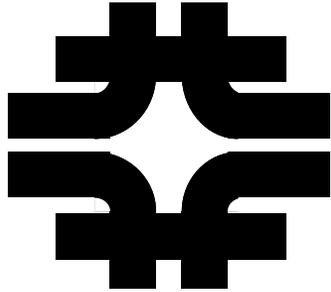


FERMI NATIONAL ACCELERATOR LABORATORY



LOW-LEVEL WASTE CERTIFICATION PROGRAM

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LOW-LEVEL WASTE CERTIFICATION PROGRAM

1. INTRODUCTION

Fermilab National Accelerator Laboratory (Fermilab) is located in the greater Chicago area and occupies a 10.6 square mile tract of land that was largely farmland at the time it was obtained. Fermilab is a national laboratory managed by Fermilab Research Alliance, LLC. (FRA) for the U.S. Department of Energy (DOE). As a single purpose laboratory, its primary mission is to conduct basic research into the fundamental structures and interactions of matter. Fermilab is home to the world's highest energy proton/antiproton accelerator. In order to accelerate protons and antiprotons to 1 TeV, a series of linked accelerators is required.

Fermilab's research program is based on the use of these high-energy proton and antiproton beams produced by the accelerators. This research program can be operated in the collider or fixed-target mode. In the fixed-target mode, proton beams are extracted from the Tevatron, split, and sent to various beamlines where consequences from the impact of high-energy protons on ordinary matter are studied. In the collider mode, counter circulating beams of protons and antiprotons are collided together and the products from those collisions are studied.

In the course of operating the Fermilab accelerators, some material activation does occur. With the exception of tritium, all activation products of significance, i.e., with half lives of hours or longer, are beta/gamma emitters. The most commonly observed activation products are H-3, Be-7, Na-22, Mn-54, Co-56, Co-57, Co-58 and Co-60.

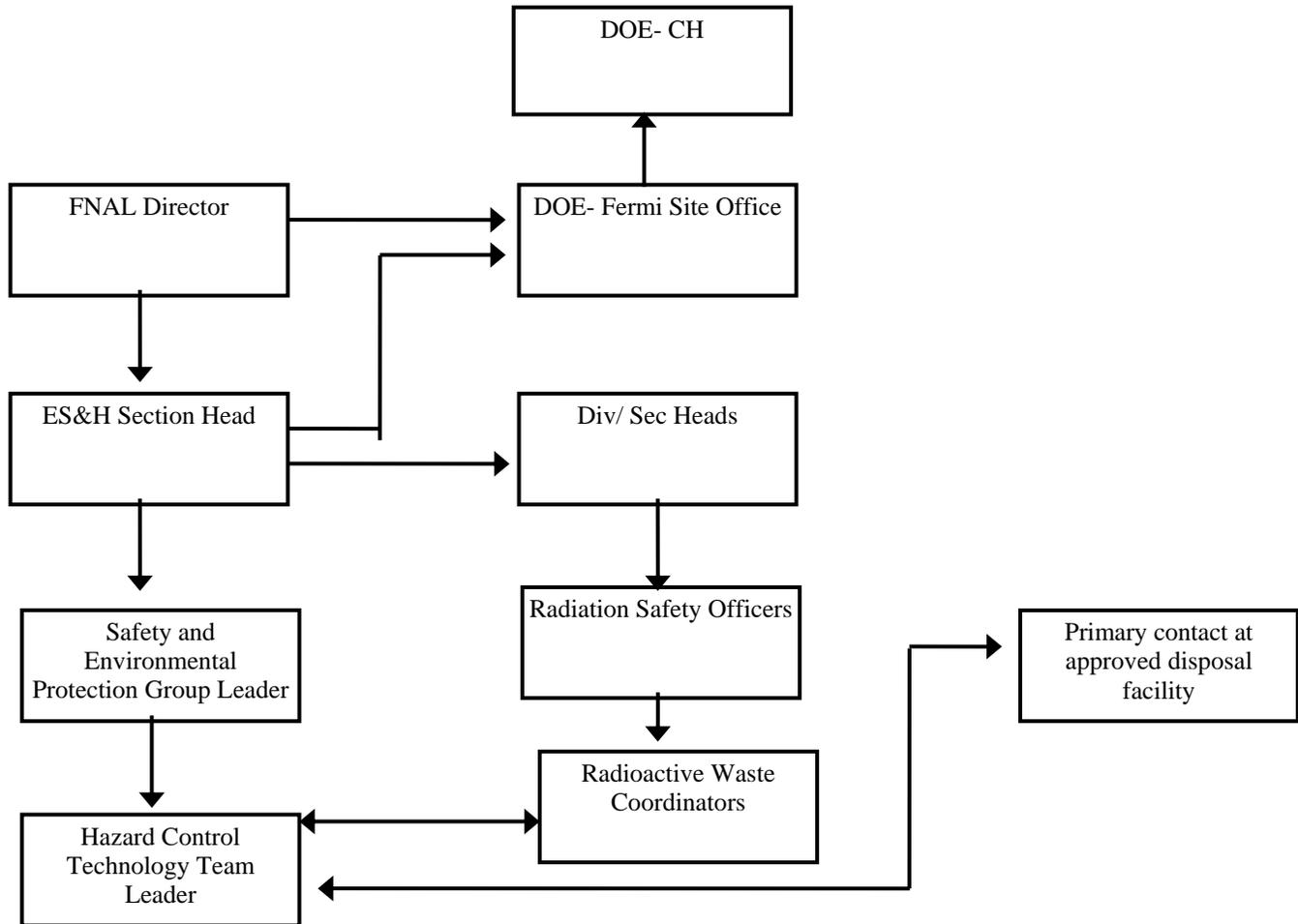
2. PURPOSE AND SCOPE

Fermilab manages radioactive waste in a manner to protect workers, the public, and the environment while meeting the Waste Acceptance Criteria (WAC) of the radioactive waste disposal facility. Fermilab complies with all existing regulations and requirements concerning the management of radioactive waste.

3. ORGANIZATION AND RESPONSIBILITIES

The DOE Fermilab Site Office in conjunction with the DOE Chicago Operations Office will approve Fermilab's radioactive waste disposal facilities.

A. Organization Diagram



B. Responsibilities

(1) Environment, Safety & Health Section (ES&H)

- *Environment, Safety & Health Section Head*- The Fermilab Environment, Safety & Health Section is responsible for insuring the Waste Acceptance Criteria of the disposal facility is being met. The ES&H Section Head will serve as a formal liaison between DOE Fermi Site Office and Fermilab.
- *Safety and Environmental Protection Group Leader*- The Safety and Environmental Protection (SEP) Group Leader will be responsible to the Environment, Safety & Health Section Head in managing the radioactive waste program. He/She will provide advice and make necessary recommendations on policies and procedures.

- Hazard Control Technology Team Leader- The Hazard Control Technology Team (HCTT) Leader will be responsible to the Safety and Environmental Protection Group Leader and will manage the day-to-day function of the radioactive waste program. He will deal directly with site radiation safety personnel in carrying out established policies and procedures for the generation of radioactive waste. He will also implement quality assurance procedures and maintain waste management records. The Team Leader may communicate with personnel from the waste disposal site and DOE Fermi Site Office on an informal basis for the purpose of information gathering.

(2) Generating Division/Section

Each Division/Section is responsible for insuring that its radioactive waste generators are properly trained. As a minimum, this training must include Radiological Worker Training. The generating areas are responsible for coordinating with the ES&H Section Safety and Environmental Protection Group as to methods of packaging, labeling, coordination of pickup and delivery of containers. They are responsible for adhering to all procedures regarding the characterization of waste, storage, loading and labeling of radioactive waste containers and bulk unpackaged waste.

4. Description of Waste Generating Processes

Beam losses from normal operations activate accelerator components and equipment. These components and equipment constitute the main source of radioactive waste. For waste generated at locations other than where the beam is intentionally targeted or dumped, the dose rates are typically less than 10 mrem/hr at 30 cm from the items.

The radionuclides and specific activity present in the waste depend on the type of material, the length of time the item was exposed to the beam and the length of time the item has been allowed to decay. Nearly every item is allowed from several weeks to several months of cool down time before it is shipped off site for disposal. By that time, typically the main isotopes present are: in iron or steel Mn-54, Co-60, Be-7, with half lives of 312.2 days, 5.2 years and 53 days respectively; and in aluminum Na-22 and Be-7 with half lives of 2.6 years and 53 days respectively.

Radioactivity in water is produced by spallation processes in primarily the cooling loops (recirculating systems) near targets and other beam loss points. Only a minor fraction of the total waste activity is in liquid form. The two radionuclides produced that require the water be disposed of as radioactive waste are H-3 and Be-7. The H-3 remains in the cooling water. The Be-7 is removed by ion exchange resins and appears in the discharge from the regeneration of these resins.

Radioactivity in oil is produced by spallation processes in vacuum systems and other equipment near targets and other beam loss points. The primary radionuclide produced in oil that requires its disposal as radioactive waste is H-3.

Fermilab's waste/material management strategy has always been to minimize the volume of waste shipped to the disposal site and insure that all quality assurance standards and waste acceptance

criteria are met. To these ends, a sorting and screening program is in effect at the Laboratory. This program is conducted by the SEP Group of the ES&H Section.

Particular attention is devoted to the prevention of the creation of mixed waste by the training of operations personnel. This training identifies hazardous materials that would be irradiated if left in beam areas, and become mixed waste.

5. DATA QUALITY OBJECTIVES

A. Required Data

Data Quality Objectives insure that data developed for the disposal facility WAC are appropriate and of the necessary quality and assure that the disposal facility has the necessary data for its radiological performance assessments.

The data required by the disposal site for each container and information that is required to supply the data is as follows:

(1) Activity

- Knowledge of the waste generation processes
- Contact dose rate readings and dose rate to activity calculations
- Activation Analysis Laboratory analysis (if determined to be required)

(2) Radionuclides

- Knowledge of the waste generation processes
- Gamma Spectroscopy, if necessary
- Off site or on site tritium analysis

(3) Hazardous Component (if applicable)

- Knowledge of the waste generation processes
- Material Safety Data Sheets and other supporting documentation
- On site analysis
- Off site analysis

(4) Form

- Knowledge of the waste generation processes
- On site tests

(5) Description

- Knowledge of the waste generation processes
- Material Safety Data Sheets and other supporting documentation

(6) Quality Assurance

- Dose rate instruments are calibrated to be within $\pm 10\%$.
- Dose rate to activity calculations will be within a factor of \pm two with the intent to estimate on the high or conservative side.
- Activation Analysis Laboratory analysis results are reported with a 10% uncertainty.

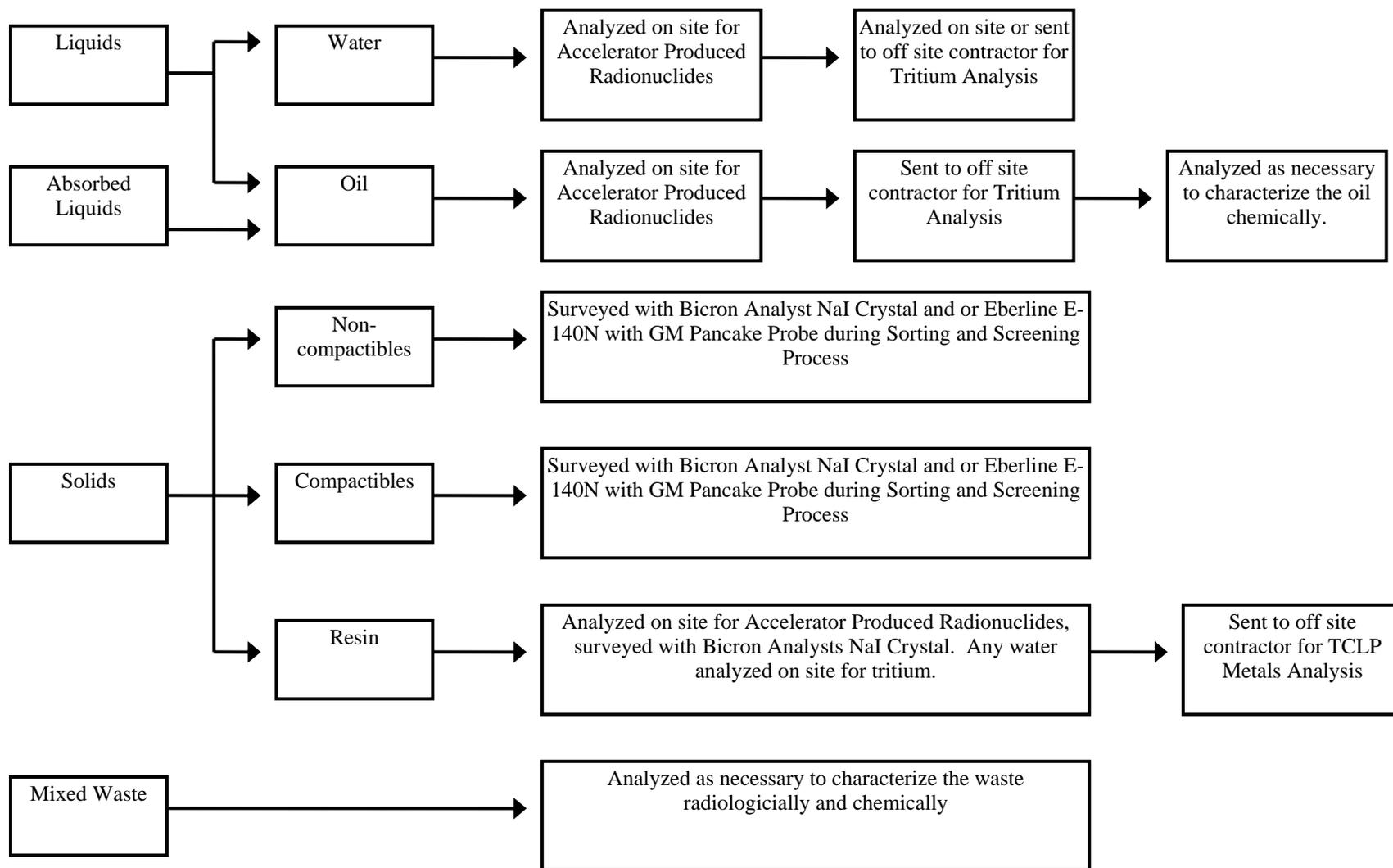
- Detectability of tritium in oil is 5 pCi/gram \pm 15%.

B. Defining the Available Data

- (1) Fermilab has a great deal of knowledge and experience in characterizing material for radionuclides and activity content. This has been obtained during 35 years experience in the operation of the Fermilab Activation Analysis Laboratory and the development of a formula for dose rate to activity conversion by members of the Radiation Physics Staff Group.
- (2) We have a functional knowledge of the various waste streams throughout the Laboratory. This includes hands-on control of the generation of radioactive and mixed wastes. Waste is segregated at the generation site by form and type.
- (3) The waste being generated in a mixed waste stream may require analysis for RCRA constituents. Mixed wastes are kept segregated from other waste streams at the generation sites and in storage.
- (4) The personnel who handle and process radioactive waste have been trained formally and through job experience in the proper handling of radioactive waste.
- (5) Fermilab's basic methodology for dealing with unknowns or infrequent waste will entail segregation, analysis, characterization, and consultation with the disposal site for proper packaging, labeling, and disposition.

6. WASTE SEGREGATION AND CHARACTERIZATION

A. WASTE SEGREGATION AND CHARACTERIZATION FLOW CHART (Fig. 1)



B. Description of Flow Chart Characterization Methods

Below is an explanation of the accompanying flow chart showing the methods employed for the segregation and characterization of waste streams at Fermilab:

- (1) **Water:** A sample of suspect radioactive water is taken to Fermilab's Activation Analysis Laboratory for analysis with a Gamma Ray Spectrometer for accelerator produced radionuclides. The sample is also analyzed on a liquid scintillation counter for tritium on site or sent to an off site contractor.
- (2) **Oil:** A sample of suspect radioactive oil is taken to Fermilab's Activation Analysis Laboratory for analysis with a Gamma Ray Spectrometer for accelerator produced radionuclides. A sample is also sent to an off site contractor for tritium analysis. In addition, samples may be sent to an off site laboratory for chemical analysis if process knowledge indicates the need.

Radioactive liquids are segregated from dry solids and stored in the liquid's containment area in the Low-Level Waste Handling Facility at Site 40.

- (3) **Absorbed Liquids:** In most cases the absorbed liquid waste would be generated when oily parts are cleaned or when materials such as rags and oil dry are used to clean up a spill. It may also include materials, which are contaminated as a result of a spill. If analytical results of the liquid that was absorbed are available, they will be used to characterize the absorbed liquid waste stream. If analysis of the liquid itself is not possible then a representative sample of the absorbed waste will be analyzed the same as oil.
- (4) **Solids:** These materials are taken by HCTT personnel to the Low-Level Waste Handling Facility at Site 40. The waste is removed from the containers and surveyed for radioactivity using detectors such as the Bicon Analyst with associated NaI scintillation probe or the Eberline E-140N with GM pancake probe. As the material is being surveyed, it is visually checked to insure that there are no violations of waste procedures. Any material suspected of being a disposal facility violation is segregated until identification can be made. The waste is checked against the Radioactive Waste Certification and Pickup Request Form (RW Form #31) completed by the generator, to insure that all the waste was listed and properly characterized.

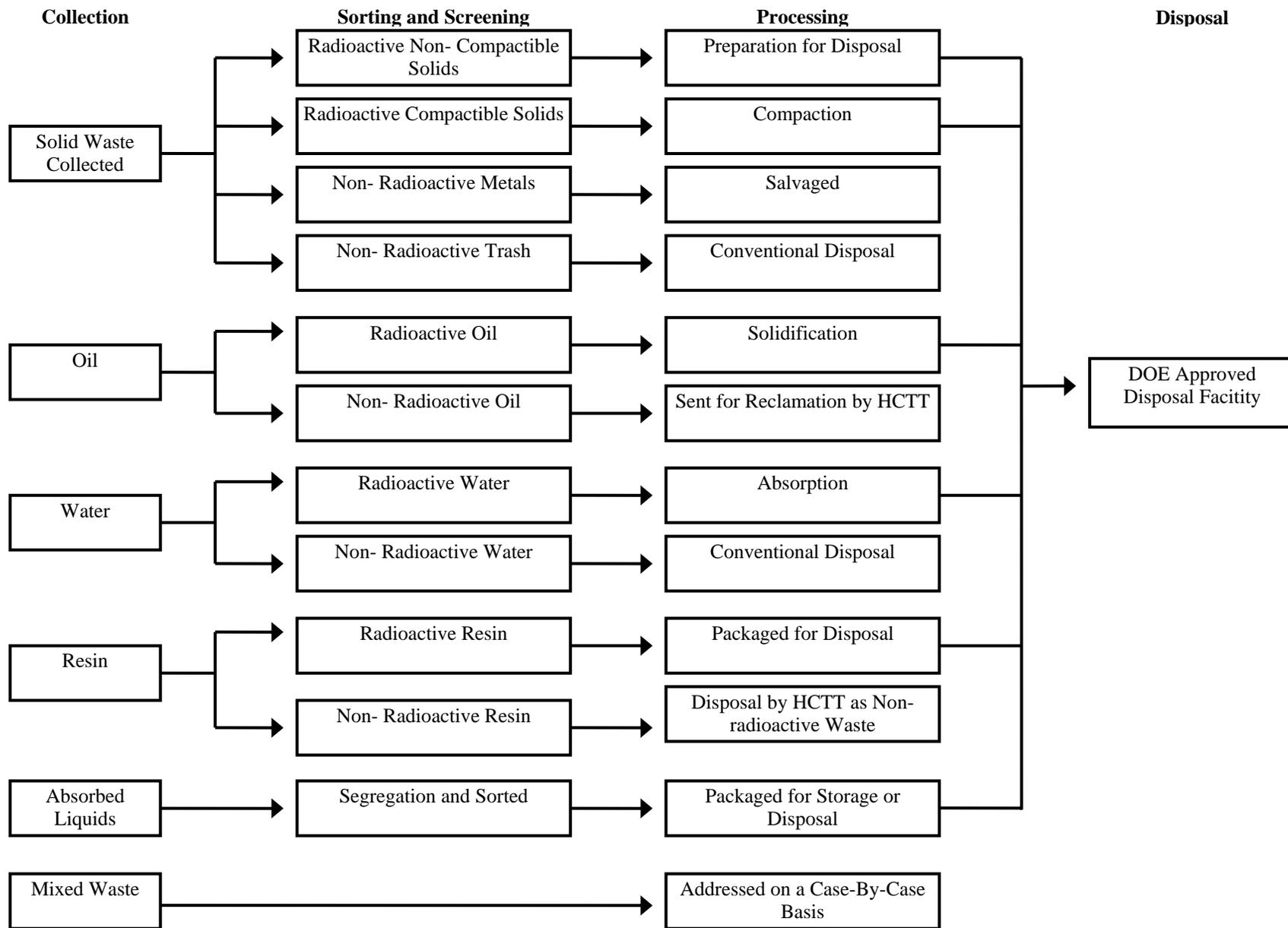
After this material is surveyed, it is packaged and characterized for activity by the utilization of a dose rate to activity conversion formula developed by Fermilab's Radiation Physics Staff Group.

- (5) **Resin:** A sample of suspect radioactive resin is taken to Fermilab's Activation Analysis Laboratory for analysis with a Gamma Ray Spectrometer for accelerator produced radionuclides. The resin is also surveyed using a Bicon Analyst with a NaI crystal. If any water is commingled with the resin a sample of the water is analyzed on site or sent off site for tritium analysis. In addition, a sample may be sent off site for TCLP analysis for metals.

- (6) **Mixed Waste:** Mixed waste is sampled and analyzed as necessary to characterize it radiologically and chemically. Each mixed waste stream is handled on a case by case basis.

7. **WASTE PROCESSING**

A. WASTE PROCESS FLOW CHART (Fig. 2)



B. Waste Processing Methods

Below is an explanation of the accompanying flow chart showing the processing methods employed at Fermilab:

- (7) **Water**: Water is normally collected in labeled 55-gallon bung type drums or 5-gallon carboys and samples are taken for analysis as covered in the text on characterization. The water is then segregated into the following two categories.
 - **Radioactive Water**: This water is absorbed for disposal using the methods approved by the receiving site.
 - **Nonradioactive Water**: This water is disposed of conventionally.
- (8) **Oil**: Suspect radioactive oil is normally collected in labeled 55-gallon bung type drums or 5-gallon carboys and samples are taken for analysis as covered in the text on characterization. The oil is then separated into the following two categories:
 - **Radioactive Oil**: This oil is picked up from the generation site, solidified, and packaged for disposal using the methods approved by the receiving site.
 - **Nonradioactive Oil**: This oil is shipped to offsite vendors for reclamation.
- (9) **Absorbed Liquids**: Absorbed liquids are collected primarily in polyethylene bags and will be segregated and stored at Site 40 until they are shipped to the storage/disposal facility.
- (10) **Solids**: These materials are collected from the generation sites on regularly scheduled days or on a case by case basis. The types of containers include 55-gallon drums, 56 cu. ft steel boxes and self-contained metal scrap and equipment. As a result of processing, the solid material is segregated into the following four categories:
 - **Radioactive Non-compactible Solids**: This is metal of various sizes and shapes and other materials which are packaged in 55-gallon drums, Fermi steel boxes or prepared for shipment as unpackaged self-contained waste.
 - **Radioactive Compactible Solids**: This material (paper coveralls, shoe covers, etc.) is compacted into 55-gallon drums at Site 40 or utilized as void space filler in 55-gallon drums and Fermi steel boxes.
 - **Nonradioactive Salvage**: This is metal scrap with a recycle value. This material is sold to local scrap vendors.
 - **Nonradioactive Trash**: This is material that is of no value and is disposed of conventionally.

- (11) **Resin**: Resin is collected in labeled 55-gallon drums and samples are taken for analysis as covered in the text on characterization. The resin is then segregated into the following two categories:
- **Radioactive Resin**: This resin is packaged for disposal using the methods approved by the receiving site.
 - **Nonradioactive Resin**: This resin is disposed of by the HCTT as non-radioactive waste.
- (12) **Mixed Waste**: Mixed waste is collected in labeled 55-gallon drums or other containers approved by the HCTT. Samples are taken for analysis as covered in the text on characterization. The waste will be packaged for shipment as required by 40 CFR, 49 CFR, and the receiving facility.

8. **WASTE CHARACTERIZATION**

The processes that we employ to characterize our waste have been covered in DATA QUALITY OBJECTIVES, by the flow chart in Fig. 1 and its accompanying explanation.

As a quality assurance requirement in the radiological sample testing procedures, QA samples are spiked with known amounts of known radionuclides by the Safety and Environmental Protection Group to verify the accuracy of the offsite contractor's methods of analysis.

9. **FACILITIES, EQUIPMENT AND MATERIALS**

The facilities and equipment used in the processing of radioactive material have been designed and constructed to enable Fermilab to meet the WAC of the receiving site.

Some specific aspects of the program where the design and construction has been achieved to meet WAC are:

- The sorting and screening area utilizes a specially designed table. This table enables the waste processing personnel to accurately separate the solid waste into its various components, i.e., radioactive vs. nonradioactive, compactible vs. non-compactible.
- The instrumentation used by processing personnel is calibrated at fixed intervals or as needed by a calibration group at the Laboratory. The sources used in the calibrations are National Institute of Standards and Technology traceable.
- The scale used to weigh waste containers is calibrated annually by an off-site contractor. The standards used in calibrating the scale are National Institute of Standards and Technology traceable.
- The absorption process for water is documented and only those personnel who have been trained are authorized to perform this task.

- The solidification process for oil has been adapted directly from the company who developed it. Fermilab contracts representatives from this company to come to the site, perform the solidification process, and certify their work.

10. **PACKAGING, HANDLING, STORAGE AND SHIPPING**

- A. **Packaging:** After the wastes have been processed by sorting, screening, compaction, absorption or solidification they will be packaged for shipment to the receiving facility. The method of packaging is determined by the receiving facility, the Department of Transportation (49 CFR) and EPA (40 CFR).
- B. **Handling/Storage:** Packaged waste is stored at the Low-Level Waste Handling Facility at Site 40 until a sufficient amount is accumulated to make a shipment for disposal practical. Large unpackaged self-contained items may be stored at Site 40 or the Railhead Boneyard. RCRA mixed waste, currently only lead waste, is stored at the Hazardous Waste Storage Facility at Site 55. This facility operates under a Part B Permit issued by the Illinois Environmental Protection Agency.
- C. **Shipping:** Shipping of radioactive waste is carried out utilizing common carriers and is arranged by Fermilab's Traffic Manager. The trucks are loaded by Hazard Control Technology Team personnel.

Accuracy is insured by re-checking all entries and documented on a quality assurance check sheet.

11. **INSPECTION**

At the present time, the waste program is subject to the following audits and inspections.

- Regular formal audits by the Department of Energy Field Office on all aspects of waste processing. This includes visits to generation, storage, and handling facilities as well as process evaluation and inspection of documentation.
- Informal audits by in-house personnel on a variable schedule determined by process changes.

It is anticipated that the Waste Certification Program will be subject to inspection by the receiving facility. The results of these audits and inspections are retained by the auditors and by the department being audited. All audit findings and observations are entered and tracked in the Fermilab ESHTRK Database.

12. CORRECTIVE ACTION

Corrective action is taken in the waste certification program for a number of reasons:

- As a result of an audit or inspection. The results are reported to laboratory management and if there are any deficiencies or flaws that would have an effect on WAC, these items are spelled out for corrective action. The infraction is listed along with the person or group responsible for the corrective action and a timetable for its completion.
- A change in the receiving sites WAC. If the methods of waste processing are unacceptable to meet the change of the receiving site's WAC, Fermilab's methods would be amended.
- As required if the method of certification was producing less than proper assurance that the waste would meet the receiving site's WAC. This would necessitate replacing the process.

13. PROCEDURES

All procedures utilized in the certification of radioactive and mixed waste for shipment to the receiving site are documented and kept on file. These procedures are reviewed periodically and updated as required. One of the functions of the auditors is to check these procedures and to verify that processing personnel and generators are carrying them out.

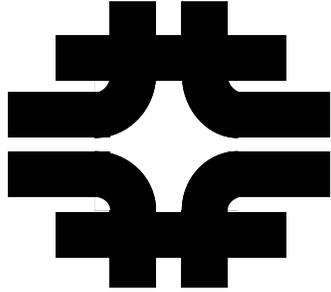
14. RECORDS

Records related to the waste certification program are maintained in fire protection storage. In addition, many of the records are maintained in computer files that are routinely backed up.

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APPENDIX A

FERMI NATIONAL ACCELERATOR LABORATORY



RADIOACTIVE WASTE MANAGEMENT PROGRAM

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FERMILAB

APPENDIX A

RADIOACTIVE WASTE MANAGEMENT PROGRAM

1. PURPOSE AND SCOPE

This program provides guidance for conducting Fermilab's day to day waste management operations in a manner to protect workers, the public, and the environment while meeting the waste acceptance criteria of the radioactive waste disposal facility. This program is supported by waste management procedures and forms to insure compliance with all applicable regulations.

2. RADIOACTIVE WASTE GENERATOR RESPONSIBILITIES

A. Training

Each Division/Section shall ensure all of their personnel generating radioactive waste are properly trained. As a minimum "Radiological Worker Training" is required. In addition, all radioactive waste generators should be trained in all requirements that are specific to their Division/Section.

B. Waste Characterization

All generators shall characterize their waste as required by the low-level waste receiving facility and DOE Order 435.1. Generators shall characterize their waste with sufficient accuracy to permit proper identification, minimization, segregation, transportation, treatment, storage, and disposal. This characterization shall ensure that, upon or immediately after generation and before packaging the actual physical and chemical characteristics and radionuclide content of the waste are known and recorded for use during all subsequent stages of the waste management process. Generators shall be responsible for submitting samples of their waste for analysis, as necessary, to properly characterize it radiologically and chemically. As a minimum, the characterization of waste shall include the following information:

- (1) Physical and chemical characteristics of the waste and any void-filling or absorbent material.
- (2) Volume of the waste (total of waste and solidification or absorbent media)
- (3) Weight of the container and contents;
- (4) Identities, activities, and concentration of major radionuclides(determined by Dose Rate to Activity Conversion or by analysis as appropriate);
- (5) Method of assay or analysis used to determine radionuclide distribution and concentration;

- (6) Packaging date, package weight, and total volume
- (7) Any other information which may be needed to prepare and maintain the disposal facility performance assessment, or demonstrate compliance with applicable performance objectives.

C. Waste Container Contents Inventory

- (1) An inventory sheet [“Radioactive Waste Certification And Pickup Request Form” (RW Form #31) or “Hazardous/Radioactive Mixed Waste Certification and Pickup Request Form” (HCTT Form #2), as appropriate] shall be maintained for each waste package as the package is filled. This inventory shall include the physical description of the waste material that is added to the package.
- (2) The physical description of the waste must be entered on the appropriate form. This description must include the specific name or names of the contents of the waste package (e.g., magnet stand, insulated wire, or absorbed liquid). The chemical form of the waste (e.g., carbon steel, PVC insulated copper, HE-150 vacuum pump oil & paper towels) must also be included. If an item is made up of more than one chemical form, then the percentage of each form must be included (e.g., 20% stainless steel, 40% aluminum, 20% plastic, and 20% copper). The physical description should also include any internal packaging (i.e., Plastic Rad. bags).
- (3) Generators must have controls in place to insure that no uncharacterized waste is placed in a waste container. Typical controls are locking 30-gallon drums, 55-gallon drums and Fermilab steel boxes and/or keeping the waste in controlled access storage areas. An example of a controlled access storage area would be a locked cabinet or a fenced in area.
- (4) The generator is responsible for insuring that no liquid is present in items placed in containers or in items that are classified as unpackaged self-contained, such as a main ring magnet. All liquids must be removed from the item and packaged separately in approved containers.

D. Waste Certification

The custodian or generator of each waste container or self-contained item must certify the waste is properly characterized by signing the certification statement on the RW Form #31. The form shall be reviewed and approved by the radioactive waste coordinator for the division/section generating the waste.

E. Waste Segregation

- (1) Waste must be segregated at the generation site to prevent the possibility of cross contamination.

- (2) The following waste classifications must be separated: non-radioactive non-regulated; radioactive non-regulated; non-radioactive regulated; and radioactive regulated.

F. Waste Minimization

Each generating division/section shall comply with Fermilab's "Waste Minimization Plan," Chapter 8022 of the "Fermilab Environment, Safety and Health Manual," and keep the volume of radioactive waste generated as low as practical. The generation of mixed waste (hazardous/radioactive) shall be prevented if at all possible. Non-hazardous materials shall be substituted for hazardous materials if a non-hazardous equivalent is available.

G. Radioactive Waste Pickups

Waste scheduled by Friday will be picked up on the next regular pickup.

- (1) All containers that are issued with closure devices must be properly secured to insure no loss of contents during transport (i.e., the lid and lock ring must be secured on 55-gallon drums with a bolt and the bungs on 30 and 55gallon drums must be securely tightened).
- (2) The generator shall insure that there is no removable contamination on the external surface of containers or unpackaged items above the Fermilab prescribed limits (Fermilab Radiological Control Manual, Chapter 4, Article 423). All containers and items should be decontaminated to below detectable levels if at all possible.
- (3) All containers or items shall have a "Radioactive Waste Label" attached prior to pickup. Labels will be affixed to drums and steel boxes at the time of issue by HCT Team personnel. Generators are responsible for affixing labels to other miscellaneous containers and bulk items. A "Radioactive Waste Label" shall be affixed to a 2 7/8" X 5 3/4" manila tag (available in the Fermilab stockroom) and tied to radioactive waste bags and unpackaged bulk items or otherwise affixed to the waste. Labels may be acquired from the HCT Team.
- (4) A Generator inventory number, contact dose rate and 1 foot dose rate shall be entered on the "Radioactive Waste Label" by a representative of the generating division/section.

H. Radioactive Mixed Waste Pickup

A HCTT Form #2 must be completed and submitted to the HCT Team at MS 363, to request the pickup of hazardous/radioactive mixed waste as defined by state and federal regulations. Mixed waste shall be segregated from all other wastes. All generator responsibilities that pertain to low-level radioactive waste also pertain to mixed waste. Examples of mixed waste that could be generated at Fermilab are ignitables (ethyl alcohol) Environmental Protection Agency (EPA) 'F' listed solvents (acetone, methanol, Freon TF), Polychlorinated Biphenyls (PCBs) (contained in some fluorescent light ballast's), TCLP heavy metals (copper pipe

joints and elbows with lead based solder, small electronic components containing lead based solder on printed circuit boards and lead coated vacuum rings).

3. **ES&H SECTION, SAFETY AND ENVIRONMENTAL PROTECTION GROUP, HAZARD CONTROL TECHNOLOGY TEAM RESPONSIBILITIES**

A. **Training**

HCT Team personnel will be trained in all waste processing and management functions they perform. As a minimum Radiological Worker Training will be required in addition to training in all waste management procedures, transportation training required by the Department of Transportation (DOT), and job specific training.

B. **Waste Characterization**

The HCT Team will assist generators in designating their waste or potential waste to the requirements of state and federal regulations. When necessary the HCT Team will request assistance from the receiving facility in designating the materials.

C. **Waste Container Contents Inventory**

- (1) The contents of all waste containers will be inspected by HCT Team personnel and repackaged in new containers, as needed, before shipment for disposal. If the contents of the container do not match what is listed on the RW Form #31, the waste will be returned to the generator for proper characterization or the generator will be required to report to the Low-Level Radioactive Waste Handling Facility (LLWHF) at Site 40 to correct any deficiencies.
- (2) During audits of radioactive waste generation areas, RW Form #31's for specific containers will be reviewed to insure the waste description is being entered on the form as the container is being filled (see 2.C.1).

D. **Waste Segregation**

- (1) Mixed waste will be segregated from low level waste while it is in storage awaiting shipment for disposal.
- (2) Liquid waste will be segregated from dry solids.

E. Radioactive Waste Pickups

- (1) A radioactive waste pickup will be performed biweekly by the HCT Team. All RW Form #31's will be reviewed by a member of the HCT Team to insure they are properly completed prior to the waste being picked up. If the pickup request is rejected it will be returned to the generator to be corrected.
- (2) Personnel from the HCT Team will perform the pickup by following the "Radioactive Waste Pickup Procedure" (RW Procedure #19).

F. Radioactive Mixed Waste Pickups

The pickup of Resource Conservation and Recovery Act (RCRA) mixed waste will be performed by representatives of the HCT Team. All RCRA hazardous waste that is confirmed to be radioactive will be taken to the Part B permitted Hazardous Waste Storage Facility (HWSF) at Site 55 for storage pending off site shipment for storage/disposal. All ES&H Section Safety and Environmental Protection Group responsibilities that pertain to low-level radioactive waste also pertain to mixed waste.

G. Radioactive Waste and Radioactive Mixed Waste Disposal

- (1) The HCT Team will complete Waste Profile Sheets and submit them to the disposal facility, along with supporting documentation, to gain approval to ship a specific low-level waste stream for storage/disposal. Material Safety Data Sheets, results of analysis, and other characterization documentation will be included with the any Waste Profile Sheet as necessary to get the waste stream approved for acceptance.
- (2) The HCT Team will perform any processing described in Radioactive Waste Processing Methods of this document.
- (3) The HCT Team will insure that all waste is properly packaged and the packages are marked and labeled as required by the receiving facility, RCRA regulations and DOT regulations.
- (4) The HCT Team will insure that all documentation required to ship radioactive waste will be prepared for each shipment of low-level radioactive waste.

4. **CONTAINERS, PACKAGING AND STORAGE**

A. **Approved Containers**

- (1) UN 1A2 55-gallon steel drum.
- (2) Steel Box 48" x 42" x 52"
- (3) Steel Box 96" x 42" x 28"
- (4) Steel Box 96" x 42" x 52"
- (5) Steel Box 62" x 38" x 24"

B. **Quality Assurance of Radioactive Waste Shipping Containers**

The HCT Team will purchase all containers used to ship radioactive waste to the disposal facility. The containers will be inspected to insure they meet the requirements of the disposal facility and DOT Regulations.

(1) *Acceptance Requirements*

The Lab's acceptance of new containers from any vendor will be based on two conditions:

- Manufacturer's certification of the drums received

The certification is stamped into the metal of new drums. All 55-gallon drums must be certified as UN 1A2. Steel boxes are constructed to Fermilab specifications and meet the requirements for strong tight packages.

- Fermilab inspection of new containers

The containers are inspected for integrity; that is, no visible holes or weld defects, dents, rust, or oil. They are inspected for a DOT certification stamp, if required; they are inspected for completeness; that is, the assurance that all closure bolts, lids, gaskets and snap rings are included with each container.

- (2) When the containers are found to be acceptable, a "New Radioactive Waste Container Acceptance Certification Form" (RW Form #4) is completed and filed.

C. **Storage of New Containers**

Once the new containers are accepted, they are properly stored. Proper storage consists of a building to provide reasonably dry conditions. Empty containers are currently stored in the LLWHF at Site 40.

D. **Issuing of Empty Containers**

Containers are delivered to the generation sites on the scheduled waste pickup days, when they are requested on the RW Form #31. HCT Team personnel will properly label and assign inventory numbers to drums and steel boxes. If containers are needed prior to the pickup day, arrangements can be made by contacting HCT Team personnel.

E. Description and Uses of Containers

No RCRA hazardous waste shall be placed in any radioactive waste container without prior approval from the HCT Team. Mixed waste shall be segregated from all other wastes.

The HCT Team will advise generators of packaging requirements for any radioactive mixed waste on a case by case basis.

(1) 55-Gallon UN 1A2 Drums

- These are yellow UN 1A2 performance based steel drums with a lid, snap ring, and bolt.
- They are used for various types of solid waste, i.e., small electronic components, nuts, bolts, wire, floor sweepings, contaminated items, etc. Absolutely no liquids are permitted in 55-gallon drums without prior approval from the HCT Team.
- All 55-gallon drums are to be stored inside or protected from the elements.

(2) 55-Gallon UN 1A1 Drums

- These are yellow or black UN 1A1 performance based steel bung type drums that are liquid tight.
- They are used for either water or oil. Absolutely no commingling of liquids in 55-gallon bung drums is permitted. Small volume liquid waste may be collected in containers smaller than 55-gallon drums. The HCT Team or the area Division/Section ES&H Group should approve containers used to collect small volume liquid wastes.

(3) Metal Boxes

- These are 3.5' X 4' X 4' steel boxes with lockable covers.
- They may be used for the collection of scrap metal, wire, cable, and other items too large to fit in 55-gallon drums. Boxes are not intended for compactible material, floor sweepings, plastic bags, or contaminated material. Boxes should be stored in secured areas. Absolutely no liquids are permitted in boxes. Waste shall not extend above the top of the box.

(4) Rad Waste Bags

- These are 8 to 10 mil polyethylene bags. Currently there are three sizes.
- They are used to collect dry compactible materials that are transported to the compacting facility at Site 40. Any bag of compactable material containing hot particles or removable contamination greater than 1 mrem/hr on contact shall have a contamination label in addition to the radioactive waste label attached to the bag. No wood, metal or other non-compactible items may be mixed with compactibles.
- Absorbent materials used to clean liquids off activated parts or used in the cleanup of spills may be collected in radioactive waste bags, but they must be segregated from other waste streams. The waste description must include a thorough description of the absorbed liquid.

(5) Bulk Item

- These are large items that will not fit in drums or boxes.
- These materials shall be banded when possible and stacked on skids or cribbing. If surface contamination is present, the items must be decontaminated below Fermilab release limits (Fermilab Radiological Control Manual, Chapter 4, Article 411) prior to pickup. If the radiation level is high enough to present an ALARA concern to the personnel who would decontaminate the item contact the HCT Team for possible options.
- If an unpackaged bulk item contains any liquid, the liquid must be drained from the item and packaged in approved containers.

(6) HEPA Vacuum Cleaners for Radioactive Materials

- These are portable vacuum cleaners containing 99.97% High Efficient Particulate Air (HEPA) filters. HEPA filtered Rad vacuums are marked with a "Radioactive Contamination" label.
- HEPA Rad Vacs may be used to vacuum dry activated dust, dirt, and other small lightweight materials that are not hazardous. Prior approval must be received from the HCT Team or the Division/Section ES&H Group before a Rad Vac can be used to collect any hazardous materials. A RW Form #31 shall be completed and delivered to Site 40 along with the vacuum when it is due for calibration, requires servicing, or needs to be emptied. The user of the vacuum is responsible for thoroughly characterizing the waste inside the vacuum.
- If HEPA filters from Rad Vacs or from fixed HEPA filter installations become radioactive waste, the filters must be characterized. If by process knowledge the generator or user of the filter cannot certify that the filters contain no hazardous materials, a sample of the filter will have to be submitted for chemical analysis.

F. Storage of Full Containers

Containers that are full and awaiting shipment are stored in the LLWHF at Site 40, the Boneyard, or the Part B permitted Hazardous Waste Storage Facility at Site 55 for radioactive mixed waste. The following steps will be taken to insure that the integrity of the containers will be maintained.

(1) 55-Gallon Drums

- 55-Gallon drums will be stored indoors at the LLWHF at Site 40 or the Boneyard.

(2) Boxes

- Steel boxes will be stored indoors at the Boneyard or the LLWHF at Site 40 while awaiting processing.

(3) Containerized liquids

- Liquids will be stored in the liquid's containment area at the LLWHF at Site 40.

5. SHIPPING RADIOACTIVE WASTE

A. Regulations and Practice

There are several sources of regulation requirements for the proper shipment of radioactive materials, and more specifically, radioactive waste. These are:

- Title 49, Code of Federal Regulations, Parts 100 - 185.
- Title 10, Code of Federal Regulations, Part 71.
- DOE O 460.1A, Packaging and Transportation Safety
- DOE O 460.2, Departmental Materials Transportation and Packaging Management
- HNF-EP-0063, Hanford Site Solid Waste Acceptance Criteria

All radioactive materials will be shipped in accordance with existing regulations. All shipments of radioactive materials will be arranged by the HCT Team and the Fermilab Traffic manager.

6. DOCUMENTATION

The following list of forms and logs are utilized in the preparation and shipment of radioactive waste.

A. Containers

- (1) New Radioactive Material Packaging Acceptance Certification (RW Form #4).

B. Accumulation and Processing

- (1) Radioactive Waste Certification And Pickup Request Form (RW Form #31)
- (2) Radioactive Waste Certification and Pickup Request Form Continuation Sheet (RW Form #31).
- (3) Hazardous/Radioactive Mixed Waste Certification And Pickup Request Form (HCTT Form #2).
- (4) Radioactive Waste Incident Report (RW Form #3).
- (5) Characterization Log for Radioactive Waste (RW Form #1).
- (6) Waste Profile Sheet
- (7) Waste Specification Record

C. Shipping

- (1) Uniform Low-Level Radioactive Waste Manifest
- (2) EnergySolutions 5 Working-Day Shipment Notification
- (3) Hazard Control Technology Team Security Check Sheet For Placarded Shipments of Hazardous Material (HCTT Form #07)
- (4) Truck Release Survey Form (RW Form #25).
- (5) EnergySolutions Shipment Checklist (RW Form #16).
- (6) Emergency Response Guide.
- (7) Straight Bill of Lading.
- (8) Fermilab Material Move Request.
- (9) Record of Radioactive Material Receipts and Shipments (RP Form #20).
- (10) Uniform Hazardous Waste Manifest (mixed waste shipments only).

References

1. DOE M 435.1-1 *Radioactive Waste Management Manual*, 7-9-99.
2. *Code of Federal Regulations, 49CFR, Parts 100 to 185*, latest revision.
3. *DOE O 460.1A, Packaging and Transportation Safety*.
4. *DOE O 460.2, Departmental Materials Transportation and Packaging Management*.