

OM12E: PCP  
 Page : 1  
 Rev. : 3

THE CLEVELAND ELECTRIC ILLUMINATING COMPANY  
 PERRY NUCLEAR POWER PLANT OPERATIONS MANUAL

Process Control Program

TITLE: PROCESS CONTROL PROGRAM (PCP)

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Process Control Program (PCP)

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SCOPE OF REVISION:

Rev. 3 - Revise PCP to meet draft NRC Guidelines of a Solid Waste Process Control Program and provide more detailed description of NUS mobile system's interconnections with plant installed system.

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PROCESS CONTROL PROGRAM (PCP)

1.0 INTRODUCTION

The Process Control Program (PCP) is designed to provide administrative control and guidance for the solidification, dewatering and other processing of applicable forms of radwaste for ultimate disposal. The PCP contains information pertaining to the current formula (mixing ratio), sampling, analyses, tests, and determinations to be made to ensure that the processing and packaging of radioactive wastes, based on demonstrated processing of actual or simulated wet solid wastes, will be accomplished in such a way as to ensure compliance with 10CFR20, 10CFR61, 10CFR71, Federal and State regulations, burial ground requirements and other requirements governing the disposal of radioactive waste.

The PCP is applicable to the plant installed and NUS supplied mobile radwaste system for solidification and dewatering of applicable waste forms.

Numerous features have been incorporated into the design of the solid radioactive waste system and the building housing this system to insure that exposures of operating personnel to radiation will be kept within ALARA guidelines.

1.1 Definitions

The following definitions are applicable to the sections that follow:

ACCEPTABLE ENVELOPE (of solidification/dewatering): specific properties of wastes that fall within the limits of the parameters required for solidification. These parameters are established within the test solidification instruction for each applicable waste type.

BATCH: the volume of isolated waste contained in a tank that will be processed for solidification or dewatering.

CONTAINER: the physical container in which the final waste product is deposited.

HIGH INTEGRITY CONTAINER (HIC); an approved container for burial having an expected life of 300 years.

SOLIDIFICATION: the conversion of radioactive materials from liquid and solid systems to a monolithic, immobilized solid with a definite volume and shape, bounded by a stable surface of distinct

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outline on all sides (free standing), with a free water content of less than 0.5% by volume.

## 2.0 WASTE TYPES

There are numerous types of radioactive material expected to be generated at PNPP that will require processing, including solidification or dewatering, prior to their disposal. These radwaste types can be categorized based on their chemical and physical properties. The waste types expected at PNPP are evaporator concentrates (bottoms), bead resins, filter demineralizer media sludge, traveling belt filter cake, filter cartridges, oily waste, and dry active waste (DAW).

The following waste types (other than DAW) may be solidified individually or in combination, with the provision that the chemistry of the waste falls within the acceptable envelope for solidification.

### 2.1 Evaporator Concentrates (Bottoms)

Evaporator concentrates (bottoms) result from the processing of the chemical waste tanks which contain condensate demineralizer regeneration solutions and/or low concentrations of the following: trisodium phosphate, minute amounts of other chemicals used for chemistry analyses, or decontamination solutions. They will normally be in the range of 5% to 25% sodium sulfate by weight.

### 2.2 Bead Resins

Bead resins are collected from the condensate, liquid radwaste, and suppression pool demineralizers and stored in the spent resin tank.

### 2.3 Filter Demineralizer Media Sludge

Sludge is the waste product generated by the backwash of the condensate filters, the reactor water cleanup filter/demineralizers, and the fuel pool filter/demineralizers. Sludge may consist of powdered ion exchange resin at varying degrees of exhaustion, fibrous filter media, and small concentrations of various solids and corrosion products. The media are decanted to approximately 10% by weight prior to solidification/dewatering in the appropriate settling tank.

#### 2.4 Traveling Belt Filter Cake

This is the product remaining on the liquid radwaste traveling belt filters used to process waste water streams. It consists of one or more of the following; diatomaceous earth or powdered resin, various solids, dirt, and corrosion products in small concentrations.

#### 2.5 Filter Cartridges

Filter cartridges from the detergent drain tank system, CRD pump suction and discharge filters, and any other disposable-type filter cartridge that may be used in permanent or temporary, plant or vendor systems are included in this category.

#### 2.6 Oily Waste

Oily waste is that oil collected in liquid radwaste systems as a resulting from leakage and maintenance on various lubrication and hydraulic systems.

#### 2.7 Dry Active Waste (DAW)

Contaminated air filters, paper, rags, clothing, tools, equipment and parts, that cannot be effectively decontaminated are contained in this category. Also included are laboratory wastes.

#### 2.8 Other Materials

Various other materials not specifically identified above, will be evaluated for solidification or dewatering on a case-by-case basis.

### 3.0 PROCESS DESCRIPTION

The following process descriptions apply to both plant and vendor supplied systems. Any differences between the two have been noted.

#### 3.1 Filling of Tanks

Once it is determined that a liquid radwaste system batch tank is to be processed, it will be recirculated to ensure a homogeneous mixture. Eductors inside the tanks enhance the mixing capabilities. The waste is then transferred from the batch tank or traveling belt filters to one of the redundant solid radwaste mixing tanks on a batch basis. After the transfer, the fill isolation valve is closed and the fill line is backflushed to the tank from which the waste originated.

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### 3.2 Sampling/Analysis

Samples will be obtained and analyzed for each batch of waste in accordance with OM12A: CHI-42, OM12A: CHI-78, and OM1E: RAP-1101, respectively for the plant system, or vendor procedures and PCP for vendor supplied systems. Prior to sampling, tanks will undergo sufficient mixing and/or recirculation to ensure representative sampling. At a minimum, analyses will be performed for radionuclide content, pH, oil content, settled solids, and temperature in order to ensure the waste falls within the acceptable envelope for solidification/dewatering.

### 3.3 Preconditioning

Waste preconditioning is the chemical or physical adjustment of the waste to bring it within an established acceptability envelope to ensure solidification. The need for and type of preconditioning shall be determined using sample analysis results and will be performed in accordance with OM12A: CHI-78 or vendor procedures and PCP. Upon completion of waste preconditioning, additional samples shall be obtained, as required, to determine solidification mixing ratios.

Oily wastes may require special preconditioning. Handling of oily wastes will be conducted in accordance with burial ground requirements.

### 3.4 Mixing Ratios

Mixing ratios give the respective amounts of waste and solidification agents required for acceptable solidification. The determination of mixing ratios shall be performed for each batch of waste to be solidified. Solidification mixing ratios are dependent upon percent settled solids and sodium sulfate concentration. The waste type and ratios of cement, waste, sodium sulfate (for Class A waste), and water are determined in OM12A: CHI-78 or vendor procedures and PCP.

### 3.5 Dewatering

Dewatering is the removal of water from solid material to a concentration of less than 0.5% or 1.0% by volume, as applicable to containers used and burial site limits. Dewatering of radioactive spent resins, filter sludges and cartridge filters shall be performed in accordance with approved operating procedures which are based upon documented test data demonstrating the ability to achieve drainable water limits as specified in applicable regulations.

### 3.6 Solidification Processing

#### 3.6.1 Description of Plant Processing System

Solidification and/or dewatering of wet solid radioactive waste will be processed by NUS, Process Service Corporation's mobile system. This system is discussed in detail in Section 3.6.2. The following description applies to the plant installed solid radwaste system that will interface with NUS's equipment (see Figure 1).

After the proper amount of waste has been transferred to the waste mixing tank, the tank is decanted to remove excess free water (except when the waste being handled is traveling belt filter cake, in which case a predetermined amount of water or other approved aqueous solution is added to the tank for slurry transfer of the contents). The waste slurry is transferred at a preset rate to the vendor's equipment, in accordance with OM13A: RWI-14, where it is either dewatered or solidified with cement. The waste mixing tanks have recirculation capabilities where a representative sample can be drawn. If needed, a dewatering connection is available which is routed to the liquid radwaste system. An additional connection has been provided back to the waste mixing tank for use in the event of a liner overflow condition. Hot water flush connections are provided to thoroughly flush the plant and the vendor equipment into the liner used for processing. The waste transfer line and dewatering return lines are located behind a two foot thick shield wall to reduce exposure to the operator during processing.

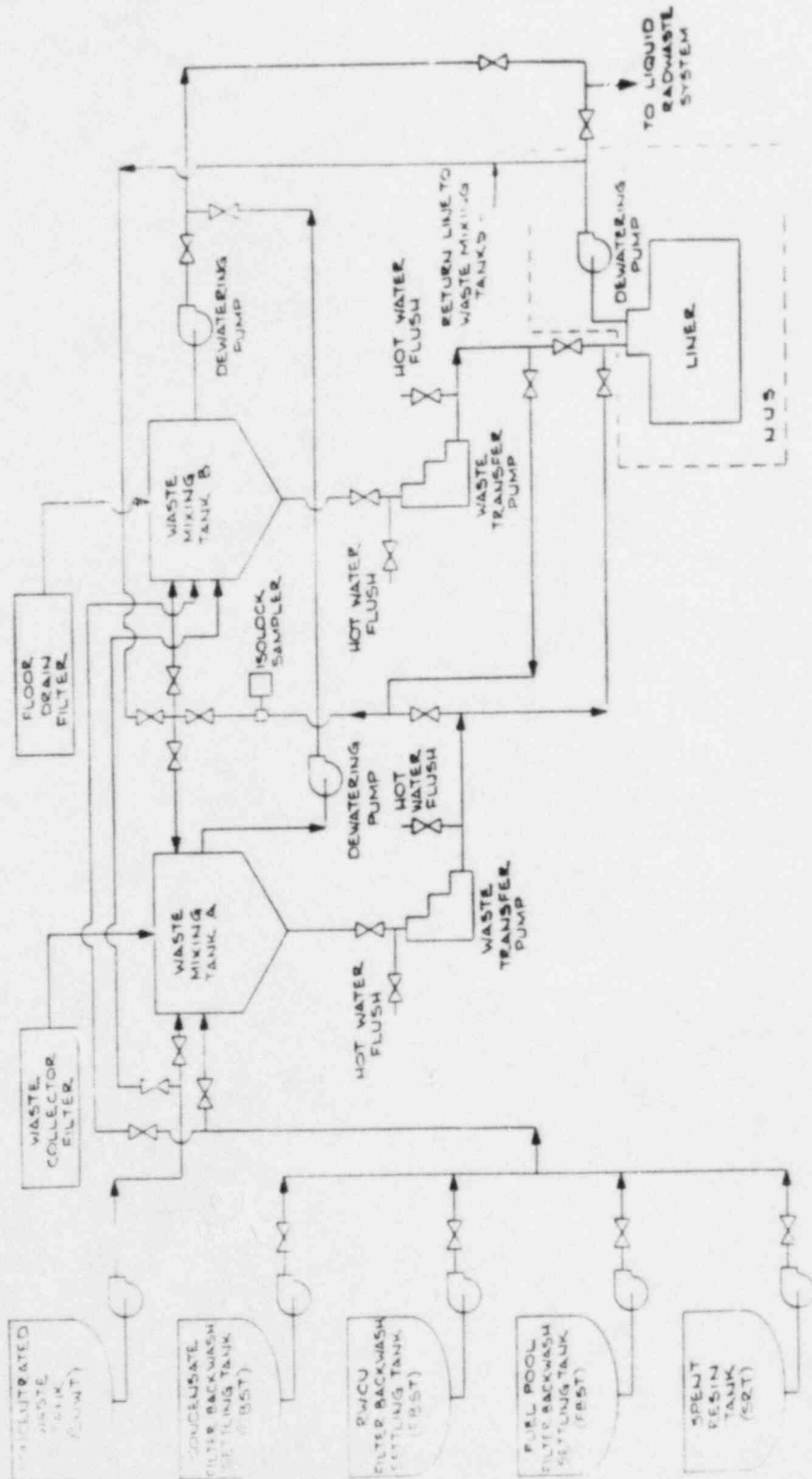
#### 3.6.2 Description of the Vendor's Waste Processing System

The wet solid radioactive waste will be transferred to NUS's equipment to be dewatered (per NUS Process Control Program for Dewatering Lines with NUSPSC Internals, No. FI-013, Rev. D or solidified (per NUS Process Control Program for NUSPSC Radwaste Solidification Systems No. SS-001, Rev. H). A complete process system description for the NUS mobile solidification system is contained in NUS Process Services Topical Report on Radwaste Solidification System, PS-53-0378, Rev. 0. The only exceptions to those NUS documents are: (1) test solidifications will be run on each batch of the same waste type instead of every tenth batch, and (2) waste will be supplied to the NUS equipment at 20 gpm instead of 40 gpm due to pump limitations.

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Figure 1  
Solid Radioactive Waste Processing System



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The vendor's equipment is located in the Radwaste Building in the fill aisle and storage area adjacent to the truck bay (see Figure 2). All processing of radioactive waste will be performed in the fill aisle with only the vendor's cement transfer equipment being located in the adjacent storage area. These areas in the Radwaste Building are specifically designed to handle radioactive waste. Concrete walls and floors in this area have protective coatings and shield walls are provided between the vendor's equipment and potential radioactive sources to keep personnel exposures ALARA. The storage area is large enough to contain 15 liners. This provides adequate storage before it is shipped to a burial site.

### 3.6.3 Radiological Effluent Controls and Monitoring

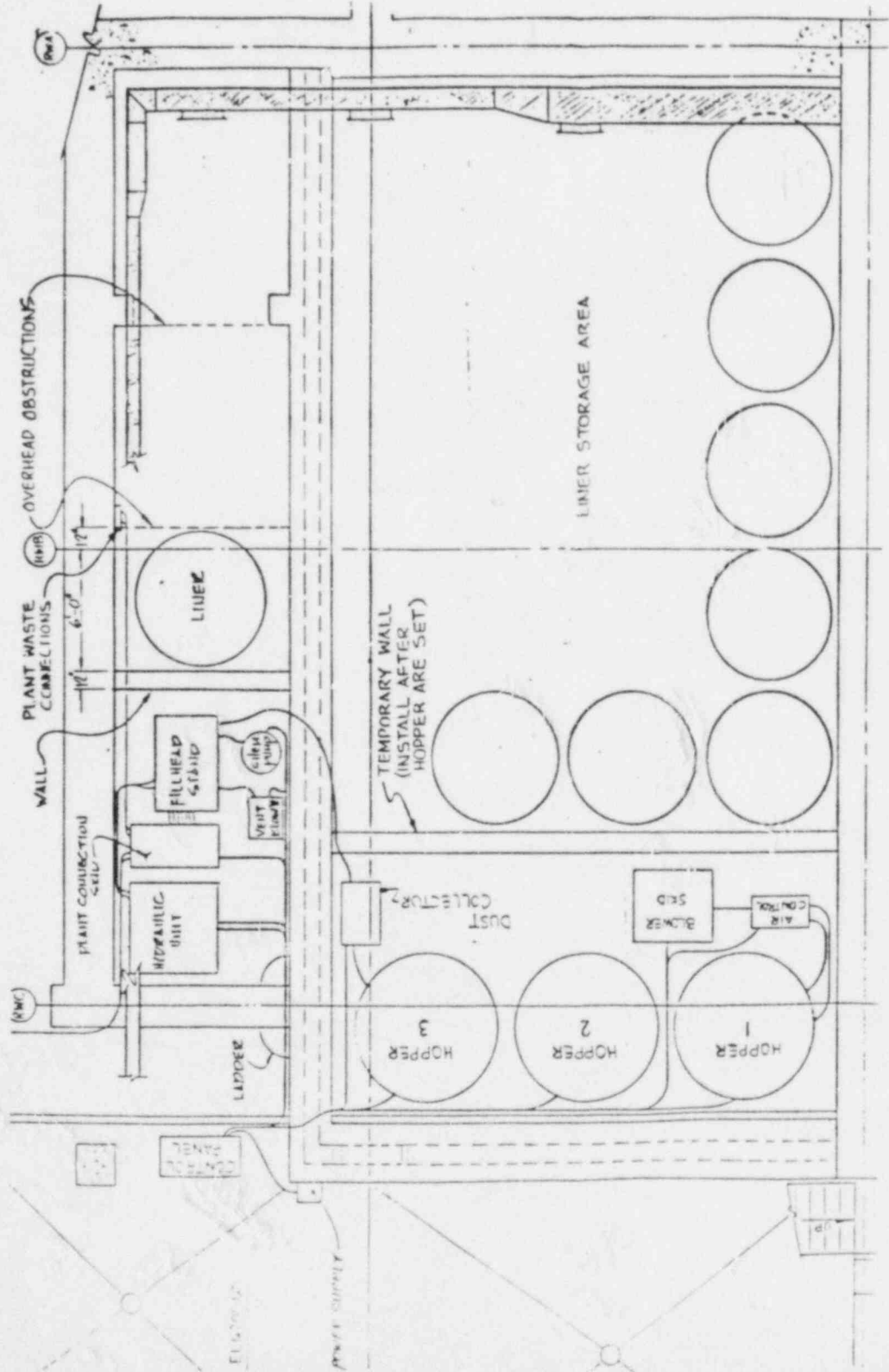
All processing with the vendor's equipment will be performed in a room with a volume sufficient to contain any postulated spill. A floor drain, routed to the liquid radwaste system, provides drainage in this area. All liquid radwaste discharges are sampled and monitored prior to their release to the environment.

Gaseous discharges from liners are processed through the vendor's off-gas blower system as described in the NUS Topical Report PS-53-0378. The vendor's equipment incorporates radiation monitors on the fill head assembly and the process piping skid.

Ventilation from the areas housing the radwaste treatment and processing equipment, including the vendor's off-gas blower system, is routed through HEPA filters and charcoal beds prior to release to the environment via the Unit 1 Vent. Radiological monitoring is provided for Regulatory Guide 1.21 compliance to meet applicable Federal Code requirements.

Figure 2

NUS Mobile Solidification Equipment Layout



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3.6.4 Health Physics Support

Health Physics personnel will provide radiological control during the solidification process. All work will be conducted under a Radiation Work Permit to keep personnel exposures ALARA.

3.6.5 Plant Utility Support

3.6.5.1 Fire Protection

Fire suppression is provided above the processing and storage area to protect against fires. A fire hose is available in the truck bay for miscellaneous uses.

3.6.5.2 Two-Way Communication

A two-way communication system will be used for communication between the plant operator and the vendor equipment operator. This will facilitate smooth coordination between the different segments of the waste processing system.

3.6.5.3 Heating and Ventilation

The Radwaste Building Ventilation System will maintain a negative pressure in the processing and storage area. Heating is provided by the building heating system whose heat source is the plant auxiliary boiler.

3.6.5.4 Overhead Crane

An overhead crane will be used to transfer equipment between the storage and processing area and the truck bay. The crane has a 15 ton capacity which is fully capable of handling solidified liners.

3.6.5.5 Closed Circuit Television

Closed circuit television will be used, where applicable, for remote viewing of the processing and storage areas. The overhead crane has an independent camera for viewing all lifting and placing operations.

3.7 Cartridge Filters

Cartridge filters may be disposed of by encapsulation in a cement matrix in steel drums or liners. The encapsulation of cartridge filters shall be performed using approved procedures that provide reasonable assurance that the final waste form will meet the

stability criteria of the Branch Technical Position on Waste Form. Cartridge filters may also be disposed of by placement in HIC's that are certified by the land disposal facility's state agency.

### 3.8 Dry Active Waste

Potentially contaminated dry wastes will be collected in containers located throughout the radiologically controlled areas within the plant. The waste will be periodically collected and transported to a temporary storage area prior to waste segregation (as per OM1A: PAP-1901). Waste segregation will be performed to reduce waste volume and to recover reusable materials.

In order to reduce the waste volume, compressible waste will be compacted into shipping containers in accordance with OM13A: RWI-15. Caution will be taken to avoid items that would cause free water formation as well as other compressibility hazards. Noncompressible waste will be loaded manually into suitable shipping containers.

### 4.0 PRODUCT CONTROL

Solidification processes will be conducted by qualified PNPP or vendor personnel in accordance with approved plant and/or vendor operating instructions and procedures.

#### 4.1 Test Solidification

Test solidifications are performed on waste stream samples to verify plant and/or vendor calculated solidification formulae. Test shall be performed to support solidification mixing formulae as follows: (1) every batch of the same waste type; (2) when sampling analysis falls outside the normal established envelope and preconditioning is ineffective, (3) following any liner of the same waste type where solidification has been determined to be unacceptable; (4) when it is believed that some unexpected or abnormal contaminant may be present; or (5) when requested by Chemistry Supervision. A batch that requires test solidification shall not be processed until such time as the test solidification proves acceptable.

Upon failure of a test solidification, additional samples shall be obtained and testing will continue until a successful solidification has been performed with revised mixing ratios as determined by Chemistry Supervision. Solidification of the batch may then be continued using the alternate solidification parameters defined by testing.

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#### 4.2 Product Quality

Solidification process product quality shall be ensured by the use of predetermined mixing ratios of waste and solidification agents. Mixing ratios are based upon laboratory testing of non-radioactive waste materials and are supported by (1) the test solidifications performed periodically, as mentioned above; (2) periodic checks, visual and physical, of actual processed containers filled with solidified waste; and (3) once every two years requalification of the waste form. Requalification includes testing for compressibility in accordance with ASTM C-39-84, following an appropriate immersion period.

#### 4.3 Acceptability

The acceptability of the solidified product shall be verified by ensuring that less than 0.5% free standing water exists and that the solidified product appears to be able to hold its shape if it were to be removed from the container.

Unacceptable solidified waste shall be handled as follows: (1) if the reason for unacceptability is free standing water, the free standing water will be removed or extra cement/sodium silicate will be added to solidify the free water; (2) if all or portions of the product did not solidify, the waste container will be capped and placed in a storage location in the Radwaste facility and periodically checked until such time that the product is acceptable or it is determined that additional solidification agents can be added to achieve satisfactory solidification. This will be determined by Chemistry Supervision. The handling of unacceptable solidified waste will be on a case-by-case basis.

### 5.0 WASTE CLASSIFICATION, CHARACTERIZATION AND MANIFEST REQUIREMENTS

#### 5.1 Waste Classification

All wastes shall be classified in accordance with the requirements of 10CFR61 as implemented by OM1A: PAP-1309 and OM1E: RAP-1102 and performed by the RADMAN computer code. Analyses shall be performed on the waste streams at least annually (biannually for Class A waste), to determine the isotopic abundance of non-gamma emitting isotopes in the streams. Scaling factors, for the non-gamma emitting and transuranic constituents, will be developed from these analyses. Prior to the establishment of an acceptable data, estimated isotopic concentrations will be those obtained from the "Data Base Analysis Report" prepared by Waste Management Group.

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The activity of each radionuclide in the radioactive waste shall be determined by a calculational method employing the isotopic analysis of the waste and scaling factors. For DAW, a dose-to-curie conversion factor, per fraction of the radionuclides, and scaling factors be used to determine activity.

#### 5.2 Waste Characteristics and Manifest Requirements

All wastes shall meet the characteristic requirements of 10CFR61.56(a) and (b), as applicable, and waste packages shall be marked to identify the waste class. The manifesting requirements of 10CFR20.311 shall be implemented by OMI: PAP-1309 and performed by the RADMAN computer code. Records are maintained in accordance with 10CFR71.91. These records will be identified in the Records Retention/Disposition Schedule.

#### 6.0 ADMINISTRATIVE CONTROLS

Compliance with applicable state and federal regulations, and with burial site criteria is ensured by compliance with the solid radioactive waste surveillance instructions, OM7A: SVI-G51-T5284. The implementing instructions and procedures for radioactive waste solidification, dewatering, and segregation describe the requirements which must be met prior to processing radioactive waste, as well as the expected condition of the resultant waste form. Test solidifications, full scale calculations and operation of solidification, dewatering and segregation equipment shall be performed by qualified plant staff and vendor personnel. Plant staff personnel shall provide Health Physics and Quality Assurance coverage, operate plant radioactive waste systems, collect waste stream samples, and perform isotopic analyses. Copies of all referenced documents are available onsite for use by personnel engaged in waste processing activities.

Any changes to the Process Control Program shall be reviewed by the Plant Operations Review Committee (PORC) and shall be detailed in the Semiannual Radioactive Effluent Release Report covering that period.

#### 7.0 QUALITY ASSURANCE

Quality Assurance related activities for the solid radwaste program are implemented as described in the Perry Nuclear Power Plant Quality Assurance Plan. To prevent unacceptable solidified waste

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from being released for shipment, test samples will be verified for acceptability by Chemistry Supervision. These activities shall provide verification that all solid radioactive waste meets applicable State and Federal regulations and burial site criteria. A flow chart illustrating the sequence of events for a waste solidification process is provided in Figure 3.

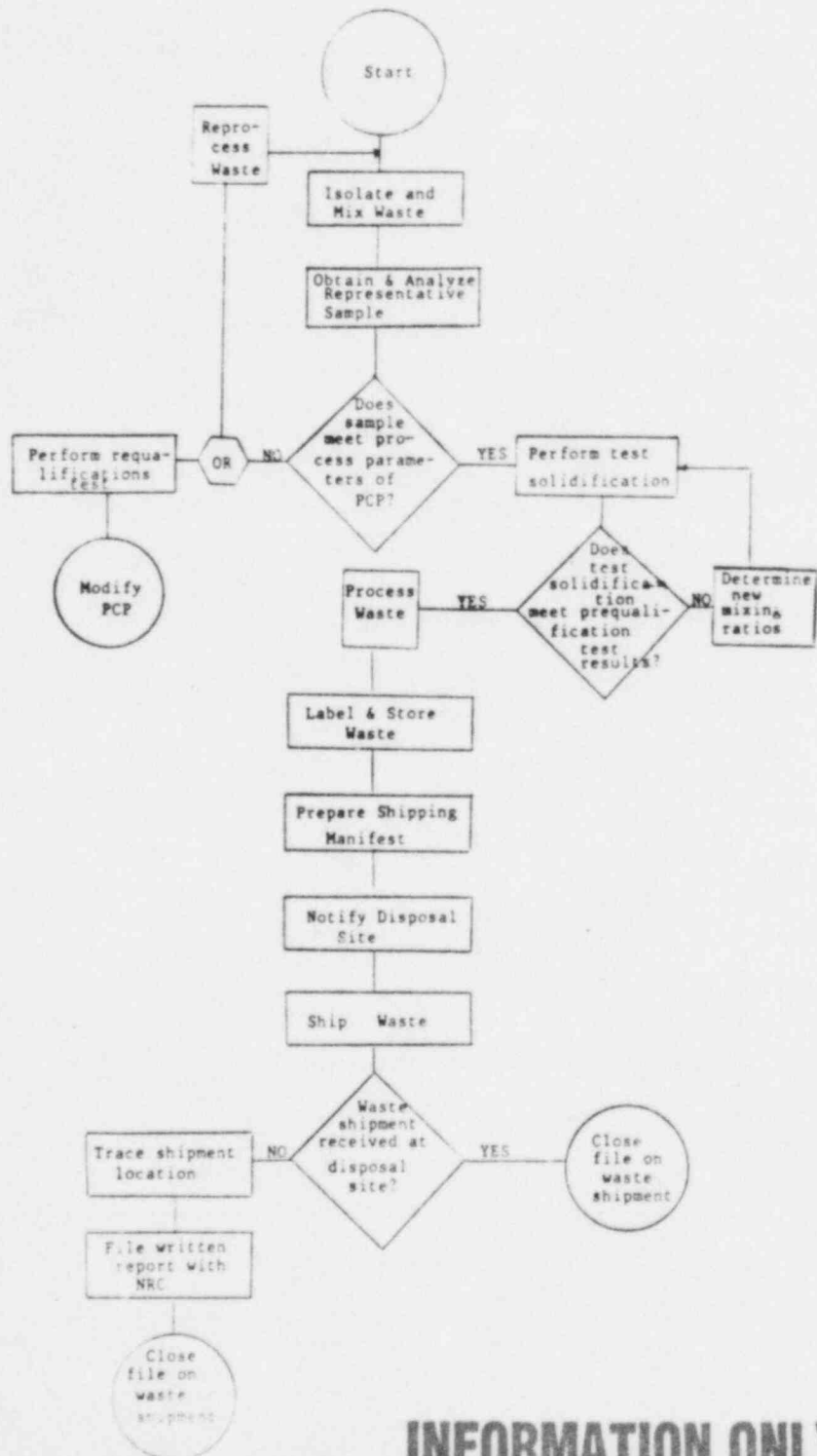
The Quality Assurance Plan also includes a management review of vendor's Topical Report. This will ensure that the vendor's operations and requirements are compatible with the responsibilities and operation of the plant.

Training and qualification of operators will be performed per Regulatory Guide 1.8 and ANSI N18.1 - 1871.

For accountability of filled waste containers, a clearly legible storage diagram will be permanently displayed near the radwaste control panel. It will show the position of containers holding wastes, the date the wastes were processed, and their dose rate(s). The storage diagram will be updated to reflect any changes, additions or deletions to storage.



Figure 3  
Radwaste Process Flow Chart



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8.0 RECORDS

The following documents are generated by this program:

Quality Assurance Records

None

Non Quality Records

None

Waste classification records, waste form records, and other records required for the preparation of the Semiannual Radioactive Effluent Release Report shall be prepared and retained in accordance with 10CFR71 requirements.

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18. Perry Nuclear Power Plant Operations Manual, "Shipment of Radioactive Waste for Disposal," OM1A: PAP-1309, The Cleveland Electric Illuminating Company, Perry, Ohio 44081.
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