Enclosure 3

Rev. A
2/27/81

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PROCESS CONTROL PROGRAM

FOR THE

RADWASTE SOLIDIFICATION SYSTEM

OF THE

SUSQUEHANNA STEAM ELECTRIC STATION

PENNSYLVANIA POWER & LIGHT COMPANY

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I. PURPOSE

The purpose of the Process Control Program is to provide reasonable assurance of the complete solidification of processed radioactive wastes and of the absence of free water in the processed waste product.

Details of the design or construction of the radwaste solidification system are not included. This information may be found in the appropriate design drawings for Susquehanna SES and the UNC Nuclear Industries TOPICAL REPORT for the radwaste solidification system, as referenced in section VIII. of this document.

No report was ever submitted

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II. RESPONSIBILITY

The responsibility for implementation of the Process Control Program is as follows:

A. Radwaste Supervisor (Operations)

The Radwaste Supervisor is responsible for assuring that the solidification equipment is operated in accordance with applicable plant operating procedures and the Process Control Program. The Radwaste Supervisor is also responsible for assuring that periodic calibrations and inspections are performed within the schedule established by the Process Control Program and that the appropriate waste solidification records are generated and retained. The Shift Supervision performs these duties in the absence of the Radwaste Supervisor.

B. Chemistry Group

The Chemistry Group is responsible for prescribing the appropriate mixing ratios and approving any changes of the solidification agents, i.e., cement type, sodium silicate concentration, etc.

C. Plant Engineering Group

The Plant Engineering Group is responsible for reviewing and approving all changes to the Process Control Program and the radwaste solidification system.

III. SOLIDIFICATION WASTE STREAMS

A. Waste Inputs to the Radwaste Solidification System

In general, radioactive waste material collected from the Reactor, Turbine, and Radwaste Buildings by the Liquid and Solid Radioactive Waste Handling Systems is eventually routed to the waste mixing tanks of the Radwaste Solidification System. Plant laundry wastes are normally processed and released to the environment, however, these wastes may be processed to the Radwaste Solidification System as well. Figure 1, located in Appendix D, is a schematic diagram of the radioactive waste flowpaths for the Radwaste Solidification System of Susquehanna Steam Electric Station.

Inputs to the waste mixing tanks are as follows:

1. Evaporator Concentrates
2. Filter/Demineralizer Media
3. Water and Chemical Additives

1. Evaporator Concentrates

Evaporator concentrates are up to 25 weight% solids solutions which consist primarily of sodium sulfate as solids due to the regenerant chemicals used for condensate demineralizer resin regeneration. The solids content may be less concentrated during certain operational conditions. The evaporator concentrates will also periodically contain decontamination agents and laboratory wastes. Laundry wastes may also be present.

2. Filter/Demineralizer Media

Filter/demineralizer media will be added on a batch basis to the waste mixing tanks by gravity from the LRW Filter located above each waste mixing tank. The filter/demineralizer media is normally dewatered to approximately 50 weight % moisture by air drying on the LRW Filter elements, and then discharged to the waste mixing tanks. In certain operational conditions the filter cake may not be air dried, but will be discharged directly into the waste mixing tanks following draining away of the gross water volumes. The filter cake may consist of fouled diatomaceous earth or powdered resin from the filtering of liquid waste waters or combinations of filter precoat materials and filtered solids from dewatering slurry wastes. The LRW Filters are typically precoated with clean diatomaceous earth or powdered resin prior to dewatering

slurries. Slurries may consist of bead resins from the Radwaste Demineralizer and the Condensate Demineralizers (Spent Resin Tank) or of powdered resins from the Reactor Water Cleanup and Fuel Pool Cleanup Filter/Demineralizers (Phase Separators). The Phase Separators may include filter sludges from the Condensate Demineralizers and the LRW Filters as well.

3. Water and Chemical Additives

Water may be added to the waste mixing tanks to slurry the dewatered filter cake in the event evaporator concentrates are not available (see section III.B.2). Water is also used to flush the system piping and pumps after processing is complete. A chemical addition funnel is provided for each waste mixing tank for waste pretreatment and system decontamination solutions as necessary.

B. Identification of Waste Types in Each Batch

The contents of the waste mixing tank are determined and recorded by the following methodology. This discussion is typical for both solidification trains.

1. The operator records the initial status of the waste mixing tank level, which would normally be 0% or empty, on the Radwaste Solidification Data sheet. If the tank is not empty, the amount and type of material present in the tank is recorded.

How is the type determined

2. The operator then adds liquid waste to the waste mixing tank in order to slurry the solid wastes when they are received from the filter discharge. Two sources of liquid are available, either chemical liquid radwaste or condensate. Evaporator concentrates are normally used and may be pumped from the evaporator concentrate storage tank or either of the two evaporator shells. In the event chemical wastes are not available or are not desired, condensate would be added to the waste mixing tank. The waste mixing tank level is again recorded to determine the amount of liquid added.

How much?

Solidified on power dependent on liquid?

3. Solid waste additions are then made to the waste mixing tank by batch solids discharges from the associated LRW filter. The level in the waste mixing tank is recorded before and after the filter discharge to determine the amount of solids added. A typical filter precoat layer of diatomaceous earth prior to waste filtering is about 0.15 pounds of precoat material per square foot of filter surface area, which is equivalent to a uniform precoat thickness of 3/32". This results in about 19 gallons of solids for the Susquehanna SES

LRW filters, which have a nominal surface area of 300 square feet. As waste and filter aid material are removed by the filter, the cake thickness will build up to a maximum of 15/16". This results in a maximum filter discharge of about 175 gallons of filter cake. The live capacity of each waste mixing tank is about 840 gallons. The precoat material and the type of waste removed during each filter run is also recorded on the Radwaste Solidification Data Sheet.

The filter cake is dewatered on the LRW filter's horizontal elements by draining the free liquid from the filter shell. The filter cake is normally further dewatered by blowing air through the LRW filter and actually drying the cake. The air being exhausted from the filter is monitored by a moisture detector which indicates the exhaust dew point on the LRW filter control panel. At the end of the cake drying operation, the dew point of the exhaust air is recorded by the operator and is used to determine the moisture content of the filter cake. If the filter cake is not dried by this forced air method, a typical value of cake moisture content will be assumed based on startup experience.

A maximum amount of solids per waste mixing tank will be determined based on startup experience to ensure solids loadings are not too high for acceptable solidification and tank mixing. Additional liquid may be added to the waste mixing tank if desired or necessary to maintain an acceptable slurry, with each addition to the waste mixing tank being recorded as to type of waste and the change in tank level.

IV. SOLIDIFICATION PRODUCT CONTROL

A. Waste Preconditioning

Certain wastes may require preconditioning to assure satisfactory solidification. Examples of this might be evaporator concentrates with a very low pH or Radwaste Demineralizer resins which were not fully spent.

The Chemistry Group will advise the Operations Section of any waste preconditioning which should be done. The specific Solidification Instructions address any preconditioning required for predetermined waste types and include limits for batch processing based on vendor, startup or operational experience.

In general, the following areas of concern will be addressed to assure satisfactory solidification:

1. Evaporator concentrates pH
2. Unspent resin ion exchange capacity
3. Cation resin swelling
4. Laundry waste phosphate and borate content

B. Determination of Mixing Ratios

The Chemistry Group of the Plant Staff is responsible for advising the Operations Section of the proper mixing ratios to be used to assure satisfactory solidification of the various radioactive wastes. Standard mixing ratios proven for certain ranges of specific wastes are given to the Operations Section for normal waste processing. These ratios, called Solidification Instructions, are based on guidelines from the solidification system vendor (United Nuclear Industries), pre-operational testing and operational experience at Susquehanna SES, or laboratory testing of non-radioactive waste specimens. Wastes which do not meet the predetermined ranges or wastes types that have not been addressed in the specific Solidification Instructions provided will be handled on a case by case basis by the Chemistry Group. Satisfactory mixing ratios will be determined and forwarded to the Operations Section or alternate methods for handling the batch will be given.

The Radwaste Solidification Data Sheet is used to determine the final batch composition. The various additions to the waste mixing tank are categorized and totalled on the data sheet. The specific Solidification Instruction which applies to the types and ranges of the batch of waste to be processed is determined and verified by the Radwaste Supervisor or Shift Supervisor. If specific mixing ratios have not been predetermined, the Radwaste Solidification Data Sheet is

forwarded to the Chemistry Group for resolution and the batch in the waste mixing tank is placed on hold, i.e. no further additions are made without the approval of the Chemistry Group. The Chemistry Group will research the batch and prescribe the appropriate mixing ratios which will result in satisfactory solidification or specify alternate measures to be taken to handle the batch, e.g., dilution of the tank or addition of caustic.

After the proper mixing ratios are determined and all required preconditioning is complete, the operator adjusts the speed control potentiometers on the solidification control panel to provide the prescribed flow rates of cement, waste, and sodium silicate. This is done through the use of the most recent equipment calibration data for the various pumps and the cement rotary feed valve. The prescribed flow rates, the speed control potentiometer settings, and the identification number of all waste containers processed from that batch are recorded on the Radwaste Solidification Data Sheet.

C. Solidification Product Quality

The quality of the solidification product is of prime importance. Product quality is the key to fulfilling the purpose of the Process Control Program, which is to provide reasonable assurance of the complete solidification of processed radioactive wastes and of the absence of free water in the processed waste product, as stated in Section I.

Solidification is defined as the conversion of radioactive materials from liquid systems to a monolithic immobilized solid with definite volume and shape, bounded by a stable surface of distinct outline on all sides (free-standing). This definition does not exclude the processing of multiple batches of waste product into a single container at different times or the placement of wet or dry filter cartridges in the solidification waste container to achieve shielding or immobilization. Satisfactory solidification is quantitatively defined as less than 0.5% of the container volume or one gallon as free water, whichever is less.

Solidification product quality is assured by the use of predetermined proven mixing ratios of waste, cement, and sodium silicate. Mixing ratios are based on actual testing, done before system contamination with radioactive materials or during operation by laboratory testing using non-radioactive waste materials. Ranges of waste properties are established which guarantee satisfactory solidification for the given mixing ratios. The actual waste material is compared to the established ranges, thereby determining the proper mixing ratios to be used to guarantee satisfactory solidification.

No sampling of radioactive sludges, resins, filter media, or processed product is planned. Solid waste sampling and handling of either the

solid waste or the processed waste/cement/silicate product would result in excessive radiation exposure to plant personnel and is contrary to station ALARA (As Low As Reasonably Achievable) policies. The use of non-radioactive waste for verification of solidification is used as a reasonable and adequate method for assurance of solidification product quality.

D. Curing Time

The solidified product may not achieve ultimate strength until several weeks after processing. For the purposes of most testing, the product is assumed to be cured within 24 hours. Some wastes may require longer curing times. The radwaste Solidification Instructions will include the required curing time for each waste category to achieve satisfactory solidification. Waste containers will not be shipped off-site until they are adequately cured.

E. Handling of Unsolidified Waste Containers

In the unlikely event a waste container is discovered which does not meet the criteria for satisfactory solidification, several options for handling the container are available. If the reason for unacceptability is excessive free water, the free water may be removed or extra cement and/or sodium silicate may be added to solidify the free water. If portions or all of the product did not solidify, the waste container may be handled by the addition of solidification agents until satisfactory solidification is achieved or the waste container may be overpacked by the use of a larger container filled with solidified cement or concrete to encase the unsolidified container in a solidified capsule.

How will you know?

This is not an acceptable method. We will not accept.

V. SOLIDIFICATION AGENT CONTROL

Portland cement and sodium silicate (liquid form) are the two agents which are used to solidify the wet radioactive wastes.

A. Procurement of Solidification Agents

The agents which are used at Susquehanna SES will be purchased to the following specifications:

Portland Cement - ASTM C-150, Type II

Sodium Silicate - Philadelphia Quartz Company, Type N, or equivalent

Weight Ratio: SiO2/Na2O	3.20
Percent Na2O	8.90
Percent SiO2	28.70
Degrees Baume	41.00
Density, lb/gal	11.60
Viscosity	180.00

Portland Type I or V cement may be purchased if Type II is not available, with prior Chemistry approval. Any deviations shall be approved by Chemistry Supervisor.

B. Receipt Inspection

Both the Portland cement and the sodium silicate will be inspected upon receipt to verify that the shipment being received is the correct material. A copy of the supplier's bill of material shall be retained and stored with the records of the waste solidifications.

C. Periodic Inspection

The sodium silicate will be sampled each time water is added to the tank to ensure the contents of the tank are at the proper concentration of 40 - 42 degrees Baume'. If the sodium silicate is not at the proper concentration, the Chemistry Supervisor will advise Operations personnel of the proper corrective action. The sodium silicate tank will be resampled to verify the proper concentration is attained if chemical adjustment is performed.

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VI. CALIBRATION OF SOLIDIFICATION EQUIPMENT

Equipment which is adjustable and important to the proper operation of the radwaste solidification system must be periodically calibrated to assure satisfactory solidification is achieved. Calibration of most of the system components requires personnel entry into high radiation areas and therefore must be done at reasonable intervals to meet the objectives of the station ALARA program (As Low As Reasonably Achievable) for reducing personnel radiation exposure.

Appendix B, "Radwaste Solidification System Calibration Requirements", specifies the equipment which must be calibrated and the frequency of calibration.

The system pumps are calibrated annually by flow tests to account for wear of the pump stators, which are made of an elastomer. The cement rotary feed valve is calibrated using valve speed only because wear is not expected for this component.

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VII. ADMINISTRATIVE CONTROLS FOR THE SOLIDIFICATION PROCESS

A. Equipment Operation

The Radwaste Supervisor or the Shift Supervisor supervises the operators of the radwaste solidification system. Each operator is trained in the operation of the system prior to processing wastes. Written procedures are provided detailing the operation of the solidification system. Processing is normally semi-automatic requiring operator action only to initiate the process and flush modes by pushbutton and monitor system performance. Manual operation is fully described in the system operating procedure.

All important information is recorded on the Radwaste Solidification Data Sheet and is initialled by the system operator. Radwaste Solidification Data Sheets are reviewed by the Radwaste Supervisor or his designee to ensure the process requirements were met.

B. Records

Records of the types and amount of radioactive waste processed, including the Radwaste Solidification Data Sheets, are retained for a period of two years subsequent to the shipment of the waste material off-site for disposal. The procedures and instructions for processing the wastes are also retained for the same time period.

C. Waste Container Numbering

Each waste container is uniquely numbered on the exterior to permit indentification of the particular waste batch and for inventory purposes. The container number is recorded on the Radwaste Solidification Data Sheet during the container filling step.

D. Changes to the Process Control Program

Any changes to the Process Control Program shall be provided in the Semiannual Radioactive Effluent Release Report filed with the NRC. All changes shall be reviewed and approved by the Plant Operations Review Committee.

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VIII. REFERENCES

A. Vendor Documents

United Nuclear Industries, Inc.

1. Operation and Maintenance Manual for Solid Radwaste Handling Equipment, Bechtel Drawing No. 8856-M74-133.
2. System Drawings, Bechtel Drawing Nos. 8856-M74-XX Series.
3. Topical Report for Radwaste Solidification System.. ← never

B. Architect - Engineer Documents

Bechtel Power Corporation (for Pennsylvania Power & Light Co.)

1. Process & Instrumentation Diagrams

   a. Liquid Radwaste Collection, M-161
   b. Liquid Radwaste Processing, M-162
   c. Liquid Radwaste Chemical Processing, M-163
   d. Liquid Radwaste Laundry Processing, M-164
   e. Solid Radwaste Collection, M-166
   f. Radwaste Solidification, M-167

2. Plant Design Drawings, M-38-X Series

3. Electrical Schematics, E-161 & 162

4. Equipment Layout Drawings, M-270 to M-274

5. Technical Specification for Solid Radwaste Handling Equipment, Spec. M-74

C. Final Safety Analysis Report for Susquehanna SES

1. Section 11.4, Solid Waste Management System.

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APPENDIX A

RADWASTE SOLIDIFICATION MIXING RATIOS

Instruction Identification Key:

B - Bead Resin
C - Concentrates (no decon agents)
D - Diatomaceous Earth
M - Mixed Filter Media (powdered resin and inert material; e.g. Ecodex)
P - Powdered Resin
W - Water (condensate)
X - Detergents
Z - Concentrates (with decon. agents)

Solidification Instructions are identified by an alpha-numeric code. Each type of waste contained in the batch to be processed is represented by its appropriate code letter(s), in alphabetical order, followed by a unique sequence number assigned after development of the mixing ratios. For example, Solidification Instruction BCD-3 represents a batch of bead resin, concentrates, and diatomaceous earth within the ranges of waste specified in instruction 3 of the BCD series.

Detailed Solidification Instructions will be developed in the future based on pre-operational testing experience. A sample list of instructions is given below:

Waste Description	Batch Composition (% Vol.)		Conc. Strength	Solidification
BC. Bead Resin (dewatered & Evaporator Concentrates	Bead Resin	Concentrates	(Wt. % Solids)	Instruction No.
	0-19	81-100	0-14.99	BC-1.0
	0-19	81-100	15-30	BC-1.1
	20-29	71-80	0-14.99	BC-2.0
	20-29	71-80	15-30	BC-2.1
	30-39	61-70	0-14.99	BC-3.0
	30-39	61-70	15-30	BC-3.1
	40-49	51-60	0-14.99	BC-4.0
	40-49	51-60	15-30	BC-4.1
	50-59	41-50	0-14.99	BC-5.0
	50-59	41-50	15-30	BC-5.1

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Waste Description	Batch Composition (% Vol.)		Solid. Instruction No.
	Bead Resin	Condensate	
BW. Bead Resin (dewatered) & Condensate	0-19	81-100	BW-1
	20-29	71-80	BW-2
	30-39	61-70	BW-3
	40-49	51-60	BW-4
	50-59	41-50	BW-5

Other typical categories are BCD, BCM, BDW, C, CD, CDM, CM, CP, CX, DW, DMW, MW, PW, X and Z.

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APPENDIX B
RADWASTE SOLIDIFICATION SYSTEM CALIBRATION REQUIREMENTS

Equip. Description	Parameter	Equip. No.	Calib. Freq. (Calib./Yr.)
1. Process Feed Pump A	Waste Flow	OP-304A/SC-06702A	1
2. Process Feed Pump A Disch.	Waste Flow	PSHL-06701A	1
3. Process Feed Pump B	Waste Flow	OP-304B/SC-06702B	1
4. Process Feed Pump B Disch.	Waste Flow	PSHL-06701B	1
5. Mixing Pump A	Wst./Cement Flow	OP-307A/SC-06704A	1
6. Mixing Pump A Disch.	Wst./Cement Flow	PSHL-06703A	1
7. Mixing Pump B	Wst./Cement Flow	OP-307B/SC-06704B	1
8. Mixing Pump B Disch.	Wst./Cement Flow	PSHL-06703B	1
9. Rotary Feed Valve	Cement Flow	OS-305/SC-06703	1
10. Rotary Feed Valve Disch.	Cement Flow	FS-06701A	1
11. Rotary Feed Valve Disch.	Cement Flow	FS-06701B	1
12. Sodium Silicate Pump	Sod. Sil. Flow	OP-309/SC-06705	1
13. Sodium Silicate Pump Disch.	Sod. Sil. Flow	PSHL-06702	1
14. Waste Mixing Tank A	Waste Tk. Lvl.	LE, LT, LSHL, LI-06701A	1
15. Waste Mixing Tank B	Waste Tk. Lvl.	LE, LT, LSHL, LI-06701A	1
16. Cement Silo	Cement Tk. Lvl.	LE,LT, LSL, LI-06702	1
17. Sodium Silicate Tank	Sod. Sil. Tk. Lvl.	LE, LT, LSL; LI-06704	1
18. Fillport	Waste Container Lvl.	LE, LT, LSH, LI-06703	1
19. Waste Mixing Tank A	Waste Temp.	TSL-06701A, 06702A	1
20. Waste Mixing Tank B	Waste Temp.	TSL-06701B, 06702B	1

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APPENDIX C

SAMPLE FORMS

1. Radwaste Solidification Data Sheet - Draft Only

RADWASTE SOLIDIFICATION DATA SHEET

Sh. of Start Date Wst. Mix. Tk. A B (C. .e)

TK. ADD NO.	TANK LEVEL BEFORE %	TANK LEVEL AFTER %	CONCENTRATES GALLONS	CONCENTRATES WT. % SOLIDS	CONCENTRATES TYPE NORMAL	CONCENTRATES TYPE LAUNDRY	CONCENTRATES TYPE DECON	CONDENSATE GAL	FILTER AGENTS (ENTER P-PRECOAT, GALS. - BODY FEED) PRECOAT GAL	DIA. EARTH TYPE			POWD. RESIN TYPE			POWD. RESIN C:A RATIO	MIXED MEDIA TYPE			MIXED MEDIA C:A:I RATIO	SOLID WASTES TO FILTER BEAD RESIN GALLONS	BEAD RESIN C:A RATIO	RWCU SLUDGE GALLONS	RWCU SLUDGE C:A:I RATIO	WASTE SLUDGE GALLONS	WASTE SLUDGE C:A:I RATIO	LRW CRUD GALLONS	DEWPT. °F
INIT.																											
1																											
2																											
3																											
4																											
5																											
6																											
7																											
8																											
9																											
10																											
11																											
12																											
13																											
14																											
15																											
16																											
SUB-TOTAL																											
ADJUST-MENT																											
TOTAL	GAL				C	X	%																				
% BATCH																											
CIRCLE			C	X	%			W	D				P				M					B		P	M	P	M	D	

Process Control Program
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APPENDIX D

FIGURES

Figure 1 . Susquehanna SES Waste Schematic

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RADWASTE SOLIDIFICATION DATA SHEET

A. APPLICABLE SOLIDIFICATION INSTRUCTION _____
(If none, send to chemistry for resolution)

B. PROCESS LIMITATIONS

1. Concentrates pH

_____	_____
Acceptable Range	Actual Value(s)

2. Laundry Concentrates

_____	_____
Phosphate Maximum	Actual Value(s)
_____	_____
Borate Maximum	Actual Value(s)

3. Decon. Concentrates

Principal Constituents & Concentrations	Acceptable Concentration Ranges
_____	_____
_____	_____
_____	_____

4. Ion Exchange Resin

_____	_____
Max. Batch % Cation Resin	Actual Batch % Cation Resin

(Required only when concentrates are not used for slurrying

_____	_____
Min % Exhaustion Cation Resin	Actual % Exhaustion Cation Resin

C. MIXING RATIOS

	QUANTITY	SPEED POT SETPOINT	CALIB.* DATE	OPERATOR INITIALS
Waste (OP-304)	____ GPM	_____	_____	_____
Cement (OS-305)	____ LB./MIN.	_____	_____	_____
Sod Sil (OP-309)	____ GPM	_____	_____	_____

*Calibrations expire one year from calib. date

D. CURING TIME REQUIRED _____

E. APPROVAL TO BEGIN PROCESSING

_____	_____
SHIFT SUPV.	DATE

F. WASTE CONTAINERS PROCESSED

Container Size	____	____	____	____	____	____	____	____	____	____	____
Volume Added	____	____	____	____	____	____	____	____	____	____	____
Container No.	____	____	____	____	____	____	____	____	____	____	____

F. BATCH COMPLETE

_____	_____	_____
Oper.	Date	Waste Mixing Tank Level

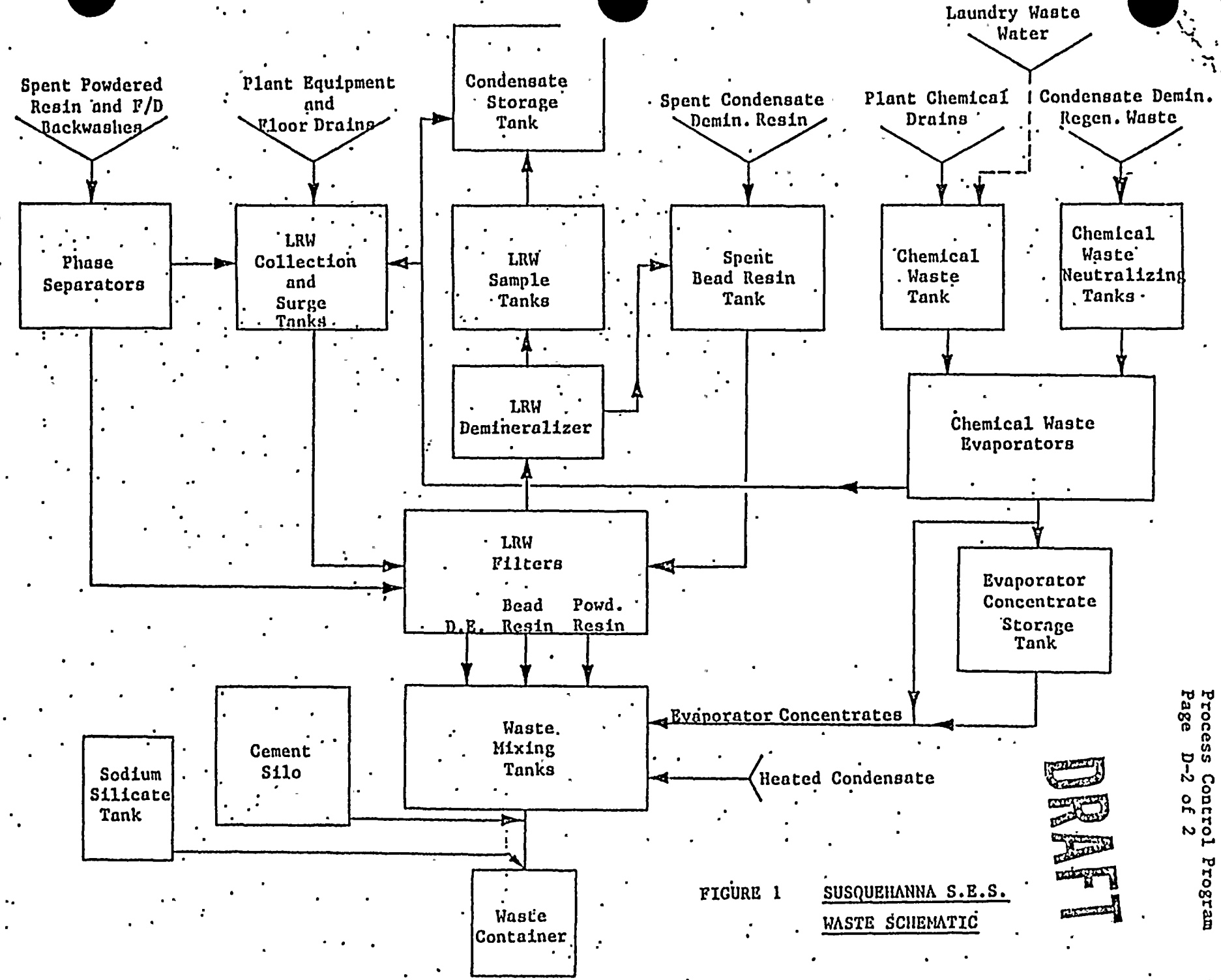

FIGURE 1 SUSQUEHANNA S.E.S.
WASTE SCHEMATIC