DRAFT

Department of Energy

STABILIZATION & PACKAGING PROJECT

SOLID WASTE MANAGEMENT STUDY

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1.0 PURPOSE

The purpose of this study is to identify a path forward for the management of solid transuranic, low-level, and Green is Clean wastes generated from the Stabilization & Packaging (S&P) Project. The S&P Project has incorporated the former processes of the Plutonium Project (PuP). The study should assist in the identification of design requirements and unit operations required to develop design documents in support of the development of a cost estimate for the S&P project. This study will also attempt to identify risk associated with S&P waste management path forward discussed in this study.

2.0 INTRODUCTION

The S&P Project includes a Direct Metal Oxidation (DMO) line, the Stabilization glovebox with a muffle furnace for stabilization of oxides, a bagless transfer system for 3013 inner canning, a dropbox, three criticality pass through airlocks, and a transition glovebox with a hood and a bag-out port. The S&P Project also includes a 3013 outer canning system in a hardened area adjacent to the current K-Area Interim Surveillance area (KIS) and vault/pack/unpack area.

The S&P Project will combine the daughter products created in KIS back into a single item, stabilize it, then package into a 3013 compliant container. The S&P Project will also provide the capability to begin processing the 3.7 metric tons of Alternative Feed Stock-2 (AFS-2) materials. AFS-2 metals can be split, oxidized and stabilized in the DMO furnace, and subsequently canned in 3013 inner and outer containers, packaged in a 9975 container and stored for future shipment to MFFF. It is anticipated that the S&P Project will begin operations in 2014.

3.0 WASTE TYPES

The solid waste types that are to be reviewed in this study are TRU, MTRU, LLW, and Green is Clean, and are defined as follows.

Transuranic (TRU) Waste – Solid waste that is contaminated with alpha-emitting transuranic radionuclides (atomic number > 92) with half lives > 20 years, and concentrations > 100 nCi/g of waste matrix at time of assay.

Mixed TRU (MTRU) Waste – TRU waste that is also hazardous, as defined by RCRA.

Low Level Waste (LLW) – Radioactive solid waste, which does not result from direct processing of spent nuclear fuel or byproducts material from uranium or thorium tailings, with a transuranic concentration of less than 100 nCi/g.

Green is Clean Waste – Non-hazardous waste as defined under the provisions of RCRA and is not radioactive.

Mixed LLW, hazardous waste, and PCB waste are not expected to be generated from the S&P Project, and are considered non-routine generated waste. These wastes will not be evaluated in this study. KIS waste will be kept separate from S&P Project waste and will not be evaluated in this study.

High level waste will not be generated from the S&P Project.

S&P solid waste may be Be contaminated. Concentrations of Be is expected to be trace to less than 1 gram, therefore no additional characterization is required. Solid waste will require Be labeling.

4.0 ASSUMPTIONS/REQUIREMENTS

The solid waste management system must provide the capabilities to collect, package, stage, assay, and store TRU, MTRU, LLW, and Green is Clean waste within waste packages, pails, drums, and B-25s in preparation for shipment. It must also provide the capability to characterize the waste generated by the S&P project. Following are assumptions/requirements for the S&P solid waste management system:

- Various containers/plastic bags must be supplied for the transport and packaging of solid waste. All levels of confinement for TRU waste must be vented/filtered. This includes plastic bags, convenience containers, 5-gallon pails, 55-gallon drums, and B-25s.
- A hood must be provided for loading glovebox waste from the transition glovebox into 5-gallon pails.
- All TRU waste will be contact-handled. Remote-handled waste will not be generated by the S&P Project.
- Process knowledge will be the primary factor in determining the waste type/TRUCON Code.
- Headspace gas sampling, real-time radiography and NDA for isotopic analysis for WIPP certification of TRU waste drums will be performed by SRS at the E-Area.
- Gram estimation equipment must be provided for waste leaving the S&P gloveboxes.
- S&P process must be able to manage solid waste generated from outside the gloveboxes.
- Smear-to-curie will be used to determine the radionuclide content of LLW.
- Bar code readers must be provided at critical locations.
- Bar codes must be provided on convenience cans, pails, drums, and B-25s for tracking the matrix and inventory of waste packages.
- A unique tracking number is hand written on waste bags and bag out bags.
- A staging area for unassayed/assayed TRU/MTRU staging drums must be provided inside the MAA. A minimum of 2-ft from other fissile material and gloveboxes is required for unassayed staging drums (Ref. 6).
- A space should be provided for a 90 day-satellite accumulation area for MTRU waste.

- NDA Equipment must be provided that is capable of performing characterization and accountability measurements inside the MAA.
- Equipment must be provided that is capable of performing SNM diversion check on TRU waste drums, and LLW and Green is Clean waste packages.
- Equipment must be provided for the transportation of drums around the S&P process area and out of the MAA.
- A staging area must be provided for loading and staging B-25s.
- Staging areas must be provided for empty 5-gallon pails, 55-gallon drums, and B-25s.
- Equipment must be provided for weighing waste packages, pails, and drums inside the MAA.
- S&P process must be able to process TRU waste shipping drums, and LLW and Green is Clean waste packages which fail SNM diversion check.
- S&P TRU waste will be packaged into WIPP-compliant DOT Type A, Specification 55-gallon drums.
- S&P LLW will be collected once per shift, placed in plastic bags, hand carried through the SNM detectors, and packaged into B-25s.
- The TRU waste pails/drums will not undergo screening for TRU threshold levels using an IQ3 Assay to determine if the waste is TRU or LLW. This is due to limited availability of space.
- KIS waste is assayed on the SWAS and will not be discussed in this study.

5.0 WASTE SOURCES

TRU solid waste generated from the S&P process originates from the DMO Line, the Stabilization Gloveboxes, the Bagless Transfer System, glovebox maintenance activities, job control, and waste packages from failed drums from SNM diversion check. Types of waste expected include empty inner/outer 3010 cans, empty convenience cans, failed inner 3013 cans, weld stubs, other glovebox waste, HEPA filter change-outs.

MTRU waste generated from the S&P process includes any TRU waste contaminated with hazardous constituents regulated under RCRA. Sources of MTRU waste include lead-lined gloves from gloveboxes that handle plutonium. Leaded glove waste is considered mixed LLW with high levels of alpha contamination (less than 100 nCi/g), and will be blended with and disposed of as MTRU to improve packaging and transport efficiencies.

LLW solid waste generated from the S&P process originates from the process area, glovebox maintenance, room waste, and GB exhaust filters.

Green is Clean waste is waste that the user believes is not contaminated and is not required to evaluated or surveyed per Procedure Manual 5Q1.1, Procedure 517. This consists of personal items or items carried through an RBA, equipment/material sorted or used only in an RBA with no potential for contamination (Ref. 9).

6.0 WASTE ASSAY EQUIPMENT

All TRU waste leaving the MBA/MAA will be assayed for accountability values and diversion. Pails will be assayed with the Waste Neutron Slab Counter and Waste Gamma Scanner for accountability values. TRU waste shipping drums will be assayed on the KAC Shuffler prior to leaving the MAA to ensure that no diversion of SNM has occurred. Large items, such as removed equipment and filters, are assayed with the Waste Neutron Slab Counter and Waste Gamma Scanner to obtain accountability values.

LLW may be assayed for accountability values and diversion prior to being removed from the MAA, and being placed into B-25 containers. Room LLW will only be assayed if it fails to pass the SNM diversion check. The same NDA instruments as utilized for TRU waste will be used if required.

Waste packages, pails, drums, and/or B-25s will require weighing. Inside the MAA, the waste packages, pails, and drums will utilize the scales in the Room 910A and for waste inside gloveboxes, scales in the airlocks/gloveboxes will be used. Outside the MAA, an additional scale will be required in the Waste Staging Building to weigh B-25s.

The following assay instruments (Ref. 5) will be utilized in the S&P Waste Management System:

- Scale
  - 0-10 kg scale to weigh WTC (located in the airlocks/gloveboxes within the MAA)
  - 0-16 kg scale to weigh waste packages/pails (located in the Room 910A within the MAA)
  - 0-500 lb scale to weigh waste packages/drums (located in the Room 910A within the MAA)
  - 0-6000 lb scale to weigh B-25s (located in Waste Staging Building outside the MAA)
- Portable Waste Gamma Assay System
  - Assay removed equipment (items too large to fit in pail or drum), filters, drums, and other items as needed for accountability values (located within the MAA)
- Portable Waste Neutron Slab Counter
  - Assay large items/drums for SNM theft diversion (located within the MAA)
- Shuffler System
  - Assay TRU waste shipping drums/LLW and Green is Clean waste packages for SNM theft diversion (located within MAA)
- Enhanced Fissile Material Detector (EFMD)
  - Assay of a waste package inside a WTC to provide criticality control by identifying the presence of fissile material and determining a mass amount

to be used in calculating the glovebox inventory (located in airlocks within the MAA)

7.0 S&P SOLID WASTE MANAGEMENT SYSTEM AREA DESCRIPTION

The S&P Solid Waste Management System consists of Room 910A, a Shuffler Area, and a Waste Staging Building.

- Room 910A –Room 910A contains the scales to weigh TRU waste pails, TRU waste drums, and LLW packages. The placement of waste pails into TRU waste shipping drums will occur at this location. TRU waste staging and shipping drums will be temporarily stored here
- Shuffler Area – The Shuffler Area is located near the vault and houses the Shuffler System. TRU waste shipping drums, and LLW and Green is Clean waste packages may undergo a SNM theft division in this area.
- Waste Staging Building – This covered building is located outside the main building, and used to stage TRU/MTRU waste shipping drums for shipment to the E-Area. The Waste Staging Building will also be used to stage B-25 containers, and load LLW waste packages into B-25s. A weigh scale and a B-25 Staging Rack with room for 10 B-25s are located inside the building. In addition, Green is Clean waste will be collected in this building for shipment to a sanitary landfill.
- Other Areas –EFMDs will be located in the DMO Line and Stabilization airlocks to provide control of fissile material. A portable Waste Gamma Scanner and a portable Waste Neutron Slab Counter will be available for SNM theft diversion and assay of TRU/MTRU/LLW/Green is Clean waste.

8.0 INVENTORY CONTROL

For TRU waste in the glovebox, the mass present in each waste package is quantified by the EFMD at each airlock. Once the fissile material is estimated on a TRU waste pail using the Waste Neutron Slab Counter/Waste Gamma Scanner, the measurement is used as the basis for subtracting mass from the glovebox inventory as part of the reconciliation/adjustment protocol (Ref. 6).

9.0 CHARACTERIZATION OF WASTE

Characterization of solid waste from S&P will involve many techniques. These include, but are not limited to, process knowledge, sample & analysis, smear-to-curie, and non-destructive assay.

10.0 SOLID WASTE MANAGEMENT ACTIVITY DESCRIPTION

10.1 TRU Waste Management Summary

TRU waste will be weighed and bagged out, placed into a 5-gallon pail, TID applied to the pail, and then placed into a staging drum where it will be manually transferred to

Room 910A. The pails will be removed from the TRU waste staging drum and then assayed with the Waste Neutron Slab Counter/Waste Gamma Scanner for material accountability and weighed. After the TRU waste pail undergoes NDA, the pail will then be sorted and loaded into a 55-gallon shipping drum. The assay of the TRU waste shipping drum will reflect the sum of the assays from each pail loaded into the drum. Up to three pails may be loaded into a shipping drum, and once full the drum will be sealed and TID applied. The TRU waste shipping drums will be weighed and temporarily staged in Room 910A or loaded into the Shuffler for SNM diversion check (Ref. 5). Any TRU waste failing the SNM diversion check will be returned to the S&P Hood/Transition Glovebox for reassessment and repackaging. Following successful SNM diversion check, the drums will be transferred to the loading dock for transfer to the Waste Staging Building for staging. The TRU waste shipping drum will be shipped from the Waste Staging Building to the E-Area. MTRU waste will be treated similarly to TRU waste with the exception that prior to shipment, MTRU waste may be stored for up to 90-days in a 90-day accumulation area without a permit or interim status in the Waste Staging Building. Any leaded gloves considered mixed LLW with high levels of alpha contamination (less than 100 nCi/g) would be blended with and disposed of as TRU to improve packaging and transport efficiencies.

10.2 LLW Management Summary

LLW will be collected and put into bags. The LLW waste package will be weighed. A gram estimate and SNM diversion check may be provided for the LLW package with the Waste Neutron Slab Counter and Waste Gamma Scanner/Shuffler, if required. Any LLW waste package failing the SNM diversion check will be taken to the S&P Hood/Transition Glovebox for reassessment and repackaging. Following successful SNM diversion check, the LLW waste package will be transferred to the Waste Staging Building where the LLW waste package will be loaded into a B-25. The LLW B-25 will be sealed, TID applied, and then shipped to the E-Area.

10.3 Green Is Clean Waste Summary

Green is Clean waste will be collected and put into green translucent bags (Ref. 9). A SNM diversion check may be provided for the Green is Clean waste package with the Waste Neutron Slab Counter and Waste Gamma Scanner/Shuffler, if required. Any Green is Clean waste package failing the SNM diversion check will be taken to the S&P Hood/Transition Glovebox for reassessment and repackaging. The Green is Clean waste bags will be hand carried to the Waste Staging Building for staging. When a sufficient amount of Green is Clean waste accumulates for a shipment, the waste will be transferred to a sanitary landfill.

10.4 Detailed Description of TRU Waste Management Process

Below are the activities required for the management of solid waste. Figure 1 provides a block diagram of the same steps described below for S&P solid waste management.

Steps 1 through 19 cover TRU waste management, steps 20 through 27 cover LLW management, and steps 28 through 33 cover Green is Clean waste management.

Step 1 - TRU solid waste is generated from the DMO Line, Stabilization and Bagless Transfer System gloveboxes, glovebox maintenance activities, and job control waste such as paper, coveralls, protective clothing, cardboard boxes, etc. Within the glovebox during normal operations, TRU solid waste is segregated by TRUCON Code, placed inside a convenience can (CC) which has a unique tracking number on the plastic bag placed inside the CC, and waste accumulates until it is full. The bagged waste is secured and weighed, and the lid is placed on the CC. The bar code is read on the full CC. The CC is placed inside a WTC, the WTC lid is secured, and bar code is read on the WTC. Bar codes are used to track the waste package from the time it is transferred out of the process box, into the waste system, and subsequently into the drum for disposal and inventory purposes. The WTC is transferred to the airlock with an enhanced fissile material detector (EFMD) and a scale. The EFMD will be used on the waste package to identify the presence of fissile material and determining a mass amount to be used in calculating the glovebox inventory. The WTC and TRU waste package is weighed, and the presence and mass of fissile material is determined with the information recorded, then the TRU waste package in the WTC leaves the airlock and enters the S&P Transition Glovebox.

Non-routine samples of the waste would be bagged out from the S&P Hood/Transition Glovebox for analysis. Excess waste samples would be bagged back into the glovebox upon return from the F/H Laboratory.

Step 2 - Empty bar coded metal 5-gallon pails are received from shipping and receiving.

Step 3 - An empty pail is staged near the S&P Hood/Transition Glovebox by hand carrying or use of a handcart.

Step 4 -In the Transition Glovebox, the CC is removed from the WTC, the TRU waste package is removed from the CC, the unique tracking number is disassociated from the CC and WTC, and the waste package is bagged out into the hood and placed in a pail. The TRU waste package loaded into the pail is associated with the identification code of the pail being loaded. Fissile material information for each package is determined from the identification code and provides inventory information for the pail. Note that only one waste cut will be loaded in each pail. Once the pail is loaded with a TRU waste package, the lid is secured with a lever-lock ring, and a tamper indicator devise (TID) is installed.

In the Transition Glovebox, an empty filtered plastic bag is placed in the empty CC and the CC is placed in the empty WTC. The WTC is returned to the glovebox of origin via the airlock.

Step 5 - Empty 55-gallon drums are received from shipping and receiving by using a forklift or drum cart.

Step 6 - An empty 55-gallon drum is staged near the S&P Hood/Transition Glovebox by using a drum cart.

Step 7 - The TRU waste pail is placed inside an empty 55-gallon staging drum. The staging drum barcode is read and is associated with the TRU waste pail.

Step 8 – The TRU waste staging drum is transferred to Room 910A for staging.

Step 9 - The TRU waste pail is removed from the TRU waste staging drum. The barcodes are read and dissociated from each other. The pail is weighed with a weigh scale and assayed with the Waste Neutron Slab Counter and Waste Gamma Scanner to determine the fissile mass in the waste. The measurement from NDA is used as the basis for subtracting the mass from the glovebox inventory as part of the mass reconciliation/adjustment protocol. (Ref. 6).

Step 10 - An empty 55-gallon shipping drum is staged in Room 910A by use of a drum cart

Step 11 - TRU waste pail is placed into a shipping drum of the same TRUCON Code. As the TRU waste pail is loaded into the drum, the TRU waste pail and drum barcodes are read and associated with each other. Up to three pails are placed into each shipping drum. TRU waste items that are too large to fit inside a pail, but small enough to fit inside a drum, are packaged directly into a drum at the point of generation. The lid of the TRU waste shipping drum is secured, and a TID is installed

Step 12 - The TRU waste shipping drum is weighed with a weigh scale in Room 910A. The individual pail assays are totaled which provides the assay for the TRU waste shipping drum. The allowable quantity of fissile material per TRU drum must meet the Waste Isolation Pilot Plant (WIPP) WAC for the final disposal destination of the wastes. If a drum contains Mixed TRU (MTRU) waste, it may accumulate indefinitely in a satellite accumulation area. The TRU waste shipping drum is staged in Room 910A until ready to be shipped out of the facility.

Step 13 - The TRU waste shipping drum is transported using a drum cart to the Shuffler for SNM diversion check prior to release from the Material Access Area (MAA).

Step 14 - TRU waste shipping drums failing SNM diversion check are transported to the S&P Hood/Stabilization Glovebox by use of a drum cart.

Step 15 – The failed diversion checked TRU waste shipping drum is opened and the TRU waste pails are removed. The TRU waste pails are opened and the waste packages are removed one at a time. The waste package's unique tracking number is disassociated from the pail and shipping drum.

Step 16 – The failed diversion checked TRU waste packages are bagged into the S&P Hood/Transition Glovebox for repackaging to meet safeguards and security requirements.

Any failed diversion checked LLW packages are also bagged into the S&P Hood/Transition Glovebox.

Step 17 - Using a drum cart, the TRU waste shipping drum is transported to the loading dock.

Step 18 – The TRU waste shipping drum leaves the MAA and is shipped to the Waste Staging Building. The TRU waste shipping drum is staged here until ready for shipment.

Step 19 – TRU waste shipping drums are shipped to the E-Area via on-site transport vehicles for final certification and packaging for shipment to WIPP.

10.5 Detailed Description of LLW Management Process

Step 20 – Solid LLW is generated and collected from process areas, glovebox maintenance, job control and room waste (wipes, protective clothing, tools, equipment, etc.), and glovebox HEPA filters. Solid LLW will be collected once a shift and bagged into plastic bags. Characterization of LLW waste will occur through the use of smear-to-curie conversion.

Step 21 – LLW waste package is hand carried to Room 910A for weighing on the weigh scale.

Step 22 – If required, the LLW waste package undergoes a gram estimation/SNM diversion check with the Waste Neutron Slab Counter and the Waste Gamma Scanner/Shuffler prior to release from the Material Access Area (MAA).

Step 23 – LLW and Green is Clean waste packages failing the SNM diversion check will have the LLW packages hand carried to the S&P Hood/Transition Glovebox. The LLW packages will be bagged into the S&P Hood/Transition Glovebox for repackaging to meet safeguards and security requirements.

Step 24 – Option 1: The LLW waste package is hand carried through the ECF Metal and SNM detectors, out of the building, and to the Waste Staging Building.

Step 25 – Option 2: The LLW waste package is hand carried through the ECF Metal and SNM detectors, and then placed into a LLW drum. The LLW drum is sealed and a TID is installed. The LLW drum is transferred to the Waste Staging Building.

Step 26 – The LLW waste package is placed into a B-25 or the contents of the LLW drum is transferred into a B-25. LLW packages accumulate in the B-25 until it is full. Once full, the B-25 lid will be replaced manually or by use of a forklift, and a TID installed. The B-25 is weighed with the weigh scale and staged in the B-25 Staging Rack. The B-25 Staging Rack holds 10 B-25s. Any B-25 with a dose rate greater than five mrem/hr at 30 cm shall be stored in a barricaded area.

Step 27 – The LLW B-25 is shipped to the E-area for disposal.

10.6 Detailed Description of Green Is Clean Waste Management Process

Step 28) – Green is Clean is generated.

Step 29) – Green is Clean waste is collected and placed into green translucent bags

Step 30) – If required, provide SNM diversion check of Green is Clean waste with the Waste Neutron Slab Counter and Waste Gamma Scanner/Shuffler.

Step 31) - Green is Clean waste is hand carried through the ECF Metal and SNM detectors, out of the building, and to the Waste Staging Building.

Step 32) – Stage Green is Clean waste until a sufficient amount of Green is Clean waste accumulates for a shipment.

Step 33) – The Green as Clean waste is shipped to a sanitary landfill.

11.0 ISSUES/RISKS REQUIRING FURTHER INVESTIGATION/SOLUTION

As part of this study, a summary review of issues/risks that would be applicable to S&P solid waste management was performed. The following issues/risks were identified and may be important to decision makers in the design of the S&P solid waste management process. The quantification of the risk identified was not discussed, only that the risk may have some impact on the project.

- The process is still maturing. The layout of the S&P as well as the PDC project is still in progress. The flow of waste through the process discussed in this study is preliminary and subject to change.

  In particular, the bagging out of waste from the Transition Glovebox to the Hood was identified as the recommended option for S&P (Ref. 6) and incorporated into this study. Direct bag out of waste from DMO Line and Stabilization gloveboxes was deemed unacceptable due to criticality concerns. Although the current S&P layout does not account for a bag-out area for wastes, discussions are underway to accommodate this option. Until this issue is resolved, there is some risk in proceeding with the current S&P solid waste management process.

- Floorspace is needed for the staging of TRU waste staging and shipping drums. Floorspace is also required for repackaging of TRU waste pails in TRU waste staging drums to TRU waste shipping drums. Additionally, floorspace is required for a weigh scale for weighing TRU waste pails, TRU waste shipping drums, and LLW packages. Room 910A has been identified as an area where theses activities would occur. The risk in the S&P solid waste management path forward

discussed in this study is that the Room 910A may not be available for S&P solid waste management activities. Another area inside the MAA would be required to provide the activities needed. This area could include the Waste Staging Buidling discussed below.

- A Waste Staging Building outside of the main building may be required due to inadequate space available inside the S&P processing area for staging TRU shipping drums and LLW B-25s. This building will also include areas for loading LLW waste packages into B-25s and accumulating Green as Clean waste. Providing a waste staging area inside the MAA would mitigate this issue. A building outside the main building to conduct the staging of Green is Clean waste would still be required. An area of 12'x16' would suffice.

- A large enough waste staging area to include a hood/glovebox inside the MAA would allow more efficient packaging of the waste (repackaging of waste packages inside pails directly into shipping drums),and staging for assayed and unassayed pails and drums.

12.0 SUMMARY

TRU waste will be bagged out, placed into 5-gallon pails, the pail TID, pails place into staging drums, and manually transferred to Room 910A. The TRU waste pails will be removed from the TRU waste staging drum. The TRU waste pails will undergo assay for material accountability and weighed. The TRU waste pails will then be sorted and loaded into a 55-gallon shipping drum. The loaded TRU waste shipping drum will be weighed and TID applied. The TRU waste shipping drum will either be temporarily stored or undergo SNM diversion check. Any TRU waste failing the SNM diversion check will be returned to the S&P Hood/Transition Glovebox for reassessment and repackaging. Following successful SNM diversion check, the drums will be transferred to the loading dock and transferred to the Waste Staging Building for staging. The TRU waste shipping drums will be shipped to the E-area for final certification and packaging.

LLW will be collected and put into bags. A gram estimate may be provided for the LLW waste package through assay. The LLW waste package may undergo SNM diversion check. Any LLW waste package failing the SNM diversion check will be taken to the S&P Hood/Transition Glovebox for reassessment and repackaging. The LLW waste package will be transferred to the Waste Staging Building, and loaded into a B-25. The B-25 will be sealed, a TID is installed, and then the B-25 will be transferred to the E-Area.

Green is Clean waste will be collected and put into green translucent bags. The Green is Clean waste bags may undergo SNM diversion check and will be hand carried to the Waste Staging Building for staging. When a sufficient amount of Green is Clean waste accumulates for a shipment, the waste will be transferred to a sanitary landfill.

13.0 REFERENCES

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S&P Solid Waste Management Block Flow Diagram - Figure 1