LASALLE COUNTY STATION PROCESS CONTROL PROGRAM

A. PURPOSE

The purpose of this procedure is to define the administrative and process control on the LSCS radioactive waste solidification system operations.

B. REFERENCES

1. LSCS Technical Specifications
   a. Section 3/4.11.3, Solid Radioactive Waste System.
   b. Section 6.7, Process Control Program.
2. LSCS Procedures
   a. See Attachment A.
3. 10CFR61

C. PREREQUISITES

1. None.

D. PRECAUTIONS

1. None.

E. LIMITATIONS AND ACTIONS

1. See Attachment A.

F. PROCEDURE

1. See Attachment A.

G. CHECKLISTS

1. None.

H. TECHNICAL SPECIFICATION REFERENCES

1. Section 3/4.11.3.

2. Section 6.7.

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LASALLE COUNTY STATION PROCESS CONTROL PROGRAM

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I. Scope

A. The LaSalle County Station Process Control Program (LSCS PCP) describes the administrative and process controls on the radioactive waste solidification system which provide reasonable assurance that the LSCS system is operated to produce stable, solidified waste with no free-standing water. The LSCS PCP is implemented by the LSCS Operating Department. The LSCS PCP satisfies the requirements of 10CFR61.

II. LSCS Solidification System Description

A. LSCS utilizes a permanently installed radwaste solidification system supplied by Stock Equipment Company. This system has been designed with numerous features to provide process control for reasonable assurance that waste is solidified with no free-standing water. The "Process Description" section on Stock Equipment Co. Solid Radwaste System Topical Report SRS-001-NP, March, 1979, gives a general description of the operation of the Stock Solidification System and notes the various process control features. The solidification system is operated by LSCS personnel.

III. Characteristics of LSCS Solidification System Feeds. Five types of waste are solidified in the LSCS system.

A. Spent Resin Tank (1). The spent resin tank receives exhausted ion exchange bead resins from the condensate polishing demineralizers, waste demineralizer, floor drain demineralizers, and chemical waste demineralizer. Resins are allowed to settle in this tank while excess water is decanted. Settled resins are discharged to the solidification system after appropriate recirculation.

B. Waste Sludge Tank (1). The Waste Sludge Tank receives backwash from the waste collector filters, fuel pool filter-demineralizers, and bottoms from various liquid radwaste collector and feed tanks. The sludges are allowed to settle in this tank while excess water is decanted. Settled sludge is discharged to the solidification system. The sludge consists primarily of diatomaceous earth and powdered ion exchange resin.

C. URC Sludge Tank. The URC Sludge Tank receives solids from the ultrasonic resin cleaner (URC) backwash. The sludge is allowed to settle while excess water is decanted. Settled sludge is discharged to the solidification system after appropriate recirculation. The sludge consists primarily of piping corrosion products and resin fines.

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D. Reactor Water Cleanup (RWCU) Phase Separator Tanks (4). The four phase separator tanks collect, settle and hold for decay sludge from the RWCU filter-demineralizer backwash. Excess water can be removed from the tanks via decanting. Settled sludge is discharged to the solidification system after recirculation. The sludge consists primarily of powered ion exchange resin and organic inert (e.g., Solka-Floc) filtering media.

E. Concentrator Waste Tanks (2). The two Concentrator Waste Tanks receive concentrates from the floor drain and chemical waste concentrators, and lesser quantities of concentrates from the laundry reverse osmosis unit. The chemical wastes concentrates consist of deep bed demineralizer regenerant wastes, concentrated to approximatey 25% by weight, Na_2SO_4. The floor drain wastes consist of floor drains concentrated to approximately 25% total solids by weight. The laundry reverse osmosis concentrates consist primarily of detergent solutions concentrated to approximately 4% by weight total solids.

IV. Solidification Formulas

A. Formula Development. Stock Equipment Company has performed extensive testing of BWR waste solidification with cement. Stock has developed specific formulas for solidification of these wastes in the Stock systems. The formulas have been pretested prior to use at LaSalle.

B. LSCS Solidification formulas. The LSCS operating procedures listed in Appendix A describe specific formulas for each type of LSCS waste. The formulas include the required amount of cement, the amount of waste, slurry setting and mixing times, and in-drum mixing times. Process control parameters for each drum of waste are recorded and reviewed to verify that the proper solidification formulas have been used.

C. The formulas for LSCS spent resin, waste filter sludge, URC sludge and filter-demineralizer sludge wastes should remain constant. When these formulas are initially used on actual LSCS wastes, the initial waste drums will be opened and visually inspected to assure proper solidification with no free-standing water. The formulas will be modified if necessary to provide solidification. Thereafter, waste drums will be periodically opened and inspected to verify solidification.

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D. The LSCS operating procedures provide for the sampling and analysis of each batch of concentrator waste. The solidification formulas for each batch of waste will be based on the total solids content of the batch sample. Graphs and instructions are provided in the operating procedures. When a specific formula is first used to solidify a batch, an initial waste drum will be opened and visually inspected to verify solidification with no free-standing water.

E. New LSCS solidification formulas may be developed and added to the operating procedures to optimize drum radiation levels or waste processing or to accommodate changes in the waste stream characteristics. For new formulas, initial waste drums will be opened and inspected to verify solidification with no free-standing water.

F. The current LSCS solidification formulas are provided in Appendix A. The formulas in Appendix A have been determined by Stock Equipment Company to provide solidification within the following tolerances for waste and cement quantities:

Cement	± 5%
Sludges	± 10%
Evap. Wastes	± 5%

Should variations in waste and cement occur for the same drum, the tolerances listed above are half of that specified.

V. Administrative Controls On LSCS Solidification

A. Use of Procedures. Written station procedures are used to implement the LSCS PCP. The station procedures address the following aspects of implementation:

1. Step-by-step directions are provided for operation of the solidification system.

2. Solidification Formulas are provided for each LSCS Waste Stream.

3. Each waste container is assigned a unique identification number. Operational parameters are recorded for each container.

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4. The container operational parameters are reviewed to verify that the drumming formula was followed:

5. Waste containers are periodically inspected to verify solidification with no free-standing water.

6. Concentrator Waste Tanks are mixed for at least 4 hours to provide samples for pH and solids content.

B. Station Procedures which implement the Process Control Program are listed in Appendix B.

C. At least one batch of solidified waste in ten batches of each waste type will be tested to verify solidification. The test will consist of opening a container at least 24 hours after mixing and inspecting for the presence of free-standing water. If any visible free-standing water is detected that cannot be attributed to operator error or system malfunction, further solidification of that type of waste will be suspended until the Process Control Program is modified and proper waste solidification is verified. Inspections will be performed prior to shipment of the solidified waste.

D. If the initial test of a batch fails to verify solidification, each succeeding batch of the same type of waste will be tested until 3 consecutive batch tests verify solidification without free-standing water.

E. Waste Sludge Tank (0WX01T), a batch is the contents of the tank when a sludge sample is drawn on the waste and until the tank has received a sludge input from one of the following:

1. Backwash of a Radwaste Filter, 1(2)WE01F

2. Backwash of a Fuel Pool Cooling Filter/Demineralizer, 1(2)FC01DA/B

3. Discharge of sludge from th Floor Drain Collector Tanks, 1(2)WF01T

4. Discharge of sludge from the Floor Drain Concentrator Feed Tanks, 1(2)WF03TA/B

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5. Discharge of sludge from the Chemical Waste Collector Tanks, 1(2)WZ01T.

Once the Waste Sludge Tank has received a sludge input, drumming of the Waste Sludge Tank contents will cease until a new sludge sample is drawn. This tank continues to receive water while solidification is in progress. The water content of this waste is controlled in the decanting stations and isotopic breakdown or other waste characteristics are not expected to change significantly by the addition of water.

F. URC Sludge Tank (0WX02T), a batch is the contents of the tank when a sludge sample is drawn on the waste and until the URC Sludge Tank has received a sludge input from the Waste Floc Tank, 1(2)WE04T. Once the URC Sludge Tank has received a sludge input, drumming of the URC sludge tank contents will cease until a new sludge sample is drawn. This tank continues to receive water while solidification is in progress. The water content of this waste is controlled in the decanting stations and isotopic breakdown or other waste characteristics are not expected to change significantly by the addition of water.

G. Spent Resin Tank (0WX03T), a batch is the contents of the tank when a resin sample is drawn on the waste and until the Spent Resin Tank has received a resin input from one of the following:

1. a discarded Condensate Polisher demineralizer bed

2. a discarded Radwaste Demineralizer bed

3. a discarded Floor Drain Demineralizer bed

4. a discarded Chemical Waste Demineralizer bed

5. a discarded Portable Demineralizer bed

Once the Spent Resin Tank has received a resin input, drumming of the Spent Resin Tank contents will cease until a new sludge sample is drawn. This tank continues to receive water while solidification is in progress. The water content of this waste is controlled in the decanting stations and isotopic breakdown or other waste characteristics are not expected to change significantly by the addition of this water.

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H. Reactor Water Cleanup Phase Separator Tanks 1(2)WX01TA/B, a batch is the contents of one waste tank when a sludge sample is drawn on the waste and until the Phase Separator Tank has received a sludge input from the backwash of a Reactor Water Cleanup Filter/Demineralizer, 1(2)G33-Z001-1A/B/C. Once the Phase Separator Tank has received a sludge input, drumming of the Phase Separator Tank contents will cease until a new sludge sample is drawn. This tank continues to receive water while solidification is in progress. The water content of this waste is controlled in the decanting stations and isotopic breakdown or other waste characteristics are not expected to change significantly by the addition of water.

I. Concentrator Waste Tanks, 0WX07TA(B), a batch is the contents of one isolated waste tank.

VI. Control of Process Parameters Which Could Affect LSCS Solidification

A. Cement Type. Type 3 Portland Cement is used as the solidification agent at LSCS. The cement is certified by the suppliers to meet the specifications of ASTM C150. Plant inspection of cement shipments will verify proper certification.

B. pH of Waste Stream. Stock Equipment Company has determined that extreme (greater than 10) pH values of waste can adversely affect solidification.

1. The Concentrator Waste Tanks receive wastes from the evaporators and reverse osmosis unit that may exceed a pH value of 10. The evaporator waste tank pH is monitored by sampling and analysis. The waste pH may be adjusted if a waste batch is found to have improper solidification.

2. The other LSCS Waste Streams consist of slurries. The pH of these waste streams is not expected to exceed 10 and is not normally monitored.

C. Solids Concentration and Type of Waste

1. The LSCS operating procedures provide formulas for each specific waste stream. The actual parameters for the waste containers are reviewed to verify that the correct formulas are used for the type of waste solidified.

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2. Evaporator Wastes batches are sampled and analyzed. The formulation used to solidify a particular batch is based on the measured batch solids content. When a particular formulation is first used an initial container of solidified waste is inspected to verify solidification without free-standing water.

3. The other LSCS waste streams are slurries. The decanting tanks are utilized to control solids concentration.

D. Slurry Settling times. In order to obtain a uniform bed-of-solids in the decanting tanks and consistent slurry concentrations the LSCS operating procedures provide specific settling times for each type of waste.

E. Drum Mixing Times. The LSCS operating procedures specify drum mixing times for each waste type. The mixing times are automatically controlled by adjustable timers. Mixing times are recommended by Stock Equipment Company for the pretested formulas.

F. Solidification (Set) Time. Stock Equipment Company has recommended 24 hours as a minimum set time to assure complete solidification of non-borated wastes. LSCS does not expect to ship waste containers within 24 hours of solidification because of the LSCS capacity to store approximately 2000 drums.

G. Concentrator Wastes Temperatures. Stock Equipment Company has recommended a maximum concentrator wastes temperature of 160°F to preclude possible overpressurization of the solidified containers. At LSCS Concentrator Wastes temperature is monitored with a thermocouple. In the event of waste temperatures exceeding 160°F the waste metering pump is tripped.

H. Presence of Oil in Waste Streams. Solidification tests performed by Stock Equipment Company involving typically encountered oil types indicated that up to 2% concentrations (by weight) do not adversely affect solidification. LSCS does not expect oil contamination of any waste stream to exceed 2% by weight. Solidified LSCS waste is periodically inspected to verify solidification.

I. Maintenance of Cement Quality During Storage. At LSCS, cement used for solidification will be stored indoors in an enclosed steel silo. The storage area temperature will be maintainewd at 60-100°F range by plant ventilation. Indoor storage provides reasonable assurance that cement quality will be maintained.

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J. Type and Condition of Solidification Containers. New solidification drum shipments are inspected to verify that certifications to DOT specifications are included with the shipments. The inspection may include verification that drum wall thicknesses are within tolerance and that seams are tight. Prior to loading with cement and waste, each drum is inspected to verify the absence of dents and holes and the presence of the required "Radioactive LSA" markings. The inspection also verifies that a 4-inch cap and gasket are installed.

VII. Shipment of Solidified Waste

A. Isotopic Analysis of Sludge and Resin. Each sludge or resin source (tank) is sampled and isotopically analyzed. Based upon this analysis, the activity (uCi/gram) and % abundance of each isotope in the sludge and resin are determined. This analysis includes determination of activity and % abundance of the radionuclides addressed in 10CFR61.

B. Curie Content of Solidified Waste. The Curie content of each processed barrel will be determined using conservative calculations which relate the average barrel surface area dose rate to the total activity.

C. Prior to shipping, drums are inspected for removable contamination and general condition. Drums found to be damaged during handling will be placed in 83-gallon drums for shipment.

D. Expended cartridge - type filter elements will be dried and shipped as Dry Active Waste (DAW).

E. Free-standing water will be removed from partially solidified drums prior to shipment.

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Appendix A
LSCS Solidification Formulas

I. Spent Resin Tank

10% free-standing water in decant tank.
Slurry settling time 1 hour.
Min. Drum Mixing Times 10 min. first time and 5 min.second time.
40 gallons of waste.
240 lb. Type 3 Cement.
Final drum weight 607 lb.

II. Waste Sludge Tank

10% free-standing water in decant tank.
Slurry settling time 4 hours.
Min. Drum Mixing Times 10 min. first time and 5 min.second time.
36.5 gallons of waste.
296 lb. Type 3 Cement.
Final drum weight 608 lb.

III. URC Sludge Tank

10% free-standing water in decant tank.
Slurry settling time 8 hours.
Min. Drum Mixing Times 10 min. first time and 5 min.second time.
40 gallons of waste.
240 lb. Type 3 Cement.
Final drum weight 607 lb.

IV. RWCU Phase Separator Tanks

10% free-standing water in decant tank.
Slurry settling time 4 hours.
Min. Drum Mixing Times 10 min. first time and 5 min.second time.
36.5 gallons of waste.
296 lb. Type 3 Cement.
Final drum weight 608 lb.

V. Concentrator Waste Tanks

Min. Drum Mixing Times 10 min. first time and 5 min.second time.
Quantity of Type 3 Cement per attached graph.
Quantity of Waste per attached graph.
Final Drum Weight Variable.

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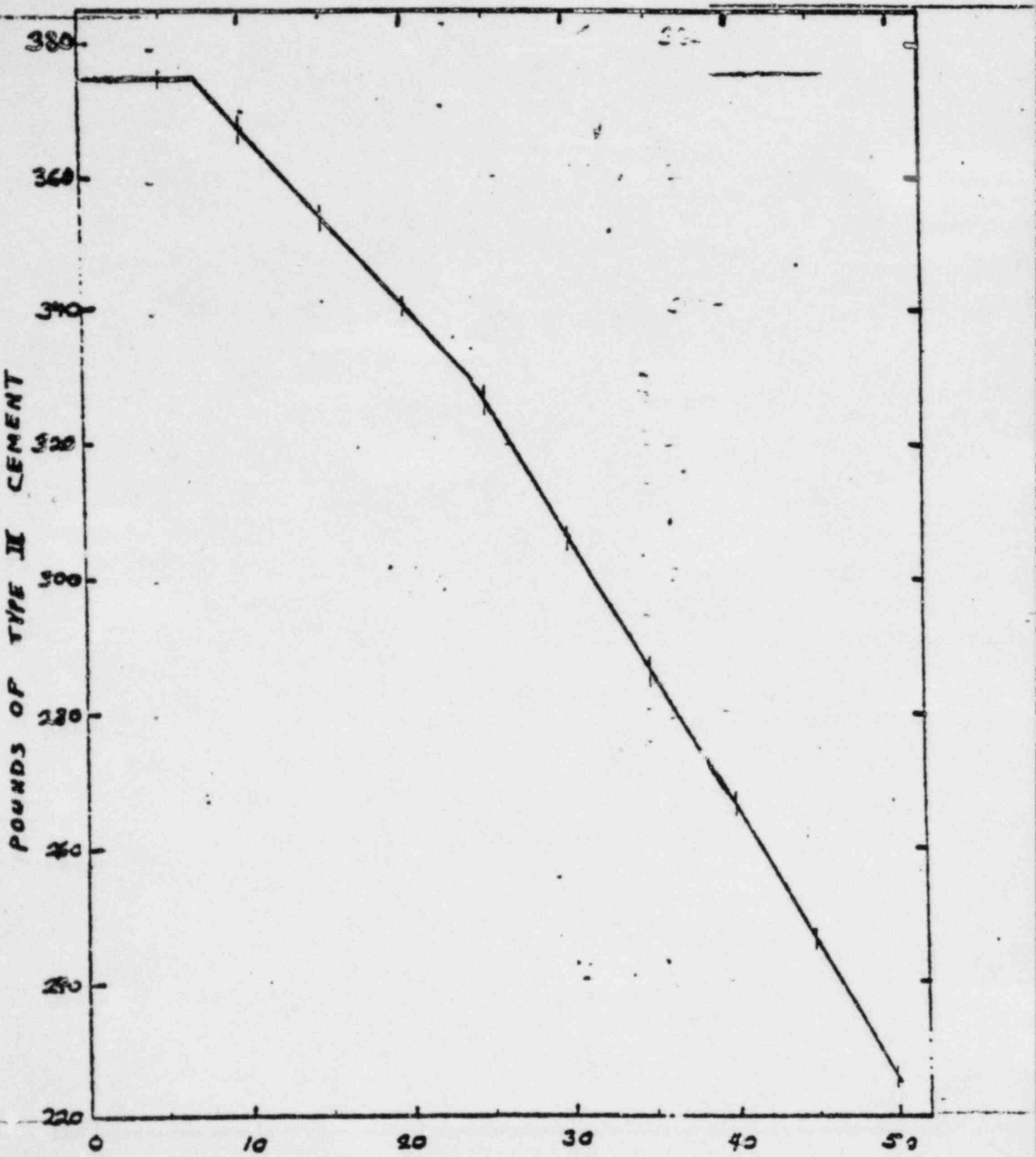
CONCENTRATED WASTE DRUMMING

FORMULA GRAPH



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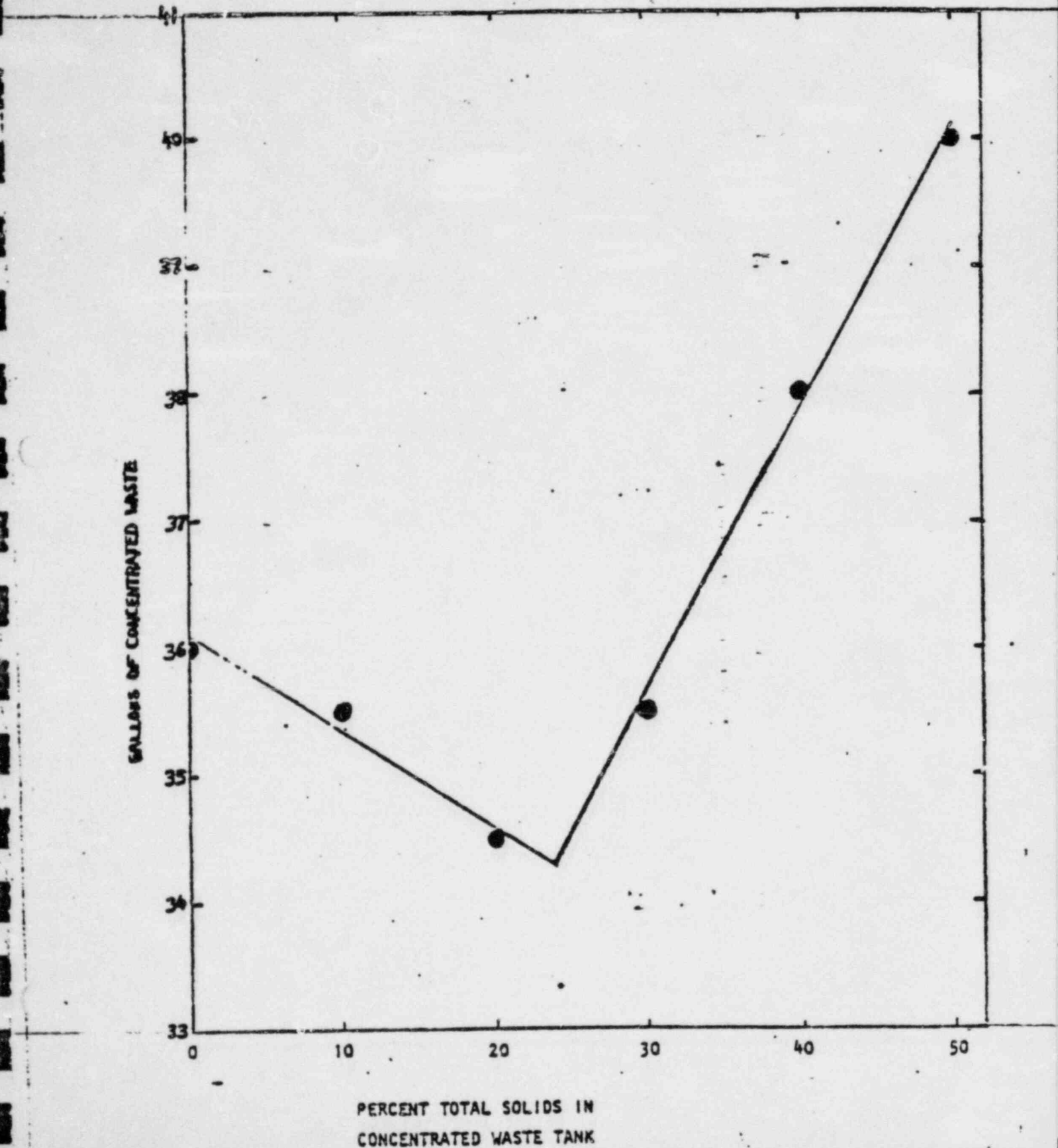
CONCENTRATED WASTE DRUMMING
FORMULA GRAPH



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APPENDIX B

LSCS Procedures Which Implement the LSCS PCP

1. LOP-WX-01, Drum Handling Bridge Crane Operation
2. LOP-WX-02, Decanting Station Operation
3. LOP-WX-03, Drumming Unit Operation
4. LOP-WX-04, Establishing a Concentrated Waste Tank Transfer Loop.
5. LOP-WX-12, Establishing a RWCU Phase Separator Tank Transfer Loop.
6. LOP-WX-14, Cement Day Tank Filling and Drum Cement Loading.
7. LOS-WX-SR1, Verification of Radwaste Solidification.
8. LOP-WX-16, Drum Labeling and Inspection Station Operation.