

VOGTLE'S RADIOACTIVE WASTE
PROCESS CONTROL PROGRAM

APPROVED BY: J. Bockhold 2/1/86

8603030101 860221
PDR ADOCK 05000424
E PDR

TABLE OF CONTENTS

		<u>Page</u>
1.0	PURPOSE	1
2.0	SCOPE	1
3.0	REFERENCES	1
4.0	OPERATING RESPONSIBILITIES	3
5.0	DEFINITIONS	3
6.0	WASTE DESCRIPTION	5
7.0	PROCESS DESCRIPTION	6
8.0	ADMINISTRATIVE CONTROLS	7
9.0	WASTE CLASSIFICATION	8
10.0	SOLIDIFICATION VERIFICATION	8
11.0	PORTABLE VENDOR SERVICES	9
12.0	MATERIALS HANDLING	9
13.0	RECORDS	11

1.0 PURPOSE

1.1 The process control program (PCP) is a description of the techniques and policies associated with the disposal of solid radioactive waste. It describes the steps used by the plant staff to; characterize the waste prior to solidification, assure the quality of materials used during processing, and verify and document the integrity of the final waste form.

1.1.1 Application of processing techniques outlined in this PCP ensure appropriate solidification of the waste. The end result being the production of a waste form which meets or exceeds the requirements of 10 CFR 20, 10 CFR 50, 10 CFR 61, 10 CFR 71, Radiological Effluent Technical Specifications, as well as other Federal, State, and Burial Ground regulations governing radioactive waste disposal.

1.1.2 This PCP meets the requirement of Technical Specifications 4.11.3 and 6.13.1.

2.0 SCOPE

2.1 The PCP explains the methods by which the radwaste disposal technology is monitored to assure production of a certifiable waste product. Procedures, administrative controls, and quality control techniques are presented.

2.1.1 The PCP and implementing procedures are approved by the Vogtle Electric Generating Plant management prior to use. Changes to the PCP will be reviewed by the Plant Review Board and in accordance with the technical specifications.

2.2 The implementing procedures reference and incorporate where appropriate, the processing information found in the vendor's PCP. Vendor PCP provides information such as:

- o Binder used
- o Additive used
- o Process control parameters
- o Waste form properties
- o Description of solidification process
- o Mixing times
- o Boundary conditions

3.0 REFERENCES

3.1 Regulatory Guidance

- 3.1.1 49 CFR Parts 170-178 Department of Transportation Hazardous Materials Regulations.

- 3.1.2 10 CFR 20 Standards for Protection Against Radiation.
- 3.1.3 10 CFR 61 Licensing Requirements for Land Disposal of Radioactive Wastes.
- 3.1.4 10 CFR 71 Packaging of Radioactive Material for Transport and Transportation of Radioactive Material Under Certain Conditions.
- 3.1.5 NUREG 0800 Standard Review Plan 11.4 Solid Waste Management Systems.
- 3.1.6 Branch Technical Position ETSB 11-3 Design Guidance for Solid Radioactive Waste Management Systems Installed in Light-Water Cooled Nuclear Power Reactor Plants.
- 3.1.7 Low-Level Waste Licensing Branch Technical Position on Radioactive Waste Classification - May 1983, Rev. 0.
- 3.1.8 Low-Level Waste Licensing Branch Technical Position on Radioactive Waste Form - May 1983, Rev. 0.
- 3.2 Licensing Documents
 - 3.2.1 Vogtle FSAR Section 11.4, 13.0.
 - 3.2.2 Vogtle Technical Specifications 4.11.3 and 6.13.1.
 - 3.2.3 Vogtle Safety Evaluation Report Section 11.4.
- 3.3 State and Local Guidance
 - 3.3.1 South Carolina Department of Health and Environmental Control Radioactive Material License No. 097, Amendment No. 4-1 (Barnwell Facility).
 - 3.3.2 Barnwell Site Disposal Criteria, (Chem Nuclear).
- 3.4 Vendor Topicals
 - 3.4.1 "Radioactive Waste Volume Reduction System" Topical Report No. AECC-3 (X6AK10A-408).
 - 3.4.2 Topical Report the Stock Equipment Company Waste Solidification Process for Low-Level Radioactive Wastes - Generic Waste Form Certification Results (X6AK10B-761).
 - 3.4.3 Topical Report the Dow Waste Solidification Process for Low-Level Radioactive Wastes -- Generic Waste Form Certification Results.

3.5 Vendor Process Control Programs

3.5.1 Radwaste Product Application.

PCP for Cement Solidification for PWR's (X6AK10B-346).

3.5.2 Radwaste Product Application.

PCP for Polymer Solidification of Dry products (X6AK10B-435).

3.6 Vendor Operating and Maintenance Manuals

3.6.1 Volume Reduction System Operating and Maintenance Manual (X6AK10A-843).

3.6.2 Stock Equipment Manual.

3.6.3 Stock Operation Manual (X6AK10B-758).

3.7 Vogtle Operating Procedures

3.7.1 Volume Reduction System Operation Procedures.

3.7.2 Cement Solidification System Operating Procedures.

3.7.3 Polymer Solidification System Operating Procedures.

3.7.4 Batch Test Sample Preparation and Verification Procedure.

3.7.5 Chemistry Analysis Procedure.

3.7.6 ALARA Program.

4.0 OPERATING RESPONSIBILITIES

The operating organization for radwaste is in accordance with FSAR Section 13.

4.1 Vogtle's radwaste group is within the Operations Department. The group is composed of a supervisor and operators.

4.2 Operators operate the actual processing equipment and the supervisor directs the daily department personnel activities as well as negotiating burial contracts and shipments of radioactive waste.

4.3 The chemistry department is responsible for analyzing the waste stream and reagent samples generated during radwaste processing. Samples are analyzed using VEGP approved procedures.

5.0 DEFINITIONS

5.1 Additive

Material which is introduced into the waste container for the purpose of promoting even, thorough, solidification of the waste.

5.2 Batch

All waste held in a storage vessel for representative sampling prior to processing.

5.3 Batch Test Sample

A quantity of waste physically removed from the waste batch and subsequently solidified according to the batch test sample procedure; the test sample is subject to verification testing which, after having successfully met test requirements, certifies the entire batch.

5.4 Binder

The actual material which, when intimately mixed with the waste according to vendor approved formulas, physically encapsulates the waste into a free standing monolith following an acceptable cure time.

5.5 Cure Time

The time interval elapsing from the initial mixing of the water, binder and additives until the onset of solidification as verified by either the exothermic heat generation or the characteristic time experienced during qualification testing of a successful batch test sample which yielded a certifiable waste form.

5.6 Free Standing Monolith

The resulting homogeneous mixture of waste, binder, and additives which, when combined in proper ratios according to the PCP procedures, yields a non-flowing, self-supporting mass.

5.7 Free Standing Fluid

The quantity of water or fluid that can be drained from a solidification container following the accepted cure time.

5.8 Onset of Solidification

The time at which the waste form is free standing and meets minimum compressive strength criteria.

5.9 Solidification

When the specified amounts of waste, binder, and additive are mixed in accordance with vendor PCP formulas, resulting in a free standing monolith and whose process parameters are within PCP stated boundary conditions and batch test sample was certified.

5.10 Waste Form

Waste in a final packaged form acceptable for shipment to a licensed disposal facility.

5.11 Waste

Those low-level radioactive wastes containing source, special nuclear, or by-product material that are acceptable for disposal in a licensed disposal facility. For the purposes of this definition, low-level waste has the same meaning as in the Low-Level Waste Policy Act, that is, radioactive waste not classified as high-level radioactive waste, transuranic waste, spent nuclear fuel, or by-product material as defined in Section 11.(2) of the Atomic Energy Act (uranium or thorium tailings and waste).

6.0 WASTE DESCRIPTION

6.1 Concentrates and Chemical Drains

Liquid waste is concentrated to between 6-12 wt. percent using the evaporators and held in the waste evaporator concentrates holdup tank. The concentrates are transferred to the solidification building evaporator concentrates waste feed tank where the chemical drain wastes are mixed with the concentrates. In the feed tank pH adjustment may be accomplished, appropriate mixing is done and representative samples are taken.

6.2 Contaminated Oil

Contaminated oil is collected at its source, contained and transported to the solidification building. There it is filtered and fed into the contaminated oil tank.

6.3 Dry Active Wastes

Dry active wastes are roughly segregated, collected and bagged in the radiation controlled areas, and transported to the solidification building. There it is sorted to eliminate undesirable metals, glass and materials containing polyvinyl-chloride. The chemically and thermally suitable dry active waste is screened for metallic objects, shredded and held for processing in a set of parallel storage hoppers. Those dry active wastes that are not suitable for incineration but are compressible are compacted into 55-gallon drums utilizing the compactor. Non-compressible wastes are packaged manually in 55-gallon steel drums or in other suitable containers.

6.4 Resins and Crud

Steam generator blowdown (SGB), liquid waste processing system (LWPS), condensate polishing demineralizer (CPD) resins and backflushable filter crud are slurried to the SGB or LWPS waste feed tank. There the tank contents are mixed, sampled, and pH adjusted as required.

Normally the SGB and CPD resins are combined in the SGB waste feed tanks, while LWPS resin and backflushable filter crud are combined in the LWPS waste feed tank.

6.5 Cartridge Filters

Primary system cartridge filters are loaded into shielded cement pre-lined 55-gallon 17H drums at the filter vaults. At the appropriate time the drums are transported to the solidification building. The remaining voids may be filled with polymer.

7.0 PROCESS DESCRIPTION

General

Vogtle's radwaste processing system, which this PCP addresses, is composed of the volume reduction system, cement and polymer solidification systems.

This section contains a brief description of VEGP systems designed to handle radioactive waste. For further details see FSAR chapter 11.

7.1 Volume Reduction System

7.1.1 The volume reduction system is operated in accordance with written procedures that are based on the vendor recommendations. Evaporator concentrates/chemical drains are fed from the concentrates feed tank to the scrubber preconcentrator where it is further concentrated and then pumped to the dryer and air atomized into the fluidized bed. Combustible trash is shredded and air transported into the incinerator. Oil is pumped to the processor and air atomized into the bed. Small quantities of resins are tapped off the resin recirculation line and injected into the incinerator. The VR system produces a combination of ash and dry salt. The product is separated from the off gas stream in the gas/solid separator. This free flowing granular material passes through an intermediate storage hopper prior to solidification.

7.1.2 As described in the Aerojet topical report, instrumentation and system interlocks are provided to ensure proper system operation. This includes pH measurement, temperature control, active pH control, and flow control.

7.2 Polymer Solidification

7.2.1 Prior to solidification, a waste drum is prepared with its appropriate binder, mixer, promoter and catalysts in accordance with the applicable procedures, and vendor PCP formulas. The information relative to the VR system input is used in determining the correct formulations. The prepared drum is then filled with dry product. Polymer may be used to encapsulate primary system cartridge filters.

7.2.2 The system includes a temperature interlock to prevent waste addition if the temperature is not within the specified boundary conditions. Once the prefilled drum has been placed in the enclosure and the hatch closed, all subsequent operations are performed automatically. The system is a microprocessor controlled closed system. The necessary system controls and interlocks are provided to prevent improper system operation. Instrumentation is provided to monitor post fill exotherms and radiation levels.

7.2.3 Suitable dry active waste is screened for large metallic objects, shredded, and held for processing in a set of parallel storage hoppers. When adequate volumes of shredded dry active waste and liquid concentrates are stockpiled, the wastes are fed into the Aerojet Volume Reduction System. Dry active wastes and liquid concentrates are processed in the dry waste processor and fluidized bed dryer, respectively.

7.2.4 The Aerojet Volume Reduction System produces a combination of ash and dry salt. This free flowing, granular material passes through an intermediate storage hopper on its way to solidification. Prior to solidification, a waste drum is prepared with its appropriate mixers, binders and catalysts according to vendor approved PCP formulas. Waste is then added to the prepared drum.

7.3 Cement Solidification

7.3.1 After the waste to be solidified is sampled, the waste drum is prepared with its appropriate additives, cement and mixer in accordance with the applicable procedures and vendor PCP formulas. The information obtained from the samples and the vendor provided boundary conditions are used in determining the correct solidification formulations. In the case of resins/backflushable filter crud, the waste is slurried into the decant tank where its weight percent water is adjusted.

7.3.1.1 The wastes are then metered into the waste drum using a double fill method, then capped and tumbled. If concentrates/chemical drains are to be solidified they are metered into the drum using a separate metering pump.

7.3.2 At the drumming station, once the prefilled drum has been placed in the enclosure, the hatch closed, the waste to be solidified selected and the quantity for proper solidification has been determined, all subsequent operations are performed automatically. The system is microprocessor controlled with the necessary system controls and interlocks to prevent improper system operation.

7.3.3 The filled drums are removed from the solidification enclosure and placed in the appropriate interim storage area using the remote controlled bridge crane.

8.0 ADMINISTRATIVE CONTROLS

8.1 Restricted Materials

8.1.1 The volume reduction system vendor recommends that certain combustible items be limited or restricted to the VR system feed. Our techniques for adhering to the vendor recommendations are through the waste segregation program and restricted procurement practices. Radwaste personnel are trained to recognize items which contain unwanted chemical species and segregate these trace materials by hand.

8.2 Independent Audits

8.2.1 The Radwaste Department is subject to independent audits of its activities. Audits are conducted according to Sections 13.4 and 17.2 of the FSAR.

8.2.2 Audits include, but are not limited to evaluating ALARA techniques, sampling techniques, shipment forms and procedures. Audits are done annually. Audit results are documented and forwarded to the appropriate department and plant managers.

8.3 Procedure Control

8.3.1 This process control program and the procedures reference herein are based on documented test data and vendor documents. These documents are controlled as described in FSAR Section 13.5.

9.0 WASTE CLASSIFICATION

9.1 This section addresses the analytical techniques which are utilized on site to comply with the applicable State, Federal and Burial Site regulations. These techniques are therefore subject to modification in the event of regulatory change or in the interest of worker exposure and reporting accuracy. Any changes are reflected in approved operating procedures.

9.1.1 Prior to shipping wastes to the burial site the waste is classified according to the Code of Federal Regulations part 61. In order to classify the waste as to the type of radioactive material to be buried, selected radionuclides, their radiation level and any other chemical species which may be present in appreciable quantities are measured.

9.2 Chemical Specie Determination

9.2.1 Chemical specie determination is done directly. As a standard operating practice, each batch of waste is mixed well and a representative sample taken. The chemistry department analyzes the sample and reports their findings to the radwaste department. Chemical analysis procedures are VEGP approved, and meet the intent of the vendor's procedures and techniques.

9.2.2 In the event radiation fields are high, small samples are taken and diluted accordingly. These dilution factors are incorporated into the analytical results. The radwaste department logs the results and adjusts the waste stream chemistry or solidification formulas to correspond with proven solidification formulas.

9.3 Radionuclide Determination

9.3.1 To accurately identify the contents of a solidified waste container, the site uses correlation factors. These factors are unitless numbers which model the relative abundance of select radionuclides as a function of other readily measured isotopes or chemical species.

9.3.2 These factors are developed through a comprehensive sampling campaign. Periodically, samples of solids and liquids are obtained from strategic locations throughout the plant and sent to a lab for a complete radioisotopic analysis. The results are reviewed and various specie ratios assembled. Correlations are calculated based on these ratios.

9.3.3 The correlation factors are applied to the appropriate specie's analytical results from the batch samples and a comprehensive waste form chemical and radionuclide description generated.

10.0 SOLIDIFICATION VERIFICATION

10.1 In order to verify proper solidification of radwaste, periodic lab scale solidifications are performed. Normally, every tenth batch will be sampled and if the radiation fields pose no hazard to personnel, actual samples are solidified. These lab samples are solidified using the same formulas as the full scale solidifications.

10.2 Waste which poses an exposure hazard to operating personnel is not used in actual lab scale solidifications. Rather, the batch is sampled, analyzed and simulated waste used for actual solidification testing.

10.3 Further batch test sample solidifications are only necessary when (1) results of batch test sample chemical analysis indicate a substantial chemical change has occurred from the previous batch (2) a batch test sample solidification failure occurs or (3) when the 10th batch of the same type of waste is to be processed.

10.4 In the event that a lab scale solidification does not provide a free-standing monolith, solidification is repeated. No further full scale solidification of radwaste is allowed until three consecutive lab scale samples meet the acceptance criteria. Subsequent full scale solidification formulas are then altered to correspond with the successful lab scale solidification formulations.

10.5 Waste forms produced are subject to a quality assurance check. The quality check verifies the integrity of the final waste form. Particular inspection and testing techniques used to check the waste form are incorporated into the respective chemistry and operating procedures. These tests and techniques meet the intent of the tests and techniques used by the vendor to evaluate the waste form. Results of product testing are used to adjust or modify the site's solidification formulas.

11.0 PORTABLE VENDOR SERVICES

11.1 Vendor services may include the use of portable demineralizer trains for liquid waste cleanup, resin slurring loops for resin dewatering in high integrity containers or full scale solidification. Having these capabilities enables waste processing to continue should the waste evaporators, volume reduction or solidification systems be unavailable. These portable systems could also be operated simultaneously with the volume reduction and solidification systems to supplement the normal processing capacity.

11.1.1 Portable processing vendors are chosen using the VEGP procurement process. The bid specification requires that vendors have approved and demonstrated waste handling processes. The portable processes must meet the Federal, State, and Burial Ground regulations identified in Section 1.3 of this process control program.

11.1.2 In addition to meeting the regulations, the vendor has to operate in accordance with this Process Control Program. Vendors must provide VEGP with their own NRC approved PCP which is subject to VEGP's approval and policies.

12.0 MATERIALS HANDLING

The solidification processes are very sensitive to the chemistry of the waste and condition of the raw materials. Thus in order to assure complete, predictable solidification of the waste stream in the binder, the condition of raw materials are evaluated on a regular basis. A log is maintained for the purpose of tracking the raw materials.

12.1 Mixing Weight

12.1.1 The cement and waste slurry is mixed using a large mixing weight which falls from top to bottom inside the waste drum as the drum is tumbled. The mixing bar is placed in the drum after the dry cement has been added to the drum.

12.1.2 The mixing weight is an 18 inch length of #10 (1.25 inch diameter) reinforcing bar bent at its midpoint to a 120° included angle.

12.2 Waste Disposal Containers

12.2.1 The solidification equipment is designed to use the standard 55 gallon closed head type drum. Dry salt, ash, spent resin, and primary system cartridge filters may be disposed of using 55 gallon drums. Drums are manufactured and tested in compliance with DOT specifications, per CFR Title 49 Section 178. DOT 17C drums are used for normal drumming, while DOT 17H drums may be used for primary system cartridge filters.

12.2.2 Drum dimensional tolerances are critical to smooth, complete processing. The drums are inspected prior to storage and marked. Prior to use the drums are inspected for any damage and the previous inspection approval mark.

12.3 Polymer Mixer

12.3.1 Unlike the cement which is mixed by tumbling, polymer solidified waste is mixed using a rotary type mixer which blends the waste, catalyst, and binder. The drum contents are mixed to a homogeneous mixture and allowed to cure. The mixer stays in the drum.

12.3.2 The polymer mixers are handled in the same manner as drums, described above.

12.4 Cement

12.4.1 Type II Portland cement is one of the solidification media. Cement is stored in bulk in a silo outside the radwaste solidification building. The cement is periodically fluffed with air during storage.

12.4.2 Prior to off-loading the cement into its storage silo, a sample is taken to the chemistry lab. After the cement has been verified to be type II, it will be unloaded into the silo. The analytical results, delivery date and amount of cement unloaded are recorded.

12.5 Sodium Metasilicate

12.5.1 Sodium Metasilicate is an additive which may be mixed with the waste-cement mixture to stabilize the solidification reaction and enhance the integrity of the waste form. Technical grade material is used. The material is measured and placed into the waste drum prior to filling with cement.

12.6 Polymer

12.6.1 Polymer is made of a 3 part system. It consists of a polymer binder, which is a modified vinyl ester resin, a promotor and a catalyst.

12.6.1.1 Binder is stored in bulk in a below ground tank. Elevated temperature and age cause premature initiation of the polymerization reaction. So, to extend the shelf life of the binder, cooling coils and aerators have been added to the tank.

12.6.1.2 The delivery date and amount of binder delivered is recorded when it is received. Since temperature and age effect binder quality, the binder storage tank cooling system will be verified operational once a day. Binder stored past the manufacturer's recommended shelf life is discarded and the tank and lines purged of old binder. Records of daily inspections, binder deliveries and replacements are maintained.

12.6.2 The promoter and catalyst are stored separately in small volume containers. Both are added to the waste drum just prior to filling the drum with waste.

12.6.2.1 These materials are transported in small, easily handled containers and stored and used according to the manufacturer's recommendations. Promoter and catalyst are discarded if it has not been used within the manufacturers suggested shelf life.

13.0 RECORDS

13.1 Materials Receipt

As described in Section 12, materials are inspected upon receipt, sampled as necessary and logged. The receipt date shelf life as applicable, and quantities are recorded.

13.2 Process Records

13.2.1 The volume reduction system provides continuous chart recording for certain parameters. These are maintained to ensure proper system operation and provide a means of showing developing trends in the system.

13.2.2 The analyses of the chemical specie determination and solidification verification batch samples are logged and maintained to ensure that each batch of waste to be solidified is within the process boundary conditions and is certifiable.

13.2.3 Each drum of waste which has been characterized using the correlation factors has a unique identification number assigned to it. That number and its complete chemical and radionuclide make up are recorded. In addition, the pertinent waste information, the quantities of binder used and the date of solidification is recorded.

13.3 Shipping Records

Shipping manifests will be prepared based on the previously recorded information for each unique drum in accordance with 10 CFR Part 20 requirements.