DUKE POWER COMPANY

MCGUIRE NUCLEAR STATION

Units 1 and 2

PROCESS CONTROL PROGRAM FOR CNSI MOBILE SOLIDIFICATION UNITS USING THE DOW PROCESS

MCGUIRE NUCLEAR STATION
PROCESS CONTROL PROGRAM
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1.0 SCOPE

1.1 Purpose

The purpose of the Process Control Program for CNSI Mobile Solidification Units using the Dow Process is to establish a set of process parameters which provide reasonable assurance of complete solidification of all types of low-level radioactive liquid waste.

1.2 Applicability

This Process Control Program shall be used by all personnel operating the CNSI Mobile Solidification Unit using the Dow Process.

2.0 REFERENCES

2.1 CN-AD-003, CNSI Procedure for Document Preparation

2.2 QA-AD-001, CNSI Quality Assurance Program

2.3 CN-AD-019, CNSI ALARA Policy

2.4 EN-AD-002, CNSI Design Control Program

2.5 SD-OP-006, CNSI Operating Procedure for Mobile Solidification Units using the Dow Process

2.6 Dow Topical Report, DNS-RSS-001-P; Topical Report: The Dow System for Solidification of Low-Level Radioactive Waste from Nuclear Power Plants (with Addenda 001 through 003)

2.7 NUREG 0472, Radiological Effluent Technical Specifications for PWR

2.8 NUREG 0473, Radiological Effluent Technical Specifications for BWR

2.9 Branch Technical Position-ESTB 11-3, Design Guidance for Solid Radioactive Waste Management Systems Installed in Light-Water-Cooled Nuclear Power Reactor Plants

2.10 ANSI 199, Liquid Radioactive Waste Processing Systems for Pressurized Water Reactor Plants

2.11 ANSI 197, Liquid Radioactive Waste Processing Systems for Boiling Water Reactor Plants

3.0 SYSTEM DESCRIPTION

3.1 Chemical Process Description

The CNSI Mobile Solidification Unit using the Dow Process is specially designed to optimize solidification of all types of radioactive wastes - evaporator bottoms, ion-exchange resin slurries, sludges, and decontamination solvents. The Dow solidification process can successfully treat liquids ranging in pH from 2.5 to 11.0 and wastes containing high concentrations of dissolved and undissolved solids.

The following sections list the process parameters that are important to successful solidification.

3.1.1 Sequence of Chemical Addition

The sequence of chemical addition is critical to successful solidification and will vary according to the type of waste being processed. For proper emulsion formation, it is essential that the radwaste solution or slurry be added to the binder. The

order of addition of the other process ingredients, the catalyst and the promoter, will be determined according to the sample verification procedure of Section 5 of this procedure and depends on the chemical composition of the waste being treated.

Though it will usually not be necessary to pretreat the waste or to add an additional chemical (extender), the sample verification procedure will indicate if pretreatment or extender addition will be required for optimum solidification.

The volumes of process agents added will also be determined according to sample verification procedure.

The amounts of chemicals to be used and the order of addition of the process agents in full-scale solidification will be determined using the results of the sample verification procedure and the conversion formulae provided on the Batch Solidification Form (Form PCP-2, Appendix C-2).

NOTE: ONCE THE BINDER, CATALYST, AND PROMOTER ARE COMBINED IN SOLUTION, A NON-REVERSIBLE REACTION IS INITIATED WHICH RESULTS IN SOLIDIFICATION.

3.1.2

3.1.3

3.1.4

3.2 Mobile Unit Description

3.2.1 The CNSI Mobile Solidification Unit using the Dow Process is a portable system containing all piping, support, control, and monitoring equipment necessary to solidify radioactive liquid waste using the Dow Process.

3.2.2 The unit is composed of several processing sub-

systems, each controlling a specific function of the Dow Process. These subsystems include waste and binder transfer, promoter injection, extender addition, and catalyst addition systems. Control functions for the unit are incorporated into the pneumatic and main control panels. Service supplies are provided by the utility and distributed through the service air, water, and electrical distribution systems.

3.2.3 Most of the mobile unit components are arranged on portable frameworks (skids) to provide flexibility of operations for either indoor or outdoor use. The plant connection stand, pump skid, and hydraulic skid contain most of the major elements of the mobile unit.

3.2.4 A closed-circuit television system is an integral part of the mobile unit and allows the operator to monitor all the steps in the solidification process.

3.2.5 A detailed description of each subsystem, and a P&ID are provided as Appendix A.

3.3 System Operation

3.3.1 Before beginning any waste processing with the Mobile Solidification Unit (MSU) using the Dow Process, the CNSI operator shall complete a successful sample verification in accordance with the Sample Verification Procedure of section 5.2 below.

3.3.2 Parameters established during the sample verification are recorded on the Sample Verification Form (Form PCP-1). These parameters will be transferred to the Batch Solidification (Form PCP-2) and, using precise scaling factors, the

required chemical volumes for full scale solidification will be calculated.

3.3.3 Actual full scale solidification shall then be conducted in accordance with the MSU Operating Procedure (Reference 2.5) and the parameters calculated on Form PCP-2.

4.0 REQUIREMENTS FOR SAMPLE VERIFICATION

4.1 Precautions and Limitations

NOTE: IF AT ANY TIME DIFFICULTIES ARE ENCOUNTERED WITH ANY PART OF THIS PROCEDURE OR IF THE CHEMICAL REACTION DOES NOT PROCEED AS EXPECTED, THE OPERATOR SHALL NOTIFY THE MANAGER, FIELD SERVICES OR HIS DESIGNEE IMMEDIATELY.

Radiological Precautions

4.1.1.1 The CNSI mobile unit operator shall be subject to the applicable health physics and safety precautions of the NRC-licensed facility providing the radioactive waste.

4.1.1.2 Laboratory gloves, cotton liners, face shield, and an apron (as a minimum) shall be worn at all times while collecting, handling, and testing all samples.

4.1.1.3 Prior to conducting the sample verification procedure, the CNSI operator shall establish radiologically clean and contaminated zones in the processing area to prevent the possible spread of contamination.

4.1.2 Chemical Precautions

4.1.2.1 DO NOT mix the catalyst directly with the promoter. The catalyst is an oxidizing agent and will react

readily with the promoter in an exothermic reaction. While the reaction is not violent in nature, direct mixing of these two chemicals shall be avoided.

4.1.2.2 The binder is a flammable liquid. For operations involving the binder, strict adherence to the following is required:

1. No smoking at any time.
2. No spark-producing motors or open flames in the vicinity.
3. The binder shall be handled only in well ventilated areas or out-of-doors.

4.1.2.3 If the binder, promoter, or catalyst should contact eyes, promptly flush the eyes with clear water for 15 minutes. If skin contact occurs, wash the affected area immediately with soap and water.

4.2 Prerequisites

4.2.1

4.2.1.2

4.2.2 Equipment and Chemicals

4.2.2.1 Equipment required for use during the sample verification procedure is listed in Table I of Appendix B to this procedure. The table assigns each piece of equipment an item number, gives a general description of the item and provides the minimum quantity required to begin the verification procedure.

4.2.2.2 Table II of Appendix B to this procedure establishes chemical inventory requirements needed for use with the sample verification procedure.

4.2.2.3 The CWSI operator shall insure that required quantities of equipment and

chemicals are available prior to beginning the sample verification procedure (See Appendix B).

4.2.3 Sampling Requirements

4.2.3.1

4.2.3.2

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4.2.3.4

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5.0 SAMPLE VERIFICATION

NOTE: IF AT ANY TIME DIFFICULTIES ARE ENCOUNTERED WITH ANY PART OF THIS PROCEDURE OR IF THE CHEMICAL REACTION DOES NOT PROCEED AS EXPECTED, THE OPERATOR SHALL NOTIFY THE MANAGER, FIELD SERVICES OR HIS DESIGNEE IMMEDIATELY.

5.1 Initial Conditions

5.1.1 Verify that all material listed in Table I, Equipment List, and Table II, Chemical Inventory, of Appendix B is available and ready for use.

5.1.2 Review section 4.0 of this procedure prior to conducting the Sample Verification Procedure.

5.1.3 Appendix C to this procedure contains the Sample Verification Form (Form PCP-1), and the Batch Solidification Form (PCP-2). These forms shall be used at all times and shall be maintained in accordance with section 6.

5.1.3.1 The Sample Verification Form (Form PCP-1) shall be used to document results of all sample verifications conducted. Starting values for sample processing will be obtained from Table I of section 5.1. Actual values for chemical volumes used and the results of the sample will also be recorded on this form.

5.1.3.2 Form PCP-1 is also used to correlate the conversion of sample verification results to the values used for full scale solidification on Form PCP-2.

5.1.3.3 The Batch Solidification Form (Form PCP-2) shall be used to calculate the chemical volumes used in full-scale solidification. Values obtained during sample verification shall be used as Input Data for computing chemical addition volumes.

5.1.3.4 Liner serial numbers shall be used to provide association between Form PCP-1 and Form PCP-2.

5.1.4 Record the required information on Part I of the Sample Verification Form (Form PCP-1) of Appendix C to this procedure.

5.1.5

Table 1

5.1.6 Refer to Table 1 (below) to determine, according to waste type, the process parameters that will be used for the verification testing. Record this information on Form PCP-1.

5.2 Sample Verification Procedure

CAUTION: IF AT ANY TIME DIFFICULTIES ARE ENCOUNTERED WITH ANY PART OF THIS PROCEDURE OR IF THE CHEMICAL REACTION DOES NOT PROCEED AS EXPECTED, THE OPERATOR SHALL NOTIFY THE MANAGER, FIELD SERVICES OR HIS DESIGNEE IMMEDIATELY.

NOTE:

5.2.1

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5.3.4

5.3.5

5.3.6

6.0 ADMINISTRATIVE PROCEDURES

6.1 Maintenance of Records

6.1.1 The CNSI operator shall forward a copy of all completed Form PCP-1's and Form PCP-2's to the Manager, Field Services for review following completion of liner solidification.

6.1.2 Form PCP-1 should be used as a cover sheet when forwarding records. All Form PCP-2's which were completed based on the values obtained on Form PCP-1 shall be attached.

6.1.3 After review by the Manager, Field Services, all forms shall be forwarded to the Solidification Engineer for final disposition.

7.0 INTERFACE BETWEEN STATION AND MOBIL UNIT

NOTE: Either Duke Power Company or the vendor may determine if pretreatment of waste is needed. Pretreatment must be agreed to by Chem Nuclear, Dow Chemical Company, and Duke Power Company. Pretreatment, if needed is executed by station chemists.

7.1 Station Responsibilities

Station personnel shall be responsible for the preparation of procedures which describe in detail the following operation:

a. Preparations for mobile unit use.
   (1) Installation of flanges to join mobile unit to external station connections.
   (2) Receipt of binder.
b. Sampling requirements prior to solidification.
   (1) Recirculation of resin and concentrates to obtain representative sample.
   (2) Sample collection using installed samplers.
   (3) Analysis of sample for radionuclides present and radioactive content, and perform calculations for solidification.
c. Transfer of waste to vendor unit.
   (1) Operation of cranes to move liners into place for solidification.
   (2) Operation of pumps and radwaste panels in the station to move waste and binder.*
d. Verification of acceptable product.
   (1) Review of process control analysis.
   (2) Inspection of final product.
e. Preparations for shipment.
   (1) Installation of cask lids.
   (2) Inspection of trucks.
   (3) Performance of surveys to determine radiation and contamination levels.
   (4) Performance of calculations for shipment based on analytical data; determine shipping requirements.
   (5) Coordination of shipments with shipper, appropriate state agencies, and burial facility.

7.2 Vendor Responsibilities

The vendor shall be responsible for:

a. Determining the chemical ratios needed to achieve solidification based on station analytical data. If station samples are not available, obtain sample using vendor equipment.
b. Running the process control analysis.
c. Submitting the process control analysis to station Radwaste Chemistry Supervisor prior to commencement of solidification operations
d. Operating the solidification process equipment.*
e. Specifying and ordering replacement chemicals.

*NOTE: Either station or vendor personnel can terminate the transfer of waste and binder using remote operation of appropriate station pumps.

Table II

APPENDIX A

APPENDIX C-1

APPENDIX C-2

APPENDIX C-2 (Continued)

DOCUMENT NOT FILMED DUE TO POOR LEGIBILITY

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