GRAND GULF NUCLEAR STATION

PROCESS CONTROL PROGRAM

December 9, 1981

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GRAND GULF NUCLEAR STATION
PROCESS CONTROL PROGRAM

I. Interfaces:

A. The Radwaste Solidification System receives inputs from the following:
Equipment Drain Filter and Floor Drain Filter (filter sludge discharge)
Evaporator Bottoms Tanks (Regenerant evaporator bottoms, floor drain evaporator bottoms, miscellaneous chemical waste evaporator bottoms)
Spent Resin Tank (Condensate Cleanup demineralizer, floor drain demineralizer, equipment drain demineralizer)
RWCU Phase Separator Tanks (RWCU and FPCC filter demineralizer backwash)
Waste Surge Tanks (condensate filter backwash)
Condensate and Refueling Water Storage System (liquid)

B. Support Systems include:
Radwaste Building Ventilation
Condensate and Refueling Waste Storage
Liquid Radwaste
Equipment and Floor Drains
Instrument Air
Service Air
125V DC
480V DC
120/208V DC

II. Operable Equipment required:

A. Either A, B or C Waste Holding Tank and associated Waste Metering Pumps
B. Either A or B train solidification equipment including:
Cement feed valves
Air slide conveyor
Mixer feed pump
Chemical addition pump
Fillport
C. Transfer cart and capping mechanism
D. Overhead crane

III. Interlocks/Instrumentation required:

A. On the operable Waste Holding Tank:
1. Level monitor and associated level alarms (Hi and Low)

B. On the operable mixer unit:

1. Pump discharge low pressure switches and associated lights for waste metering pump, chemical additive metering pump, and mixer feeder
2. Drum in place switch and associated light
3. Fillport down switch and associated light

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4. Cement flow switch and associated light
5. Waste container full switch and associated annunciator

C. Modicon programmable controls or manual controls.

IV. Administrative Controls:

A. Administrative procedures will require that:

1. Directions for extensive or complex jobs where reliance on memory cannot be trusted shall require the written procedure to be present and referred to directly.
2. Directives shall include appropriate quantitative and/or qualitative criteria for verifying that the specified activities have been satisfactorily accomplished.

B. Operation of the Radwaste Solidification System will be performed by operators using a directive, meeting the Administrative Procedure requirements in IV.A (above).
C. Access to process flow control (Modicon Program) will be limited to the Radwaste Supervisor or his designated alternate.

V. The interlocks/instrumentation provided in III (above) will assure that:

A. The operator knows the level in the Waste Holding Tank.
B. Process flow is established in all required flow paths.

1. This will prevent the introduction of waste to the shipping container without the proper solidification agents.

C. The shipping container is in place under the fillport and the fillport lid is sealed against the container before any process flow can start.
D. The shipping container will not be over filled.

VI. Sampling and Process Parameters:

A. This section and Enclosure I of the Process Control Program will establish the program of sampling, analysis, test solidification, and evaluation which is necessary to insure complete solidification of each type of radioactive waste.
B. The minimum sampling requirement for test solidification is every tenth batch of each type of waste (filter sludges, spent resins, evaporator bottoms, and filter media).
C. Batch, Process Parameters, and boundary conditions are defined in Table I.
D. Verification of solidification is as follows:

1. Three test samples (500ml) will be taken in plastic beakers.
2. The design proportions of solidifying agents, (Table I), will be added to all test samples.
3. Test samples will be allowed to cure. The cured product will be split to verify the mass is a solid with definite shape and no free water.
4. All test samples must past solidification tests. If test fails, retest as per Section E of Enclosure I.

VII. Packaging Procedures

The total contained activity, external dose rate, surface contamination, and physical form of solidified waste will be verified to be within limits prior to shipment.

A. Containers will be remotely smeared and decontaminated prior to storage.

   1. Containers that are not within limits will be manually decontaminated and re-smeared.

B. The curie content of each container will be estimated from the following parameters:

   1. Type of waste contained (corrosion products, fission products or mixed).
   2. Mid plane, centerline container dose rate.
   3. Density of material in container.
   4. Geometric configuration.
   5. Correction factor (C).

C. An isotopic analysis will be performed on every tenth batch of waste input to the solidification system.

   1. Total activity in a container will be calculated from the isotopic analysis.
   2. The calculated activity will be compared to the estimated activity.
   3. The correction factor (C) will be adjusted, as necessary, to assure that the estimated activity is greater than or equal to the calculated activity.

D. Plant operating instruction 04-S-05-4, "Preparation of Solid Radwaste for Off Site Shipment" shall be followed to assure that the requirements of 49CFR Parts 100 to 199, "Transportation" are met.

GRAND GULF NUCLEAR STATION
TYPICAL INSTRUCTIONS/REQUIREMENTS
TO BE PROVIDED FOR
SOLIDIFICATION OF RADWASTE SLURRIES AND
EVAPORATOR BOTTOMS CONCENTRATES

A. General

1. The Radwaste Solidification System is designed to mix waste slurries and evaporator bottoms concentrates with specific proportions of Portland Cement and Sodium Silicate in order to obtain a solid with definite shape and no free water.

2. Each of the two mixing "trains" (i.e., Trains A and B) is provided with the ability to select one of nine generic waste streams identified by number:
   Stream #1 - Waste Surge Tanks (condensate filter backwash)
   Stream #2 - RWCU Phase Separator Tanks (RWCU and FPCC filter demineralizer backwash)
   Stream #3 - Liquid Radwaste Filters (Ecodex)
   Stream #4 - Resins H-OH from Liquid Waste System with fines
   Stream #5 - Resins H-OH from Condensate
   Stream #6 - Evaporator Bottoms from Resin Regeneration
   Stream #7 - Evaporator Bottoms from miscellaneous chemicals
   Stream #8 - Future
   Stream #9 - Future

3. Parameters have been established for various pump speeds required to maintain correct flow rates within the system. These have been preset within the system Modicon Programmable controller. When a particular stream type is selected, the controller will operate the various pumps as required for the solidification process, at speeds appropriate for the waste stream type being process.

4. The operator will determine which specific generic batch the waste input represents (using methodology specified in Section B of this Enclosure) and select the corresponding generic batch position before starting the solidification process.

   a. The operator is not authorized to "adjust" the individual process pump speed settings without specific authorization from the Radwaste Supervisor.
   b. If the waste input cannot be categorized into a specific generic batch using Section B of this Enclosure, a sample of the waste input will be obtained and analyzed. Process selection is then made using Section D of this Enclosure.

5. The Solid Radwaste System will be operated in accordance with GGNS operating procedures in a manner which will permit segregation of waste inputs into generic batches. With proper segregation, the only parameters that are variable are pH (applicable for evaporator

bottoms only) and percent solids. Categorized wastes will be conditioned to adjust the pH and solid/liquid content within boundary conditions and then solidified as a batch with no further additions of solids or liquids into the respective waste holding tank(s) until the batch is completely processed.

6. Waste holding tanks A and B should be normally used only to collect radwaste equipment drain filter and floor drain filter discharges (Ecodex) respectively. Liquid additions may be from the Condensate and Refueling Water Storage and Transfer System (CRWST) or regenerant evaporator bottoms.

7. Waste holding tank C should normally be used for spent resin discharges and filter and filter/demin (Ecodex) sludge with liquid additions from regenerant evaporator bottoms or CRWST.

8. Reactor Water Cleanup System (RWCU) filter/demin sludge (Ecodex) is, typically, approximately one hundred times higher in specific activity than other sludges processed and should be segregated from other wastes and handled with extra care. RWCU filter/demineralizer sludge is normally processed through waste holding tank C.

9. Evaporator bottoms should normally be processed through waste holding tank C.

B. Categorizing Waste Holding Tank Contents Into Specific Generic Batches

1. A knowledge of the sources of sludge and segregation of specific types of waste inputs is essential.

2. The operator will determine from the Water Treatment/Radwaste Logbook the type and volume of waste to be transferred to the waste holding tank. Typical inputs will be:

   a. Spent resin tank contents; bead resin from the condensate cleanup demineralizer or radwaste (i.e., floor drain or equipment drain) demineralizers.
   b. Filter sludge from the condensate cleanup filter; (Ecodex).
   c. Filter sludge from the RWCU and FPCC filter/demineralizers; (Ecodex).
   d. Filter sludge from radwaste (i.e., floor drain or equipment drain) filters; Ecodex.
   e. Evaporator bottoms from regenerant of resin will normally be 25% sodium sulphate with trace amounts of other dissolved solids and suspended solids.
   f. Evaporator bottoms from floor drains will normally be 25% to 50% suspended solids with dissolved solids significantly below saturation.
   g. Evaporator bottoms from miscellaneous chemical waste will normally contain dissolved solids from water treatment chemicals (sodium nitrate, TSP), pH neutralizers (H_2SO_4 or NaOH), miscellaneous laboratory wastes and trace amounts of suspended solids.

3. If the operator can not obtain adequate information from the inline instruments to categorize the waste as a specific generic type designated for solidification, a grab sample will be taken, analyzed and categorized.

   a. If the batch does not fall within the boundary conditions for any of the specified generic types, processing will be in accordance with Section D of this Enclosure.

4. A sampling program will be established to ascertain that the various individual batches are within established boundary conditions for specific generic batches. Sample frequency will be as follows:

   NOTE: The sample may be analyzed for pH, conductivity, total suspended solids (TSS), silica and presence of oil or grease to determine if its constituents are similar to the original specific generic type or may be solidified in the laboratory using the proportions of solidifying agents specified for the original specific generic type.

   a. The first five batches after plant startup with actual radwaste
   b. One batch out of every ten processed after the first five batches.
      NOTE: A batch is defined in TABLE I.
   d. If any sample indicates an off-standard batch (i.e., outside the boundary conditions for the specific generic type), the sampling frequency will be increased to a higher rate.
   e. Samples will be analyzed from each batch of miscellaneous chemical evaporator bottoms to assure the batch is within the boundary conditions for the generic type.

5. If the sampling program indicates a trend in specific generic type constituents beyond the boundary conditions originally established, the Process Control Program will be modified to assure continuing production of acceptable solidified wastes as follows:

   a. New specific generic types will be established with appropriate changes to the proportion of solidification agent(s).

      1. These new specific generic types will be tested in a manner similar to the original test program.

   b. Tests will be conducted to determine the acceptable changes in the boundary conditions for existing generic types based on the analysis trends.

C. <u>Conditioning of Specific Batches of Waste</u>

Conditioning waste holding tank contents for solidification as a specific generic type will consist of adjusting the water content of the slurry to within the solids/liquid boundary conditions and pH to within the pH boundary conditions specified for the particular waste.

1. Radwaste filter sludge as transferred to the waste holding tank may have an excess of solids and therefore need liquid added to prepare it for solidification as generic stream #3 (20% or 27% solids).

   a. With the agitator OFF, add regenerant evaporator bottoms (preferred source) or condensate and refueling water until there is an observable change in tank level.
      NOTE: This will assure that the filter sludge is sufficiently wet to prevent agitator overload.
   b. Turn on agitator and add liquid as indicated on graph, Attachment I, to obtain a 20% by weight mixture or Attachment II for a 27% by weight mixture.
   c. Start the agitator at least 30 minutes prior to solidifying to assure a homogeneous mixture.

2. RWCU and FPCC filter/demin sludge as transferred to the waste holding tank will have an excess amount of water which must be reduced to prepare it for solidification as generic batch no. (later).

   a. Transfer sludge from the phase separator until the level in the waste holding tank is (later %).
   b. Allow contents to settle for at least four hours, then decant excess liquid to the RWCU phase separator until the decant pump trips.
      NOTE: This will leave approximately 1" of free standing water above the sludge.
   c. Start the agitator and add liquid from the regenerant evaporator bottoms (preferred source) or condensate and refueling water as indicated on graph, Attachment II, to obtain a 27% by weight mixture.
   d. Start the agitator at least 30 minutes prior to solidifying to assure as homogeneous mixture.

3. Spent resin beads as transferred to the waste holding tank have an excess amount of water which must be reduced to prepare it for solidification as generic stream #4 or #5.

   a. Transfer resin from the spent resin tank until (later) level is reached in the waste holding tank.
   b. Allow contents to settle for at least 30 minutes, then decant excess liquid to the RWCU phase separator until the decant pump trips.
   c. The mixture is now ready to process with approximately 25% by weight of solids.
   d. Start the agitator at least 30 minutes prior to solidifying to assure a homogenous mixture.

4. Regenerant evaporator bottoms as transferred from the evaporator bottoms tank may be added (after pH adjustment) to filter, demineralizer, or filter/demineralizer sludges to adjust liquid content as required for specific generic batches or may be solidified directly (i.e., without combining with any additional water as generic batch.)
5. Evaporator bottoms as transferred to the waste holding tank will be solidified directly as generic stream #6 or #7.

D. Adjustment/Conditioning of Non-Specific Batches of Waste

Adjustment/conditioning of non-specific batches of waste (i.e., wastes not categorized as generic batch (later) through (later).

1. If a batch of waste cannot be identified as a specific generic batch designated in C.1 through 5 (above), a grab sample of the mixture will be obtained and the following steps will be performed:

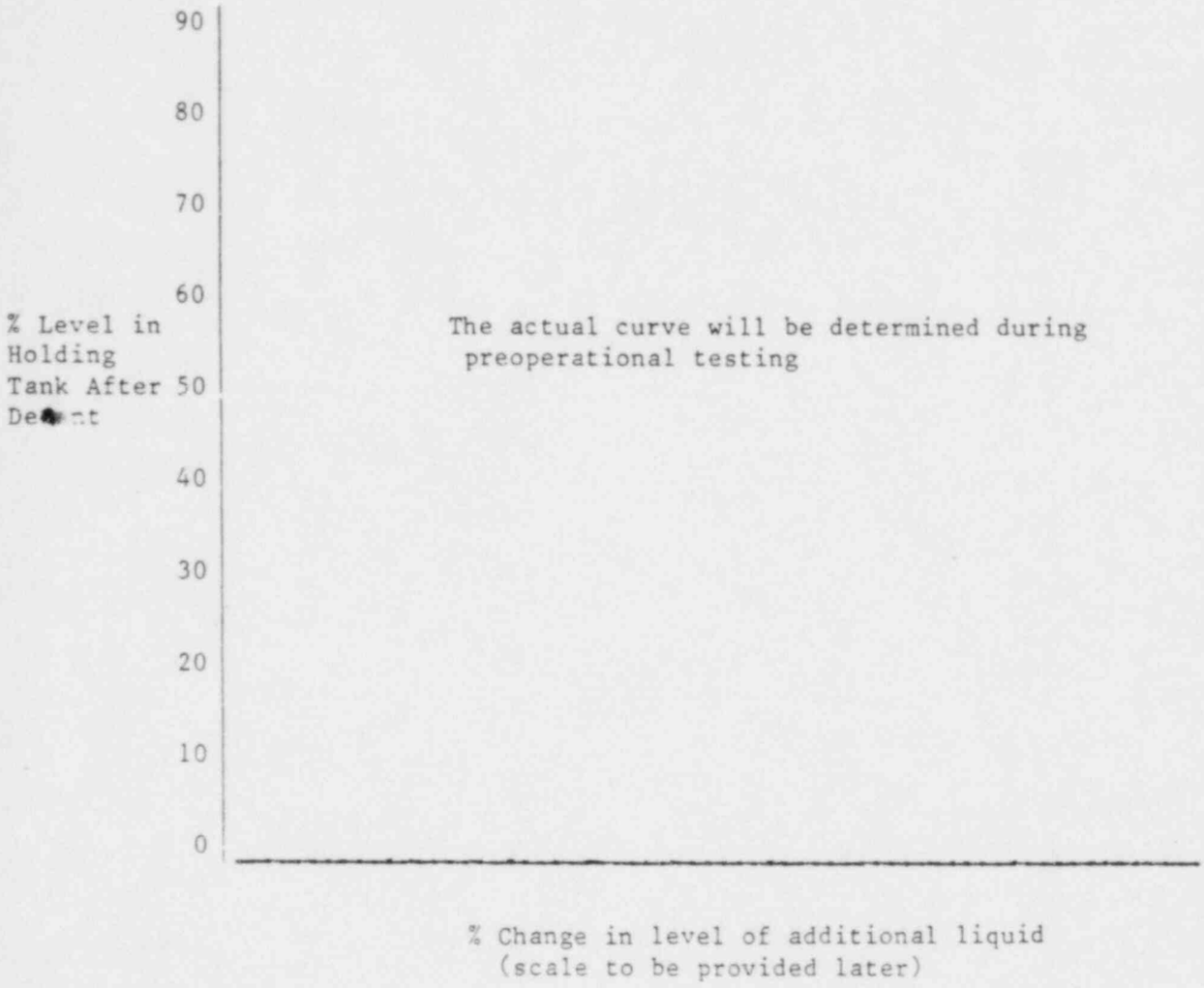
   a. The chemist will analyze the test sample for activity, pH, conductivity, TSS, silica, and presence of oil or grease.
   b. With the above data, the operator will adjust the waste to within the boundary conditions of a generic batch.
   c. A sample of the batch will be mixed with cement and sodium silicate according to ratios specified for that generic batch and verified to solidify after a 30 minute curing time with no free water.
   d. If the batch is not solidifiable using any of the specific generic batch feed rates available, the operator will receive guidance from the Radwaste Supervisor.

E. Sampling of Solidification System

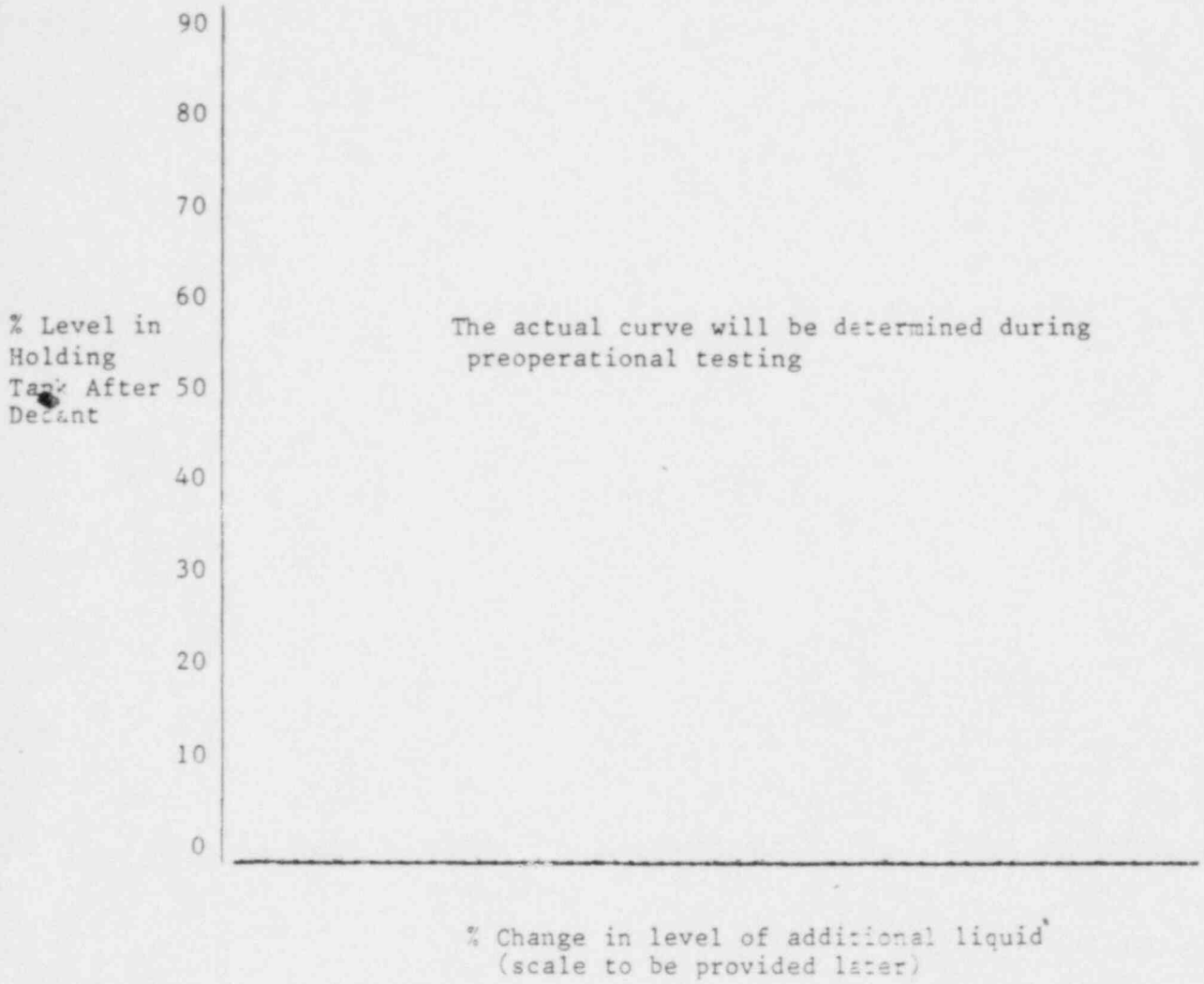
1. For batches of specific generic wastes processed according to Section C of this Enclosure, (other than every tenth batch) no effluent sampling is required since these have been proven to be solidifiable in the preoperational test program and this process control program.
2. For batches of non-specific wastes processed according to Section D of this Enclosure, a grab sample will be obtained and analyzed to determine if its constituents are similar to a generic type. This sample may be solidified in the laboratory using the proportions of solidifying agents specified for the generic type.
3. If the test sample of non-specific waste fails to fall within the boundary conditions for a generic type of waste, the following shall be done:

   a. Effluent will be collected in three 500ml plastic beakers.
   b. Three proportions of solidifying agents, specified by the Radwaste Supervisor, will be added to the three test samples.
   c. The three test samples will be allowed to cure.
   d. The cured product will be split to verify the mass is a solid with definite shape and no free water.
   e. The test sample proportions used to produce the best product, as determined by the Radwaste Supervisor, will be used for solidification of the non-specific waste.

Curve of Liquid Adjustment for Ecodex in the Waste Holding Tank
(20% by Weight Mixture)



Curve of Liquid Adjustment for Ecodex in the Waste Holding Tank
(27% by Weight Mixture)



PROCESS CONTROL PROGRAM
TABLE I

STREAM #	SOURCES	BATCH	WASTE TYPE	PROCESS PARAMETERS	BOUNDARY CONDITIONS	REMARKS OR SPECIAL CONDITIONS (Cement/Vaste Ratio)
1	Condensate Filter Backwash	Waste Surge Tanks	Ecodex	Solid Contents	(Later)	
2	RWCU & FPCC Filter Backwash	Phase Separator Tanks	Ecodex	Solid Contents	(Later)	
3	Liquid Radwaste Filters	Waste Holding Tanks A or B	Ecodex	Solid Contents	(Later)	
4	Liquid Radwaste Resins	Spent Resin Tank	Resin Beads H-OH	pH, Solid Contents	(Later)	
5	Condensate Resins	Spend Resin Tank	Resin Beads H-OH	pH, Solid Contents	(Later)	
6	Evaporator Bottoms (Regeneration)	Evaporator Bottom Tanks	Na2SO4 & Solids	pH, Solid contents	(Later)	
7	Evaporator Bottoms (Misc. Chemicals)	Evaporator Bottom Tanks	Solids	pH, Solid Contents	(Later)	
8	Future	(Later)	(Later)	(Later)	(Later)	
9	Future	(Later)	(Later)	(Later)	(Later)	

E3rgl