shows that it is currently possible for workers to exceed 500 mrem/year simply handling shipments. It is clear that if the number of shipments increase as they are projected to do that these workers will routinely exceed 500 mrem/year. Any provisions which have been made to prevent this from occurring should be indicated. Furthermore, if the doses mentioned on p. IV-44 do not include unnecessary doses (e.g., sitting on or standing near radioactive

cargo), which they apparently do not, the problem becomes worse than estimated on p. IV-44. We believe that if unnecessary exposures are indeed a fact of life, they should be included in the environmental impact assessment. Any plans underway to mitigate or eliminate these unnecessary exposures would be of interest also.

10. p. V-13: The scheme of the de-rating of aircraft accidents seems somewhat unrealistic in one sense and quite arbitrary in another. First, airline routes do not blanket the entire country uniformly, especially flights carrying radioactive materials. It would seem much more realistic to determine the proportion of flights carrying radioactive cargo over the various land surfaces and then de-rate the accidents. Second, the reasons for choosing the number of accident severity classes by which accidents are de-rated are not apparent. The arbitrary nature of the statements brings them into immediate question.

11. p. V-24: EPA previously stated and still believes that a technical analysis should be performed relating packaging test requirements to the forces a package may experience in an actual accident environment since primary protection in transportation is currently provided by the packaging itself. Special attention would be given to the probable extent of damage expected to be suffered by the package and the resulting quantity of radioactive materials which may be released to the environment under the various accident conditions. In developing this analysis, it is important to use as much test data as possible rather than relying on unverified engineering models. EPA is encouraged that data is now being gathered from actual tests, however, it appears that insufficient data makes it too early to use "Model II" in Table V-6. In our opinion, Model I should be used as the basis for the risk assessment at this time, with Model II used only as a comparison.

12. p. VI-40, Table VI-25: The discussion on the mitigation of accident consequences which precedes this table in this section indicates a decrease in the "Accident L.C.F." rather than an increase as given in Table VI-25. The reason for this seeming inconsistency should be explained.

13. p. VI-46, B.3-1, 2nd paragraph: Correction of the term "ny" is necessary to clarify the sentence's meaning.

14. Appendix B: The list of references should be more specific where appropriate when only one part of a book or one article in a collection is used. Other references need to give more information to be complete, such as numbers 5 and 12.

On p. B-7, the first paragraph, the movement of particles captured in the mucoid lining is more properly termed transported not sloughed.

In section E, we have several comments. On page B-10, to prevent confusion, a beta particle is not an ion and it is confusing to describe its nature as ionic, its nature is more properly termed that of a charged particle; also, beta particles can travel much further than a few microns in body tissue, in fact into the centimeter range. In the cited case of the Los Alamos personnel, the draft statement indicates that "...none of these people has shown any evidence of radiation injury." It seems this statement is probably too broad and could be optimistic. We doubt that all possible indicators have been checked and even if they have it is quite unlikely that there has been no radiation damage. This statement, if taken literally, would indicate that the NRC has adopted a threshold model for radiation effects. If this is true, the decision should be documented.

In section E.3, first, there are no references cited for the information given; second, there are apparently symbols missing from the amounts of plutonium cited, 0.5 curie Pu-239/gram of lung is the same as 8.2 grams Pu-239/gram of lung.

The discussion in section F on chelating agents does not mention any side-effects of their use, e.g., possible deposition in other organs, rather than excretion, which could create worse problems.

And, finally, the comparisons given on p. B-12 are too simplistic. Nowhere is it stated that the effect of these materials depends on innumerable factors, e.g., exposure time, time between intake and effect, condition of the victim, and how the material acts in a biologic system. This should be corrected in the final statement.

15. Appendix C: The listing of incidents as presented is hard to follow since there are neither dates indicating when incidents occurred nor meanings of the abbreviations used. Such data needs to be included in the final statement.

Editorial Comments

1. p. IV-24: In the "Dose to Crew" equation the "D_c" factor is unnecessary. Its inclusion squares the dose rate.

2. pp. V-9 and V-20: The squares listed for the following figures are apparently mislabeled: Figure V-6: 0-0.5 hour fire, 30-55 mph and, 0.5-1 hour fire, 11-30 mph; Figure V-20: 1-1.5 hour fire, 40-60 mph.

3. p. VI-1: The act referred to as the National Environmental Protection Act is correctly cited as the National Environmental Policy Act of 1969.

4. p. B-7, middle paragraph: The clearance time for soluble plutonium needs to have units added to it.

DOCKET NUMBER
PROPOSED RULE PR-71,73(40FR23709)

Office of Planning and Budget

Executive Department

James T. McIntyre, Jr.
Director

GEORGIA STATE CLEARINGHOUSE MEMORANDUM

TO: U.S. Nuclear Regulatory Commission
Office of Standards Development
Washington, D.C. 20545

DOCKETED USNRC AUG 5 1976 Office of the Secretary Docketing & Service Section

FROM: Charles H. Badger, Administrator
Georgia State Clearinghouse
Office of Planning and Budget

DATE: July 29, 1976

SUBJECT: RESULTS OF STATE-LEVEL REVIEW

Applicant: U.S. Nuclear Regulatory Commission

Project: The Transportation of Radioactive Material by Air and other Modes

State Clearinghouse Control Number: 76-04-14-05

The State-level review of the above-referenced project has been completed. As a result of that review process, the project is recommended for further development with the following recommendations for strengthening the project:

1. The draft EIS deals with the transportation of all types of radioactive materials, including pharmaceutical as well as spent fuel. It is broad, general, and non-specific. Because of the way it is organized and presented, it is practically impossible to sort out the real issues and impacts associated with an area of prime interest such as the transportation of spent fuel. The NRC should seperate out the issue of spent fuel and do a seperate detailed and factual EIS on its transportation aspects.

2. Throughout the document, the dose estimates are related to the average exposure to population in man rems. The NRC should also include dose values based on the maximum exposure to individuals.

Acknowledged by card 8/5/76

3. With reference to accident analysis, the EIS seems to look at alternatives in a broad, general context and only related to the average exposure concept. It is questionable as to whether some of these same alternatives would still be valid if the maximum exposure concept were used.

4. In addition to the general considerations of transportation of nuclear materials throughout the United States, specific consideration must also be addressed with regard to large metropolitan areas such as Atlanta, posts of entry, and other large transportation centers. NRC has a definite and specific responsibility in the development and application of proper procedures for the transportation of nuclear materials through such areas in order to insure the complete protection of the citizens of the area. Such procedures must be useable and acceptable by the States that are impacted.

5. In general, the EIS is too general and non-specific to be of much use as a planning tool for specific areas. As was stated in (4) above, NRC has the obligation and responsibility to issue a report that is useable by the States.

The State of Georgia asks that the final environmental impact statement prepared for the project contain a greater degree of specificity when addressing the aforementioned areas of concern.

cc: ...ce Osborn, Executive Department, Office of Planning and Budget
...i Walden
Leonard Ledbetter, Department of Natural Resources
David Tundermann, Council on Environmental Quality
Ray Siewert, Department of Natural Resources

DOCKET NUMBER PROPOSED RULE PR-7173 (40 FR 23760)

STATE OF NEW YORK

DEPARTMENT OF LAW

TWO WORLD TRADE CENTER
NEW YORK, N.Y. 10047

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LOUIS J. LEFKOWITZ
ATTORNEY GENERAL

PHILIP WEINBERG
ASSISTANT ATTORNEY GENERAL
IN CHARGE OF
ENVIRONMENTAL PROTECTION
BUREAU

August 4, 1976

DOCKETED USNRC AUG 17 1976 Office of the Secretary Docketing & Service Section

Director
Office of Standards Development
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Re: Comments on the Nuclear Regulatory Commission's Draft Environmental Impact Statement on the Transportation of Radioactive Materials (NUREG - 0034)

Dear Sir:

Recently it was announced by the U.S. Energy Research and Development Administration ("ERDA") that it will take over the transportation of all strategic amounts of non-weapons special nuclear materials ("SNM") by October 1 of this year. ERDA stated that the takeover was being made because a "higher degree of security is essential." Nuclear News, June 1976, p. 125, copy attached. According to affidavits filed by ERDA and the NRC in the federal case of the State of New York v. NRC, et al., 75 Civ 2121 (WCC) (SDNY), these shipments had been made until now by commercial transport. We are unaware of any action by the NRC to similarly remove from commercial transport SNM shipments by its licensees although it has been stated by the NRC and ERDA that:

> "As a matter of ERDA and NRC policy the control measures imposed on plants and transportation of ERDA license-exempt contractors and of NRC licensees are either the same or comparable." Presidential Report to the Congress Regarding Laws and

Acknowledged by card 8/17/76

Regulations Governing Nuclear Exports and Domestic and International Safeguards, March 31, 1975, prepared by ERDA & NRC.

ERDA's recent finding that a higher degree of security is essential indicates the vulnerability of ERDA and NRC controls on commercial air and related connecting transport to terrorist action as is thoroughly discussed in the comments of this office on the above-referenced environmental impact statement ("EIS") and the prior comments and enclosures dated July 2, 1975 and August 12, 1975, submitted by this office in this administrative docket as originally noticed at 40 Fed. Reg. 23768 (June 2, 1975). (See especially comments of Messrs. Mason and Leamer, submitted by letter dated May 17, 1976, and copies of affidavits of Messrs. Mason and Leamer, dated November 30, 1975 and January 20, 1976, resubmitted by letter, dated August 3, 1976, to J. Corr, NRC Office of General Counsel).

This new development and the anomalous situation which it creates must be publicly addressed by the NRC in a direct and prompt manner.*

The NRC is now once again urged to recognize that the continued commercial transport of SNM runs an unacceptable risk of diversion or loss of SNM. More secure modes of transport must be immediately designed and implemented. As this office has previously stated it is our view that the NRC should require that shipments of plutonium be made by military surface transport and that shipments of uranium**

* Additionally, the Final EIS on transportation should, of course, reflect the NRC response to ERDA's concern over the inferior control measures which are not capable of providing an adequate degree of security for the transport of SNM.

** Other than uranium enriched in the isotope U-233.

be made by military air transport, using military bases as points of shipment and interim storage for all SNM.

It is requested that this letter be docketed and made part of the record of this proceeding.

Very truly yours,

LOUIS J. LEFKOWITZ
Attorney General
By

JOHN F. SHEA, III
Assistant Attorney General

JFS:rab

APPENDIX "A"

safeguards

SNM

ERDA to assume shipments by October

Because it says a "higher degree of security is essential," the U.S. Energy Research and Development Administration will take over transportation of all strategic amounts of non-weapons special nuclear material by October 1. These shipments are now being made via private shippers. One of them, Edlow International, of Washington, D.C., had objected to ERDA's plan before it was made final.

Following a meeting with Edlow, ERDA reasserted its position. Alfred D. Starbird, a retired Army lieutenant-general and now ERDA's assistant administrator for national security, said, in a letter to the shipper, "Based on our analyses we are convinced that significantly greater security will be provided at an earlier time by expansion of the existing ERDA system" to cover the strategic quantities of SNM.

An ERDA spokesman later emphasized that the agency will continue to study the situation, even as it implements its plan.

October 1 was picked as the deadline after considering the time required to obtain shipping materials and work out security procedures. Contracts with the private shippers will be terminated or adjusted by that date.

STATE OF NEW YORK
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LOUIS J. LEFKOWITZ
ATTORNEY GENERAL

PHILIP WEINBERG
ASSISTANT ATTORNEY GENERAL
IN CHARGE OF
ENVIRONMENTAL PROTECTION
BUREAU

DOCKET NUMBER
PROPOSED RULE PR-7173(40FR23768) August 3, 1976

RECEIVED
AUG 17 1976
Office of the Secretary
Docketing & Service
Section

Janice K. Corr
Attorney
Office of the General Counsel
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Re: Comments on the Nuclear Regulatory Commission's Draft Environmental Impact Statement on the Transportation of Radioactive Materials (NUREG-0034)

Dear Ms. Corr:

Judge Conner has ordered that the seal on the affidavits of Messrs. Mason and Learner, dated November 30, 1975 and January 20, 1976, submitted in State of New York v. NRC, et al., 75 Civ. 2121 (WCC) (S.D.N.Y.), be broken.

In accordance with our previous discussions, I enclose copies of those affidavits for submission in conjunction with the other comments of this office which have already been accepted for consideration by the NRC in preparing the final environmental impact statement.

Very truly yours,

LOUIS J. LEFKOWITZ
Attorney General
By

JOHN F. SHEA, III
Assistant Attorney General

JFS:dg
Encl.

Acknowledged by card 8/27/76

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

DOCKETED USNRC AUG 17 1976 Office of the Secretary Docketing & Service Section

THE STATE OF NEW YORK, Plaintiff, -against- THE NUCLEAR REGULATORY COMMISSION, et al., Defendants.	AFFIDAVIT 75 Civ. 2121 (WCC)

STATE OF NEW YORK)
: SS.:
COUNTY OF NEW YORK)

THEODORE T. MASON and ROBERT R. LEANER, being duly sworn, depose and say:

Purpose of the Affidavit

1. This affidavit is submitted in support of plaintiff's motion for a preliminary injunction and motion for summary judgment, and is made with regard to the possibility of terrorist activities directed toward destruction or seizure of special nuclear material or SNM.

2. This affidavit augments and refines the affidavit of 16 June, 1975 submitted by Theodore T. Mason and Robert R. Leaner in support of the position that there is a substantial likelihood that a motivated, trained and equipped group of terrorists could be successful in destroying or seizing SNM in the course of its transportation by commercial air and related connecting ground services. The principal purposes of this affidavit are to address (1) the air transport of uranium as opposed to plutonium, (2) and the vulnerability of commercial air transportation systems currently employed industry-wide as compared to a variety of military assisted air transport systems. Plutonium constitutes a threat as a toxic dispersant and therefore a terrorist might well seek to

destroy a plane transporting it. On the other hand uranium, other than U_{233}, constitutes a threat only as an explosive and requires a terrorist action plan of seizure and escape for later explosive deployment.

4. Each of the following military assisted transportation alternatives for enriched uranium is considered less vulnerable to terrorist action than current commercial practice. The least vulnerable alternative is presented first, the most, last:

(1) long haul military air cargo, leaving from and flying into a military airfield, and connecting with short haul military helicopter service between the airfield and the origin/ultimate destination;

(2) same as (1) but with military surface transport service between the airfield and the origin/ultimate destination;

(3) long haul commercial air cargo, leaving from and flying into a military airfield, and connecting with short haul military helicopter service between the airfield and the origin/ultimate destination;

(4) same as (3) but with military surface transport service between the airfield and the origin/ultimate destination;

(5) long haul commercial air cargo, leaving from and flying into a military airfield, and connecting with commercial surface(truck) service or commercial air(helicopt service between the airfield and the origin/ultimate destination.

5. <u>Nature of the Threat</u>

Since the terrorist objective will be to seize and escape with the enriched uranium in contemplation of later actual o threatened explosive deployment, he has only limited courses

of action:

a. hijack the aircraft;

b. theft at the airport;

c. inception and theft between the airport and the origin/ultimate destination.

The threat of destruction of the long haul aircraft in the air, upon landing, or in parking position is minimal as it is quite unlikely to facilitate a uranium seizure and escape. Complete destruction of short haul transport, either air or surface, is also unlikely for the same reason. The uranium must be seized intact and not destroyed or lost in the process of bringing down the aircraft.

6. Evaulation Criteria

In our affidavit of 16 June, 1975, the earlier planning steps and subsequent destructive employment steps were found to be within the capability of terrorists. Vulnerability of competing transport systems to the threat described in previous paragraphs can be assessed in terms of the relative likelihood of terrorist success in accomplishing steps (5) through (11) under paragraph 8 of our previous affidavit dated 16 June, 1975. These steps are:

(5) acquisition of information on material location, protection and movement;

(6) external penetration of facility (airport);

(7) access to interim storage facility (if applicable);

(8) control of vehicle (aircraft/truck);

(9) access to container (or material);

(10) manipulation of container (or material);

(11) removal of material (from area/authorized control).

7. Assessment of Alternatives

A number of action plans which terrorists might implement to gain their objectives were identified in our affidavit dated 16 June, 1975. A transportation system alternative may be considered vulnerable if implementation of those or similar action plans are likely to allow a terrorist to effect the steps enumerated in paragraph 6 above.

8. A summary vulnerability assessment of each military assisted transportation system alternative described in paragraph (4) above is provided below. The commercial air transport system currently employed industry-wide was found highly vulnerable in our affidavit of 16 June, 1975, and it is not reevaluated herein. Each military assisted transport system considered below is superior to(less vulnerable than) the current commercial system. Varying degrees of military assistance are evaluated in order to show that there is a range of policy options yielding varying degrees of lower vulnerability.

Alternative (1) - All Military with Short Haul by Helicopter

9. Hijacking -- considered remote because the military cargo aircraft would load enriched uranium at and depart from a military airfield. Security at a military base is generally quite rigorous, making access to the base, and the airfield, and then the aircraft, rather difficult. Additionally, military communications can be made very secure, so that terrorist access to critical information on the nature and timing of enriched uranium movement would be quite difficult.

10. Destruction of long haul aircraft--not an appropriate action plan since [illegible] physical control of enriched uranium for later use in a bomb.

11. Seizure of enriched uranium at destination military airfield considered remote for following reasons:

--difficulty of accessing military airport;

--military police are armed, motivated and likely to prevent terrorist escape even if a seizure is effected;

--all base personnel can be placed upon immediate alert in the event of an incident;

--military communications are excellent and additional response capability is generally available;

--information on enriched uranium movements can be made extrerely difficult to acquire. Secure and controlled communications are central to military operations;

--temporary storage or hold over of enriched uranium at military airports is unlikely since a military helicopter responsible for the short haul leg to a final destination is not likely to be assigned other functions which would delay or conflict with the SNM delivery mission;

--established and tested procedures for secure handling of nuclear weapons have been in use for some time.

12. Seizure of enriched uranium during short haul helicopter transit to or from the ultimate origin or destination -- considered difficult because:

--information on aircraft movement can be made very difficult to acquire;

--the aircraft's route to destination may be made deliberately erratic and such a route clearly is not constricted to available roads as in the case of surface transport;

--it is not appropriate to shoot down the aircraft, since it does not assure the terrorists that they will reach the crash site, find the cargo,

and successfully escape before being apprehended (assuming cargo remains intact);

--the aircraft may fly over water in many instances to minimize both the land based ambush opportunities, as well as render difficult unauthorized recovery of enriched uranium if the aircraft went down. Additionally, the potential for crashing in populated areas is minimized;

--aircraft (helicopter) may deliver enriched uranium directly into the destination's secured zone without interim use of even limited surface transport.

Alternative (2)--All Military with Short Haul by Convoy

13. This alternative preserves high security during the long haul transport and at the airport, but sacrifices the extreme flexibility of helicopters for the short haul transport. Relative to commerical surface transport, the military convoy advantages under this alternative are:

--avoidance of population centers associated with large commercial airports;

--information on planned convoys and actual movements are within military structure and hence are highly secure;

--military convoy practices anticipate ambushes and plan accordingly, making use of decoys, advance and rear guard escorts, deliberately erroneous movement information, adequate armed personnel, quick response assistance teams, etc.

Alternative (3)--Commercial Long Haul Cargo Aircraft Using Military Airfields with Military Air Transport for the Short Haul Transit. Alternative (4)--The same as (3) Except Using Military Surface Transport for the Short Haul Transport.

14. These alternatives preserve a measure of security during long haul transport and at the airport, but increase the

possibility that planned movement information will be more widely disseminated and/or that inflight communications will be handled in a less secure manner.

It is anticipated that any commercial aircraft departing fr a military field would be searched for stowaways prior to departure (to avoid hijacking) and would not land at any commercial field before unloading its enriched uranium cargo. Either military air (helicopter) or military convoy would be employed for the short haul transit, each with its attendant security posture.

Alternative (5) Commerical Long Haul Cargo Aircraft Using Military Airfields with Commercial Air or Surface Transport for the Short Haul Transit.

15. This alternative preserves a measure of security during the long haul transport, and at the airport, but greatly increases the possibility of movement information (i.e. air and surface related) being more widely disseminated and/or subject to in-transit monitoring as more commercial interface is necessitated. Also short haul commercial ground or air transit is highly vulnerable for some on all the reasons set forth in our affidavit of 16 June, 1975 and below in paragraph 16.

Concluding Comment

16. Any of the military assisted transportation system alternatives presented are considered more secure than the current commercial practice. The military assisted alternatives to the present commercial air transport cycle for enriched uranium are less vulnerable to terrorist action because of:

(1) less dissemination of movement information, vigorous [illegible] control;

(2) more secure in-transit communications;

(3) personnel with security training and clearances;

(4) appropriate selection of weapons and vehicles

(5) superior reaction capability;

(6) physical remoteness of airfields and facilities;

(7) reliable and highly motivated personnel;

(8) psychological deterrent of a U.S. military protective force.

17. Although the entire affidavit thus far has addressed itself to enriched uranium transport, one comment regarding plutonium transport is worth making. A recent report by Ensign Dwight L. Gertz, USN, in Terrorist Weapons and the Terrorist Threat, "U.S. Naval Institute Proceedings," October, 1975, pp. 113, 114, confirms our conclusion expressed in our 16 June, 1975 affidavit that the terrorist motivation and threat to destroy aircraft is real and the weapons are readily available. In a recent instance, five Arabs rented an apartment in Ostia near Rome, 4 miles from Leonardo da Vinci Airport, directly underneath the North-South runway approach, and were only hours away from initiating a planned attack on a commercial airliner. They were equipped with two Russian made Grail missile launchers and a supply of missiles. In a second recent instance, when authorities were informed that terrorists in the Brussels area had been shipped Grail launchers, hundreds of troops were called out to cordon off airports in Brussels and London. The Grail is combat proven and available to Soviet supplied nations and some "neutral" countries. The missile is heat-seeking. The launcher is hand held and simple to use.

In-transit dispersion of plutonium oxide in many instances would be both a highly effective terrorist act and one of far lesser difficulty than seizure and escape. Hence the threat becomes one of destruction of the aircraft in order to breech the plutonium oxide containers and disperse their contents.

THEODORE T. MASON

ROBERT R. LEAMER

Sworn to before me this
30th day of November, 1975

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Terrorist Weapons and the Terrorist Threat

By Ensign Dwight L. Gertz, U.S. Navy,
Patrol Squadron Nine

Dozens of airlines and governments operate the big jets which take off from the airport in a steady stream. The departure of each is pinpointed by the roar of engines and the flashing of lights as it roars into the sky. The pilots and passengers can make out only hints of the city that bustles below. Hundreds of thousands of men and women live in the sprawling blocks of apartment buildings underneath the flight path of the ascending aircraft. In one fourth-story apartment, three young men open a closet door and remove something which would remind a movie buff of the bazooka he had seen in a late show war movie. They slide the window open and watch the plane [illegible] marked representative of an unfriendly nation. As the marked aircraft arches overhead they take aim at the human silhouette . . .

The professional naval officer spends a great deal of his time aboard ships, but [illegible] in spite of the potential [illegible] in recent years, this attention [illegible] the U.S. [illegible] officers, on the rapidly improving Soviet Navy. In our concern for this massive challenge, we must guard against a tendency to forget that the goals of war are political and that these goals may be achieved by forces other than the regular military establishments of the combatants.

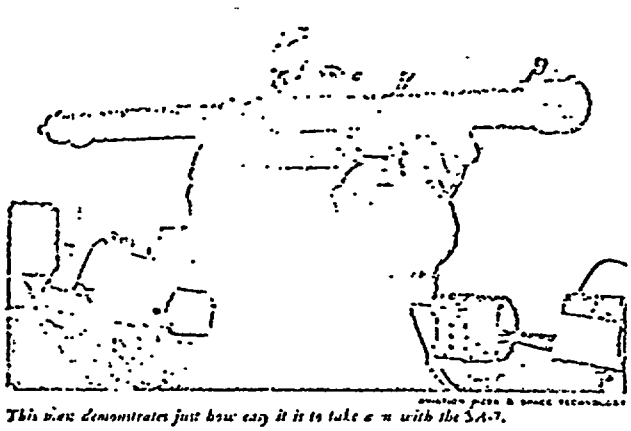
In the gray area between peaceful politics and war lie numerous organizations capable of contributing to the achievement of national goals. Although this has never been a secret, it is sometimes surprising that these organizations are improving their tactics and arms inventories in much the same manner as the world's more conventional mili[illegible]

[illegible] embarrassing loss on an individual compound [illegible] an attack on a [illegible] the political environment in which the conventional [illegible] operates. For this reason, it may be interesting to see what sort of improvements have been made in the terrorist [illegible]

It would not hopelessly threaten plausibility to discuss the possibility of nuclear weapons or other exotic weaponry falling into the hands of a terrorist group. Both the spy thrillers and other military analyses have brought this problem to light. Effective weapons do not have to be exotic, however. The conventional arsenals of the major military powers contain plenty of weapons for the terrorist which do not saddle him with the technical or political burdens inherent in the use of nuclear, chemical, or biological weapons.

One such conventional weapon is the Soviet built SA-7 Grail surface-to-air missile. The Grail's launcher tube, which is about the size of a World War II [illegible] bazooka, [illegible] which [illegible] the infrared radiation from [illegible] engines. It is considered comparable to the U.S. built Redeye missile, which is about four feet long and weighs [illegible] at supersonic speeds for a considerable distance in pursuit of a low flying aircraft.

The simplicity and [illegible] reasonable cost of [illegible]



This view demonstrates just how easy it is to take aim with the SA-7.

weapon (POW) make it a prime candidate for deployment with the armed forces of the Soviet Union in a variety of applications. It can be lugged by foot soldiers, mounted on vehicles, or carried on board naval combatants. The technology involved is simple enough to lend itself to mass production.

One reason for heavy Soviet investment in the Grail is that it is a combat-tested system. Use of the Grail against U.S. aircraft in Vietnam was first reported in the spring of 1972. It downed several aircraft at that time and seriously disrupted reconnaissance and helicopter operations, close air support missions, airborne artillery spotting, and other low altitude aviation operations.

U.S. countermeasures, most notably the use of hot flares to mislead the missile's infrared guidance system, held the casualty rate down but also provided the users of the Grail with a laboratory situation in which to test improvements. The October 1973 Arab-Israeli War offered yet another opportunity to test modifications to the system. As a result, a Grail [illegible] has become a improved [illegible] modifications to one of the most sophisticated radar systems in production, he can be ready for a enemy aircraft before it even comes into view.

The successful record of the Grail has created a demand for the antiaircraft missile in traditionally Soviet-supplied nations and some "neutral" nations. Several countries already have the Grail system, and as the number of countries increases so do the chances that the link will be created in the chain which will lead to terrorist possession of the deadly missile.

From its Soviet origin, the missile might proceed by any number of circuitous routes on its way to a terrorist organization. The missile might begin as part of an arms shipment to a Soviet-supplied nation such as Syria. Syria, like several of its Arab allies, arms and supports the Palestine Liberation Organization (PLO). This "group" includes several factions, each with varying degrees of loyalty to the central command and differing concepts of the most effective means of obtaining Palestinian goals. It is not too difficult to imagine the possibilities by which a radical faction such as the Black September might obtain weapons from more conservative groups in the PLO by theft, theft, defection of personnel or sheer mismanagement.

Another possible pipeline exists in [illegible] the terrorist [illegible] give the effective missiles directly. The Qaddafi regime in Libya, recently the recipient of large quantities of Soviet military hardware, has been suspected as the source of Grail shipments to terrorists on at least two occasions.

In the first case, Italian police apprehended five young Arabs who had rented an apartment in the seaport city of Ostia, near Rome. The apartment was four miles from Leonardo da Vinci Airport and directly underneath the flight pattern for the North-South runway. Cached in their apartment were two Grail launchers and a supply of missiles. The Italian press reported that the terrorists were only hours away from a planned attack on a commercial airliner.

This demonstration of the reality of the Grail threat led to a dramatic reaction by Western European governments when they were informed that Grails had been shipped to terrorists in the Brussels area. Hundreds of troops were required to throw up a special security cordon around airports in Brussels and London. The Grail attack never materialized, but the security measures necessary to protect against it illustrate the type of response required to counter a threat posed by a small group of people equipped with a very small, but effective, weapon.

Different activist groups in nearly every part of the world would certainly like to acquire weapons like the Grail whether they planned to employ them or not. Groups in Ireland, Quebec, Black Africa, Asia, and even the United States have resorted, for political reasons, to tactics which emphasize quick, spectacular actions. Spectacular attacks have become recognized as important facets of numerous successful revolutions or "wars of national liberation." The embryonic revolutionary can look to the histories of Israel, Cyprus, Mozambique, Vietnam, and a host of other countries to see places where terrorism helped spawn either a conventional war, or a political victory without large scale military action.

With the respect generated by their successes, terrorist and guerilla movements are gaining support daily. With money, influential support, and a feeling of growing power, the [illegible] their new weapons [illegible] in evidence in the coming months and years.

EDITOR'S NOTE: *The views expressed are those of the author and do not necessarily represent the position of the Department of Defense or the U.S. Government.*

UNITED STATES DISTRICT COURT
SOUTHERN DISTRICT OF NEW YORK

----------X

THE STATE OF NEW YORK,

Plaintiff,

-against-

THE NUCLEAR REGULATORY COMMISSION, et al.,

Defendants.

----------X

AFFIDAVIT IN PLAINTIFF'S SUPPORT OF PLAINTIFF'S MOTIONS

STATE OF NEW YORK)
: SS.:
COUNTY OF NEW YORK)

THEODORE T. MASON and ROBERT R. LEMIER, being duly sworn, depose and say:

Introduction

1. The purpose of the affidavit submitted by ourselves dated 16 June, 1975 was to (1) demonstrate that there is a substantial likelihood that a highly motivated group of terrorists could be successful in destroying, or seizing for destructive use SNM in the course of air transport, or related connecting transport, notwithstanding existing safeguard regulations and/or actual practice, and (2) argue that the military has the current safeguard capability to move SNM by surface transport which is significantly less vulnerable to terrorists than commercial air transport and related connecting transport.

2. The purpose of the affidavit submitted by ourselves dated 30 November, 1975 was to augment and refine the affidavit of 16 June, 1975, [illegible] by [illegible] the question of the transport of uranium as opposed to plutonium and the vulnerability of commercial air transportation systems currently employed industry-wide as compared to a variety of military assisted air transport systems.

Purpose of This Affidavit

3. The purpose of our current affidavit is to restate our positions as outlined in the two above-noted affidavits and, further, to (1) respond to arguments raised in the defendants' answering affidavits insofar as they relate to the vulnerability of transportation alternatives to the threat of terrorist action, (2) provide an assessment of the impact of recent changes in Part 73 of Title 10 of the Code of Federal Regulations, and (3) present recent information contributing to the argument that there exists alternative military SNM transport capability that is less vulnerable to terrorists than the current commercial system.

J. Edlow, Affidavit of January, 1976

4. In paragraph 6. of his affidavit, J. Edlow's reference to "strategic" quantities of SNM misses the point. Apparently Edlow is referring to the fact that CFR Sec. 73.30 sets minimum requirements for NRC licensee shipments of certain amounts of SNM computed by formula, which include 5,000 grams or more of U_{235} enriched to 20 per cent or more, or 2,000 grams or more of plutonium. This regulation fails to cover various significant dangers. For example, any amount of PuO, if used as a dispersant, could cause death and injury. Also, the psychological aspects of SNM seizure are almost equally as real whether the material is low or highly enriched, or in small or large quantities. Any amount of SNM in the hands of a terrorist group would be of great blackmail value and could certainly be used to their advantage. Finally, the factor of multiple thefts must be taken into consideration, with the possible stockpiling of seized SNM.

5. In paragraph 8. Edlow's concurrence with his father's recommendation of "expediting" falls short of accomplishing the task of deterring a determined terrorist group

from successful seizure of SNM. The statement that "[t]his method and this method only will provide early notice that shipment is astray or diverted" is somewhat after the fact and does not preclude the possibility of diversion by seizure or hijacking. The only reaction to the discovery, or "early notice, that a shipment is diverted, is to notify the NRC or "an appropriate law enforcement authority." This is not security in the prevention sense and unless a more secure mode of transport is provided at the same time, seizure is not prevented and potential for recovery may be meager.

6. As we have indicated in our earlier affidavits, one of the weakest links in the current security chain with respect to prevention of successful terrorist action is the wide dissemination of advance shipment information. "Expediting," as described by Edlow, is directed toward loss through misrouting or causual theft. However, such programmed pre-scheduling of times, routes, mode of transport, etc., provides precise information on shipment movement and unless access to such information is strictly limited, may add to a successful terrorist act. According to Peter N. Skinner, affidavit of April 29, 1975, a minimum of 124 people had knowledge of the details of the arrival of a specific shipment of plutonium before it arrived at J.F. Kennedy Airport from Brussels on February 25, 1975. As can be seen, the question of knowledge prior to shipment is one of the greatest short-comings of the civilian transport mode and one of the advantages of the military mode. Mr. Edlow at paragraph 15 of his affidavit stated categorically that "SNM cannot be lost or diverted under current regulations . . . ." Such an unqualified statement raises questions about his expert objectivity. He would not categorize the current system as failsafe.

7. In paragraph 11, Edlow's reference to the two principal additions to the regulations which "prevents the possibility of loss or misrouting of SSNM while being transported", i.e., "continuous visual surveillance" and "frequent communications," again oversimplifies terrorist and related security problems. Adherence by shippers to these two requirements is intended to provide a degree of protection against misrouting and casual theft, but standing alone, it is inadequate protection against determined terrorist attacks and organized theft.

8. Further, a report prepared for the NRC, released only in December, 1976 (MITRE Technical Report 7022, September, 1975, The Threat To Licensed Nuclear Facilities ["MITRE Report"] para. 3.12.3, page 88) points out the inadequacy of current communications systems, "One weakness in the operation of these private firms involves the communication system and the difficulties incurred during communication blackouts. Vehicles equipped only with a radio-telephone to handle communications to a base station are subject to periodic blackouts due to terrain and atmospheric conditions. Thus, to comply with a necessary two-hour check with headquarters [10 CFR Sec. 73.31] the driver must on occasion leave his vehicle and use a hand-line telephone. During these blackout periods and during the time the driver leaves his truck to use a telephone, the potential for a hijacking or theft is increased."

9. Regarding Edlow's statements (Aff. paras. 12-14) concerning delivery by armored truck with armed guards, one should note that the MITRE Report, para. 3.12.4, page 89, points out:

"It should be noted that armed guards of an interstate shipment have no statutory authority to carry weapons in states other than the one in which they are licensed or across state lines, yet regulations require that they carry weapons in exercising their primary duty of protecting SNM in their custody. These guards are probably often in violation of both state and federal laws."

In other words, the fact that a guard is armed, and in an armored truck, is not necessarily a strong deterrent to terrorist or organized attack; the guard probably knows that he may be in violation of a state or federal statute or law, and, when faced with an armed attack situation, may simply not use the weaponry available for fear of legal, as well as physical, consequences to himself.

10. The MITRE Report confirms and augments the observations and conclusions stated in this and our earlier affidavits regarding the inadequacies of the requirements regarding visual surveillance and communications and armed guards, as outlined by NRC's 10 CFR Part 73, of April, 1975.

Captain James A. Eckols, Affidavit of 28 November, 1975

11. Captain James A. Eckols' affidavit of 28 November, 1975 recounts numerous terrorist acts occuring aboard commercial aircraft and/or associated with commercial air facilities and installations. The MITRE report itemizes no less than 20 commercial aviation-related terrorist acts in the last 6 years. These findings are consistent with the view expressed in our earlier affidavit that successful terrorist action against

commercial aviation is feasible. We believe that transport of SNM in commercial aircraft provides the terrorist with particularly attractive incentive for action.

Assessment of 10 CFR 73 through 73.36 and 73.72 as Amended

12. At paragraph 56 of our affidavit of 16 June 1975 we stated that the regulations as republished on December 20, 1973 were not adequate to prevent or deter a determined group of terrorists from succeeding with their mission. Those regulations were the regulations in effect on March 4, 1974. A review of 10 CFR 73.1 through 73.36 and 73.72 as amended through December 15, 1975, was made to determine whether amendments after March 4, 1974 would substantially alter our assessment of the vulnerability to terrorist action of SNM carried in commercial transport.

13. Our assessment has not changed. The thrust of these Part 73 regulations remains that of protecting against loss, misrouting and casual commercial theft. Assuming full compliance with the letter and spirit of those sections of Part 73 by all responsible parties (an assumption with which we disagree), the amended regulations do not provide for adequate personnel, equipment or procedures to effectively deter and prevent successful terrorist action or organized theft.

14. The requirements of Part 73 which may give the appearance of providing good security are grossly inadequate. Among the inadequacies are:

(1) shipments of less than 5000 grams of SNM are not covered;

(2) though plans for selecting, qualifying and training guards as well as for specially-designed trucks are called for, neither minimum standards or implementation dates are specified;

(3) the number of guards provided for and their arming is minimal;

(4) communication requirements in terms of the frequency of communication in transit as well as the number and capability of communication channels is inadequate.

15. The Mitre report states: (para. 3.12.5, pp. 89-90)

"a. A wide dispartiy (sic) presently exists in the various screening techniques used in selecting guard personnel and in the training they receive.

b. So long as contact is not always possible with vehicles carrying high security material, the present communication system will contain weaknesses. Response capability suffers accordingly.

c. Armored vehicles used to transport SNM currently vary in construction and in the extent of denial and immobilization features.

d. The present regulations do not provide a sound legal basis for the carrying or emergency use of weapons by guards transporting SNM across state lines.

e. Escort vehicles on overnight and long distance hauls frequently have no sleeping accommodations; thus occupants must rest

16. The Mitre report contains extensive corroboration of numerous points made by us in our current and previous affidavits e.g.:

Terrorists -- 54 pages directed to the history, tactics, capabilities, affiliations, motivations and recent activities of terrorists operating throughout the world. (Mitre Report, pp. 1-55)

Transport Industry -- 10 pages devoted to the extensive role of crime, corruption, employee colusion, and international influences in undermining industry services. (Mitre Report, pp. 55-64)

Weapons -- 6 pages citing types of weapons, their availability and recent employment by terrorists. (Mitre Report, pp. 65-70)

Conclusions reached include "terrorism has become commonplace in the Western World and weapons of large caliber and full-automatic fire can be easily procured," and "a veritable army of criminals and hoodlums in this country is waiting and willing to undertake any activity, including murder, if the profit justifies it."

17. It is apparent that the conditions in the commercial transportation industry described by Sam Edlow in the 1969 speech attached to J. Edlow's affidavit as Exhibit 1 have not substantially improved. Sam Edlow characterized the industry as untrustworthy (Exhibit 1, p. 3) and incompetent (Id. p. 9) and the environment in which the industry operates as one of criminality (Id. p. 6). Indeed he felt that the most that might be accomplished by strengthening requirements within the commercial industry might be early detection and recovery, rather than prevention (Id. pp. 6, 10, 11, 12). As pointed out above in paragraphs 5, 6 and 7 current regulations regarding

What Sam Edlow called "expediting" reflect a goal of detection, rather than prevention, of diversion.

18. As to demonstrating that the commercial air system is potentially unsafe from the terrorist threat viewpoint, the recent bombing of LaGuardia Airport is indicative of a level of vulnerability to terrorist activity which far exceeds the vulnerability of military controlled systems, vehicles and installations.

Recent Information

19. We note that in a January 12, 1976, p. 11, col. 1 New York Times article by David Burnham, the following was reported:

> "The commission [NRC], however, is considering recommending the possibility that an existing Defense Department agency such as the Army's special forces be given training to enable it to react to a situation where a terrorist band seizes and holds a nuclear facility for a relatively long period of time."

Moreover, it was stated in the New York Times, January 18, 1976, News Of The Week in Review, p. 3, col. 2:

> "The Federal Nuclear Regulatory Commission is preparing to recommend that Congress consider, instead of creating a special police force to guard nuclear power plants, training Army units to prepare for attacks on the installations by terrorist groups."

It is clear that even defendant NRC now considers military safeguards against terrorist attack against nuclear facilities and materials to be necessary and desirable.

THEODORE T. MASON

ROBERT R. LEAGUE

Sworn to before me this
20th day of January, 1976

Assistant Attorney General
of the State of New York

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(96)

DOCKET NUMBER
PROPOSED RULE PR-71, 73

August 31, 1976

The Hon. Samuel J. Chilk
Secretary
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

Re: NUREG-0034 - Draft Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes, NRC Docket No. PR-71, 73 (40 FR 23760)

Dear Mr. Chilk:

On August 26, 1976, the United States Energy Research and Development Administration transmitted to you for inclusion in the above the evidentiary record to date in Docket No. 36325, Radioactive Materials, Special Train Service, Nationwide, now pending before the Interstate Commerce Commission.

Since August 26th, the shippers other than Federal agencies which are parties to the pending Interstate Commerce Commission proceedings involving the transportation by rail of certain radioactive materials filed comments on a Draft Environmental Impact Statement prepared by the Office of Proceedings of the Interstate Commerce Commission, served July 21, 1976. A copy of those comments is enclosed for consideration by the Nuclear Regulatory Commission in its pending evaluation of the environmental impact of radioactive material shipments.

Very truly yours,

L. Manning Muntzing

Enclosure

Acknowledged by card 9/8/76

Before the

INTERSTATE COMMERCE COMMISSION

DOCKETED USNRC SEP 3 1976 Office of the Secretary Docketing & Service Section

Docket Nos. 36307, 36307(Sub. 1), 36307(Sub. 2) and 36307(Sub. 3)

RADIOACTIVE MATERIALS, MISSOURI-KANSAS-TEXAS RAILROAD COMPANY, ETC.

Docket No. 36312

U.S. ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
v.
THE AKRON, CANTON & YOUNGSTOWN RAILROAD COMPANY, ET AL.

Docket No. 36313

ALLIED-GENERAL NUCLEAR SERVICES, ET AL.
v.
THE AKRON, CANTON & YOUNGSTOWN RAILROAD COMPANY, ET AL.

Docket No. 36330

GPU SERVICE CORPORATION, ET AL.
v.
THE AKRON, CANTON & YOUNGSTOWN RAILROAD COMPANY, ET AL.

Docket No. 36335

COMMONWEALTH EDISON COMPANY, ET AL.
v.
THE AKRON, CANTON & YOUNGSTOWN RAILROAD COMPANY, ET AL.

Docket No. 36336

GENERAL ELECTRIC COMPANY
v.
THE AKRON, CANTON & YOUNGSTOWN RAILROAD COMPANY, ET AL.

Docket No. 36325

RADIOACTIVE MATERIALS, SPECIAL TRAIN SERVICE, NATIONWIDE

Comments of Shippers Other Than Federal Agencies on the Draft Environmental Impact Statement by Office of Proceedings.

Comments on the Draft Environmental Impact Statement prepared by the Office of Proceedings of the Interstate Commerce Commission, served July 21, 1976, ("the Draft EIS") hereby are submitted by the following parties to the above-listed proceedings:

Allied-General Nuclear Services
Carolina Power and Light Company
Commonwealth Edison Company
Duke Power Company
Exxon Nuclear Company, Inc.
General Electric Company
GPU Service Corporation
Houston Lighting & Power Company
Kansas City Power and Light Company
Kansas Gas and Electric Company
Niagara Mohawk Power Corporation
NL Industries, Inc.
Northern States Power Company
Pacific Gas and Electric Company
Pennsylvania Power and Light Company
Philadelphia Electric Company
Power Authority of the State of New York
Public Service Company of Indiana, Inc.
Rochester Gas and Electric Corporation
Southern California Edison Company
Union Electric Company
Vermont Yankee Nuclear Power Corporation
Virginia Electric and Power Company

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SUMMARY OF COMMENTS

I. The Draft EIS contains fundamental errors as shown by the following statement:

> This Impact Statement is generic in nature and can be used by the Commission in any proceeding in which the issue is the health and safety aspects associated with special rather than regular train service.

This threshold statement creates problems throughout the entire Draft EIS. First, it mistakenly assumes that all three types of proceedings currently before the Commission concerning the transportation of radioactive materials involve special versus regular trains when in fact only one of the proceedings involves that issue; and secondly, it states that any action to be taken or not to be taken by the Commission is on the basis of health and safety issues, in spite of the fact that the Congress has given this responsibility to the Nuclear Regulatory Commission (NRC) and the Department of Transportation (DOT).

II. The Commission should rely on the expertise of other governmental agencies in areas in which the Commission is not expert in preparing Environmental Impact Statements. However, the manner in which the Commission has relied on the Draft Environmental Statement of the Nuclear Regulatory Commission in this case is inappropriate. That

approach tends to obscure the issues in these proceedings and could easily lead to misunderstanding of the impact by persons who are not sufficiently familiar with the subject areas to separate what is relevant from what is irrelevant. The manner in which the NRC document is used is inappropriate because that document is directed primarily to radioactive materials other than spent nuclear fuel and wastes and is concerned primarily with modes of transportation other than rail or highway. Further, the document is in draft form subject to change and the Commission does not really know what the final document will be or the conclusions which it will reach. While we do not believe it to be inappropriate to use such information as a base, the Commission's Environmental Affairs Staff, alone or with assistance from experts in the field such as NRC, should rewrite the Environmental Impact Statement using only the relevant portions of that and other documents, supplementing that information where necessary for these proceedings.

III. The properties of the spent nuclear fuel and radioactive wastes should be explained more fully in the Environmental Impact Statement in order to better assess the consequences of normal and accident conditions. The referenced descriptions which are in the Uniform Freight Classification 12 (I.C.C. 8) are primarily for identification purposes only and do not describe characteristics of

the materials essential for evaluating environmental effects.

IV. The containers are designed to meet rigorous standards set by NRC and DOT Regulations for performance under both normal and accident conditions. These regulations are very comprehensive and the containers undergo extensive evaluation to determine that they satisfy the conditions imposed on them. Substantial testimony by Government and other shipper witnesses in these proceedings indicate that these casks can survive any conceivable railroad accident. Conversely, the railroads have made no quantitative analysis of either accident conditions or of the effect of such conditions on these containers.

V. The Draft EIS consideration of alternative modes is inadequate because it does not consider in sufficient detail the impact of those modes of transportation. As described in testimony before the Commission, truck is not a viable mode for spent nuclear fuel and for most wastes because the containers, suited for regular train service, are too heavy to be transported by truck. While small truck casks could be used, they would increase the number of shipments by a factor of seven to ten. This would greatly increase the number of miles traveled, and the number of people involved in handling the cask at the reactor, reprocessing plant, and waste disposal site. It also would require

extensive changes to facilities (many already built) to accommodate the smaller casks.

VI. The definition of special-train service relied on by the Environmental Affairs Staff in the Draft EIS is not part of any published tariff nor is it binding in any manner on the railroads. Under the Special Freight Train Service Tariffs, the railroads could handle a shipment in whatever manner might suit their convenience.

VII. The Environmental Affairs Staff has improperly concluded that special trains will add some increment of safety. These is extensive evidence in the record that the risk of transporting radioactive materials in regular trains is no greater than in special trains.

VIII. The treatment of the commitment of future resources in the Draft EIS is inadequate. This commitment of future resources is dismissed as "infinitesimal in relation to total material resource consumption". The waste of natural resources which would be involved in the mandatory use of special trains is substantial today and will increase greatly in the future as additional reactors are put into service.

IX. The Draft EIS is incomplete because it does not include a balancing of the costs of the actions against the benefits allegedly to be derived therefrom. Based on a

balancing of the cost of the special-train service against the reduction of risks associated with the shipments, the imposition of mandatory special-train service is not justified even if such special-train service could completely eliminate the risks involved in the shipments, which it cannot do. We believe that a meaningful cost-benefit balance must be included as a part of the Final Environmental Impact Statement.

In order to assist the Environmental Affairs Staff in the preparation of an Environmental Impact Statement, detailed comments have been provided in the following sections.

I. Introduction

A. What is before the Commission

The Draft EIS prepared by the Environmental Affairs Staff of ICC Office of Proceedings ("the Staff") lists in the caption seven proceedings now pending which involve the transportation of radioactive materials by rail. It correctly notes that those proceedings are of three different types but it makes no effort to identify the specific environmental issues in each type of proceeding. On the contrary, it states:

> This impact statement is generic in nature, and can be used by the Commission in any proceeding in which the issue is the health and safety effects associated with special rather than regular train service. (Summary Sheet).

Underlying this threshold statement are two fundamental errors: (1) It incorrectly assumes that the environmental issue in all the pending proceedings (and in unidentified future proceedings) relates to the question of special trains versus regular trains. (2) It identifies as the environmental issue (and the only environmental issue) before the Commission in these cases the "health and safety effects associated with the special rather than regular train service" for the carriage of the radioactive materials involved, which is not an issue on which this Commission can properly pass. Moreover, the issues which are presented by each of

the three types of pending proceedings are more complex than the Draft EIS suggests.

One type of pending proceeding ("the Eastern railroads complaint proceedings") involves the refusal of the Eastern railroads to publish tariffs for the carriage of spent nuclear fuel and radioactive waste materials as those materials are defined in Items 80762-A and 80764-A of Uniform Freight Classification 12 (I.C.C. 8).[1/] These proceedings (Dockets 36312, 36313, 36330, 36335 and 36336) were commenced when five individual or groups of complainants, including the United States Energy Research and Development

1/ Item 80762-A defines spent nuclear fuel to be: "Fuel elements, nuclear reactor, irradiated and requiring protection shielding, also irradiated parts or constituents, in containers required by I.C.C. regulations, . . . , shipped to Atomic Energy Commission-owned or licensed sites for chemical reprocessing."

Item 80764-A defines radioactive waste to be: "Waste materials having no reclamation value, requiring protection shielding, or requiring radioactive-materials labeling, marking or placarding, in containers required by I.C.C. regulations, ..., shipped to Atomic Energy Commission-owned sites or to sites operated by contractors or licensees of the Atomic Energy Commission for disposal."

Due to changes in the law, the references to the regulatory authority of the Interstate Commerce Commission and Atomic Energy Commission should be changed to the Department of Transportation and the Nuclear Regulatory Commission, respectively. References to Atomic Energy Commission-owned or contractor operated sites should be to Energy Research and Development Administration-owned or contractor operated sites.

Administration ("ERDA"), filed complaints against the Eastern railroads under Section 13 of the Interstate Commerce Act.[2/] The Commission has consolidated these five proceedings, which present the single issue of the Eastern railroads' status as common carriers of spent nuclear fuel and radioactive waste materials.

A second type of proceeding now before the Commission is Docket 36307, Radioactive Materials, Missouri-Kansas-Texas Railroad Company, 36307(Sub. 1), 36307(Sub. 2) and 36307(Sub. 3) ("the M-K-T proceedings").[3/] The M-K-T proceedings involve that single railroad's announcements in the form of published tariff "flag-outs" that it would no longer participate as a common carrier in the rail transportation of spent nuclear fuel, radioactive waste materials, and other radioactive

2/ At page 3, the Draft EIS notes that the initial flag-outs were not protested. Most of these flag-outs occurred in 1962 and were not protested at that time because the nuclear reactor industry had not developed, as it has today, to the stage where reliable common carrier railroad service had become essential. The U.S. Government at that time was the only shipper of spent nuclear fuel and wastes, and it had separate arrangements with the railroads under Section 22. The flag-outs of the Chicago, Rock Island and Pacific Railroad Company and the Soo Line Railroad Company occurred more recently, but were not caught by interested shippers at the time. In fact, the Rock Island flag-out occurred on only five days notice.

3/ The Draft EIS does not mention Sub Nos. 1, 2 and 3 of Docket 36307. We assume this was inadvertent and that it was the intention of the Staff to include those sub-numbered proceedings as well. Sub No. 1 is entitled Empty Containers for Radioactive Materials, Missouri-Kansas-Texas Railroad

materials and containers therefor on which no other railroad has flagged-out. Similar to the Eastern Railroad complaint proceedings, the M-K-T proceedings present the single issue of the M-K-T's status as a common carrier of the involved radioactive materials and containers therefor.[4/]

The third type of pending proceeding is Docket 36325, Radioactive Materials, Special Train Service, Nationwide ("the Southern and Western railroads special train proceeding" or "the special train proceeding"). As accurately described in the Draft EIS (at 3), this proceeding involves the investigation of the Southern and Western railroads' proposal to impose a mandatory special train requirement upon

Company and is the M-K-T's flag-out from empty radioactive materials shipping containers if previously used to ship radioactive materials. (Item 20907 of Supplement 5 of Uniform Freight Classification 12 (I.C.C.8)).

Sub No. 2 is entitled Restricted Usage of Containers and Cars, Non-irradiated Cores and is the M-K-T's flag-out from cores or core assemblies or fuel blanket assemblies, nuclear reactor, not irradiated, with non-irradiated fuel or without fuel, in packages when shipments are made in containers and/or cars which have been used previously to ship radioactive material. (Item 30818 of Supplement 8 of the Uniform Freight Classification 12 (I.C.C. 8)).

Sub No. 3 is entitled Restricted Usage of Cars, Radioactive Materials and is the M-K-T's flag-out from radioactive material shipping cars moving on their own wheels unless such cars are empty and have not been used previously to ship radioactive materials. (Item 81295-C of Supplement 10 of the Uniform Freight Classification 12 (I.C.C. 8)).

4/ The Illinois Terminal Railroad, in Supplement 12 of Uniform Freight Classification 12 (I.C.C.8) has published its flag-out from spent nuclear fuel and radioactive wastes to be effective August 31, 1976. On August 26, 1976, the Suspension and Fourth Section Board voted to investigate this matter and assigned it Docket No. 36307(Sub. 4). A number of protests were filed.

all shippers of spent nuclear fuel and radioactive waste materials. The shippers would be required to request and pay for special train service as provided for by the special freight train service tariffs published by the Southern and Western railroads. As also noted in the Draft EIS, the Southern and Western railroads are not seeking to deny their common carrier status for transporting radioactive materials.

B. What the Commission Must Assess

An environmental impact statement generic to all the pending (and possible) Commission proceedings involving the transportation by rail of radioactive materials must consider a range of effects and alternatives. See 42 U.S.C. § 4332(C)(iii). The Draft EIS (at 3) thus is in error when it states that in the three types of pending proceedings ". . . the same basic question is presented, i.e., whether environmental and safety considerations justify the railroad's (sic) proposed requirement that spent nuclear fuel and radioactive waste materials move in special trains as opposed to regular train service." This basic misconception of the issues pervades the entire Draft EIS.

First of all, the issue of regular train service versus special train service is presented directly only in the Southern and Western railroads special train proceeding.

In that proceeding, the Commission, in assessing the environmental ramifications of mandatory special train versus regular train service, must consider a broad spectrum of impacts. For instance, the Commission must consider the immense added costs and the need for additional railroad equipment and other resources that would be irretrievably committed by the requirement of mandatory special trains. In addition, the availability of alternate transport modes must be considered (especially if costs of rail transportation encourage shippers to change modes). An essential element of this evaluation involves taking notice of compliance with the safety regulations established by the Department of Transportation ("DOT") and the Nuclear Regulatory Commission ("NRC") governing the transport of radioactive materials and the fact that such regulations govern the transport of radioactive materials.[5/] Needless to say, through the vehicle of an environmental impact statement, the ICC has not suddenly gained authority which it does not otherwise have to evaluate safety considerations and impose additional regulations.

5/ The correction of deficiencies in such regulations, if there are any, are for the DOT or NRC, the agencies empowered by law with exclusive authority to act in the public interest in the area of safe transportation of radioactive materials. See 10 C.F.R. § 2.802 (1975) and 49 C.F.R. § 170.11 (1975) (providing, respectively, that any person may petition the NRC or the DOT to issue, amend or rescind any regulation).

The M-K-T proceedings and the Eastern railroads complaint proceedings present different issues for the Commission to assess.[6/] These two types of proceedings will not decide what should be the characteristics of the respective railroads' operations in transporting any radioactive materials (such as by special train or otherwise), but will determine only whether those railroads have a common carrier duty to perform those operations. The ICC will be presented with the special train issue therein only if it determines in those proceedings that these railroads are common carriers of the involved radioactive materials and then only if these railroads seek to include a provision for mandatory special train service in their published tariffs[7/] and only if the Commission were to decide that the flag-out railroads must participate in the presently published tariffs. In these cases, the shippers seek a Commission determination that

6/ When the railroads in the Eastern railroads complaint proceedings filed their pleading in Docket 36313 entitled "Motion to Require the Commission to Prepare an Environmental Impact Statement," that motion was opposed by complainants. While the parties hereto are filing these comments, they have not abandoned their position that the railroads have not demonstrated how the mere resolution of the legal issues presented by both the M-K-T proceedings and the Eastern railroads complaint proceeding will constitute a major Federal action significantly affecting the quality of the human environment requiring the preparation of an environmental impact statement.

7/ If the M-K-T is denied the right to flag-out, it would remain subject to the existing tariffs applicable to the Western railroads (unless it deviated therefrom). If the Commission finds that the M-K-T and/or the Eastern railroads are private carriers and therefore that their flag-outs are lawful, the Commission will lose any power to control what the railroads may then do in connection therewith.

the railroads be required to carry the involved radioactive materials as common carriers. The alternative to be assessed is the denial of that relief, in which case there would be no tariff in effect requiring that these materials be shipped in either regular or special trains. In that case, the railroads could refuse altogether to transport these materials. In these two types of proceedings, the Commission should assess the potential impacts of permitting the respective railroads to refuse to serve as common carriers. The Commission should consider what the results of that alternative would be if shippers turned to truck transportation, which in itself might require basic changes in the entire nuclear fuel cycle. (A possible alternative result could be that shippers, in some cases, could arrange for transportation by the railroads in private carriage under conditions and at costs as to which one can only speculate.)

In assessing the environmental impacts in all three types of cases, the Commission needs to examine the extensive record being developed in the pending proceedings. Examination of this record will enable the Commission to reach more informed judgments about complicated issues which (especially in the nuclear field) may be outside the scope of the Commission's usual experience and expertise. Reference to the record also will serve to avoid inconsistencies.

C. What the Interstate Commerce Commission Lacks Authority to Implement

Regardless of the environmental impacts which may be associated with the instant proceedings, the Interstate Commerce Commission must be mindful of the fact that it lacks statutory authority to establish safety standards or to allow any common carrier (by rail or otherwise) to do so. The Federal regulatory framework governing the safe shipment and carriage of radioactive materials has been prescribed by the Congress, which has vested exclusive control over those activities in the Department of Transportation and the Nuclear Regulatory Commission.[8/] It is those two agencies and not the ICC or individual carriers which have been given authority to establish regulations and criteria to insure the safety of the public, including carriers and carrier personnel, as to the transportation of radioactive materials.[9/]

8/ The Draft EIS (at 6) has incorporated by reference the entirety of Chapter II of the NRC's Draft Environmental Statement on the Transportation of Radioactive Material by Air and Other Modes, NUREG-0034 (March 1976) ("the NRC's DES"). Chapter II of the NRC's DES summarizes the Federal regulations pertaining to the transportation of radioactive materials, and notes that such transportation is regulated by the NRC and the DOT. See NRC DES, pages II-1 to II-2. Some of the undersigned during the course of hearings previously held in the pending proceedings have submitted a memorandum of law which contains a detailed description of the comprehensive safety regulations promulgated by the NRC and the DOT (M-K-T Proceedings Exh. 1; Special Train Service Proceeding Exh. 1).

9/ The memorandum of law referred to, supra, note 8, contains a discussion of the Price-Anderson Act insurance

The railroads' basic position in the three types of proceedings is that, whether or not radioactive materials are tendered to them in compliance with applicable government regulations, they nevertheless may impose their own standards or refuse to transport the materials because they are unwilling to accept whatever risk their transportation might involve. This contention must be put in perspective. Radioactive materials are hazardous and their transportation involves some degree of risk (as does the transportation of other hazardous and even non-hazardous materials), but the hazards of transportation can be (and have been) reduced to acceptable levels.

The Congress could have determined that the risks involved are unacceptable and could have prohibited the development and use of atomic energy for peacetime purposes. After weighing this question very carefully, the Congress determined that the hazards could be controlled and that the benefits from its peacetime use would outweigh the risks involved in the development of a properly controlled nuclear industry. See 42 U.S.C. §§ 2011 et seq. The policy of the

policies and indemnity agreements whose "omnibus" features protect rail carriers without payment of premiums by the railroads. For the reasons stated in the memorandum, the ICC may not sanction the railroads' actions on the ground that the availability of the Price-Anderson insurance-indemnity system provided for in the Atomic Energy Act of 1954, as amended, together with other available insurance, might not adequately protect the railroads against risk of loss or liability.

Atomic Energy Act of 1954, as amended, and the Energy Reorganization Act of 1974 is to encourage the development of atomic energy by (1) providing for the steps necessary to reduce the hazards to an acceptable level and (2) making sure that it will not be burdened, in the name of safety, with restrictions on its use having little or no safety value but imposing a financial burden which would limit its development and use. To accomplish this objective, the Atomic Energy Act established a comprehensive system of licensing by the Atomic Energy Commission (now NRC). E.g., see 42 U.S.C. § 2201 (b).

Congress also understood that, if atomic energy were going to be developed, radioactive materials would need to be transported under regulations designed to accomplish the twin objectives of encouraging its development and reducing the hazards connected therewith to acceptable levels.

Section 834 of Title 18 U.S.C. at one time authorized the ICC to formulate regulations for the safe transportation within the United States of explosives and other dangerous articles, including radioactive materials. The authority conferred by the Transportation of Explosives Act, of which 18 U.S.C. § 834 is a part, has since been transferred

to DOT. 49 U.S.C. § 1651 et seq.[10] It is abundantly clear that, since passage of the Department of Transportation Act of 1966, the ICC has had no statutory authority to set transportation safety standards based on the hazardous nature of radioactive materials[11] and that it may not--directly or indirectly--undercut the jurisdiction of the NRC and DOT to establish such standards by allowing common carriers to deviate from the regulations established by those agencies.[12] That is exactly what the railroads would have the ICC do.

10/ The regulatory authority conferred on DOT was expanded and strengthened by the Transportation Safety Act of 1974, 49 U.S.C. § 1801 et seq.

11/ The Interstate Commerce Act, as amended, 49 U.S.C. § 1 et seq. (1970) contains no such authority. It is axiomatic that agency action cannot exceed or extend the scope of its statutory authority. Trenton Chemical Co. v. United States, 201 F.2d 776, 778 (6th Cir. 1953). In other words, the power of an agency "is circumscribed by the authority granted" by Congress. Stark v. Wickard, 321 U.S. 288, 309 (1944). The "authority granted" is determined in turn by the language of the statute and by its "aim and nature." FTC v. Bunte Bros., 312 U.S. 349, 351 (1941).

12/ In Burlington Truck Lines v. United States, 371 U.S. 156 (1962), the Supreme Court warned of the possible dangers when a Commission action intrudes upon another agency's jurisdiction. In examining an ICC case that involved the authority of the National Labor Relations Board, the Court stated:

> Implicit in this analysis is a recognition that if either agency is not careful it may trench upon the other's jurisdiction, and, because of lack of expert competence, contravene the national policy as to transportation or labor relations . . . the Commission must act with a discriminating awareness of the consequences of its action.

371 U.S. at 173, 174. Because the ICC unjustifiably intruded upon the NLRB's jurisdiction, the Court set aside the order of the Commission there at issue.

Congress has not only made it clear that DOT and the NRC are the sole Federal agencies granted statutory jurisdiction to regulate in this area; in both the Atomic Energy Act and the Transportation Safety Act it has specifically legislated that there are to be no varying or inconsistent regulations. Certainly, the railroads' position is at variance with the DOT and NRC requirements.[13/] It would make no sense for Congress to have expressed itself in the fashion it has if it had intended to allow carriers of hazardous materials to engage in regulation of the transportation of such materials.[14/] Thus, the ICC lacks authority to allow the railroads to establish their own regulatory framework for the transportation of radioactive materials.

* * * *

13/ It should be noted that carriers of hazardous materials have in the past imposed general restrictions on that carriage through the mechanism of a tariff in conformance with DOT requirements. Such restrictions must first be promulgated as regulations by the DOT (or the NRC) before being filed or accepted as tariff material. The nation's railroads have in the past followed this procedure in publising tariffs containing safety requirements. See, e.g., Rule 39 of the Uniform Freight Classification 12 as supplemented: R. M. Graziano's Tariff No. 29, I.C.C. 29. Particular operating restrictions for a limited time period may, of course be imposed in specific circumstances. See 49 C.F.R. § 174.575 and 49 C.F.R. § 1006.1. Cf. Airline Pilots Association, Int'l. v. C.A.B., 516 F.2d 1269, 1275-76 (2d Cir. 1975).

14/ That this is the course which the railroads must follow is pointed out in Kappelmann v. Delta Air Lines, Inc., No. 75-1830 _____F.2d_____(D.C. Cir., April 16, 1976). In that

In the following sections, we shall discuss the various matters which the Commission should consider in further assessing the environmental impacts associated with the transportation by rail of radioactive materials. These comments are an attempt to place the issues in focus and to eliminate misconceptions and inaccuracies which may have found their way into the Draft EIS.

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case, the plaintiffs sought an injunction requiring the defendant airline to give warning to prospective passengers on airplanes carrying a significant amount of radioactive materials. After reviewing at some length the legislative history of the Hazardous Materials Transportation Act, the Court sustained the judgment of the District Court which dismissed the complaint, stating:

> In conclusion, we hold that the trial judge properly invoked the doctrine of primary jurisdiction. The need for uniformity and a tribunal of special competence have been shown. It also appears that rulemaking is a more appropriate means of resolving the problems presented than is adjudication. Therefore, we affirm dismissal of the requests for injunctive relief. If appellants in the future desire to impose their suggested regulations upon any interstate common carrier of this limited category of hazardous materials, they must in the first instance request that the Secretary of Transportation or his delegate undertake a rulemaking procedure under section 105 of the Hazardous Materials Transportation Act, 49 U.S.C. § 1804 (1974 Supp.). Slip op. at 16-17.

Even in Delta Air Lines, Inc. v. Civil Aeronautics Board, Nos. 74-1984, et al. __F.2d__(D.C. Cir. June 22, 1976) where the Court determined that Congress had left in the Civil Aeronautics Board certain residual safety responsibilities, the court stated that the CAB ". . . should defer to the safety expertise of its sister agencies and accept the FAA/DOT position of safety as establishing both an inner and an outer limit in its safety jurisdiction." (Slip op. at 22.)

II. The Draft EIS Has Improperly Relied on a Nuclear Regulatory Commission Draft Environmental Statement Which (1) is Directed Primarily at Radioactive Materials Other than Spent Nuclear Fuel and Wastes and at Transportation Modes Other than Rail, and (2) is Still in Draft Form.

The Draft EIS has incorporated by reference the entirety of Chapters II through VII of the NRC's DES. While some portions of the NRC's draft document are pertinent to the issues before the ICC in these proceedings, most of the material is not pertinent to such issues.

The NRC's DES, which was published in March 1976, originally was prompted by concerns about the air transportation of radioactive materials. Even more to the point, the NRC's DES is addressed to concerns about the transportation through populated areas of radioisotopes and of plutonium and other special nuclear materials.[15/] Most of the calculations in the NRC's DES deal with these particular elements in the form of pure elements in a readily dispersible form. Although these elements are found in small measure in spent nuclear fuel and some wastes, they are tightly bound in the fuel matrix or are otherwise diluted and incorporated in a non-dispersible form. For this reason, neither

15/ The term "special nuclear material" ("SNM") is used to describe plutonium, and uranium enriched in the isotope 233 or in the isotope 235. See 42 U.S.C. §§ 2014aa ard 2071.

the tables reproduced in the Draft EIS nor the related discussion sheds light on the issues now before this Commission.

Wholesale inclusion, without explanation, of material from the NRC's DES, by reference or otherwise, obscures the information related to spent nuclear fuel and radioactive wastes and confuses persons who do not have sufficient background in this subject to recognize the distinctions between the commodities and the issues considered in the NRC's DES and those before the Commission in this proceeding. Therefore, to avoid the confusion which has been created by the incorporation by reference of large portions of the NRC's DES, the ICC should edit the NRC's DES and include only those portions which are pertinent to the radioactive materials involved in these proceedings. Further, editing alone will not suffice without additional work and the rewriting of some portions to provide the necessary framework and background for understanding the results set forth in the remaining portions of the NRC's DES. Moreover, even if the NRC's DES were pertinent, it is not final and is subject to change. For that reason alone, caution should be used whenever parts of it are referred to.

In addition to material in the NRC's DES which is relevant herein, detailed information, findings and conclusions about the rail transportation of spent nuclear fuel and radioactive waste materials are set forth in Environmental

Survey of Transportation of Radioactive Materials to and From Nuclear Power Plants, WASH-1238 (December 1972) (hereinafter "WASH-1238"). This document was prepared after a rulemaking by the former Atomic Energy Commission. It since has been supplemented twice by the NRC.[16/] Much of the material in WASH-1238 and its supplements is directly pertinent herein, so the Commission should consider incorporating it or, for clarity, quoting it in the final EIS.

Listed below are comments on the portions of the NRC's DEC which are germane and applicable to the rail transportation of the involved radioactive materials as well as comments pointing out which portions of the NRC's DES are not relevant or applicable. These comments include specific references to WASH-1238 and its supplements, including further information which should be considered:

1. Chapter II of the NRC's DES, while generic, contains much discussion that is neither relevant nor applicable to the present proceedings. The irrelevant discussions include the discussion of exempt quantities, low specific activity ("LSA") materials, Type A packages, shipment by aircraft, and safeguarding of special nuclear material ("SNM").

16/ WASH-1238 is Exhibit 15 in Docket 36325 and Exhibit 2 in Dockets 36307 et al. The first NRC supplement, NUREG-75/038 (April 1975), is Exhibit 16 in Docket 36325 and Exhibit 3 in Docket 36307 et al. The second NRC Supplement, NUREG-0069 (July 1976), has not been introduced formally in these proceedings at this time.

The Draft EIS should include a discussion of only those portions of the regulations applicable to the commodities covered by these proceedings, i.e., spent nuclear fuel and radioactive wastes, the package types for those commodities, and the modes of transport likely to be used, i.e., rail, highway and possibly water. Any discussion of or reference to Section J of the NRC's DES should be eliminated in its entirety because spent nuclear fuel is exempt from such requirements due to the high radiation levels associated with the unshielded spent fuel (NRC's DES page II-32) and radioactive wastes are not considered to contain sufficient SNM to require safeguarding. Guidance as to appropriate discussion of the regulations pertaining to these shipments can be derived from reference to the verified statements and cross-examination of ERDA and Industry Witnesses R. F. Barker, R. W. Peterson and W. E. Potts in Docket No. 36325.

2. Chapter III of the NRC's DES is also mostly generic but needs substantial revision to eliminate the references to radioisotopes and plutonium and to include the properties of spent nuclear fuel and radioactive wastes, the materials of concern in the proceedings now before the ICC. Specifically Table III-7 as now presented is totally inappropriate as it nowhere even mentions spent nuclear fuel and

radioactive wastes. Also, references to plutonium isotopes on page III-24 and in Figure III-2 (page III-26) of the NRC's DES are not applicable to the present proceedings, and thus should be deleted.

3. Only those portions of Chapter IV of the NRC's DES which are applicable to transport of spent nuclear fuel and radioactive wastes should be included in the Draft EIS and the sections now dealing with rail and highway transport should be rewritten to reflect the differences between the handling of spent nuclear fuel and radioactive wastes and the handling of plutonium and small packages of radioisotopes that now permeate the entire discussion. Specifically, the Introduction except for page IV-7 and portions of page IV-11 are pertinent. Section D-1 should be eliminated. The balance of the Chapter is a good outline if rewritten to reflect realistically the shipment of spent nuclear fuel and radioactive wastes. For example, the analysis should be based on a mid-1980's projection (i.e., 200-1000 MWe reactors), the known geographical locations of the reactors, that at least two reprocessing plants will be operating, and the waste disposal sites presently contemplated by ERDA. In addition, the TI in Table IV-7 (page IV-32) is too high and not representative of spent nuclear fuel and waste shipments by rail.

To the extent that the Draft EIS addresses the truck alternative, the radiation exposure penalty to the public from truck transportation should be quantified.

4. To the extent that Chapter V of the NRC's DES is generic with respect to risk analysis, it may be used. For example pages V-1 through V-8 may be used except that the figures on pages V-5, V-6 and V-7 should be modified or replaced with figures appropriate for the transportation modes of interest in the proceedings now before the Commission. In Section B (pages V-8 through V-26) only the Introduction and Subsections B.2 and B.4 are germane to these proceedings and they should be revised to assure that they properly reflect transportation of spent nuclear fuel and radioactive wastes. Section B.6, while good in theory, is not applicable in actual practice because of the extensive differences between the containers for radioisotopes and special nuclear material and those for spent nuclear fuel and radioactive wastes as well as the differences between the contents of such containers. Furthermore, the treatment of probability and consequences of accidents in special train vs. regular train service is totally inadequate for use in these proceedings. The Draft EIS suggests the conclusion that special train service will lead to lower risk. For reasons stated elsewhere in these comments, we believe this is misleading and without soun basis.

In Table V-6 of the NRC's DES (page V-5), Model I release fractions should be deleted from the Draft EIS: Both the spent nuclear fuel and radioactive waste casks referenced in the present proceedings far exceed Model I containment capability assumptions. Furthermore, on page V-26, NRC's DES states that ". . . typical containers are probably better than Model II would indicate." The analysis of consequences of rail accidents in WASH-1238 when updated by Supplement II is a reasonable but conservative estimate (design of the spent fuel casks that have been described in the present proceedings preclude possibility of the accident involving loss of fuel assemblies described on page 87 of WASH-1238). None of the references to other modes of transport and other commodities contained in this Chapter of the NRC's DES should be included in the Draft EIS. Tables V-1, V-2, V-3 and V-5, for example, deal with accidents involving aircraft, trucks, delivery vans and helicopters.

The references to plutonium (pages V-30 through V-53) are irrelevant and misleading in this proceeding. Tables V-16 and V-17 (pages V-52 and V-53) clearly show plutonium to be 98-99+ percent of the total transportation risk with the risk from spent fuel being from negligible to 0.1 percent of the total risk.

The NRC's DES Curie content and dose calculations for spent nuclear fuel in Tables V-8 (page V-35) and V-11 (page V-38) and related latent cancer fatalities (LCF) in Tables V-14 through V-17 (pages V-49 to V-53) appear to have been made prior to the calculations reflected in WASH-1238 Supplement II, which was published in July 1976. Therefore, the calculations in the NRC's DES need to be updated to reflect this later input. Tabulations such as Table V-18 (page V-58) of the NRC's DES should be deleted or revised to reflect spent fuel and wastes only. In general, as stated above, the individual dose calculation in WASH-1238 is more meaningful than the population dose and LCF calculation in the NRC's DES.

5. Applicable portions of the discussion of Alternatives in Chapter VI of the NRC's DES could be included in the ICC statement. Particular attention should be given to the discussion in the NRC's DES of use of special trains for spent nuclear fuel at pages VI-44 to VI-45 which indicates that the use of special trains does not appear to be cost effective for such shipments and that any alleged safety improvement is problematical at best and therefore does not support the ICC Staff's conclusion on special train safety benefits.

Potentially applicable sections of Chapter VI would include Section A Introduction (pages VI-1 through VI-4) provided that numbers are changed to reflect spent nuclear fuel and wastes. In Section B the only applicable parts are B.1-6 (pages VI-27 through VI-30), B.2-3 and B.3-4 (pages VI-41 through VI-45) and B.4 (pages VI-47 through VI-52) and then only if the discussion is limited to those parts applicable to spent nuclear fuel and radioactive wastes. Section C on the radiological effects of the alternatives would need extensive rework to separate the very small effects due to spent nuclear fuel and radioactive wastes from the effects of the other items. For example, only a single line in Table VI-31 through VI-33 is applicable to spent nuclear fuel shipments.

6. Inclusion in the Draft EIS of Chapter VII of the NRC's DES was improper. Security and safeguards requirements are not applicable to spent nuclear fuel and radioactive wastes. The NRC's DES (at page VII-1) specifically notes that there are only two groups of nuclear material that may require safeguarding: (1) certain strategic quantities and types of special nuclear material (SNM) such as highly enriched uranium and plutonium and (2) a few radioisotopes such as cobalt-60. Moreover, spent nuclear fuel is exempt from the safeguarding regulations by 10 C.F.R. 73.6(b), as specifically noted in the NRC's DES at page II-32.

III. A More Complete Description of the Properties and Characteristics of the Radioactive Materials Being Shipped is Needed Than That Provided in the Draft EIS.

The Draft EIS (at 1) references the definition of the principal radioactive materials involved in these proceedings in railroad tariff terminology as set forth in Items 80762-A and 80764-A of the Uniform Freight Classification 12. A more complete technical description is required for a proper assessment of possible environmental effects of both normal transportation and accident conditions.

The principal commodities covered in the proceedings are spent nuclear fuel and four types of radioactive wastes: namely, Low-Level Reactor Wastes, General Trash (GT), Hulls and Non-Fuel-Bearing Components (NFBC) and High-Level Waste (HLW).[17/] These materials are described below to assist the ICC in preparing a more complete definition of the commodities before the Commission in these proceedings.

A. Spent Nuclear Fuel

Spent, or irradiated, nuclear fuel as shipped consists of bundles of round zircalloy tubes filled with UO_2

17/ The M-K-T proceedings, as described in greater detail in note 3, supra, also involve both empty containers and cars used previously to ship radioactive materials and cores (cold fuel) or core assemblies. By any reasonable standards, the risk associated with the shipment of these commodities is even less than that associated with spent nuclear fuel or radioactive waste materials.

pellets (fuel pins), which tubes are seal-welded and mechanically bound together into a square assembly. The assemblies range in size from 5 to 9 inches square by 11 to 15 feet long and weigh up to 1,600 pounds. The tubing or fuel pins are retained in the square array by stainless-steel end fittings and intermediate inconel spacer grids.

The UO_2 fuel in the fuel pins consists of pressed and sintered ceramic-like pellets which have a high density (about 10-11 grams/cubic centimeter), high-melting point (about 4,000°F) and which are insoluble in water. The UO_2 is neither flammable nor explosive. Initially, the pellets are enclosed in the fuel-pin tubing in a helium atmosphere; during operation small quantities of fission-product gases such as krypton, iodine and tritium accumulate within the void spaces in the fuel pins. All other fission products remain tightly bound in the fuel pellets. The fuel pins are designed to withstand the external and internal pressures experienced during operation in the reactor. Radiation and heat release from spent nuclear fuel are such that both shielding and heat dissipation are required during handling and shipping.

B. Radioactive Waste Materials

1. Low-Level Reactor Wastes

Low level reactor wastes consist of radioactively contaminated resins and sludges which typically have been

solidified at the reactor by the addition of concrete or other materials such as urea formaldehyde and packaged in 55-gallon steel drums. These wastes are the residues left over from handling large volumes of very slightly contaminated water from such sources as reactor coolant, spent fuel storage pool water, and collection from floor drains in areas where potentially contaminated water could leak. The resins' principal function is to demineralize water and consequently to pick up radioactive minerals and contamination as well. The sludges result from evaporation of large volumes of water, thereby reducing the volume of wastes which must be disposed of. As indicated, these reactor wastes are in solid, immobile form packaged in steel drums with low radioactive material concentrations such that heat dissipation is not a significant problem.

2. General Trash (GT)

GT consists of a variety of dry solids which have become contaminated with radioactive materials in nuclear reactor and spent fuel shipping, handling and reprocessing operations. Such materials include metal, wood, paper, glass, plastics, clothing, shoe covers, wiping cloths or paper and air filters. Prior to shipment these materials will be classified and sorted according to subsequent disposition method

and destination and enclosed in steel drums. Since radiation levels from these materials are generally very low, most drums will not require shielding. Heat generation will be negligible in these shipment.

3. Hulls and Non-Fuel-Bearing Components (NFBC)

Hulls consist of short pieces of zircalloy fuel tubing remaining after chopping the fuel assembly into a dissolver tank and chemically removing the UO_2 fuel. The stainless-steel end fittings and spacer grids also remain with the hulls along with other non-fuel-bearing reactor components which may be received with the spent nuclear fuel. Occasionally, failed process equipment may also be included with the hulls. These materials are contaminated from reactor operation and are handled and enclosed in stainless-steel containers. While radiation from these materials is sufficient to require shielding, heat release is not a problem.

4. High-Level Waste (HLW)

HLW is the residual elements (fission products) remaining after chemically removing the uranium and plutonium from the spent nuclear fuel. The material is removed in liquid solution, but a special process will solidify the material and fix the elements, most likely in borosilicate glass. This glass will then be encapsulated in stainless-steel canisters for handling, shipping and disposal. The

glass is very stable, has a melting point of about 1,800°F and is insoluble in water. The stainless-steel canister provides further containment integrity during handling and shipping. Stainless-steel has a melting point of about 2,600°F). Radiation from the canisters requires shielding and heat release is such that heat dissipation is required during handling and shipping.

IV. Casks Designed to Meet NRC and DOT Regulations Will Withstand Severe Railroad Accidents.

The Draft EIS (at 4) cites the railroads' contention that the stress and accident tests performed on casks for the rail transportation of radioactive materials are not adequate in that the circumstances under which they are tested "do not approach actual railroad operating conditions." This conclusion cannot be supported as testimony in the special train proceeding indicates.[18/]

This section will discuss the regulatory requirements for these casks, the evaluations to which they are subjected, an analysis of how the casks will stand up in a railroad accident environment, and a description of the requirements for operation and maintenance of the casks.

A. The Federal Regulatory Program

1. DOT and NRC Regulations

The regulations of the Nuclear Regulatory Commission (10 CFR Part 71) and the regulations of the Department of Transportation (49 CFR Parts 170-179)[19/] contain stringent standards

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[18/] For example, see Exhibits 18-20 and 54-59 and associated testimony in the transcripts in Docket 36325.

[19/] An outline of some of the more important DOT regulations is attached as Appendix I.

and requirements designed to assure that the transportation of spend (irradiated) and/or fresh (unirradiated) fuel and radioactive waste from nuclear facilities will be carried out in a safe manner. These regulations, which are applicable to nuclear facility licensees and their carriers, place primary reliance on packaging to assure safety in transport. The regulations rest on the premise that most shipments of radioactive material move in routine commerce on conventional transportation equipment and are subject to the same transportation environment, including accidents, as non-radioactive cargo, and that the conditions of the transportation environment, including the probability of the shipment being involved in an accident, are, for the most part, beyond the shipper's control. The regulations are also premised on the principle that the public is best protected by making certain that only those shipments of radioactive materials which are safe enough to withstand transportation hazards are delivered to a carrier for transport.

The basic objectives of the regulations are to protect employees, transport workers and the public from external radiation in the transport of radioactive material under normal conditions and to assure that the packaging for radioactive materials is designed and constructed so that, under both normal and accident conditions, the radioactive material is unlikely

to be released from the packaging, or, if the container is not designed to withstand accidents, the contents are so limited in quantity as to preclude a significant safety problem if released. In accordance with these objectives, the regulations contain stringent standards and requirements to assure that radioactive material packages are designed and constructed to maintain, over their useful lifetime, the necessary design integrity (considering the type, form and quantity of radioactive contents) to prevent a significant loss of radioactive material from a package or a significant increase in radiation levels from a package, to assure nuclear criticality safety and to provide adequate heat removal. The regulations also place limitations on radiation levels on the outside of packages of radioactive material and include stowage and segregation provisions.

Irradiated fuel and nuclear waste must be shipped in Type B packaging, that is packaging which must be designed to withstand normal transport conditions without any impairment of normal operating capability and without loss of contents, increased radiation (levels) or reduction of heat dissipation capability and to suffer not more than the specified loss of contents, or increased radiation levels if subjected to the sequence of severe accident damage test conditions specified in 10 CFR Part 71. Those test conditions make up the design basis

accident for Type B packages, i.e., package designs which meet the criteria under these test conditions are considered by the NRC and the DOT to provide completely adequate protection to the public and operating personnel in transportation accidents (as well as under normal operating conditions).

2. Licensing of Packaging

Before these materials can be shipped, a "Certificate of Compliance" (COC) must first be obtained from the NRC on the packaging design and operational plans and then a license must be obtained from the NRC authorizing the user to deliver the material specified in the COC to a carrier for transport in the packaging. The NRC, through its office of Inspection and Enforcement, audits packaging manufacturers and users (licensees) to assure compliance with its regulations and with the specific conditions in the COC covering the packaging.

The COC is obtained only after an extremely rigorous and thorough safety analysis by the Applicant and independently by the NRC to assure that the packaging will withstand both normal and accident conditions in the transportation environment without creating radiological hazards which could cause death, injury, extensive property damage or unacceptable environmental impact. When necessary, analysis is augmented by testing of systems and components to achieve the desired level of confidence in the packaging design. In the case of the packaging to be used for shipping spent nuclear fuel, the

safety analysis proceeding between the NRC and the Applicant has taken many years for each packaging design and has resulted in thousands of pages of documentation. This indicates the degree to which the applicant and the NRC consider protection of the carriers and the public in general in transportation of these materials. At present, only six designs of casks have been approved by NRC for shipment of commercial irradiated nuclear fuel. The model numbers of those approved for shipment primarily by rail are the IF 300 (General Electric Company) and NLI 10/24 (NL Industries, Inc.). The packaging for radioactive wastes will undergo the same rigorous safety analysis prior to its approval for use.

There are many detailed requirements in the NRC and DOT regulations on structural integrity and containment. However, the principal requirement is that it must be demonstrated by analysis and/or testing that adequate containment is assured under both normal and accident conditions.

To satisfy normal condition requirements, the packaging must withstand continuous exposure, i.e., equilibrium conditions, to direct sunlight at an ambient temperature of 130°F in still air and continuous exposure to an ambient temperature of -40° in the shade in still air. See 10 CFR Part 71, Appendix A (1975). It must also withstand rough handling which is typified by a one-foot free-fall on an unyielding surface in an

attitude that produces maximum damage or other conditions representative of rough handling, and vibrations normally incident to the mode of transport.

Under these normal conditions (which are really fairly severe abnormal conditions) no release of radioactive material or coolant is allowed and shielding effectiveness must not be reduced. In addition, contamination of liquid or gaseous primary coolants must not exceed certain specified low levels.

Accident condition requirements are much more severe. The packaging must withstand very severe impact, puncture, fire and immersion in water test criteria. Impact is defined as a 30 foot free-fall onto an unyielding surface in an attitude that produces maximum damage. Puncture is represented by a 40 inch free-fall onto a 6 inch diameter pin, mounted on an unyielding surface; at an attitude to produce maximum damage. Fire resistance requirements are that the package withstand an exposure to an all-enveloping thermal radiating environment at 1475°F for 30 minutes and no external cooling for 3 hours thereafter. The package must also withstand immersion in water. The regulations require sequential application of the above conditions. The cask must be able to withstand immersion in water after it has been subjected successively to impact, puncture and fire conditions as described above.

Under these accident conditions, no release of radioactive material is allowed except for very small quantities of gases and contaminated coolant with the quantities allowed to be released based on the form and relative biological hazard of each isotope. In addition, shielding effectiveness must be maintained such that radiation levels do not exceed one REM/HR at three feet from the package.

While the packaging and transportation of spent fuel has been treated in great depth by NRC, ERDA and by the industry in the present proceedings, it has not been possible (nor necessary) to treat radioactive wastes in the same manner. This is primarily because detailed primary containment specifications and repository acceptance criteria have not been finalized by ERDA. Accordingly no final packaging designs have been developed and manufactured nor will there be any need to transport these materials for 2-3 years. However, we can nevertheless conclude at this time that the risks related to radioactive waste transportation will be even less than for spent fuel for the following reasons:

1. Fissile content is low.
2. Radiation levels from the wastes are lower because of smaller quantities of radioactive materials and longer delay times in the case of fission products from spent fuel. Accordingly, shielding requirements are less.

3. Heat release from the wastes is lower in the case of HLW and insignificant in the case of HULLS, NFBC and GT.

3. Operations and Maintenance

The NRC requires detailed procedures for initial acceptance testing, loading and unloading, routine testing prior to each shipment and periodic retesting of the packaging. These procedures are designed to assure that the packaging meets performance requirements initially, is loaded and prepared for shipment properly, and is adequately maintained. In particular, the packaging is inspected for any signs of damage, closure seals and valves are inspected, presence of reactivity control materials required in the design is confirmed and leak tightness is checked prior to each shipment. In addition, internal pressure and temperature are measured to assure that design limits are not exceeded and coolant activity and external radiation and contamination levels are measured to assure compliance with regulatory limits prior to each shipment.

B. Analysis of the Casks in a Railroad Accident Environment.

The environment existing during a rail accident is at best complex and one might ask how well the qualification tests contained in 10 CFR Part 71 duplicate those conditions. The tests are not intended to duplicate the environment, but rather

to produce damage equivalent to the most extreme and unlikely accidents. Because of unfamiliarity with the behaviour of structures during impact, misconceptions exist about the severity of the 30-foot drop test. It is important to emphasize, in the description of that test, that the cask must impact upon an "essentially unyielding target." An "essentially unyielding target" is defined by the International Atomic Energy Agency in Safety Series No. 6, Para. 708, as a "flat, horizontal surface of such a character that any increase in its resistance to displacement or deformation upon impact by the speciman would not significantly increase the damage to the speciman." In practice that has come to mean a target with a total mass at least ten times that of the object being tested with an upper surface covered by a minimum of 2 inches of armor plate. In addition, the concrete mass must be thick enough to prevent failure of the concrete upon impact. Tests conducted at Sandia Laboratories in New Mexico demonstrate that concrete alone is not an unyielding target and the use of concrete only for a target in contrast to steel covered concrete greatly will reduce the effective damage to the package.

In a test to evaluate the damage to packages which impact on realistic surfaces, as contrasted to the specified test surface, a 16,500 pound cask was dropped 2,000 feet onto undisturbed soil at a location just east of Albuquerque, New Mexico. The soil in this particular locality is

predominantly clay that has been undisturbed for a minimum of 25,000 years covered by a thin layer of very fine dust. Attempts to use a shovel on such soil are totally fruitless. The cask that was dropped landed upright on the soil and penetrated a distance of about 4 feet. The result of this test was essentially zero damage to the cask which was still serviceable, although there was some minor compaction of the lead. (Compaction of the lead occurs when the lead deforms to fill numerous small voids between the lead and the steel shells of the cask as the result of the large forces exerted on the lead during impact.) The result of this compaction was that the lead inside the cask moved away from the upper, flat surfaces of the cask by a distance of approximately 1/8 inch.

An identical cask dropped 30 feet onto an unyielding surface at Oak Ridge, Tennessee, showed more damage, including some weld damage, bulging, and lead compaction.[20/] While the cask dropped 30 feet onto an unyielding surface at Oak Ridge was not longer serviceable, it should be noted that the cask itself was not breached. Had it contained radioactive material, no material would have escaped. Had an accident causing damage of this severity occurred in actual use, there would have been no exposure of the source and thus no harmful radiation exposure to those people in the vicinity of this cask.

[20/] Note that this was an obsolete cask. Modern designs are stronger.

To understand why the 30-foot drop test is so severe, it is necessary first to understand (1) that what produces damage is peak deceleration and (2) that peak deceleration is a function of both the velocity of the object and the hardness of the target. In the 2,000-foot drop test, the shipping cask hit the ground at a velocity of 325 ft/sec (about 220 MPH) giving it a kinetic energy of about 2.71×10^7 foot-pounds. In contrast, when the same container was dropped on an "essentially unyielding surface," from a distance of 30 feet the kinetic energy of the cask was only 4.97×10^5 foot pounds. In other words, the cask dropped 2,000 feet had about 54 times the kinetic energy of the one dropped 30 feet. Since the cask with the lower kinetic energy suffered the most damage, damage must be due to a factor other than kinetic energy. That factor is peak deceleration.

It is difficult, in simple terms, to calculate peak deceleration but we can talk about average deceleration and the two are closely related. The average deceleration of an object impacting a surface in such a way as to absorb all of the kinetic energy involved, is equivalent to the square of the velocity divided by twice the stopping distance. Again, considering the two cask tests, the 2,000-foot drop onto undisturbed soil stopped the cask in about 50 inches while the elastic deformation (and thus the stopping distance) of the

"essentially unyielding target" in the second case was estimated to be about 1/10 of an inch. Thus, the calculated average deceleration for the 2,000-foot drop is 12,675 ft/sec^2 while the 30-foot drop resulted in an average deceleration of 116,160 ft/sec^2 or an average deceleration about nine times as great. Since it is the force exerted on the cask to produce the deceleration that causes the damage, there was more damage from a 30-foot drop onto an unyielding target that the 2,000-foot drop onto soil. Equating the 30-foot drop onto an "essentially unyielding surface" to the impact of a cask involved in an 80 mph railroad accident, the average decelerations would be equal only if the stopping distance in the accident case were about one-third of an inch' To stop in such a short distance is obviously incredible.

For realistic targets such as bridge abutments, natural rock outcroppings, etc., the fact that the surfaces of these targets are not flat, but have projections on them, can strongly influence the amount of damage caused. During the impact, these projections are loaded to the point of their failure, thus slowing down the container before its major impact with the surface. Such progressive failure of a target reduces the peak deceleration forces involved and, therefore, reduces the damage experienced by the container. In the railroad environment, there are simply no unyielding surfaces available. Even granite outcroppings do not approach the

unyielding nature of the targets used in these tests. Limestones and sandstones are even further from unyielding.

Equally as important is the fact that railroad equipment does not present an "essentially unyielding surface" for the transmission of energy during accident impacts. While it is true that a moving railroad train has enormous kinetic energy, that fact must be put into perspective. The enormous kinetic energy of a train traveling at high speed is absorbed without damage in the normal process of stopping the train by using its brakes. It is only when the forces causing the deceleration exceed the structural strength of the objects involved that damage begins to occur. An impact between a shipping cask and a locomotive will not produce significantly more damage to the fuel shipping cask if the locomotive is trailing a string of cars than if the locomotive alone hits the cask. One reason, for this is that the train is made up of loosely connected units, and not all of that kinetic energy can be brought to bear on a single point. Another reason is that the kinetic energy is dissipated by the crushing of the locomotive structure at the point of impact, by collapse of the column of cars, and by crushing of the softer structures within the train (i.e., railcars and crushable containers).

With respect to puncture or piercing conditions, the force developed in the design condition by the 6 inch diameter

steel pin varies from 1.5 to 4 million pounds. Again, there are no objects in the rail transportation environment of such small cross-sectional area and high strength that are so rigidly supported that they would not buckle or otherwise fail rather than inflict significant damage on the cask.

In the case of fire, initial flame temperatures of 2000°F are not uncommon in fires involving flammable liquids or gases and it is conceivable that sufficient quantities of such liquids in the general area of an accident could burn for more than one-half hour. However, the temperatures quickly fall to approximately 1600 degrees Fahrenheit because of the fuel-rich mixture in this type of all-enveloping fire. The overall average temperatures would be approximately 1500 degrees Fahrenheit which is quite close to design requirements. It is hard to conceive of a set of conditions in which the cask would be suspended in and completely enveloped by flames at higher temperatures such that the heat input to the cask would exceed that from the design condition. More realistically, the cask would still be on the car along the right-of-way and there would not be sufficient flammable liquids in the area of the car beneath or around the cask to fully envelop the cask in a fire. Even if the cask did come to rest in a large depressed area filled with a flammable liquid, the fully developed fire would be well above the cask and the area under and around the cask would be relatively cooler.

While the torching condition from a ruptured LPG tank car could create higher localized heat input, the overall effect on the cask would be no more severe than the all-enveloping test required by the regulations.

With respect to closure head and seal design, the NRC regulations, which require no release under normal conditions and allows release of only gases or coolants under accident conditions, results in very high integrity closure designs. In spent nuclear fuel casks, special metal seals are used and bolting arrangements can withstand internal pressure up to 7,000 psi before failure. The force required to fail the bolts and dislodge the closure head in these casks in 4 to 8 million pounds. It is inconveivable that such internal pressures or forces can be developed and cause release of spent nuclear fuel from the cask. Because casks for hulls, non-fuel-bearing components (NFBC), and high-level wastes will be designed to the same requirements, the same degree of containment integrity applies to containers for those wastes also.

The requirement that the containers withstand immersion in at least three feet of water for not less than eight hours following the other accident requirements is intended to assure that fissile material packaging (to which it is limited) would remain subcritical, even if subjected to immersion in water following the drop, puncture and fire tests. The test

is not intended as a requirement that the containers withstand external pressure. As a practical matter, the spent nuclear fuel and most radioactive waste containers have capabilities for withstanding external pressure that far exceed those which would be imposed by the tests because of the materials of construction and other design requirements. For example, spent fuel casks are routinely loaded and unloaded under approximately fifty feet of water. With the design features that are necessary to meet other requirements, the casks will withstand pressures several times those indicated by this test.

Thus it is clear that the casks can withstand any conceivable railroad accident. Because there are no "unyielding surfaces" in the real world, the stress and accident tests subject the casks to greater forces than they would receive in rail accidents. These tests are thus more than adequate to assure safety in transporting these materials.

V. The Diversion of Rail Shipments to Alternate Transport Modes is Impracticable, Would be Inefficient, and Would Involve an Unwise Use of Resources.

While the Draft EIS lists modal shifts as an alternative, it is not covered adequately either in the statement or by reference to the NRC's DES.

A. The Radioactive Materials Involved

1. Spent Nuclear Fuel and High-Level Waste

Due to the size and weight of shipping casks, rail has been recognized as a necessary mode of transportation for spent nuclear fuel and radioactive waste materials. Trucks cannot carry most of the containers required for these materials in the volumes necessary in the near future. Therefore, they must be shipped by rail. To ship the equivalent amount of spent nuclear fuel or high-level wastes contained in one rail cask by truck would require 7 to 10 cask loads. This results in an added expense not only in transportation but also in reactor and reprocessing facility operations. In addition, the overall transportation risk to the public would be increased because of the number of shipments and the increased miles traveled. For these reasons, large spent fuel casks have been developed which can be transported only by rail.

A commercial reprocessing plant is already located in Barnwell, South Carolina, and one is planned for Tennessee. The most cost-beneficial safe means of transportation must be available to move spent fuel from the reactor to these reprocessing plants, and that method in most instances is regular train service.

To design a reactor or reprocessing plant, it is necessary to know well in advance during the conceptual design stage, and certainly at the detail design stage, what containers and shipping casks are to be shipped and/or received and at what rate. This planning concerning transporation is started at least eight to ten years prior to the start-up of a plant. From the beginning, this planning has relied on the availability of economic rail transportation. This is necessary to get the cask and container shipping and receiving rate up to a plant throughput rate that is economically justifiable.

Reprocessing facilities today have been built to receive casks shipped primarily by rail. They cannot handle the additional number of smaller casks that would result from the truck transport. It would require a larger receiving and handling area along with more basins at the reprocessing plant. In fact, the AGNS commercial reprocessing facility at Barnwell, South Carolina, was designed and built according to such requirements for shipping spent fuel and high-level wastes

primarily by rail and the new, large reprocessing plant under consideration by Exxon Nuclear Company, Inc. for possible construction in Tennessee likewise plans to rely primarily on rail shipments.

A large reprocessing plant, like the Barnwell Plant in South Carolina or the Exxon facility, will have a reprocessing capacity of about 1,500 metric tons per year. They each will provide reprocessing services for services for 50 to 60 light water reactors, distributed over large areas of the United States. The investment to build such a facility would be about $1 billion today.

Insight into the amount of needed transportation can be obtained by considering the number of shipments needed per year for a 1,000 megawatt reactor. The 1,000 megawatt reactor is typical of reactors being built today and is used in calculations to obtain a magnitude of the shipping required per reactor year. At the ratio of 7 to 10 truck shipments to equal one rail shipment, about 60 shipments per year of spent fuel are required if trucks are used and about 6 to 9 shipments per year if rail is used. The ratio would vary slightly depending on the fuel elements shipped.

At a large reprocessing plant, this ratio becomes critical. For illustration, if truck shipments were used exclusively at a plant such as the AGNS Barnwell facility,

over 3,000 shipments per year, or 10 a day, of a 25-ton truck cask must be received and a corresponding number of empty casks shipped out. If the larger rail casks are used, those shipments drop to a reasonable number of only about 300 per year or 1 per day.

When waste shipments are added, this aggravates the already substantial logistic problem in moving these materials, adding to the larger cost of transportation containers, facilities and manpower. In addition, denial of rail service for transportation of spent fuel and wastes could jeopardize nuclear energy as a strong energy option for the United States.

Water transportation is an alternative that may be employed in the 1980's in connection with rail service. There are 115 reactors on navigable waters, but present and planned reprocessing plants will require rail service to get from the water to the reprocessing plant. There are isolated cases where neither rail nor water service is available and intermodal (truck-to-rail here) transportation will be required. Again, the rail option must be available for intermodal service. Because of the container size and weight, air transport is not an alternative.

2. Low-Level Waste

The only radioactive waste now moving is low-level waste in steel drums. ERDA's rail shipments of this commodity

even now exceed its spent nuclear fuel shipments. Truck transportation of low-level waste possibly could be an alternative. However, the truck alternative may not be as efficient in many cases, and should not be forced on the shipper by the unneeded and costly requirement of special trains for these shipments.

For example, Mr. Davidson of the Tennessee Valley Authority ("TVA") testified in Docket No. 36325 that by 1986, TVA alone could require shipment of 500 train car loads per year of these wastes. If these same wastes were shipped by truck, the number of shipments and the miles traveled would increase by a factor of two to three. Thus it is apparent that while truck shipments can and will be used for some shipments of these materials, there is substantial impact if the nuclear industry and the Nation should have either to rely exclusively on truck transport or to pay an exorbitant premium to use rail shipment. This is especially so when TVA's projections are extrapolated to include the entire Nation's requirements for low-level waste shipments.

B. The Waste of Resources

The use of truck transport rather than regular freight train service would be a waste of our natural resources. If all spent fuel traffic were shifted to truck, the diesel fuel waste compared to regular train service would be 10 million gallons

per year. Handling radioactive waste in this manner could be expected to double these estimates of diesel fuel waste. Regardless of the percentage of our total national consumption which these numbers represent, it is an unnecessary waste of energy at a time when energy and fuel supplies need to be conserved. Even in the context of our "total natural resource consumption," this can hardly be dismissed as "infinitesimal." Cf. Draft EIS at p. 19.

VI. The Elements of Special Train Service As Described in the Draft EIS Are Not Contained in Any Tariff.

The Draft EIS (at 4) lists what it finds to be the "major elements" of the special train service which the railroads are demanding as a mandatory requirement for transporting spent nuclear fuel and radioactive wastes. These "major elements" are described as follows:

1. "The carrier provides an engine, crew, and cabocse. . . . ;
2. "No other type of freight is handled. . . ;
3. "Special trains generally operate on a thru-service basis, by-passing freight yards and avoiding normal switching between railroads;
4. "Special train shipments have the flexibility to be routed around major population centers where feasible;
5. "When a train handling one of these shipments passes or is passed by another train, one train must come to a standstill while the other moves past; and
6. "Special train speeds are restricted to 35 miles per hour."

The provision in Supplement 3 of the Uniform Freight Classification 12, which imposed special train service on spent nuclear fuel and radioactive wastes, does not mention these "major elements". All it says is: "NOTE 5. - Ratings are applicable only on shipments moving in special freight

train service subject to provisions of applicable Special Freight Train Service Tariffs."21/

From this, it should be expected that the "major elements" of the special train service would be set forth in the Special Freight Train Service Tariffs referred to, but such is not the case. None of the "major elements" of special train service is contained in the railroads' Special Freight Train Service Tariffs, even though these Tariffs state the charges the railroads will exact for providing that service. These Tariffs say only that the railroads will furnish special train service "upon request" and "at their convenience". They define special train service only to mean "a train which is operated on an expedited schedule at a charge in addition to the applicable class or commodity rates".22/

These Tariffs do not articulate or require any of the "major elements" of special train service as described in the Draft EIS. For the Draft EIS to find that these "major

21/ This is Item 80769.5 of Supplement 3 to Uniform Freight Classification 12, ICC 8. It is quoted at Tr. 282-3 of the proceedings in Docket 36325.

22/ Southern Freight Tariff Bureau Tariff S-842-N, ICC S-1155, Item 120, 130; Western Railroads Freight Tariff 1-B, Items 120, 130. These Tariffs are attached to the Verified Statement of Walter E. Potts, which is Exhibit 24 in Docket 36325. Items 120 and 130 of these Tariffs are also quoted at Tr. 281-282 in Docket 36325. It should be mentioned that there is no definition of "expedited schedule" and no penalty if the scheduling is not expedited. Any implied assurance of expedited service is cancelled out by the provision that the trains will be operated at the carrier's convenience.

elements" will characterize the railroads' special train service is to write on sand that may shift in many different directions depending on the railroads' "convenience" in particular situations. Yet, in an effort to save themselves from a violation of Section 6 of the Interstate Commerce Act, the railroads have made clear in Docket 36325 that their special train service for spent nuclear fuel and radioactive wastes will be furnished only under those Tariffs.[23/] In fact, the railroads have sought to characterize such "major elements" as being merely operating practices or rules that normally are not published and that railroads are free to add to, subtract from, or totally ignore based on their sole discretion without any right of the shipper to object thereto.

Thus, those Tariffs are the railroads' mode of fixing the charges the shippers must pay for special trains, but they do not specify the service which the shippers will receive for their money. Shippers must therefore be content with what, in particular circumstances, proves to be at the

23/ This was stated by Counsel Phillips: "Your Honor, this proceeding is only concerned with special trains as defined in the tariff. If a particular road calls something else a special train, they cannot charge under the special train tariff, for it is against the law for any railroad to charge, except what is provided in the tariff. . . ." (Tr. 235).

The trouble is that these Tariffs are evidently designed to accomodate shipper request for special service and carrier and shipper joint agreement on the particulars of that service. The railroads are here putting those Tariffs to a purpose--mandatory, unilaterally defined special train service--for which they obviously were not intended and are not appropriate.

railroads' "convenience" in accordance with those Tariffs. That this is so is demonstrated on the record in Docket 36325 (see the testimony of the railroads' witnesses at Tr. 368 and 472 in that proceeding). That the shippers also are not likely to receive "expedited scheduling"--this being the one characteristic of special train service that is stated in the Tariffs--is also indicated in that record (see e.g., the railroad witnesses' testimony at Tr. 107 and 481 explaining when it will be the "special train" that will stop when it meets another passing train).

Doubt whether the "major elements" of special train service will actually materialize is increased by the ignorance which the railroads' witnesses displayed in Docket 36325 concerning the contents of the Special Freight Train Service Tariffs. Their testimony reveals their appreciation of special trains only in terms of operating practice, instructions to trainment, and the like, not derived from or confined by any tariff specification of the service (see, e.g., Tr. 106, 130-1, 150-1, 233, 302-3, 356, 425, 471).

For these reasons, the Draft EIS should be revised to state that there is no assurance that the described "major elements" of special train service (other than added charges) would in fact be provided in view of their absence from any publication in any tariff.

VII. There is no Substantial Evidence that Special Trains Add Any Increment of Safety.

The Draft EIS concludes that, because the accident probability is so small, the associated environmental impacts are not significant but that speical trains would provide "a small safety dividend" because they have an incrementally lower accident potential. The Draft EIS makes a number of assumptions regarding the nature of special train service and safety advantages of special trains, but no authority is cited for any of these assumptions. Apparently they are based, to a large extent, on the self-serving position paper issued by the Association of American Railroads referred to at footnote 7 of page 6 of the Draft EIS.

The nature of special train service and the relative safety of a cask car being transported in regular and special train service have been the subject of extensive testimony in Docket 36325. The picture there developed differs in essential respects from the unsupported assumptions in the Draft EIS.24/

24/ Reference is made specifically to Exhibits 27, 28, 60 and 61; the cross-examination of witnesses Garrick, Sperry, Eldridge and Power at Tr. 794 et seq., Tr. 1204 et seq., 1241 et seq., and 1131 et seq.; and the portion of the cross-examination of witness German at Tr. 140-152. It is also noted that, in response to a request by the attorney for the Southern Railway Company (Tr. 1138-1143), Westinghouse Electric Corporation has supplied data which shows that accidents have occurred in at least 20 Westinghouse shipments handled in special train service for the period August 1, 1970 to April 30, 1976.

Page 4 of the Draft EIS lists what the authors assume to be "the major elements of special train service". These are listed below, together with our comments:

1. The carrier provides an engine, crew and caboose. The radioactive material is contained in a 100-ton cask loaded on a flat car between the engine and the caboose.

This statement is reasonably accurate. However, where the movement is over more than one line, each carrier provides an engine, caboose and crew. It is possible, moreover, for more than one cask car to be carried in a special train.

2. No other type of freight is handled on these special trains, in order to prevent contamination of other freight being transported with the radioactive material. It is also possible that highly explosive or other hazardous materials, if transported with radioactive materials, might cause additional safety hazards.

It may be true that no other type of freight would be handled on the special trains, but the statement that the purpose is "in order to prevent contamination of other freight being transported with the radioactive material" has no basis ordinarily.[25] The reason that other materials ordinarily would not be handled in the special trains is that there would be no occasion for doing so. If some other material were to

[25] The Special Train Service Tariffs permit the railroads to add cars of other commodities.

be transported from the same origin to the same destination at the same time, there would be no reason for not sending it by the special train. Not even the railroads have argued that the prevention of contamination of other freight is the purpose or effect of using special trains.

The suggestion in the last sentence that special trains are safer because highly explosive or other hazardous materials are not transported in them with the cars of radioactive materials, likewise has no foundation. In regular trains, highly explosive or other hazardous materials are separated from cars of radioactive materials. DOT regulations prohibit the carrying of cars of explosives or other hazardous materials in close proximity to such cars in regular train service.

3. Special trains generally operate on a thru-service basis, by-passing freight yards and avoiding normal switching between railroads.

There is no basis for this statement. Special trains are operated at the convenience of the railroads. They must, moreover, change crews at regular terminal change points and locomotives and cabooses must be serviced where fuel, water, etc., are available. Further, much additional switching of these special trains could be required because of the speed or passing restrictions the railroads have indicated may be imposed on the special trains.

4. Special train shipments have the flexibility to be routed around major population centers where feasible.

Regular trains can be, and frequently are, routed around major population centers to avoid congested terminal areas. There is no reason to assume that special trains would avoid major population centers any more than regular trains do.

5. When a train handling one of these shipments passes or is passed by another train, one train must come to a standstill while the other moves past.

As already noted, there is no such requirement in the special train tariff and this may or may not be done. Even when done, it provides no additional safety, as discussed hereinafter.

6. Special train speeds are restricted to 35 miles per hour.

This requirement, likewise, is not contained in the tariffs and may or may not be observed. It is, moreover, an unnecessary restriction, as hereinafter set out.

Section 2.4 (page 7) of the Draft EIS cites a number of reasons why "institution of special train service may result in a reduction in the severity of accidents." The reasons cited are discussed below.

1. Because of the exclusive nature of the shipments, special trains have the flexibility to be routed around population centers. In the event that a nuclear

> incident occurred in transit, the amount of the population exposed to radiation might be significantly less if a special train, rather than a regular train, is involved. Special trains will operate on a thru-train basis and will avoid switching yards where possible. This will eliminate the need for cars carrying nuclear materials to wait at classifications yards or to sit on a siding until a full train is made up. By continuously moving, there will be less likelihood of theft or sabotage. Finally, establishment of thru-trains will decrease the total amount of time required to transport the shipments, thus reducing the statistical probability of accidents.

As already noted, there is no reason to assume that special trains would be routed around population centers any more than regular trains are. Regular trains avoid congested areas to the extent that they can do so feasibly and it must be assumed that special trains would follow the same routes. If the assumption herein is that special trains would be shipped over extremely circuitous routes in order to avoid population centers which trains must pass through when using normal routes, the result would be additional mileage and additional switching, with a concomitant increase in the risk of accident, costs and delays. Also, many of the secondary routings that undoubtedly would be used are not maintained in as good condition and, as indicated in the Draft EIS(p. 9), many accidents occur on such secondary track.

Moreover, the type of accident which occurs in moving through a congested area is generally minor in nature and the risk of a nuclear incident occurring in such an accident is so infinitesimal as to be non-existent for all practical purposes. The more severe accidents occur in the open country, and circuitous routing of a special train would increase not only the risk of accidents but the severity of accidents which might occur.

Special trains might avoid some switching but they require the same crew and locomotive changes as regular trains. Assuming that the special trains operate at slow speeds and stop to permit other trains to pass, the amount of switching to and from sidings could well exceed any amount of other switching avoided by their use.

The suggestion that there is serious danger in having a car of nuclear materials waiting in a classification yard is wholly without merit. Cars requiring special handling receive from railroad police a high degree of protection against theft and sabotage. They also receive a high degree of protection from switching accidents by reason of the careful transportation practices accorded them as set out in the railroads' Book of Rules and Special Instructions, including, for example, no humping, no switching without a locomotive attached, etc.

There is no basis for the conclusion that a car of radioactive materials will be transported more quickly

in a special train than in a regular train. Such trains are operated at the convenience of the railroad, and railroads with heavy traffic may encounter very substantial delays as scheduled trains are given priority. Moreover, as the number of spent fuel shipments increases and more and more special trains are required, situations undoubtedly will be encountered where locomotives and crews are not always available as needed.

2. As stated previously, special trains will be considerably shorter in terms of length than regular trains. This will enable train crews located in both the engine and the caboose to constantly observe the flat cars containing the radioactive material, something which is not possible on longer regular trains (due to track curvature). Other important factors to be considered are the type of equipment and the mixture of lading. Inasmuch as special trains do not haul different kinds of cargo and different equipment on the same train, there is less likelihood of a derailment or accident. The absence of other kinds of freight eliminates the possibility of radioactive contamination of other commodities. This also prevents the transportation of other hazardous or combustible materials with nuclear materials, which could result in excessively hot and long-lasting fires which might affect the protective casks containing the nuclear material.

Special trains will be shorter than regular trains but this does not mean that cars containing radioactive materials will receive any better surveillance. Such cars are not placed in the middle of long trains. The established

practice is to place them immediately before the caboose or with a buffer car between the radioactive car and the caboose. Occasionally such cars would be placed at the front end of the train behind the locomotive. In either case, the car would be subject to surveillance. There would be no necessity to have two crews in a position to observe it.

Whether the risk of derailment is greater on a regular train is speculative. A derailment rarely involves more than 15 or 20 cars and is more likely to occur near the front or middle of a train. If 80 cars pass safely over a section of track, it is unlikely that the 81st car will suffer derailment. It follows that a car at the rear end of a long train is relatively safe from derailment accidents. On the other hand, the possibility of derailments on special trains is increased if these trains are required to enter and leave side tracks frequently in order to permit other trains to pass. 26/

As previously discussed (see note 25, supra, and accompanying text), special trains might carry other material as well. Regulations do not permit radioactive materials to be placed in close proximity to cars containing hazardous or combustible materials. Moreover, the protective casks

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26/ The data supplied by Witness Power identified 27 derailments of 17 Westinghouse special trains for period August 1, 1970 to April 30, 1976. One shipment sustained 7 derailments.

are so constructed as to withstand any credible fire, further reducing any conceivable risk due to mixture of lading.

3. Many of the main line tracks in the Nation permit train speeds up to 70 mph. It is obvious, however, that a derailment or other accident will be much more serious in terms of damage to the cargo at higher speeds than at lower speeds. It is for this reason that special trains will be restricted to speeds no greater than 35 mph, thus reducing both the theoretical potential for accidents and the resulting damage. Although the vast majority of derailments occur at speeds less than 45 mph, derailments are most closely related to track conditions rather than to train speed (although trains operating over poor track are usually subject to slow orders). Consequently. most derailments occur on light density lines which exhibit poor track conditions.

It is true that accidents are more serious at higher speeds but the cask cars here involved are constructed to withstand the forces involved in a 70 mile per hour accident. Moreover, there is no occasion to ship cars of radioactive materials at such speeds. Most freight trains travel at speeds lower than 70 mph, and there is no reason why cars of radioactive materials cannot be handled in regular service on trains which move at normal speeds.

4. Another major cause of rail accidents is collision. Even though special trains will operate on rail lines which handle other trains, the railroads are requiring that when a special train passes or is passed by a regular train, one of the trains must come to a complete halt. The purpose of this precaution is to reduce the potential

for accidents which may occur as a result of train sway, and objects which fall or hang from regular trains.

The risk of damage from collision to a car of radioactive materials is substantially greater in special trains than in regular train service. In special train service, such a car is in a vulnerable position whether the collision is a head-on or a rear-end collision. In regular train service, if the car is at the rear of the train, it is as vulnerable to a rear-end collision as if it were in a special train, but it is protected from the effects of a head-on collision by the cars in front of it. Conversely, if placed at the front of the train, it would be as vulnerable as in a special train in the event of a head-on collision but would be protected from the effects of a rear end collision. In crossing accidents, where a train hits a truck or other object in the crossing, the car at the rear end of a regular train is, of course, protected, whereas it is vulnerable in a special train. If the car is hit from the side in a crossing accident, the type of train makes no difference.

Stopping a special train to permit others to pass is a precaution which is used only where the special train has an excessive width or an excessively high center of gravity. In such cases, there is a danger that train sway

could cause a collision. Cars of radioactive materials do not pose such a danger; they are not oversize and they do not have a high center of gravity so the danger in passing a train going in the opposite direction is no greater than for any other equipment.

If the risk of a wreck as a result of "objects which fall or hang from regular trains" had any substance (except where oversize loads are involved), this precaution would be required for most trains, regardless of the nature of the lading. Surely, if the danger from this was real the railroads would not be permitted to have passenger trains and freight trains pass each other at combined speeds of over 150 miles an hour, as they do, since the wreck of a passenger train under such conditions would be catastrophic.

To sum up the foregoing, there is no basis for the unsupported assumption in the Draft EIS that the use of special trains for radioactive materials would provide a "small safety dividend." If all the factors carefully are weighed, the conclusion might well be that transportation of radioactive materials in special trains is less safe than in regular trains.

VIII. The Mandatory Use of Special Trains Will Involve a Large Commitment of Resources in the Future.

The Draft EIS (at 19) notes that use of special trains instead of regular trains is "less efficient," but inappropriately dismisses this as having an "infinitesimal" effect on our total natural resource consumption. Contrary to this unsupported conclusion, two factors need to be considered:

1. Railroad equipment and manpower.
2. Differential fuel consumption via rail.

With respect to utilization of railroad equipment and manpower, which even now is in short supply, special trains will be wasteful. Furthermore, looking to the future, Volume 1 of the Federal Energy Administration's Project Independence Task Force Report entitled "Analysis of Requirements and Constraints on the Transport of Energy Materials" (November 1974) has identified as a critical uncertainty the railroads' capability to handle the necessary increased coal traffic. The FEA Task Force Report makes it clear that the railroads will be called upon to handle about twice the volume of coal by 1985, and it cites the uncertainty in the availability of equipment, manpower, and diesel fuel. It must be concluded, therefore, that the unnecessary and wasteful practices in the transportation of spent nuclear fuel

and wastes being proposed by the railroads at the same time they are being called upon to double their capability to handle coal is, to say the least, counterproductive and not in the national interest.

While it is not known exactly what a "special train" would be, the waste of equipment and manpower that such would involve is obvious. It takes the same locomotive, caboose, and crew to handle a special train as a multi-car regular train. The addition of a car of radioactive materials to a regular train would result in only an incremental increase in cost. In most cases, no additional crew or equipment would be required, and very little additional fuel would be consumed. It follows that use of fuel (and other resources) via special trains would be many times greater than in regular freight train service. Regardless of the percentage of our total national consumption which this use would represent, it is an unnecessary waste of energy.

IX. The High Added Costs of Mandatory Special Train Service Cannot be Justified When Compared to the Difference in Risk, if Any, Between Using Special Trains and Regular Trains for the Carriage of Radioactive Materials.

An essential part of an EIS such as that being prepared by the Commission's Environmental Affairs Staff is a balancing of the benefits to be derived from, or claimed for, the proposed action against the costs of implementing the proposed action. Such an analysis should be as objective as is achievable, free of emotion and other biases. In this connection, as quantitative a cost-benefit analysis as possible should be prepared in order to reach an objective decision.

In the instant case, the benefits claimed by the railroads (both of which are disputed by industry) are reduced risks resulting from accidents and expedited service. We have not attempted to quantify any benefit from expedited service since, in our opinion, it is problematical at best that any expedited schedules could be achieved with the restrictions, i.e., speed limits and stopping, that the railroads have stated they intend to impose.

In this section, a quantitative cost-benefit analysis is presented that shows the cost incurred for the shipment of spent fuel from nuclear power plants by special trains as

opposed to regular service [27] and the benefits, measured in reduction of risk, if any, that result from such expenditures. This cost-benefit analysis shows that special trains cannot be justified on the basis of risk reduction.

The risk calculations are based on an assumed average distance of 1,000 miles from a reactor to a reprocessing plant. Using that same 1,000 mile from a reactor to a reprocessing plant. Using that same 1,000 mile shipment, the added cost of the special-train service would be about $20,000 per trip at the current cost of about $20 per mile even if special trains are required only for the loaded movements. This would add millions of dollars per year to utility operating costs. These additional costs, when applied to both spent fuel and radioactive wastes and when escalated to 1986 dollars, could amount to more than $600 million annually by 1986.[28]

By comparison, using the NRC published value of $1,000 per man rem as the cost of radiation exposure, the total calculated risk using the very conservative values in Table 3 below is less than $1,000 per shipment for regular train shipments. The value of special-train service must then be measured against the reduction of risk, if any, that could be achieved by the

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[27] In light of the discussion of the differences between spent nuclear fuel and radioactive waste material at pages 29-33, supra, it must be concluded that the potential radiation hazard to the public from the rail shipment of other radioactive materials is substantially less than that from the rail shipment of spent nuclear fuel. This section, therefore, will focus its calculations on spent fuel.

[28] See testimony of Witness Peterson on July 30, 1976 in Docket 36325 (Tr. 1250).

use of special trains. In our opinion, it is doubtful that the use of special trains would result in any reduction in this risk, but even if special trains could eliminate this risk entirely (which they cannot), use of special trains still would not be justified based on a balancing of the costs to be borne against the alleged benefits to be derived.

A detailed explanation of the derivation numbers follows. In all cases, bases have been used which tend to overestimate the risks and which realistically reflect the costs involved.

Cost of Special-Train Service

The added costs of mandatory special trains contain a number of variables. For example, these variables include special train charges; cask use charges; rail freight tariffs; location of future reprocessing plants, storage facilities, and reactors; round-trip travel times; turnaround time for containers; frequency of container pickup and delivery by the railroad; container utilization; container capacity; and number of cars per shipment.

In order to gauge the economic impact of mandatory special trains, a number of the shippers involved in these proceedings have estimated the added costs that would be incurred.

George P. Rifakes of Commonwealth Edison Company has calculated the cost of shipping by rail all of the fuel to be discharged from 41 reactors during the 10-year period 1977 to 1986, both under the basic freight rates and with the added cost of mandatory special trains. See Exhs. 31 to 33 in Docket 36325. He estimated that in 1976 dollars the basic round-trip freight tariff costs of shipping spent fuel during this period would be $37,944,000 for the fourteen utilities involved. Adding the mandatory special train costs more than trebles this cost of shipping to $131,039,000. One-way shipment of spent fuel from these 14 companies for the same period of time would increase the basic freight costs from $20,176,000 to $66,723,000. By 1986 the annual round-trip added charges for special trains (in 1976 dollars) would be $14,105,000 and for one-way service an added $7,052,000. These figures represent only about one-fourth of all United States reactors planned to be completed by the mid-1980's.

The added costs of special trains even when considered from the perspective of individual utilities close to reprocessing plants are large. Duke Power Company has estimated that its added costs for shipment of spent nuclear fuel by special trains would be $1,527,300 for the period 1980 to 1990. See exh. 34 in Docket 36325. Virginia Electric and Power Company (VEPCO) has calculated that the added costs for shipment of spent nuclear

fuel in 1988 when all reactors currently planned are in operation will be $443,000 with freight rates at the 1976 level. Carolina Power and Light Company (CP&L), whose Robinson and Brunswick nuclear units are only 132 and 228 rail miles, respectively, from Barnwell has determined that its additional costs for special train shipments of spent nuclear fuel would be approximately $260,000 per year in 1976 dollars. See Exh. 36 in Docket 36325.

The Tennessee Valley Authority (TVA) has estimated that the requirement for use of special trains for spent nuclear fuel would add about $1,400,000 per year to TVA's transportation costs during the late 1980's. See Exhs. 29 and 30 in Docket 36325. If special trains are required for shipments of radioactive wastes from its nuclear power plants, TVA has estimated that such could result in additional costs to TVA of as much as $1,000,000 per year. When this amount is added to the special train costs for transporting spent nuclear fuel, the total annual additional cost to TVA amounts to $2,400,000.

Allied-General Nuclear Services (AGNS) has evaluated the costs for both spent nuclear fuel and radioactive waste shipments that will be required for its reprocessing plant at Barnwell to operate at its design capacity. See Exh. 24 in Docket 36325. AGNS has estimated that the increased cost of

special trains for spent fuel shipments alone will be from some $3,000,000 per year if more than one car per special train is shipped to some $6,100,000 per year if only one car is shipped per train. Special train charges for waste shipments could range from $4,900,000 to $26,800,000 per year depending upon the destinations and the use of single or multiple car special trains.

General Electric Company and a number of its electric utility customers are involved in transactions relating to the transportation of up to 4,200 metric tons (uranium weight) of irradiated nuclear fuel over the next ten years. If all of the material is shipped to storage using the General Electric IF-300 cask, the cost of regular freight service will be about $8,000,000. The use of special trains with one cask per movement would add nearly $21,000,000 to the cost. The stored fuel ultimately will have to be moved again for reprocessing, thus further increasing the transportation costs. The waste generated by 4,200 metric tons of fuel will be transported by rail for disposal. The cost of these waste movements is estimated at $5,000,000 for regular freight service with the cost of special trains estimated at $15,000,000. There is an additional cost to General Electric which is more difficult to estimate, namely that associated with loss of cask lease

revenue. Its IF-300 casks are offered to the utility industry for lease service in railroad transportation. Unreasonable restrictions on the use of this equipment, such as mandatory special train service, will cause those potential customers who can do so to shift their business to less efficient but less costly transport modes. At an approximate daily lease charge of $3,000 it is easy to see that a significant amount of lease revenue could be lost. The four existing IF-300 casks at full utilization would bring in about $4,000,000 per year. If the imposition of special trains resulted in a 50 percent reduction in utilization, over a ten-year period this would be a $20,000,000 loss in lease revenue. See Exh. 54 in Docket 36325.

The added costs to the Federal government also must be taken into consideration. The U.S. Energy Research and Development Administration (ERDA) has already stated that its additional costs from transportation of spent nuclear fuel will be significant. ERDA has calculated that its costs will increase as much as five times on shipments in the lower (75,000 to 100,000 pound) weight range. See Exh. 21 in Docket 36325.

All of the costs presented above are in 1976 dollars except as otherwise indicated. The U.S. Department of Labor, Bureau of Labor Statistics Price Indexes for Total Railroad Freight indicate that the cost of shipping goods by rail in the

United States has nearly doubled since 1969. Mr. Reuben Peterson, testifying before the ICC on July 30, 1976, stated that the use of special trains for 200 nuclear reactors in the 1980's would add $600 million annually in transportation charges at escalated dollar value. See Tr. 1250-55 in Docket 36325.

The added expense of special trains can be computed on a per shipment basis or a cost per mile basis. Section B.2-4 of Chapter VI of the NRC DES, which has been incorporated by reference into the ICC DES, estimates the cost of a spent fuel shipment involving seven fuel elements by special train to be $24,000 versus $9,000 by regular freight train. The existing special train tariffs indicate that the normal additional per mile charge is between $18.93 and $20.24 (requiring a 110-mile minimum).

The risk calculations that follow are based upon a 1,000-mile trip. Using the 1,000-mile trip as a standard, the extra charge per shipment would be about $20/mile x 1,000 miles, or $20,000. This cost figure thus provides a convenient basis for comparing cost and benefits.

Calculation of Risk

Based upon railroad statistics developed through the years and analyses prepared by the United States Government,

calculations of risk and its reduction by use of special trains has been estimated. The approach to this calculation has been to use conservative or upper-bound assumptions rather than what would be more realistic assumptions in order to eliminate any argument concerning the assumptions. The basis for the calculation is as follows:

(1) Spent fuel shipment mileage -- 10 shipments per reactor year at 1,000 miles each (10,000 miles per reactor year).

(2) Accident rate -- One railroad accident per 1,000,000 miles, or each 1,000 shipments.

(3) Accident rate per reactor year -- Multiplying 10,000 miles per reactor year times one railroad accident per 1,000,000 miles yields a figure of one railroad accident per 100 reactor years.

Following the method of the Environmental Protection Agency study,[29] three categories of accident severity are used: minor, moderate and severe. Based upon the data used in that study, probabilities for each category of severity given an accident are as follows:[30]

P (minor/accident) = 0.909
P (moderate/accident) = 0.09
P (sever/accident) = 0.001

Thus, (for example) one accident in a thousand, or one accident in a hundred thousand reactor years, is severe.

Next, four categories of release of radioactivity are established: none, small, medium, and large. These

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29/Transportation Accident Risks in the Nuclear Power Industry, 1975-2000, U.S. Environmental Protection Agency, NSS 8191.1 (November 1974). (Exhibit 28 in Docket 36325.)

30/"P (minor/accident)" is read as follows: The probability, given that an accident has occurred, that the accident is minor.

categories are defined in terms of the amount of radioactivity which might be released, according to the following table:

Table 1

Release Categories

Amount of Radioactivity, in Curies,[31/] Defined to be Released in the Various Release Categories

Radioactive Material Released	Release Category		
	Small	Medium	Large
Kr-85	108	5,400	10,800
I-131	.0014	.070	.14
Other Fission Products	130	6,500	13,000

The more severe the accident, the more likely a large release. This is expressed in the following table of c conditional probability of release category given an accident of a certain severity:

Table 2

Conditional Probability of Release Category Given Accident Severity Category

Release Category	Accident Severity		
	Minor	Moderate	Severe
None	.988	.986	.982
Small	.0092	.01	.013
Medium	.0023	.0027	.0034
Large	.00097	.00011	.00015

31/ A unit quantity of any radioactive nuclide in which 3.7×10^{10} disintegrations occur per second.

Combining Table 2 with the probabilities of accident, the conditional probabilities or release given an accident may be estimated as follows:

P (none/accident) = 0.988

(Example: .988 x .909 + .986 x .09 + .982 x .001 = .898 + .089 + .001 = .988)

P (small/accident) = 0.0093
P (medium/accident) = 0.0023
P (large/accident) = 9.8×10^{-5}

Or, in round numbers:

probability of no release given an accident	= 99%
probability of small release given an accident	= 1%
probability of medium release given an accident	= 0.2%
probability of large release given an accident	= 0.01%

Thus, one out of 100 accidents will result in a small release of radioactivity, one in 500 in a moderate release, and one in 10,000 in a large release.

If there were a release of radioactivity, the consequences would depend upon the number of people in the vicinity, the wind speed at the time, etc. The net effect

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Continuation of footnote 31.

which 3.7×10^{10} disintegrations occur per second.

of these variables has been computed in WASH-1238 and has been presented in an appendix of WASH-1238. Table 3 herein, which is a summary of the probability of a given number of people receiving a given dose from an accident for each trip, is derived by using the results in that appendix of WASH-1238, and especially Table 7 and Figure 5 therein, and combining those results with the release definitions of Table 1 herein, and with the release probabilities stated above.

Table 3[32/]

Probability, in a 1,000-Mile Train Shipment of Spent Nuclear Fuel, That N or More Persons Will Receive D or More Dose to the Whole Body From Gross Fission Products Which are Released in an Accident During This Shipment and Which Deposit (I.e., Fallout) on the Ground[33/]

Number of People	Dose, Millirems						
N	1	10	10^2	10^3	10^4	10^5	10^6
1	$1x10^{-5}$	$1x10^{-5}$	$1x10^{-5}$	$1x10^{-5}$	$9x10^{-6}$	$4x10^{-6}$	$1x10^{-6}$
10	$1x10^{-5}$	$1x10^{-5}$	$1x10^{-5}$	$9x10^{-6}$	$4x10^{-6}$	$2x10^{-6}$	$5x10^{-7}$
10^2	$1x10^{-5}$	$1x10^{-5}$	$8x10^{-6}$	$5x10^{-6}$	$2x10^{-6}$	$1x10^{-6}$	$9x10^{-8}$
10^3	$1x10^{-5}$	$9x10^{-6}$	$6x10^{-6}$	$2x10^{-6}$	$7x10^{-7}$	$1x10^{-7}$	$4x10^{-9}$
10^4	$1x10^{-5}$	$7x10^{-6}$	$4x10^{-6}$	$1x10^{-6}$	$2x10^{-7}$	$1x10^{-9}$	
10^5	$9x10^{-6}$	$6x10^{-6}$	$2x10^{-6}$	$4x10^{-7}$	$1x10^{-7}$	$6x10^{-10}$	

32/ Based upon Table 7, in WASH-1238.

33/ Exposed persons are assumed to remain in the contaminated area for one year and it is assumed that there is no loss or cleanup of radioactivity from the ground. 50 percent of the dose is to the skin.

Table 3 is essentially a calculation of the risk surface[34/] in tabular form for regular train service. Thus, it says, for example, that in a 1,000-mile shipment, the probability that there will be an accident which will result in 100 (10^2) or more people receiving a dose of 1 rem (10^3 millirem) or more as a result of fission product fallout is 5×10^{-6}, i.e., one chance in 200,000 shipments of spent fuel.

The numbers in Table 3 may be put into context by comparison. For example, a typical medical x-ray is of the order of 10^2 to 10^3 millirems. The threshold for observable effects from whole body radiation is 50 rems, or 50,000 millirems. Therefore, the millirem doses in Table 3, which are doses resulting from an accident, become biologically significant only somewhere between the 10^5 and 10^6 column.

The curve for special train service must be computed so that the difference between the two curves, which is risk reduction, can be measured against the cost of the reduction. However, the risk surface for special trains cannot be calculated in a definitive way, since no statistical data have been presented on accident rates for special trains. There are only some

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34/ See Appendix II. More accurately, Table 3 represents an upper bound to the risk surface. It assumes, in a "large" release, a release of radioactivity 100 times greater than that assumed in WASH-1238, Table 7. Table 3, moreover, assumes no evacuation or cleanup or natural dispersion for a period of one year. Moreover, since 80 percent of the dose in Table 3 is to the skin, and the threshold for biological effects is 50 rem, the doses in Table 3 become biologically significant only between the last and next-to-last columns (10^5 and 10^6 millirems).

opinions by railroad personnel to the effect that these rates are lower. Cask cars on special trains are more vulnerable to collision damage than on regular trains and it may be that the risk for special trains is actually higher than for regular trains.

Thus, a definitive risk curve for special train service cannot be calculated, and a convincing argument cannot be made that this curve is lower than the regular curve. Thus, it cannot be said that there is in fact a reduction in risk.

However, the maximum possible reduction in risk would be to eliminate the risk entirely. Even if the risk in special trains were absolutely zero, the maximum reduction in risk is the risk that exists in regular trains, i.e., Table 3. The maximum possible reduction in risk in such an unlikely situation then would be the difference between the probabilities presented in Table 3 and zero. It is infinitely more likely that the difference in risk between special and regular trains is much less than the difference between the probabilities presented in Table 3 and zero. Because elimination of even this gross upper bound risk reduction is not worth the price of special trains, the actual risk reduction is, a fortiori, not worth it.

Conclusion

We may now ask: Suppose the reduction in risk is all of that shown in Table 3; would that be worth $20,000 per shipment?

The number $1,000 per man-rem is currently being used by the Nuclear Regulatory Commission as a measure of the

detrimental value of radiation.[35] It should be noted that the use of this figure is conservative, because another distinguished study estimated the figure at $12-$120 per man-rem.[36] Based upon the use of $1,000 per man-rem, Table 3 would imply an expected detriment of less than $1,000, far below the $20,000 per shipment cost.

Thus, Table 3 illustrates that the expected detriment per shipment is extremely low. These figures illustrate the point that the railroads are proposing protection against risk which exceeds any possible loss that might result.

There is, of course, no assurance that special trains decrease risk -- their use may in fact increase it. Special trains should not be used, of course, unless it can be persuasively shown that their use decreases risk. But even if it is assumed that the use of special trains does decrease risk, they should not be used unless that benefit (decrease in risk) exceeds their cost. We have, however, demonstrated that costs exceed any possible benefit to be derived from the use of special trains. Thus, the conclusion is inescapable, in light of the above cost/risk/benefit analysis, that special trains are an unjustified and unreasonable alternative.

35/ 10 C.F.R. 50, Appendix I, Sec. II D (1976).

36/ "The Effects on Populations of Exposure to Low Levels of Ionizing Radiation", Report of the Advisory Committee on the Biological Effects of Ionizing Radiation, National Academy of Sciences (1972), p. 70.

Respectfully submitted,

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CERTIFICATE OF SERVICE

We hereby certify that on this 30th day of August, 1976, we served copies of the foregoing Comments on the Draft Environmental Impact Statement upon all parties of record in Docket Nos. 36307, 36307 (Sub 1), 36307 (Sub 2), 36307 (Sub 3), 36312, 36313, 36330, 36335, 36336 and 36325, and upon other persons known to be interested, by mailing copies of the same to them, postage prepaid, in accordance with the General Rules of Practice of the Interstate Commerce Commission.

JAMES F. BROMLEY

OMER F. BROWN, II

JOHN F. DONELAN

JOHN K. MASER III

DOCKETED USNRC
SEP 8 1976
Office of the Secretary Docketing & Service Section

APPENDIX I

Outline of Department of Transportation (DOT) Regulations

The DOT regulations deal primarily with shipper and carrier responsibilities in preparation of the package for shipment; external temperature, radiation and contamination limits, labeling and placarding, and certification; and with transportation requirements, restrictions, and emergency notifications during shipment. The DOT, in keeping with the Memorandum of Understanding with NRC, accepts the adequacy of packaging for which NRC has issued a COC. Some of the more important DOT regulations are:

Temperature [49 CFR 173.393 (e)2]	For sole-use rail cars, the maximum allowable temperature of accessible surfaces is specified.
Radiation - [49 CFR 173.393 (j) and 173.29(e)]	For sole-use rail cars loaded, the maximum allowable radiation levels around the car are specified. Empty packaging is limited to 0.5 mrem/hr on contact.
Contamination - [49 CFR 173.393 (h), 173.29(e) and 174.566(d)]	No "significant" removable surface contamination on the exterior of the package. Significant is rigorously defined in the regulations. Also, limits on rail car contamination are specified.

Loading and Testing - [49 CFR 173.393 (m)]	Reiterates and reemphasizes NRC requirements on proper loading and testing prior to shipment.
Labeling and Placarding - [49 CFR 173.399 173.402(a), 173.416 and 174.541(b)]	The package must be labeled according to its contents and the vehicle must also be placarded to make persons aware of the contents of the shipment.
Certifications - [49 CFR 173.427, 173.430 and 174.510-511	The Bill of Lading given to the Carrier must include the information specified regarding the contents and packaging and certification that the contents have been properly classified, described, packaged, marked, labeled and are in proper condition for transportation according to DOT regulations.
Mixing and Handling Radioactive Materials with Other Hazardous Materials - [49 CFR 174.527, 532(j), 538, 586(h), 589(m)]	Controls are placed on the Carrier to avoid the presence of explosives or flammable materials in close proximity to radioactive materials both in a train and while standing

in a terminal. The primary intent of these controls is to minimize the possibility of explosion or fire caused by other materials in the train in close proximity to radioactive materials.

Routing and Movement - [49 CFR 174.582]

Carriers are required to assure that shipments go forward promptly.

Accidents - [49 CFR 171.15-16 and 174.588(c)]

Carriers are required to notify DOT and the Shipper immediately in event of serious accident or fire, breakage, spillage or suspected contamination involving radioactive materials and are advised to notify the AAR and ERDA for assistance, if needed. Both ERDA and Shippers are prepared to make available promptly any assistance that is requested.

DOCKETED USNRC SEP 3 1976 Office of the Secretary Docketing & Service Section

Appendix II

Decision Theory and Its Application To the Special Trains Case

Outline of Decision Theory

A concise, yet quite general, presentation of the ideas of decision theory is contained in the diagram of Figure 1 which shows the anatomy, or structure, of a general decision problem. At the point of decision we have various "indications" or items of information. With this information we are faced with choosing between the various decision options A, B, C, . . . etc.

If we knew what the outcomes of the various options would be, we would have little trouble making a choice. What makes the problem interesting is that there are a number of possible outcomes, or ultimate results, from each decision option. So at this point the diagram represents the range of possible outcomes coming from each decision option and indicates the probability (likelihood) of each such outcome. Thus, if option A is chosen, the probability is p(A1) that the outcome will be A1, p(A2) that it will be A2, and so on.

Each outcome, if it occurs, does not have just a single effect; it usually has a number of effects -- effects on people, property, environment, costs, etc. In general then, one can make a list of all these effects or impacts. This list is what we call the impact "vector"

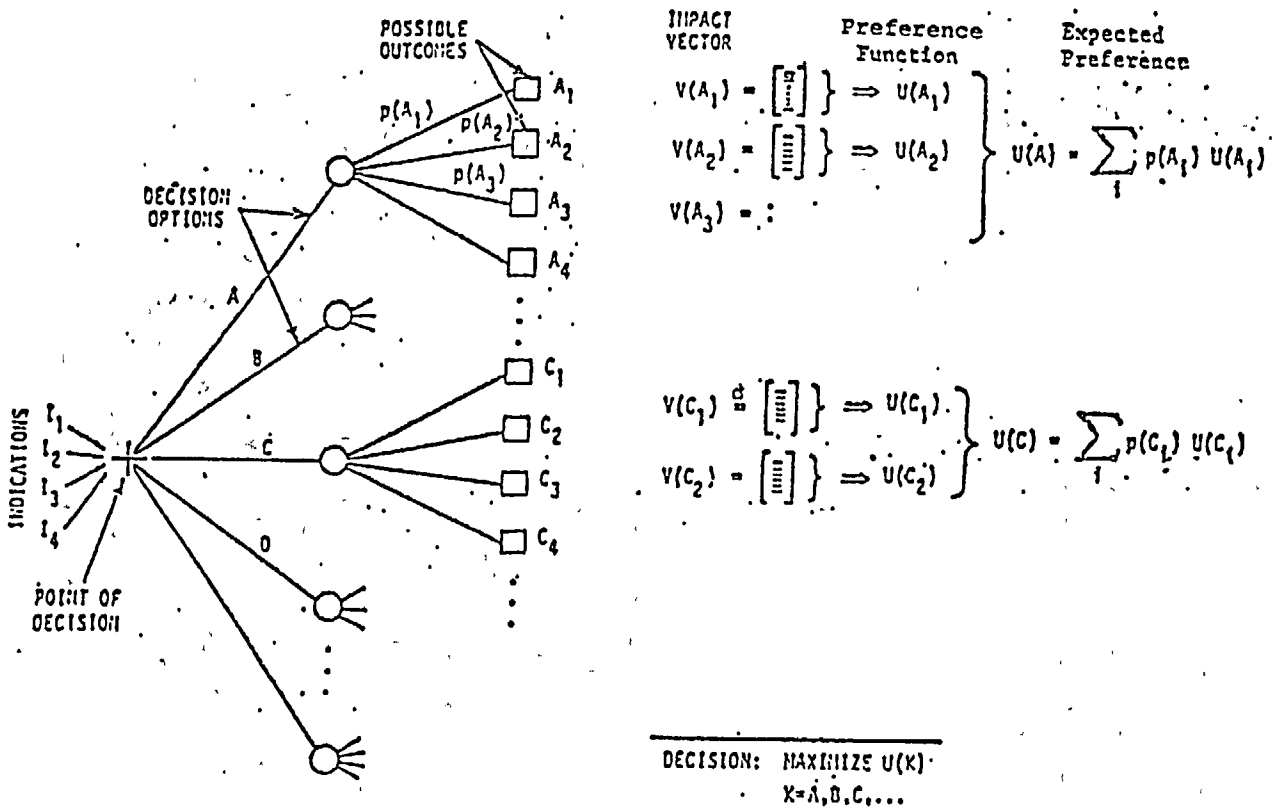

FIGURE 1. ANATOMY OF A DECISION

where the word vector connotes, as usual, that we are talking about a multiple valued, rather than a single valued, quantity.

In general, certain of the impacts, i.e., the individual items in the list, will be desirable, and some will be undesirable. Yet they come all together as a set in the impact vector. The set as a whole then may be desirable or undesirable and any given set may be more or less desirable than any other set. Thus, with respect to the collection of impact vectors we will have in our minds a notion of "ranking" or "preference". That is, we will prefer one set of impacts to another. We could express this preference by assigning a numerical value to each impact vector. This numerical value is often called the "utility function". So each impact vector has a "utility" associated with it which expresses our degree of preference for that set of impacts.

Each possible outcome of the decision thus also has a "utility" value assigned to it. And the "expected utility", then, for any decision option is the sum over all possible outcomes of that option, of the probability of the outcome times the utility of the outcome.

The "optimal" decision then is that option which has the largest expected utility. Note that within this general framework we regard no decision as just another decision option -- it has its own outcomes and impacts.

Application to the Special Train Question

In order to place the special train question within the general forumlation of the last subsection, let us imagine that we have a specific shipment of spent fuel to make. At the point of decision then, we have a choice of sending this shipment by special train or regular train.

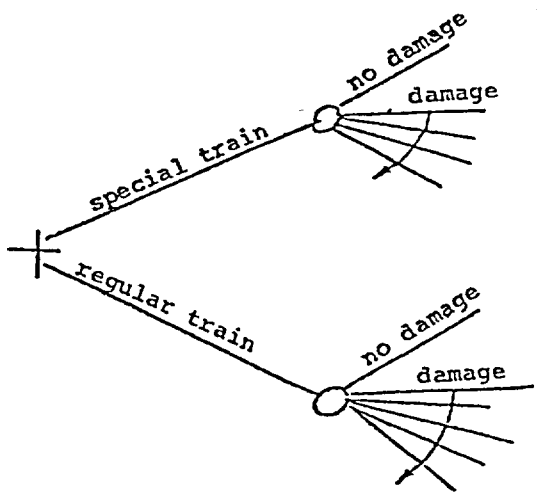

FIGURE 2. SPECIAL TRAIN DECISION TREE

The outcome or consequence of most interest to us is the degree of damage to people as a result of possible release of radioactivity to the environment. Either there will be a release during the shipment or there will not. If there is, it may be of varying quantities at various locations with various consequences, etc. Thus,

in concept there is an infinity, a whole continuum, of possible "bands" of outcome possibilities. Likewise in concept there exist probability density functions erected over the bands of outcomes. The question we wish to resolve is what are these probability functions and how do they differ on the special and regular train branches of the decision tree shown in Figure 2.

These probability functions may be visualized in graphical form as a risk curve, Figure 3.

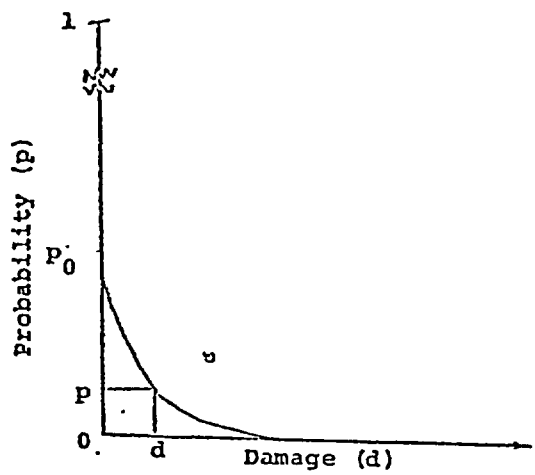

FIGURE 3. RISK CURVE

The ordinate, p, of this curve at any point d on the abscissa expresses the probability that as a result of this shipment we will have damage to the public of amount d, or greater. This curve thus tells the total risk story in far more complete fashion than one can by speaking

in terms of "mean" or "expected" values. Observe that the curve starts at a value p_o, much smaller than one. The difference $1 - p_o$ in fact is the probability that there will be no damage at all to the public in this shipment.

Data are not available from which to plot a risk curve for special trains. The Draft EIS assumes that the risk is less for special trains. The contrary may well be true. But, if a risk curve could be plotted for special trains and if it was lower than the risk curve for regular trains, the difference between the two curves would represent what would be gained by going to special trains.

The other impact of importance is the costs, ultimately to the public, of going to special trains. This must be included in the impact vector for if there were no extra costs, we would of course opt for the lower curve regardless of how low the curves are or how small the difference between the curves. On the other hand, if there is extra cost, and if the probability p_o and the possible damage values are sufficiently small, then it would not be worth going to special trains even if the special train curve were reduced to absolute zero.

The impact vector therefore consists of two components: cost and damage. The damage must be expressed probabilistically for the two options; the cost can be

expressed deterministically from the rates for special and regular trains. The decision then rests on the utility function applied to the impact vectors, which is to say whether the reduction in risk, if there is one, is worth the extra cost.

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ENVIRONMENTAL PROTECTION
BUREAU

97

August 25, 1976

Director
Office of Standards Development
United States Nuclear Regulatory Commission
Washington, D.C. 20555

Re: Comments on the Nuclear Regulatory Commission's Draft Environmental Impact Statement on the Transportation of Radioactive Materials (NUREG-0034)

Dear Sir:

The New York State Attorney General has submitted a series of comments to you on certain portions of the above-referenced document.

Further consideration of this document has illuminated several other deficiences in the presentation which have been numbered according to the prior Resnikoff-Skinner comments.

48. Your analyses have considered impacts of transportation accidents in terms of population dose only. Careful consideration must be made in the final document of the clean-up costs of all postulated accidents as well as a qualitative description of the inconveniences suffered by residents adjacent to and within accident contamination zones.

49. Your analyses should contain reviews of typical accidents which have already occurred and the costs and difficulties of clean-up at each. These reviews should include plutonium clean-up operations at Thule, Greenland and Palomares, Spain.

50. No discussion appears in the alternatives section concerning the impact of facility location on the severity of accidents and the probability of their occurance.

51. Many accident modes within each transportation pathway have been overlooked. Such likely occurences as fork lift puncture and container leakage are not treated in each pathway.

52. No discussion in the Draft Impact Statement can be found relating to errors in record-keeping, radiation monitor errors, container maintenance hazards, and other miscellaneous causes of inadvertant over exposure to the public during transportation.

We hope these comments will further assist you in preparation of a thorough Final Environmental Impact Statement on Transportation of Radioactive Materials.

Very truly yours,

LOUIS J. LEFKOWITZ
Attorney General
By

PNS:FC

PETER N. SKINNER P.E.
Environmental Engineer

JANET WILLEN
Environmental Investigator

ASSOCIATION OF
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HARRY J. BREITHAUPT, JR.
Vice President and General Counsel

DOCKET NUMBER
PROPOSED RULE PR-7173

(98)

DOCKETED USNRC
SEP 17 1976
Office of the Secretary Docketing & Service Section

September 14, 1976

Mr. Samuel J. Chilk, Secretary
Nuclear Regulatory Commission
Washington, D. C. 20555

Re: NUREG 0034 - Draft Environmental Statement on the Transportation of Radioactive Materials by Air and Other Modes

Dear Mr. Chilk:

I have received a copy of the letter dated August 26, 1976, addressed to you by Mr. Joseph DiStefano, Attorney for the Energy Research and Development Administration, in which he questions the credibility of certain conclusions contained in the five Verified Statements furnished to me by member railroads and enclosed with my letter to you of June 25, 1976. Since the AAR is not a party to ICC Docket No. 36325, Radioactive Materials, Special Train Service, Nationwide, or related proceedings, I have not had access to any of the data referred to in Mr. DiStefano's letter and cannot determine the credibility of that data.

My purpose in writing to you initially was to advise your Commission that experienced railroad officers in the ICC proceedings had expressed conclusions on special train service which were contrary to the conclusions stated in the Draft Environmental Statement. As I understand, the evidentiary record in the ICC proceedings is not closed as yet, but I feel confident that when all of the facts are made known, the railroad officers' conclusions will be fully supported and verified by such facts. The ICC proceedings will be very informative on special train service, so I would hope that the Nuclear Regulatory Commission would not

Acknowledged by card 9/17/76

J-98

make a statement concerning special train service in its final Environmental Statement until all of the facts are developed in those pending proceedings.

Very truly yours,

cc: Mr. Joseph DiStefano, Attorney
U. S. Energy Research and
Development Administration
Washington, D. C. 20545

UNITED STATES
ENERGY RESEARCH AND DEVELOPMENT ADMINISTRATION
WASHINGTON, D.C. 20545

AUG 26 1976

(99)

DOCKET NUMBER
PROPOSED RULE PR-71,73 (40FR23768)

DOCKETED USNRC
DEC 9 1976

Mr. Samuel J. Chilk
Secretary
Nuclear Regulatory Commission
Washington, D.C. 20555

Dear Mr. Chilk:

NUREG 0034, DRAFT ENVIRONMENTAL STATEMENT ON THE TRANSPORTATION OF RADIOACTIVE MATERIALS BY AIR AND OTHER MODES

We recently received a copy of a letter dated June 25, 1976, to you from Mr. Harry J. Breithaupt, Jr., General Counsel, Association of American Railroads. He enclosed copies of certain verified statements of the railroads in Docket No. 36325, Radioactive Materials, Special Train Service, Nationwide, now pending before the Interstate Commerce Commission. He apparently did not enclose the verified statements of the other parties, nor the transcript containing cross-examination of any of the witnesses. In order that you will be assured of having the complete ICC record for your files, we are transmitting herewith a copy of the entire evidentiary record to date in Docket No. 36325 as well as a copy of ERDA's brief in Docket No. 36307, another ICC proceeding involving the transportation of radioactive materials. We have omitted the following exhibits from the copy of the record in Docket No. 36325:

> Exhibits No. 15, WASH 1238; No. 16, NUREG 75/038; No. 20, film; No. 26, NUREG 0034; No. 55, photograph; No. 56, photograph; and No. 57, photograph.

We do not have additional copies of Exhibits 20, 55, 56, 57, which, however, can be made available to you upon request on a loan basis; and, of course, Exhibits 15, 16, and 26 are readily available to you.

Mr. Breithaupt criticizes NUREG 0034 in his letter for its alleged failure to take into account the "special service" that would be afforded by the special trains that the railroads would force the shippers of spent fuel and radioactive waste to use. Mr. Breithaupt claims that the special handling connected with special trains "virtually eliminates accidents," based on the statements of five railroads that in their experience there had never been an accident of any sort involving a special train operation.

AMERICAN REVOLUTION BICENTENNIAL 1776-1976

First, our information is quite different. There is evidence that there have been special train accidents (e.g. Tr. 1203, 1229-31); and it is the opinion of a respected witness with 40 years of operating experience on the railroads that a special train is no safer than a regular train (Tr. 1226).

Second, the comparative safety of special trains is essentially beside the point, because the transportation of spent fuel and radioactive waste in regular trains entails such a very low risk. In this connection, we refer you to the testimony and cross-examination of Robert F. Barker of the NRC staff, and of B. John Garrick.

The very high cost of special train service is described in the testimony of Murray Chais for ERDA and that of several other witnesses for the industry. Accordingly, the statement in NUREG 0034 that "the use of dedicated trains does not appear to be cost-effective," is fully supported by the ICC record, and indeed understates the waste of resources that would flow from the mandatory use of special trains for the transportation of all spent fuel and radioactive waste.

Sincerely,

Joseph DiStefano

Joseph DiStefano
Attorney
Office of the General Counsel

Enclosures:
As stated

cc: Mr. Breithaupt, AAR
Attorneys of Record in
ICC Docket 36325

Due to its bulk the evidentiary record was not reproduced. It has been reviewed by Standards Development and will be on file in the Docketing and Service Branch.

APPENDIX K

COMMENTS ON THE DRAFT FINAL ENVIRONMENTAL STATEMENT

DATED FEBRUARY 1977

Commenter	Page
Karl Z. Morgan	K-1
H. M. Parker	K-4
Environmentalists, Inc.	K-8
Georgia Public Interest Group, Inc.	K-12
The Georgia Conservancy	
February 24, 1977	K-15
March 4, 1977	K-19
State of New York, Department of Law	K-23

Comments on NUREG-0170

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by

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Karl Z. Morgan
February 25, 1977

U.S. NUC... COMM.
ADVISORY ... COMMITTEE ON
REACTOR SAFEGUARDS

1. When Dr. C. Siess announced and Dr. D. Hopkins confirmed at the Atlanta meeting that NUREG-0170 in its present form was essentially the final manuscript for the NRC Impact Statement on Shipping, some of the persons attending this meeting--and especially some of the consultants--had the feeling that maybe we had wasted our time reading this material and attending the meeting. Perhaps there is a compelling reason why this material must be rushed into print, but it is a shame that the published report cannot be modified in such a way as to benefit from the numerous constructive criticisms expressed at this Atlanta meeting. Although, in many respects NUREG-0170 is more carefully prepared than many other NRC documents I have reviewed, it is far from a polished publication; it fails to answer satisfactorily several questions raised at the meeting, and in some cases lacks clarity and makes it possible for the reader to arrive at wrong and unintended conclusions.

2. The final drafts of the papers under review did not reach the hands of the consultants and many of others who might have input to the meeting. Usually, I like to check equations and verify a few of the calculations by spot checks, but, because of the shortness of time, no one could do a good job of this. This is especially true for busy persons who cannot drop everything else a few days before the meetings.

3. My general impression of NUREG-0170 is that it is not an attempt to assess the effects on health and the risks of surreptitious diversion of fissile or radioactive materials during shipping, but rather an attempt to prove the effects on health and the risk of surreptitious diversion are completely negligible. Sometimes there is only a shade of difference in these two styles of writing, but the effect of one is concurrence and acceptance of the public and the result of the other is a challenge to the public to show the NRC is wrong. The job of the NRC would be easier if the public were made to believe NRC was simply stating the true facts and

explaining their meaning. Nuclear energy could sell itself better sometimes without the aid of a salesman.

4. I do not believe this report treats adequately the long term problems of wide spread contamination of a city by plutonium and transplutonium following a major shipping accident. In Rocky Flats, Colorado, we have many square miles contaminated with plutonium above the 2.2 dpm level and this contaminated desert land is resulting in serious immediate and long-term problems. Not many persons would care to live in a building or make their home in a city that is badly contaminated with plutonium.

5. I think a poor case is made for shipping plutonium and transplutonium material by air.

6. The cost comparisons for shipment via air, truck, train and barge are biased because of transhipments at each end. What would be the cost (in man-rem) were barge or train terminals located at all nuclear facilities? In a proper comparison, I believe the man-rem cost by rail would be about 1/10 that by truck and the cost by barge would be about 1/100 that by truck.

7. I would like to see the estimated saving in costs (in man-rem) were we to completely change our future nuclear power program and do the following:

a. Discontinue the LMFBR program for the present.

b. Establish large reactor parks over suitable bedded salt formations such that:

1) High level waste would not have to be shipped
2) Build converter ($Pu \rightarrow {}^{232}Th + {}^{233}U$) reactors at the parks
3) Denature the ${}^{233}U$ with ${}^{238}U$ when it is shipped outside the park to reduce the risk of hijacking and diversion.
4) Have proper isolation of these parks
5) Several studies at Georgia Tech suggest Th-breeders are possible which would have a negative void coefficient in the coolant, and would have a doubling time much less than that of the LMFBR.
6) Pu and trans-Pu elements would not be produced
7) The problems of ${}^{232}U$ and ${}^{234}U$ production in the Th cycle are minor compared with the Pu problems.
8) Of course, the parks would have fuel reprocessing and fabrication plants as well as power reactors (convertors and breeders).

8. I think NUREG-0170 should have given more attention to the recommendation of the Special Panel to Study Transportation of Nuclear Materials and its report to the JCAE of Congress (December 17, 1974).

9. It was indicated by Mr. Hoppins in answer to my question that some of the shipping containers that were improperly designed and approved by the AEC (now NRC) are still in use under the grandfather clause. This presumably includes the C-10 industrial source shipping container which occasioned the serious accident into Atlanta in which I became involved a few years ago. It was indicated that NRC places reliance on administrative control rather than upon safe design in these cases. I think this is a very serious situation because unless the operator is careful about what he is doing, the source will be pushed outside the C-10 shipping container where no shielding protection is provided. I think NRC must share responsibility for any accidents that result during the term of the grandfather clause because it (or the AEC) is responsible for this ridiculous design in the first place.

RECEIVED

MAR 7 1977

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Pacific Northwest Laboratories
Battelle Boulevard
Richland, Washington 99352
Telephone (509) 946-2222
Telex 32 6345

March 1, 1977

U.S. NUCLEAR REGULATORY COMMISSION
ADVISORY COMMITTEE ON
REACTOR SAFEGUARDS

Mr. G. R. Quittschreiber
Senior Staff Engineer
Advisory Committee on Reactor Safeguards
Nuclear Regulatory Commission
Washington, D. C. 20555

Dear Mr. Quittschreiber,

At the conclusion of the Working Group Meeting on Transportation, Atlanta, Georgia, February 24, 1977, Chairman Siess invited the consultants to submit comments on the review of NuReg-0170. We understand that the Working Group is not proposing to advise NRC on this topic at this time.

Therefore, the following comments are intended solely to document my personal concerns.

I am disappointed to discover that it is proposed to publish NuReg-0170 in essentially the form discussed on February 24. Despite the evident care that has gone into this preparation, I believe that the end-product is far less useful than it could have been. I understand that it started in support of proposed rule-making concerning air transportation of radioactive materials (Federal Register June 2, 1975). Such a study would have considered alternatives to air transport but only for such packages as a reasonable person would have contemplated sending by air as one option. That vital distinction has not been observed so that one immediately becomes involved with the whole gamut of transportation scenarios.

The new lists of package types for standard shipments are impressive in two ways:

1. They are so different from the earlier NuReg-0034 versions in number and activity that one wonders whether a third look would bear any resemblance to either -0034 or -0170 tallies.

2. They contain packages whose "hazard properties" are polar extremes. For example, a typical radiopharmaceutical source

is a short-lived gamma emitter requiring some heavy material shielding for normal transport. If it is either misplaced or damaged in transit, it is not likely to be very hazardous. At worst, the effect is gone in a relatively short time. At the other extreme is the long-lived alpha emitter. In this case the hazard in normal transport is essentially zero. In an accident capable of releasing the product, one has the long-term risk of contamination.

In NuReg-0170 the so-called alternatives group all these classes together so that real differences between modes tend to cancel each other out.

The quoted differences in health effects for the various scenarios, are in my opinion below the uncertainty level of any of the calculations of risk and cost-effectiveness.

I, for one, believe that air shipments should be limited to cases where speed is of the essence*--in practice, to the radiopharmaceutical case, where the public does accept a compensating social benefit. If that analysis had been made separately it would at once have been clear that innovative alternatives have not been included. As examples, let it be assumed that estimated doses from air shipments are too high. Then, at the source of the transportation web, one must analyze the merits of radiopharmaceutical preparation at more and better chosen locations. Upon loading on planes, one must consider packaging with one thick shielding face under the passengers instead of conventional equal shielding on all sides.

At the natural terminals, usually large cities with clustered hospitals, one must examine the possibility of underground tube delivery, and so on.

For other modes of transportation, one should make the alternatives for <u>each generic type</u> of shipment--not for all taken together.

The above steps seem to be necessary to develop an environmental statement of adequate sensitivity. There are many minor points to be raised of which the following are examples.

a. The above scenario was predicated on the assumption that dose from air shipments was too high. Table IV-19 (p.IV-55) displays an annual individual dose to an airline passenger of 108 mrem, which translates the issue from assumption -

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* These comments are a more simplified exercise than the detailed rule-making. For example, I could accept the reasonableness of helicoptering survey sources to otherwise inaccessible locations, where special circumstances other than speed prevail.

to fact. In view of the NRC's efforts to get reactor fencepost doses down to the range of 10 mrem/yr, casual acceptance of 108 mrem/yr for an unsuspecting passenger is incredible. Surely the ALARA principle calls for reduction by about one order of magnitude.

b. It is somewhat difficult to fault the authors in their attempt to use numerical health effects such as a Latent Cancer Fatality Index. The plain truth is that whatever figure is used, vociferous objectors will appear quoting studies of their choice with different results, not a single one of which is definitive in 1977, nor likely to become so in the 20th Century. Yet the -0170 approach must be faulted on two counts:

1. Genetic effects are excluded on the grounds of scarcity of information. Curiously, this is one area in which there is essential agreement on a dose and dose-rate effect. There is no real way to add genetic effects and cancer fatalities on a common scale, but some arbitrary allowance has to be shown.

2. There is much more scarcity of information on the somatic side than is reflected by an LCF Index of 121.6 per 10^6 person-rem. The implied precision for a number that may be 12 (or even zero) on the one side or perhaps 600 on the other side is entirely out of place. The best efforts of NRC to set dollar indices such as $1000 per person rem, or $8 million per LCF simply cannot be accepted.

c. Some of the basic dosimetry equations need better support. Even the point source formulation

$$\frac{Ke^{-\mu D}B(D)}{D^2}$$

where μ is some formal absorption coefficient and B(D) is a Berger build-up factor is arbitrary. The relevant absorption factor is rarely well known and the build-up factor is both empirical and terrain-variable. What is known is the total energy emitted from any well described source. Then, the integration of energy absorption over all space would demonstrate the appropriateness of the combinations of μ and B(d) used.

In the integration of dose at a point from a source moving uniformly in a straight line, we have mathematically the same issue as dose at a point from a uniform line source, the familiar Sievert equations published in Acta Radiologica

in 1928. Formal demonstration of this equivalence would have improved confidence in the result.

In the second stage of double integration as in Fig. D-2 of p. D-4, the same result should be obtained by integrating the dose from an infinite disc of radioactive material (also a familiar Sievert equation) as the receptor moves uniformly across a diameter.

Sincerely yours,

H. M. Parker

H. M. Parker
Consultant

Copies to: Dade Moeller
J. W. Healy
K. Z. Morgan

SAFE ENERGY

ENVIRONMENTALISTS INC.

FOUNDED 1972

TO: ADVISORY COMMITTEE ON REACTOR SAFEGUARDS

FROM: ENVIRONMENTALISTS, INC., a non-profit South Carolina Corporation

SUBJECT: NUREG -0170

DATE: FEBRUARY 24, 1977

Environmentalists, Inc., is a non-profit public education organization existing in South Carolina. This group has a strong interest in potential existing problems surrounding shipment of radioactive materials. In addition to studying nuclear fuel reprocessing for five (5) years, the organization is officially intervening in the licensing proceedings for both the Barnwell Nuclear Fuel Plant and the Barnwell Fuel Receiving and Storage Station. Obviously, the transportation of radioactive materials by any mode will have a significant environmental impact. Environmentalists, Inc., recognizes the importance of having a well-documented and realistic estimate of such impact. On behalf of Environmentalists, Inc., this statement is submitted to ACRS for its consideration.

We know of no report which adequately assesses the outcomes of transportation of radioactive materials. Estimates of the radiation doses to the public from the shipment of radioactive materials presented in the Draft Environmental Impact Statement on the Transportation of Radioactive Materials by Air and Other Modes, NUREG-0034, are based on incomplete and incorrect information. The following examples are among the numerous deficiencies:

1. The impact of transporting radioactive nuclear materials associated with nuclear weapons is excluded.

Continued . . .

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2. Accidental releases are not among the factors included in the models used to calculate radiation dose predictions.

a) The long-term detrimental environmental impact from a major transportation accident, such as an unplanned release of radioactive materials, is not included in the models used to calculate radiation dose predictions. The pathways by which such radioactive releases might continue to increase the public's exposure to radiation are not considered.

b) The cumulative impact from frequent small leaks, the escaping of radioactive materials due to such human error as not fastening an opening securely, failures of gaskets and other equipment, highway, rail, air, and barge incidents that may not be reported are among the exposure increases which have been excluded.

3. The increase of radiation exposure to the public and to workers at those points where delays in shipment occur are not included as part of the model calculations, i.e. on highways, in rail, air, and barge transport, during switch operations in freight yards, and at transfer points.

4. The failure to calculate radiation exposures with consideration for the converging of transportation routes to one central point is conspicuous.

5. The study fails to include an estimate for the releases that might result during hijacking, theft, and other terrorist activities.

6. There is an absence of any evaluation of genetic damage resulting directly from transportation activities or indirect damage to the gene pool from such activities.

Continued . . .

7. The study fails to reveal whether or not the "No Threshold/Linear Hypothesis" is utilized in assessing the impact on public health. Any amount of man-made radiation is damaging and is an added harm over and above the harm done by natural radiation.

8. The study fails to prepare a number of models which would be relevant to special areas. Many vicinities will be receiving radiation exposure from a number of sources: nuclear power plants, waste handling facilities, weapons operations, etc.

9. The study fails to take into account the varying qualities of rail points in existence on the various routes proposed.

The defects in calculating and assessing the effects of radiation exposure due to the transport of radioactive materials make the existing report practically useless. Environmentalists, Inc., is most concerned about transportation activities associated with the various Barnwell facilities. The Barnwell area will be the terminal of many transportation routes. The population will be exposed to radiation not only from numerous shipments, but will be exposed to accidental and normal releases from the Savannah River Plant, BNFP, converging transportation routes, Chem Nuclear waste handling, nuclear submarine base, nuclear power plants --- including leaks to the drinking water. NUREG-0170 will be of small value in assessing the environmental impact of the Barnwell operations.

We question the use of taxpayers' money for a report which appears to have little if any use. The report does not follow the provisions of NEPA. The alternative section does not include discussion of the possibility of not transporting nuclear materials nor the alternative of halting the use of nuclear energy.

Continued . . .

The cost-benefit analysis fails to quantify many of the transportation costs and some are not even listed.

Environmentalists, Inc., regrets not having had the opportunity to make initial comments on NUREG-0034. However, since NUREG-0170 appears to have such little merit, we anticipate a redundant study for the purposes of licensing the Barnwell facilities.

G P I R G

Georgia Public Interest Research Group, Inc.
201 Washington Street SW
Atlanta, GA 30303
(404) 659-7082

G-PIRG COMMENTS CONCERNING NUREG-0170
FINAL ENVIRONMENTAL STATEMENT ON THE
TRANSPORTATION OF RADIOACTIVE MATERIAL
BY AIR AND OTHER MODES

The Georgia Public Interest Research Group (G-PIRG) is a private, non-profit organization concerned with consumer and environmental issues in the state of Georgia. We would like to thank the Advisory Council for the opportunity to present these comments.

Before commenting, we would like to express our concern of the adequacy of notice for this meeting. There has been no notice that NUREG-0170, a lengthy and complex document, was schedule for release. The most recent notice in the Federal Register announced an ACRS meeting "to review public comments on NUREG-0034 'Draft Environmental Statement on Transportation of Radioactive Materials by Air and Other Modes'." There was no mention of comments on the Final Draft NUREG-0170. Finally, NRC's Regional Office did not receive verification of this meeting until fourteen days prior to date.

In light of these facts, and because of the inability of G-PIRG and other interested parties to adequately review the document under consideration, we strongly urge that the Advisory Council schedule an additional public meeting with 60-days notice to each agency or group represented here today.

G-Pirg's chief concern with the Final Draft Environmental Statement is with the adequacy of treatment accorded coordination between State and Federal Authories. There are twenty Federal and State agencies that could be called upon to act in the event of an incident. The instant document does not adequately deal with this problem.

The New York Department of Law asked similar questions in a letter to NRC dated May 17, 1976. The NRC failed to sufficiently address the issue. For example, there are no regulations or plans for communication equipment or frequent contact between local law enforcement agencies along truck routes (see VII-10). Nor does NRC's answer deal with distances, transportation, or communications between airports (see VII-11) or with regulations concerning "airport security personal" as stated in VII-11, or airplane security personal.

G-PIRG also feels that the FES should have focussed more attention on the issue of financial responsibility in the event of an incident. Will the costs be borne by the agencies involved or by the carrier? If by the former, how would the liabilities be apportioned?

G-PIRG also feels compelled to ask who is responsible for the planning and approving of routes and times of travel and for the notification of checkpoints. These activities are vital in the effort to reduce the risk of incidents. Again, these questions are not sufficiently

dealt with in the FES.

Finally, G-PIRG cites the NRC for not confronting the potential problem of non-compliance. It is naive to assume that the regulations will be followed merely because they exist. We are mindful of the Brown's Ferry incident. G-PIRG also submits that it is extremely unwise to accept "industry practices" as assurances of compliance.

In conclusion, we feel that the potential dangers of transport of radioactive materials are great enough to warrant an unhurried and careful consideration of all the issues and ramifications. These risks are particularly acute to Atlanta and to Georgia because of their location at the crossroads of America's transport links and because of their proximity to the Barnwell Nuclear Reprocessing Plant. In light of this, G-PIRG urges more thorough attention to the issues addressed in this paper and to the convening of another public meeting in Atlanta concerning NUREG-0170 with proper advance notice to all interested parties.

- Sharon Collings,
  Project Coordinator

- Larry Katzman,
  G-PIRG Executive Director

The Georgia Conservancy

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THE GEORGIA CONSERVANCY
COMMENTS GIVEN FEBRUARY 24, 1977
BEFORE THE ADVISORY COUNCIL FOR
REACTOR SAFEGUARDS ON
NUREG - 0170

FINAL ENVIRONMENTAL STATEMENT ON THE
TRANSPORTATION OF RADIOACTIVE MATERIAL
BY AIR AND OTHER MODES

Docket N PR - 71,73 (40 FR 23768)
February, 1977

Before making specific comment on various issues contained in the Statement, we first wish to express our vigorous disapproval and criticism of the lack of notice to interested parties, and the inadequate time interval between publication and availability of the material on which comment was solicited and the date set for the public hearing. The impossibly short time period between availability and the date set for comment evidences on the part of the NRC either a lack of competence in establishing and meeting reasonable time schedules or a lack of sufficient consideration for the schedules of those for whom the hearing is held.

Whether due to incompetence or unconcern, the result is burdensome to public participation and lowers the quality and value of the hearing. We deeply resent such a cavalier approach by a Federal Agency created to serve the public interest.

It is self evident that a generic statement such as this is inadequate to meet the needs of specific areas of the Nation where a concentration of nuclear facilities or a convergence of transportation routes to such facilities create circumstances demanding independent and detailed treatment. This is particularly true of Georgia, where the presence of the Savannah River Plant, Chem-Nuclear low level waste storage facility, Barnwell Nuclear Fuel Reprocessing Plant, together with the proposed Posiedon Base at Kings Bay, nuclear reactors, weapons systems and weapon components within the State, medical radio-pharmaceutical, industry, etc. will funnel a disproportionate shore of hazardous nuclear materials through Georgia's rails, highways, waterways, and airways. A separate Environmental Impact Statement incorporating the aggregate and cumulative effect of such activities is a minimal requirement for the understanding and protection of those asked to accept and support their existence. We need a comprehensive study of precisely what is moving through and to our State now, and a projection for 1985 and beyond.

(1) The cost for land reclamation of a radiation accident site is stated to "exceed $200 million" in the Summary and Conclusions. However, table V-14 shows the cost of decontamination being as high as $8.21 billion which is 40 times as much cost. We therefore find it materially misleading to include only the lower figure in the summary statement.

(2) As seen by the above comment, the possible costs resulting from a radiation transport accident are enormous. It appears that insufficient attention has been given to the question of who will be responsible for absorbing these costs and their financial ability to pay. It is questionable that the shipper would be able to cover such costs and the State of Georgia should certainly not be required to bear the responsibility for reclamation and decontamination.

What provisions have been made for assurances that these costs are paid?

Will the Federal Government be prepared to cover such costs? Through what mechanism?

(3) It's apparent that the accident risks and health effects due to a given accident are directly tied to the frequency of shipments and routes of transport. The full impact of radioactive transport on the State of Georgia or communities in the State cannot be fully assessed without adequate information on these factors.

Is information on the projected frequency and routes of shipments available to the State of Georgia and concerned citizens?

It is imperative that the State be provided with advance notice of radioactive shipments and that the State be given the option of prescribing acceptable routes and times of transport.

It is our understanding that the State of Florida is already pursuing this option.

Is there provision for Georgia to exercise this right?

(4) The magnitude of health effects following a radioactive transport accident will obviously depend to a large degree on what immediate action is taken at the accident site to minimize these effects.

Has an established procedure been developed for handling such an event and have responsibilities for specific activities been fully defined?

For example, who will be responsible for radioactive monitoring, for evacuation of adjacent areas, for retaining contaminated people at the site, for decontamination of the accident site?

We question whether there are even adequate medical and personnel decontamination facilities in Georgia to handle victims of such incidents.

(5) We question whether all reasonable alternatives have been considered to reduce the environmental effects of radioactive transport. For example, the alternative of limiting the amount of radioactive material transported should be addressed. This would include limiting the number of nuclear power plants in the country to those now in operation or under construction. This would significantly reduce the risk of adverse environmental effects due to transport, and particularly in Georgia, it would help to minimize the amount of nuclear materials transported across the State to and from the Barnwell, South Carolina Reprocessing Plant.

(6) Spent fuel shipments are specifically exempted from physical protection requirements of 10CFR Part 73. No discussion of special precaution or less rigorous methods of protection proportionate to the risk are discussed. The rupture of a cask is a stated possibility, resulting in a total of 244 predicted deaths (page VII-2). A consequence of this magnitude (or worse, should the cask fall in a water supply for example) merits more serious consideration of escorts or other appropriate types of safety precautions.

The final conclusion of Section VII dealing with special nuclear materials, states that "alternative means of protection --- are neither necessary nor desirable for the protection of privately owned materials." Apart from the highly debatable merit of this conclusion, a more profound question which should be addressed is "What are materials such as these (which have the potential for cataclysmic harm to society in a variety of ways) doing in private ownership to begin with?"

It seems to us that there is a substantial question as to whether bomb grade material should be introduced into the general stream of commercial traffic.

(7) Table VI - 2 sets forth the economics of rail and truck shipments of spent fuel. Do the "costs" include the costs to the State for road damage and maintenance (particularly for overweight shipments), bridge strengthening where needed, increased police coverage and special equipment, if necessary?

Who bears these costs? Sec. 168 of the AEC Act of 1954, as amended, and Sec. 91 of the Atomic Energy Community Act, of 1955, as amended, provide a specific statutory mechanism for the evaluation and determination of the need for financial assistance to local entities which may be affected by ERDA activities.

Would these or similar costs imposed by any of the various modes of transport contemplated by this statement qualify for relief under these provisions?

(8) On Page XXV of the Detailed Summary as one of the long term positive results from the shipment of radioactive materials the assertion is made that the use of nuclear fuels in reactors allows production of electricity for society with lower costs than is possible by more conventional methods of generating electricity.

Statements like the above have for far too long accompanied cost benefit assessments. To state it now, without qualification or supporting data, in the light of increasing numbers of critical analyses which arrive at contrary conclusions, is simply inexcusable.

This is particularly true when it is characterized as a "long term" benefit, implying either (1) an adequate supply of uranium for the indefinite future, (2) the acceptability of plutonium recycle, (3) and/or the economic and environmental viability of a breeder reactor, none of which has or can be demonstrated at the present time.

Cecil R. Phillips

Cecil R. Phillips
Executive Director
The Georgia Conservancy

The Georgia Conservancy

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ADDITIONAL COMMENTS ON THE FINAL ENVIRONMENTAL STATEMENT ON THE TRANSPORTATION OF RADIOACTIVE MATERIAL BY AIR AND OTHER MODES, NUREG-0170
Docket N. PR-71, 73 (40 FR 23768), February 1977

March 4, 1977

We are pleased to accept the invitation of the Chairman to offer further comment to become a part of the record of this Proceeding. While our additional remarks will be confined to two principal matters, we would like it to be clearly understood that our silence in regard to a variety of other issues is not to be construed as consent or acquiescence, but simply reflects the limitations of available resources to adequately address them in a restricted period of time.

I. We recognize that this meeting was not intended as a "public hearing" in the usual connotation of that term, with the opportunity for full participation. There was, however, a clear expectation that members of the public and other interested parties would attend and contribute to the substance of the meeting by comment.

As a part of the written comment furnished prior to the meeting we expressed our disappointment and indignation at the lack of adequate time between the date when the Final Environmental Statement first became available and the date set for the meeting. We now learn from NRC's Mr. Hopkins that the sole reason for such haste was to meet the exigencies of a lawsuit against the NRC by the State of New York, an admission of an outrageous unilateral decision which passed without a single comment or critical observation on the part of the Ad Hoc Committee.

A further abuse of the rulemaking process, to our understanding of the purpose of the meeting, and to the assembled consultants and members of the Committee, was that, as far as the NRC was concerned, the document was in final form. They intended it to be printed substantially as it now exists, apparently without regard to what may have transpired at the meeting.

II. Among the final matters dealt with by the Committee was the question of what consequences might reasonably be expected as a result of a successful "diversion of special nuclear materials", a question wholly omitted in the Statement itself.

Let us first comment the Committee Chairman for directing the NRC Staff to initiate a study of this question. And now we would like to talk about it for a while.

First we would suggest that euphemistic terms like "special nuclear materials" and "diversion" be deleted entirely from any communication which is intended to enlighten or edify. "Special nuclear material" means bomb grade material and "diversion" means theft. It does not change the nature of a substance or an act to call it something else. The literature of this industry and the agencies governing it is replete with similar efforts to obscure reality. Please stop it. Learn to tell the truth in a fashion that can be understood and dealt with.

In the NRC spokesman's formal presentation on the threat of "diversion," in the following sequence we understood him to say first that "it is impossible to quantify the threat" and later on to state that "any mode of transportation can be protected against any level of threat." Those two statements are totally inconsistent. More importantly, they reveal an attitude, a "way of thinking" as the Chairman expressed it, which in our opinion has characterized the Government's role in the nuclear industry from its inception, and accounts in large part for the growing mistrust and resistance on the part of the public to continued or increased reliance on nuclear power as the sine qua non of our economic existence.

Some years ago Dr. Edward Teller, an outspoken advocate of nuclear power, presented the question of reactor safety as an interesting mathematical problem - "What is the product of zero times infinity?" It is indeed interesting, because the survival of our nation as we know it may depend upon the answers to a number of such questions inherent in the use of nuclear materials as an everyday article of commerce.

The specific question addressed briefly in this proceeding were the probabilities and consequences of theft of bomb grade material. We suggest for your consideration that history supports the view that any human endeavor whose success depends upon achieving "zero defects" is doomed to failure. Recent examples in the realm of technology are the Apollo and SNAPS programs. A similar failure in the field of "anthropology" is exemplified by the actions of Mr. Nixon's staff.

We further suggest that any serious effort to achieve zero probability of failure, whether technological or anthropological, will, in itself, incur unprecedented costs to our society. Financially, power companies are already chafing under the escalating capital costs of nuclear facilities which knowledgeable critics proclaim to be still not safe enough. Societally, you gentlemen calmly discussed the introduction of guards armed with automatic weapons to traverse America's expressways - a profound "environmental impact" upon our society, we should say. We urge you to reflect upon it.

Nuclear power generation has already distorted our judicial system in a variety of ways. Most notably, the ancient doctrine of tort law creating liability to innocent third parties for harm done them by a negligent act has been laid aside to accomodate the growth of this particular industry, and for none other.

Less obviously, but perhaps even more importantly, scientific dissent is quelled, not encouraged, as it properly should be in the search for truth. William Rowe, a ranking official of the Environmental Protection Agency, recently responded to a question on this topic by stating that no effort was made to discourage dissent "except, of course, when it is contrary to departmental policy."

Examples abound. The price already paid or incurred to generate electricity in this way is far greater than that which appears in any cost-benefit analysis. The more we seek to attain zero defects the more the price will rise.

And we have no choice but to seek it, for the consequences of a major failure, whether it be a transportation accident, a successful theft, or any other mode, though not infinite would surely be intolerable. With costs in the billions, and fear of repetition rampant, regardless of who pays what to whom, what do you think would happen? Do you think it would end there? Would a new Rasmussen study placate the public?

And suppose it happens when 20% - 40% of the electrical power of the United States is generated by nuclear fission and you are the President? What do you do?

This EIS is inadequate in failing to consider the above questions. They are being discussed in other forums. As a presidential candidate addressing the Washington Press Club, Mr. Carter predicted that a major reactor accident would mean the end of the nuclear power industry. Dr. Lynn Weaver head of Georgia Tech's nuclear Engineering Department has expressed the same opinion. Countless others share this view. Clearly, it is a credible consequence of any major nuclear disaster, including theft or transportation accident, and should be included in any responsible overall assessment of acceptability.

It seems to us, as it has for a long time now, that, in dealing with the nuclear questions we will remain torn between intolerable risk and intolerable cost.

In summary, then, we ask that these specific matters be addressed:

1. Adequate notice and availability of subject matter to all interested parties in timely fashion.

2. A clarification of language using plain english rather than terminology which tends to obscure fact or meaning.

3. The <u>ultimate</u> consequence of a successful theft of bomb grade materials, or any major credible catastrophe which might occur anywhere in the commercial fuel cycle. Such an assessment should address not just the immediate economic or biological effects of such an occurance as this statement does, but the predictable events which are likely to ensue, including the possible shutdown of the industry and the attendant disruption in our economy and other major effects (on our foreign policy for example). Alternatively, if the plants are not closed, what effect on public and worker morale? And to production costs if more stringent safety features were demanded?

4. A more comprehensive review of the societal effects of efforts to shield from error, accident, or misuse ultra-hazardous materials in huge quantities as a day-to-day commercial enterprise. We have identified a few examples:

(a) Civilian guards armed with automatic weapons. What effects, subtle or overt, on travelers sharing the expressways and the general public? What specific instruction to the guards as to their response in a wide range of potential encounters, both real, or as they may be perceived by the guards in a sudden and unexpected confrontation? What quality of individual is contemplated to be recruited and entrusted to bear these weapons? What program of indemnification and financial responsibility on whose part for error in selection, training, supervision or performance?

(b) What surveillance systems are specified and in place to identify and monitor potential threats to transportation of nuclear materials? The statement was made that there are no known groups who have the motivation and capability to successfully divert bomb grade materials. Who made that determination? The FBI? The CIA? The NRC? Is the dollar cost of acquiring and maintaining such information charged to the public generally, or is it internalized and accounted for in the cost-benefit analysis? Apart from financial cost, what loss of freedoms is likely to occur to individual citizens? Will there be increased numbers of phone taps and similar encroachments on privacy deemed necessary to adequately protect these materials? Will the need to protect them result in the successful passage of legislation such as that proposed in the State of Virginia to grant to the Virginia Electric and Power Co. a variety of police powers?

(c) What additional effects can be expected in our judicial and political systems to protect and encourage nuclear power generation? We have identified the abandonment of tort liability, the repression of dissenting opinion, and the extension of police powers to private firms. Will the states be preempted by the Federal Government from a voice in nuclear plant siting and the regulation of nuclear materials transported within their borders? Is that good or bad? Who decides? These are not frivolous questions and they are not adequately considered (if addressed at all) in the Final Environmental Impact Statement. We think they should be.

James T. Mills
Chairman, Energy Sources Committee

Cecil R. Phillips
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PHILIP WEINBERG
ASSISTANT ATTORNEY GENERAL
IN CHARGE OF
ENVIRONMENTAL PROTECTION
BUREAU

April 29, 1977

Director
Office of Standards Development
United States Nuclear Regulatory
Commission
Washington, D.C. 20555

Re: The Nuclear Regulatory Commission's Environmental Statement on the Transportation of Radioactive Materials (Draft: NUREG-0034, Final: NUREG-0170)

Dear Sir:

Pursuant to the Notice of Availability of the above-referenced Draft Environmental Impact Statement ("DES") published at 41 Fed. Reg. 12937 and the solicitation of comments on that DES as contained in the Notice of Availability, the New York State Attorney General submitted a series of comments on the DES. It was noted in the Attorney General's filing of May 17, 1976 that the DES did not address the issues set forth in the materials previously submitted by the office to the NRC in the course of this administrative proceeding on transportation of nuclear materials as originally noticed in the Federal Register. 40 Fed. Reg. 23768 (June 2, 1975). More specifically the DES did not address the materials submitted by way of this office's letter, dated July 2, 1975, which letter and materials are apparently on file in the Commission's public docket room.

It has been brought to our attention that, as with the DES, the unreleased final environmental impact statement ("FES") ignores the above described

materials and, in part, subsequent filings. In addition, we have been informed that certain comments are dismissed as being based on "unconfirmed analysis." Such a response to the comments, calculations and estimates of this office is meaningless and displays a failure by staff to resolve factual disputes. All the comments and supporting materials filed by this office must be responded to in a thorough manner in order for the Commission to comply with the Guidelines of the Council on Environmental Quality under the National Environmental Policy Act, 42 U.S.C. § 4321 et seq. It is particularly appropriate for the Commission to attend to this matter now in view of its recent decision to have the FES redrafted.

For your convenience, the filings by this office which have been incorporated into its comments include

letter and enclosures dated July 2, 1975
letter and enclosures dated August 12, 1975
letter and enclosures dated February 23, 1976
letter and enclosures dated May 17, 1976
letter (from John F. Shea, III) and enclosures (comments By Dr. Marvin Resnikoff and Peter N. Skinner, P.E.) undated
letter and enclosures dated August 3, 1976
letter and attachment dated August 4, 1976
letter dated August 25, 1976

We hope this letter will further assist you in preparing a thorough FES on the transportation of radioactive materials.

Very truly yours,

LOUIS J. LEFKOWITZ
Attorney General
By

JOHN F. SHEA, III
Assistant Attorney General

JFS:rab