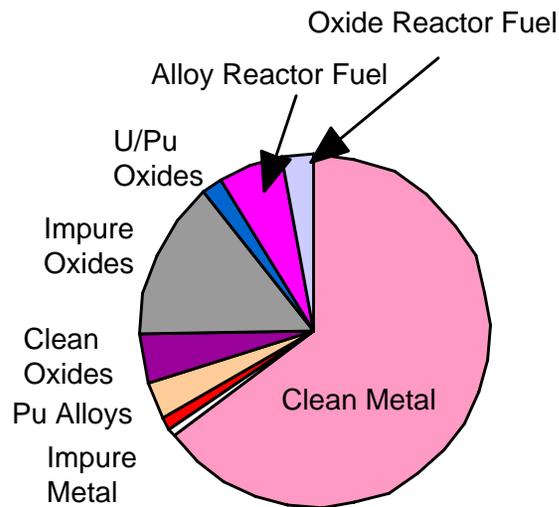


# Comp Codes and Materials Management: Their Uses, Limits, and Futures



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2005 NMMSS Users  
Annual Training Meeting  
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*NMMSS "Mapping" of Comp Codes  
for Surplus Weapons-Grade Plutonium*

# Composition Codes - Talk Outline

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- What Are “Comp Codes”?
- Current NMMSS Structure
- Communicating Materials & Management Issues
- Use for Conceptual Program and Facility Design
- Limitations
- Options for the Future (Open Discussion)

# Codes Overview

- NMMSS Fields
  - COEI = “Composition of Ending Inventory”
  - ANSI = “ANSI Scrap Codes” (for Uranium and Plutonium)
- Designed to Show Status of inventory
  - Material Forms (Metal, Oxide, Assembly, etc.)
  - Location within Production Operations (Creation, Purification, Fabrication, End Use, Recycle & Recovery, Scrap)
- Tool for Scheduling, Supply & Demand, Program Summaries

# Codes History

- COEI Codes: Created in 1972 -- Materials Management Committee from DOE-Complex Nuclear Material Managers
- Objective: Codify Process Steps (In Use at That Time) -- Attribute Inventories to Them -- Gain a “Process” Perspective on the State of NM at Any Time
- Code Structure
  - 58 Summary Codes
  - 437 Detail Codes
  - 288 ANSI Scrap Codes

# Process Summary Codes

024 Mining	354 Assembly	619 Deuteride/Trit. Mix
039 Milling	369 In Reactor	629 Tritiding
054 Refining	379 In Cooling	639 Sintering
069 Hydrofluorination	399 Irrad. Material	684 Isotope Enriching
094 Fluorination	444 Separation	714 Recovery Process (Unirr.)
114 Enriching	469 Oxide Conversion	739 Unirradiated Scrap MAR
124 Hex-to-Tetrafluor.	499 Source Fabric.	764 Other Special Uses
139 Reduction	509 Distillation	829 Other Products
159 Casting	519 D2O Rework	839 DOE Program (Book)
174 Rough Machining	529 Tritium Purification	854 On Loan or Lease
189 Briquetting	544 D2O Electrolysis	890 Comm. License Not Else.
214 Forming	554 Lithium Chloride	909 Weapons
229 Finish Machining	564 Deuteriding	919 Non-Weapons
244 Billet Fabrication	574 Hydriding	928 Losses
264 Canning & Cladding	584 Disassembly	944 Section 91C
279 Powder Metallurgy	599 Dissolution	954 Potential Avail. Recovery
299 Fuel & Target Fab.	609 Chloride Process	969 Disposition of Waste

# Example of COEI "Total" Codes

355	In Reactor	369	
360	In Reactor	369	In Reactor, Fuel
361	In Reactor	369	In Reactor, Moderator
362	In Reactor	369	In Reactor, Targets
363	In Reactor	369	In Reactor, Product
369	In Reactor - Total	369	
370	In Cooling	379	
375	In Cooling	379	Irradiated Recyclable Fuel
376	In Cooling	379	In Cooling, Product
379	In Cooling - Total	379	
380	Irrad Matl Await Proc	399	
385	Irrad Matl Await Proc	399	Al Process (Irrad.)
386	Irrad Matl Await Proc	399	Zr Process (Irrad.)
387	Irrad Matl Await Proc	399	Electrolytic Proc (Irrad.)
388	Irrad Matl Await Proc	399	Graphite Comb Proc (Irrad.)
389	Irrad Matl Await Proc	399	U-233 Process (Irradiated)
390	Irrad Matl Await Proc	399	Fluorinel Process (Irrad.)
391	Irrad Matl Await Proc	399	Custom or Spec Proc (Irrad)
392	Irrad Matl Await Proc	399	No Planned Process (Irrad.)
399	Irrad Matl Await - Total	399	

# ANSI Unirradiated Scrap Codes

## Separate (But Similar) Codes for Plutonium & Uranium

- COEI 721 - A00 through A99 - Unalloyed Metal
- COEI 722 - B00 through B99 - Alloyed Metal
- COEI 725 - C00 through C99 - Compounds
- COEI 726 - D00 through D99 - Combustibles
- COEI 727 - E00 through E99 - Non-Combustibles
- COEI 728 - F00 through F99 - Solutions
- COEI 729 - G00 through G99 - Process Residues

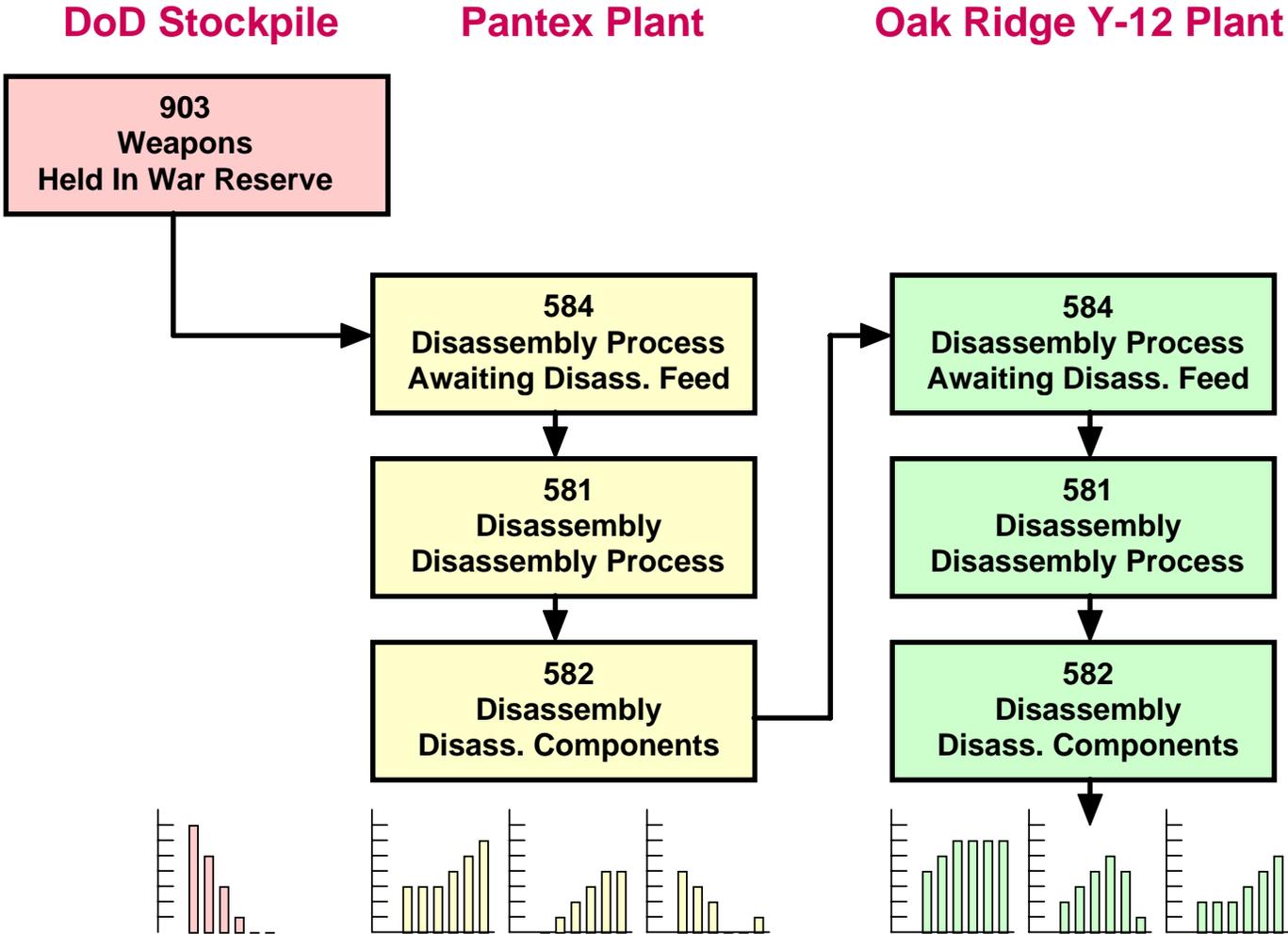
# Plutonium Compounds - Scrap Codes

C00 Non-Conforming Compounds  
C01 Oxides (low-fired)  
C02 Oxides (high-fired)  
C03 Oxide with Be  
C04 Oxide with Zr  
C10 PuF<sub>3</sub>  
C11 PuF<sub>4</sub>  
C12 Misc. Pu Fluorides  
C13 Pu Chloride Salts  
C14 Other Pu Halides  
C25 Pu Carbides  
C26 Pu Hydrides  
C27 Pu Nitrides  
C30 Encapsulated Pu Compounds

C40 Pu-DU Compounds  
C41 Pu-DU Oxides (low-fired)  
C43 Pu-DU Oxides (high-fired)  
C44 Pu-DU Halides  
C45 Pu-DU Carbides  
C46 Pu-DU Hydrides  
C47 Pu-DU Nitrides  
C50 to C57 Pu-NU (repeat as above)  
C70 to C77 Pu-HEU (repeat as above)  
C80 Pu-Th Compounds  
C90 Pu-Np Compounds

*Most Codes Serve Only to Link Records  
for Multiple-Isotope Items and Groups*

# Communicating Material Flows



(Storage & Shipping Requirements)

# Strategic Materials Management

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- Analysis by Material Forms for Broad Programs
- Summary Level
  - U.S. Policy and International Reporting
  - DOE Financial Accounting
- Item Level
  - Site Materials Management & Scheduling
  - Materials Disposition (especially HEU and Pu)

# Summary Material Form Codes

- Developed by Mapping COEI/ANSI to Categories
  - Metals
  - Oxides
  - Reactor Fuel
  - Irradiated Fuel
  - Weapons Components
  - Other Forms
    - Scrap (Compounds, Solutions, Combustibles, Noncombustibles, Other Residues)
    - Sources & Standards
    - Licensee Materials
    - Miscellaneous

# Programmatic Use of Summary Groups

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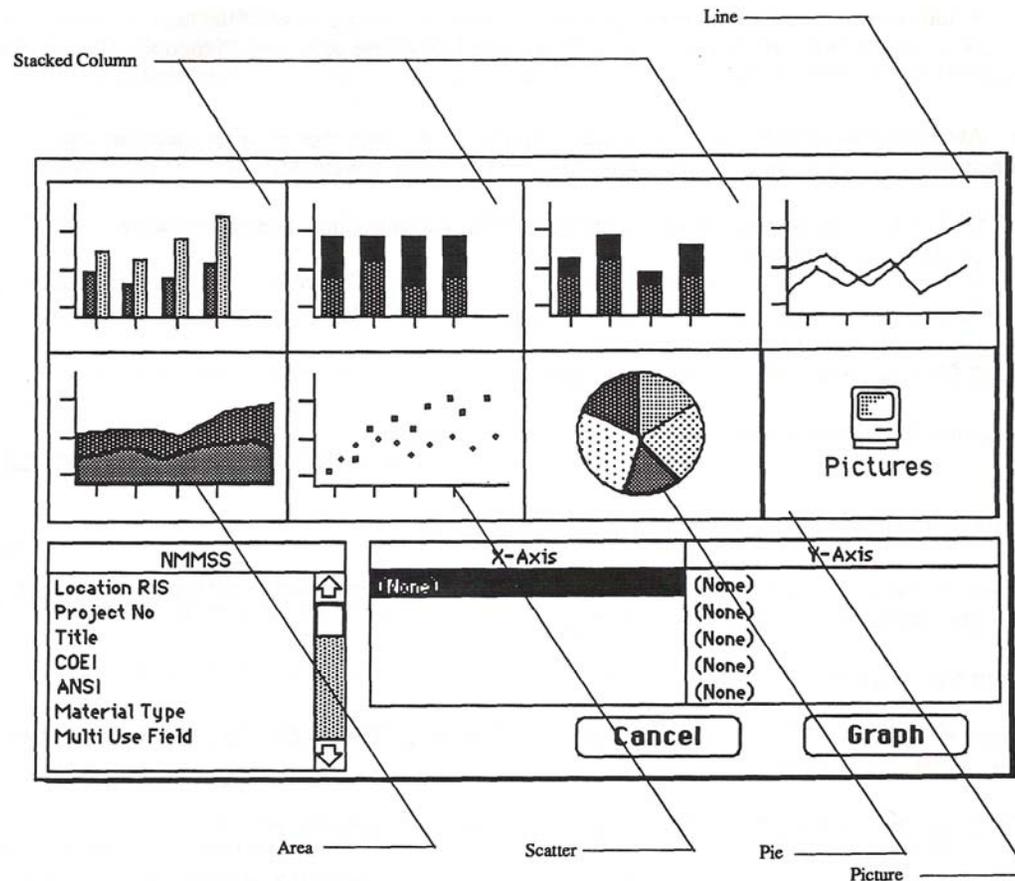
- DOE Complex Materials Management Plans (1980s)
- Modernization, Reconfiguration, Complex-21 Studies (late 1980s-early 1990s)
- Strategic Management Plans (U, Pu, T) & Task Forces
- DNFSB 94-1 (1994-1995)
- Surplus Fissile Materials Baseline (1994-1998)
- Nuclear Materials Integration/Stewardship (1998-2001)
- Continuing Stakeholder Communications

# “Modeling” the Complex

- Convenient Method to Display Major Process Flows
  - Current and Projected Demand on Capacity
  - Shipping Requirements & Load Leveling
  - Storage Requirements
- Simple Models Show Intra- and Intersite Relations
- 1990s Strategic Management Plan for Uranium
  - Materials Flows Modeled as P112 NMMSS Transactions
  - Add Throughputs as Constraints
  - Input Process & Shipping Scenarios
  - Evaluate Ability to Meet Production Goals
  - Output Shipping & Storage Schedules

# Nuclear Inventory Management System

- “NIMS”: DOE-AL / UNC Analytical Services - 1992
- Prepare Charts & Briefings from NMMSS Fields



# NIMS Form Selection & Display

## The COEI Menu



The COEI Menu displays nuclear material compositions grouped by major activities. The Composition of Ending Inventory (COEI) are DOE establishment codes which are used in inventory reporting to NMMSS. To view a complete listing of COEI descriptors the user can scroll down and select COEI Descriptions from the menu (see Figure 1.5).

- All Records
- Mining
- Refining
- Hydrofluorination
- Fluorination
- Enriching
- Hex-to-tetrafluoride
- Reduction
- Casting
- Rough Machining
- Finish Machining
- Billet Fabrication
- Canning & Cladding
- Powder Metallurgy
- Fuel Element & Target Fab
- Assembly
- In Reactor
- In Cooling
- Irrad Mat'l Await Processing
- Separation

# U.S. Policy & International Reporting

- Distribution of Excess Weapons Grade Plutonium
  - “Plutonium: The First 50 Years” - 1996
  - 1994 Declaration, Basis for Annual Reporting to State/IAEA

**Table 15. Excess Weapon Grade Plutonium (MT Pu)**

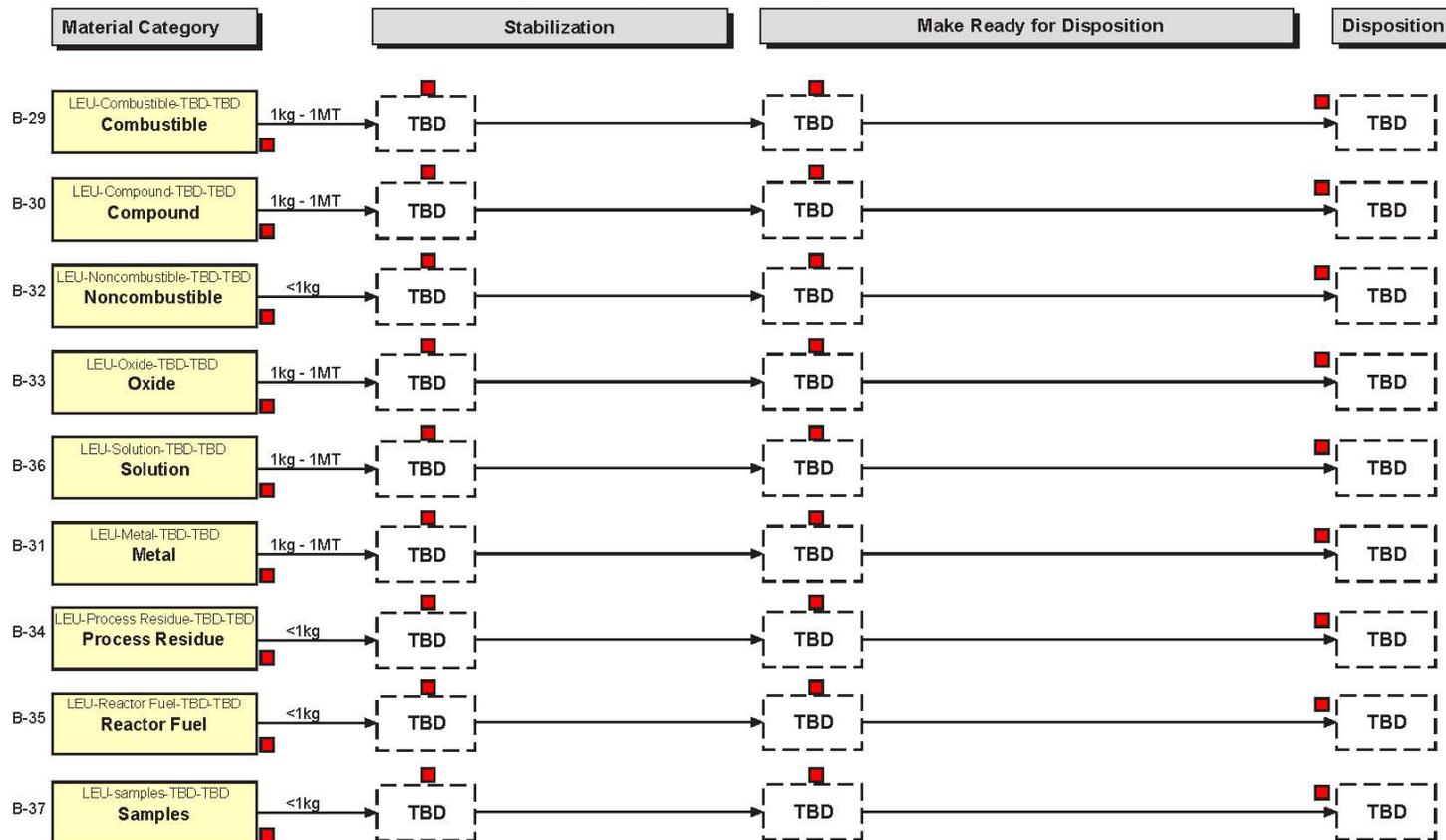
<b>Location</b>	<b>Metal</b>	<b>Oxides</b>	<b>Reactor Fuel</b>	<b>Irradiated Fuel</b>	<b>Other Forms</b>	<b>Total</b>
Pantex /future dismantlements	21.3	-	-	-	-	21.3
Rocky Flats	5.7	1.6	-	-	4.6	11.9
Hanford Site	<0.1	1.0	-	0.2	0.5	1.7
Los Alamos	0.5	<0.1	<0.1	-	1.0	1.5
Savannah River	0.4	0.5	-	0.2	0.2	1.3
INEL	<0.1	-	0.2	0.2	<0.1	0.4
Other Sites	<0.1	-	-	<0.1	<0.1	0.1
<b>Total</b>	<b>27.8</b>	<b>3.1</b>	<b>0.2</b>	<b>0.6</b>	<b>6.4</b>	<b>38.2</b>

Note: Totals may not add due to rounding to the nearest tenth of a metric ton.

# Nuclear Materials Integration - 1998

- Initial Groupings for Program Planning

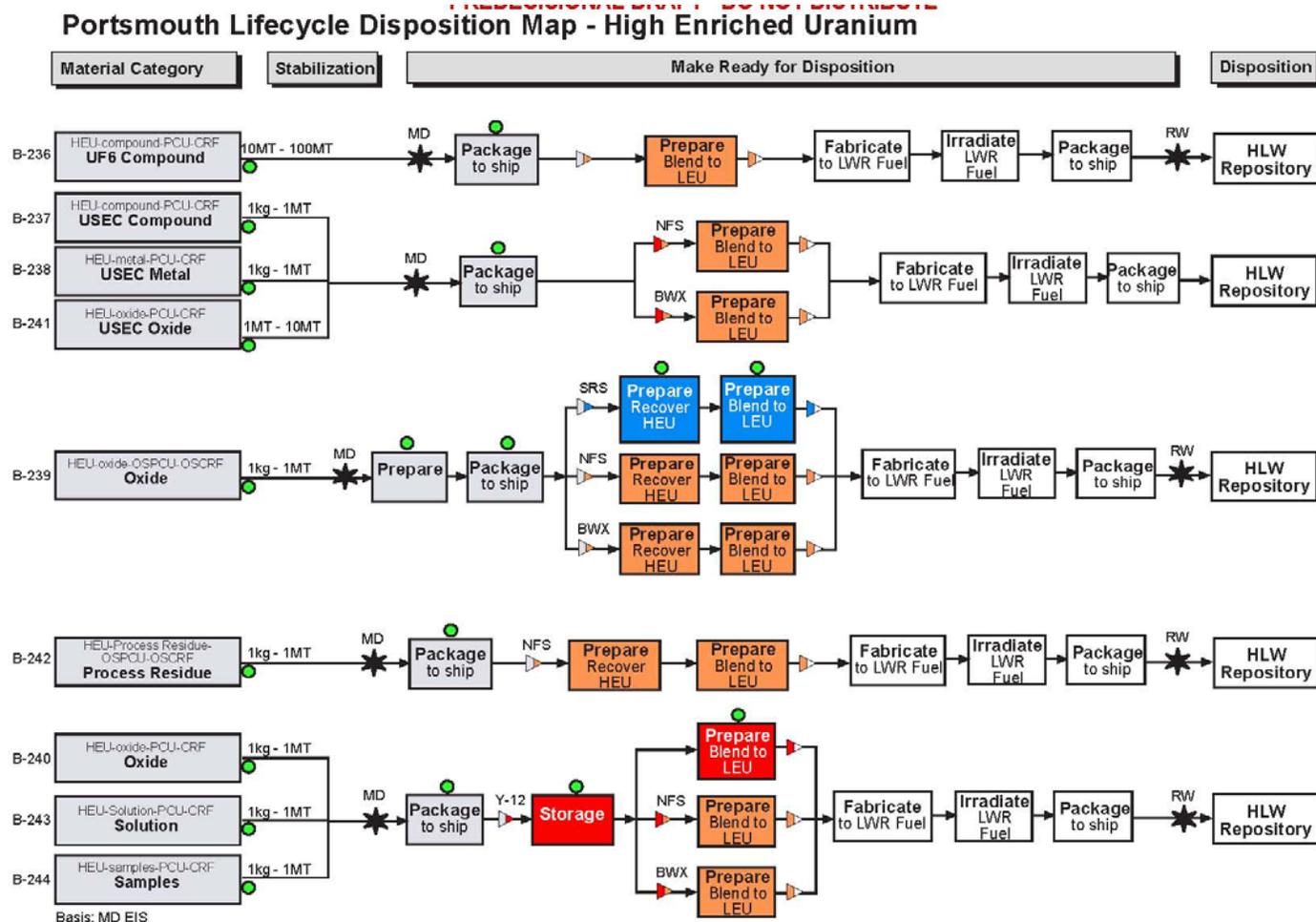
Los Alamos National Lab Lifecycle Disposition Map - Low Enriched Uranium



Basis: Site Discussions

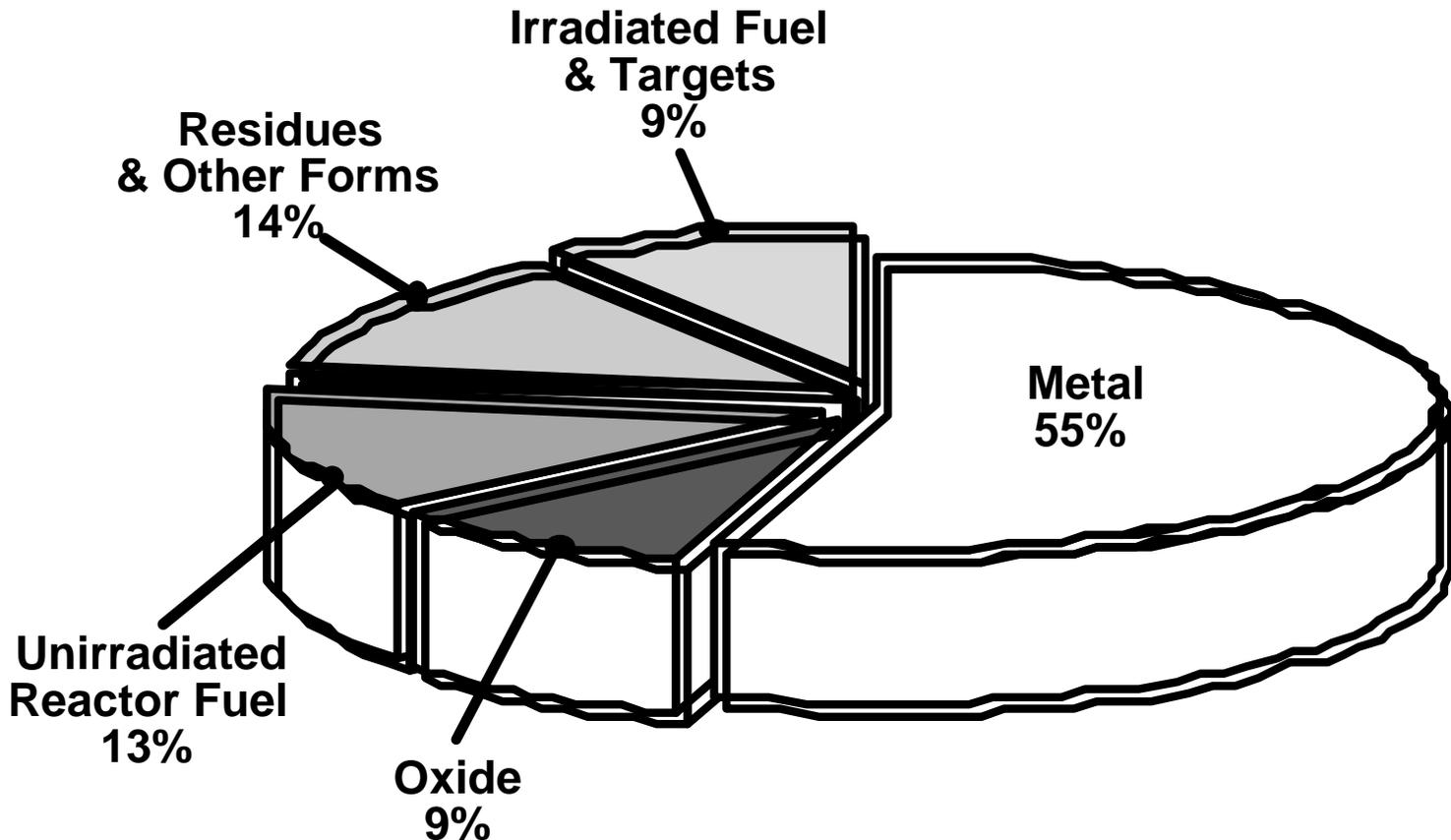
# NMI Materials Management Plans

- Refined Groupings for Item-Level Analysis



# Integrated Nuclear MMP - 2001

- Surplus Plutonium Distribution



# Detailed Material Form Codes

- Subdivisions of Major Material Groups
  - Different Rollups of Interest to Disposition Planning
  - “Current” and “Future” Forms
  - Conversion of Site Codes to Standard Groupings
- Major Initiatives
  - HEU Disposition
  - Plutonium Disposition
  - Reconciliation of Major Studies

# HEU Disposition Preliminary Mapping

Alloyed Metal

Combustibles

Compounds

Domestic Licenses

For Recovery

Foreign Licenses

Nitrate Solid

Nitrate Solution

Non-Weapons DoD

Non-Combustibles

Other Oxides

Process Residues

Solutions

Spent Fuel / In Reactor

UF<sub>4</sub>

UF<sub>6</sub>

Unalloyed Metal

UO<sub>2</sub>

UO<sub>3</sub>

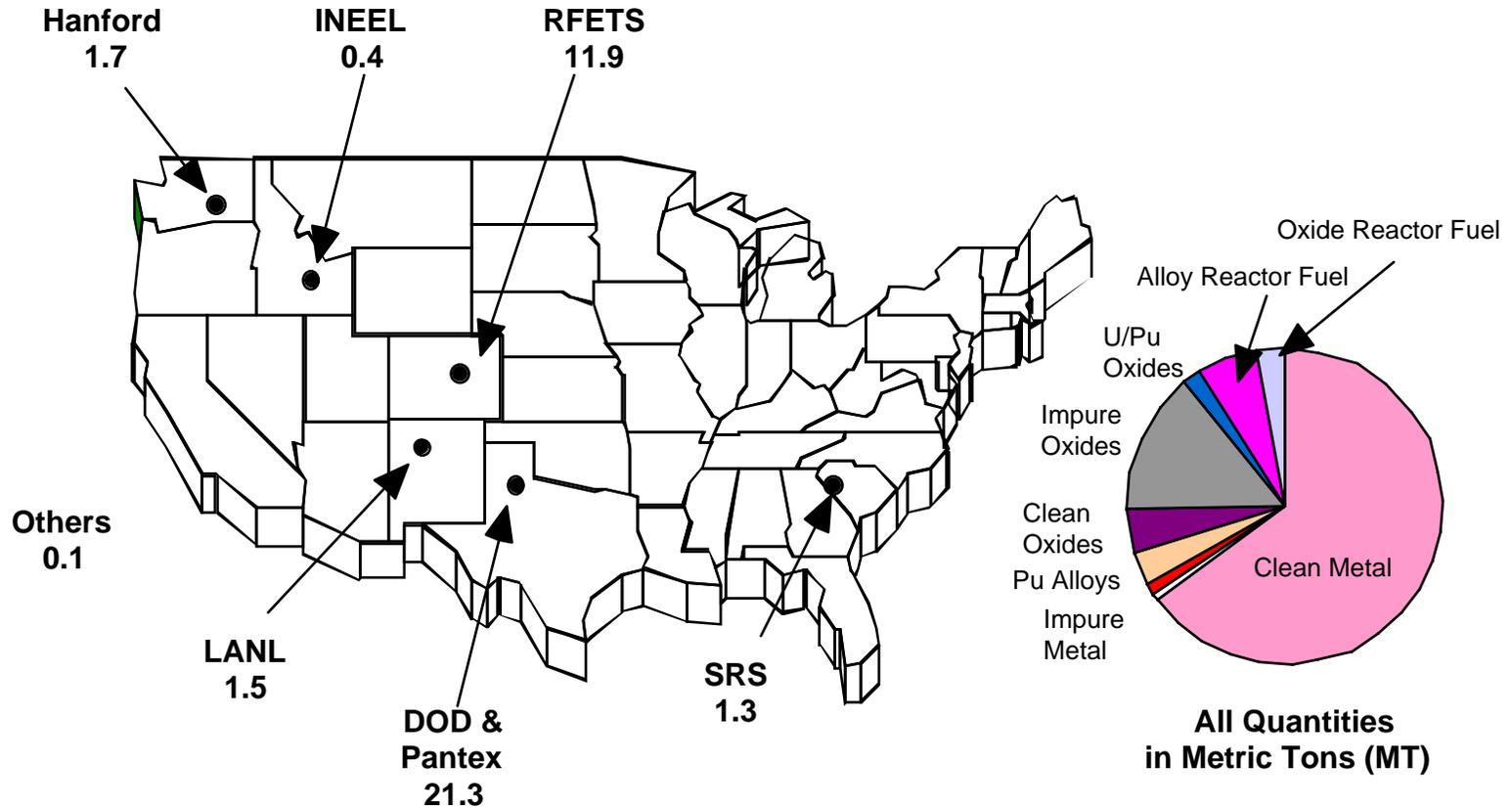
Weapons DoD

# Pu Disposition Preliminary Mapping

- 01 Pits
- 02 Clean Metal
- 03 Impure Metal
- 04 Pu Alloys
- 05 Clean Oxide
- 06 Impure Oxide
- 07 U/Pu Oxide
- 08 Alloy Reactor Fuel
- 09 Oxide Reactor Fuel
- 10 Oxide-Like Materials
- 11 Halide Salts/Oxides
- 12 Sand, Slag, Crucibles
- 13 Residues
- 14 Irradiated Fuel

Important Data: "What Will It Be When It Grows Up," e.g.,  
when Stabilized for Storage and Disposition

# Surplus Weapons-Grade Plutonium



Basis: "Plutonium: The First 50 Years", for September 1994 inventory date

# Pu Disposition Subcategories

## Example: MD-04 Alloys

01 Buttons	132,133,146,257
02 Billets, Ingots, Castings	155,170,196,207
03 Weapons Components	225,
04 Recov. Metals, Small Parts	305,690,691,702,A00,B03
05 Misc. Alloy	B02,B05,B10,B20,B34
08 Pu-EU Alloys	B70
09 Pu-Ga Alloys	B00,B04
11 Pu-Be Alloys	B13
13 Pu-U-Np Alloys	B49
16 Metal with Cladding	B01

# Comp Code Analysis - Pluses and Minuses

- Comp Codes Used for Strategic Management: “It’s Not Perfect or Even Good, But It’s the Only Tool in Town.”
- Effective in Summarizing Broad Initiatives, Across Programs and Sites
- But: 1972 Groupings Do Not Represent Today’s Needs
- Extensive Detail That’s Not Necessary for Strategies; Some Required Detail Is Not Available
- No Breakdowns for Licensees, Loan/Lease, Misc.
- Sites Use Codes in Different Ways, Different Missions: “One Man’s Scrap Is Another Man’s Treasure.”
- Sites and Programs Still Require Coordination

# Objectives for Change

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- Simplify Reporting after NMMSS Upgrade
- Streamline Codes to Simplify Programming
- Make MC&A Reporting Consistent (Enduring Uses for Codes Are at Summary Level)
- Recognize Item-Level Management Needs Are Handled Elsewhere, e.g., NMIA
- Encourage Consistent Application By Sites

# Operational Requirements

- Streamlined Code Must Be Backwards-Compatible with Existing Code (via Crosswalk Tables)
- Process Must Be Transparent to NRC Users/Licensees
- Data Submitted Using the Detail of the Current COEI Codes Is Retained (But Not Utilized By System)
- Retain Some Method to Identify Multiple-Isotope Records

# Current Uses and Detail Level

Data User		Site	DOE Complex	HQ Program	International
Item Level	Various	IDES	MD Form Codes EM Disposition Map IDs	Not Required	
Summary Level	Not Required	Not Required	NEED	IAEA Comp Codes	

**COEI/  
ANSI**

# Streamline to Only Necessary Codes

	Data User Site	DOE Complex	HQ Program	International
Item Level	Various	IDES	MD Form Codes EM Disposition Map IDs	Not Required
Summary Level	Not Required	Not Required	Streamlined COEI/ANSI	IAEA Comp Codes

# Suggested Changes

- Utilize Capabilities of Current Databases, NMIA Reporting, & NMMSS Upgrade
- Eliminate Summary-Level “Total” Codes
- Eliminate Process Details That Exist Only at One Site
- Merge Key ANSI Scrap Codes with COEI Form Codes
- Keep (Maybe) 60 Form/Subform Groupings That Can Be Mixed & Matched for Various Purposes
- Rely on NMIA and IDES for Rollups from Item Level
- Expand Project Code Utilization

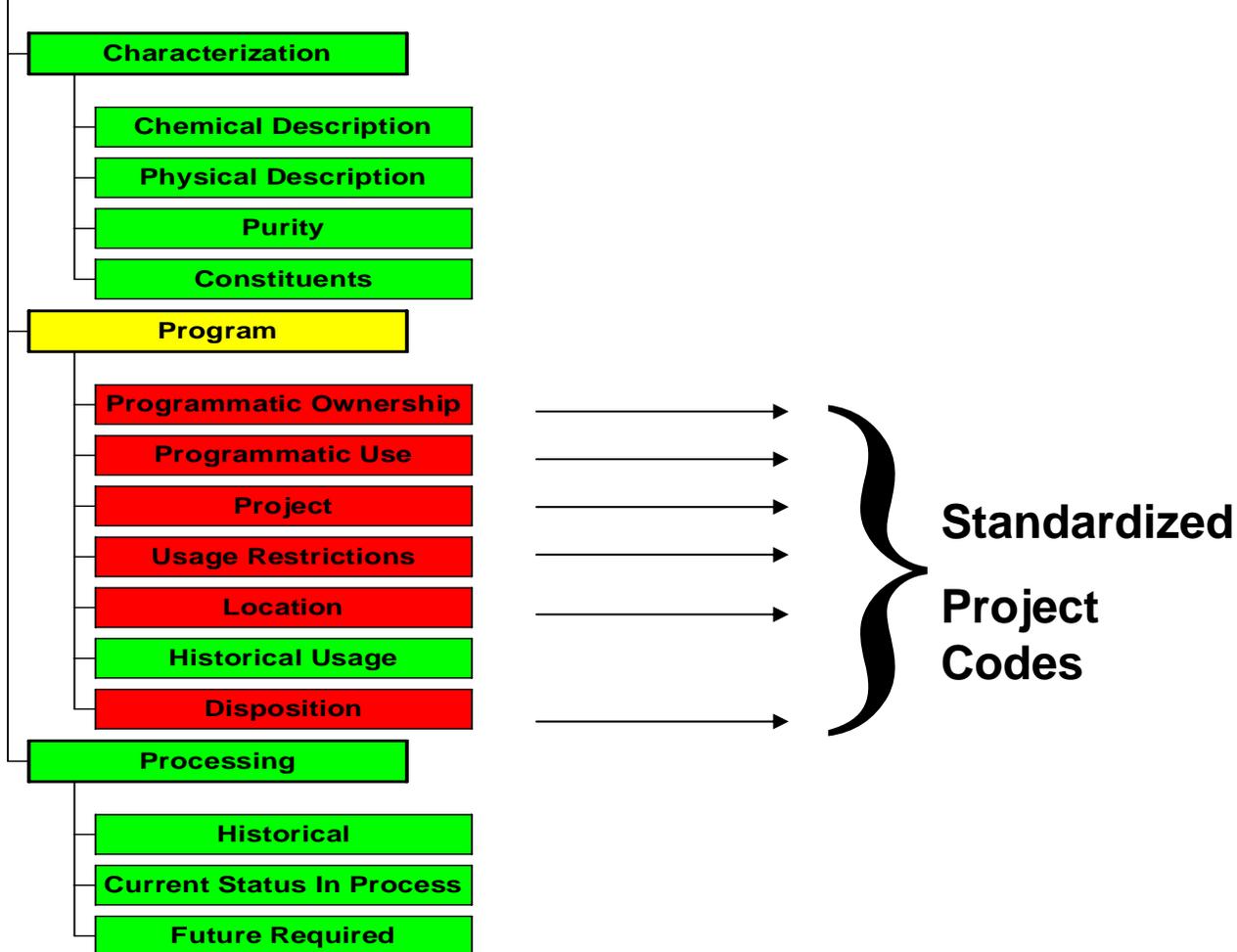
# Suggested Changes, cont'd

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- Accept Submitted Data Using Current COEI/ANSI Codes (~725 Total)
- Convert Data Using Crosswalk Table to Form/Subform Paradigm (~58 Total)
- Retain Submitted Data for Archive and Special Reports, But Do Not Check or Transact on Old COEI/ANSI
- Use Alphanumeric 6-Character Data Field to Retain Consistency with All Current Form Codes

# Realignment of COEI/ANSI Functions

## COEI/ANSI Functions



- Which Sites, If Any, Use COEI/ANSI Structure Heavily for Their Own Materials Management, with MC&A Records and NMMSS as a Primary Tool?
- Is It Possible to Track Multiple-Isotope Materials without Item-Level NMMSS?
- What Historical Analyses Have Been Performed That Would Encourage Maintaining History/Continuity?

# Summary

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- **Comp Codes Have Supported Multiple DOE-Wide Analyses and Communications**
- **Current Codes Are Somewhat Obsolete, and Are More Complex Than Necessary for Summary-Level Analyses**
- **Other Tools and Item Information Are Available Through NMIA, Site Databases, and LANMAS (or Equivalent) Modules**
- **Streamlining Would Benefit NMMSS Upgrade and Site Reporting**

## OPEN DISCUSSION