

BYRON STATION PROCESS CONTROL PROGRAM

A. STATEMENT OF APPLICABILITY:

The Byron Station Process Control Program (BYRON PCP) describes the administrative and process controls on the radioactive waste solidification system which provide reasonable assurance that the Byron system is operated to produce solidified waste with no free-standing water. The Byron PCP is implemented by the Byron Operating Department.

B. REFERENCES:

1. Byron Technical Specifications
 - a. Section 3/4.11.3, Solid Radioactive Waste System
 - b. Section 6.7, Process Control Program
2. Byron Procedures
 - a. See Attachment B
3. NUREG 0133, Preparation of Radiological Effluent Technical Specifications for Nuclear Power Plants - Oct. 1978

C. MAIN BODY:

1. Byron Solidification System Description.

Byron 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 of 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 Byron personnel.

2. Characteristics of Byron Solidification System Feeds. Wastes are solidified in the Byron system from two sources:

- a. Spent Resin Tank (1). The spent resin tank receives exhausted ion exchange bead resins from the blowdown, radwaste and letdown mixed bed demineralizers and boron thermal regenerative, letdown cation bed, spent fuel pit, recycle evaporator feed and recycle evaporator condensate demineralizers. Resins are allowed to settle in this tank while excess water is decanted. Settled resins are discharged to the solidification system after appropriate recirculation.

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- b. Concentrate Holding Tank (1). The Concentrate Holding Tank receives concentrates from the boric acid recycle evaporators and radwaste evaporators. The concentrates consist of deep bed demineralizer regenerant wastes concentrated to approximately 20% Na_2SO_4 by weight, floor drain wastes consisting of approximately 10% total solids by weight, equipment drain waste concentrates consisting of approximately 10% total solids by weight and chemical drains consisting approximately of a 4% boric acid solution.

3. Solidification Formulas.

- a. Formula Development. Stock Equipment Company has performed extensive testing of simulated PWR waste solidification with cement. Stock will develop specific formulas for solidification of wastes in the Stock systems. These formulas will be pretested by Stock prior to use at Byron.
- b. Byron solidification formulas. Attachment A describes specific formulas for each type of waste. The formulas will include the required amount of cement, the amount of waste, slurry settling 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 Byron spent resin should remain relatively constant. When these formulas are initially used on actual Byron 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.
- d. The Byron operating procedures provide for the sampling and analysis of each batch of concentrate waste. The solidification formulas for each batch of waste will be based on the total solids content of the batch sample. Graphs and instructions will be 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 Byron solidification formulas may be developed and added to the operating procedures to optimize drum radiation levels, 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 Byron solidification formulas will be provided in Attachment A. The formulas will be determined by Stock Equipment Company to provide solidification within the following tolerances for waste and cement quantities:

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|--------------|-------|
| Cement | + 5% |
| Slurries | + 10% |
| Evap. Wastes | + 5% |

4. Administrative Controls On Byron Solidification.

- a. Use of Procedures. Written station procedures are used to implement the Byron 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 will be provided for each Byron Waste Stream.
 - 3). Each waste container is assigned a unique identification number. Operational parameters are recorded for each container.
 - 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.
- b. Station Procedures which implement the Process Control Program are listed in Attachment B.
- c. At least one batch of solidification waste in ten batches of each waste type will be tested to verify solidification. The test will consist of opening a container at least 48 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. For the Spent Resin waste stream, a batch is defined as the contents of the tank when solidification of the contents commences, and for 30 days thereafter. This tank continues to receive water and waste while solidification is in progress. Since water content of these wastes is controlled in the decanting stations, and other waste characteristics are not expected to change significantly, 30 days is chosen as a conservative interval.
 - f. For the Evaporator Concentrate Tank waste stream, a batch is defined as the contents of one isolated waste tank.
5. Control of Process Parameters Which Could Affect Byron Solidification.
- a. Cement Type. Type 2 Portland Cement is used as the solidification agent at Byron. 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 Concentrate Tank receives waste from the evaporators that may exceed a pH value of 10. The evaporator waste tank pH is determined by sampling and analysis. The waste pH may be adjusted if it is found to exceed a value of 10.
 - 2). The other Byron Waste Stream consists of resin slurries. The pH of this waste stream is not expected to exceed 10 and is not normally determined by sampling or analysis.
 - c. Solids Concentration and Type of Waste
 - 1). The Byron operating procedures will 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.
 - 2). Evaporator waste 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 Byron 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 Byron operating procedures will provide specific settling times for each type of waste.
- e. Drum Mixing Times. The Byron operating procedures will 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 48 hours as a minimum set time to assure complete solidification of borated wastes. Byron will not be required to ship waste containers within 48 hours of solidification because of the Byron capacity to store approximately 1210 drums.
- g. Concentrate Waste Temperatures. Stock Equipment Company has recommended a maximum concentrate waste temperature of 160°F to preclude possible overpressurization of the solidified containers. At Byron, Concentrate Waste 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. Byron does not expect oil contamination of any waste stream to exceed 2% by weight. In addition, solidified Byron waste is periodically inspected to verify solidification.
- i. Maintenance of Cement Quality During Storage. At Byron, cement used for solidification will be stored indoors in an enclosed steel silo. The storage area temperature will be maintained at a maximum of 110°F by plant ventilation. Indoor storage provides reasonable assurance that cement quality will be maintained.
- 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 in DOT 17C drums.

6. Shipment Of Solidified Waste.

- a. Isotopic Analysis of Resin and Concentrates. The spent resin and concentrate holding tanks are sampled and isotopically analyzed for gamma emitters. Based upon this analysis, the activity (uCi/gram) and % abundance of each isotope in the spent resin and concentrates are determined.
- 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 70-gallon drums for shipment.
- d. Expended cartridge - type filter elements will be placed in 55-gal drums lined with precast cement.

ATTACHMENT B

BYRON PROCEDURES WHICH IMPLEMENT THE PCP

1. BOP-WX-28, Drum Handling Bridge Crane Operation
2. BOP-WX-29, Decanting Station Operation
3. BOP-WX-30, Drumming Unit Operation
4. BOP-WX-31, Radwaste Tunnel Transfer Car Operation
5. BOP-WX-32, Cement Filling Station operation.
6. BOP-WX-33, Drum Labeling and Inspection Station Operation.
7. BOP-WX-34, Transferring Spent Resin from the Spent Resin Storage Tank to the Decant Tank
8. BOP-WX-35, Transferring Concentrate from the Recycle Evaporator to the Concentrate Holding Tank
9. BOP-WX-36, Transferring Concentrate from the Concentrate Holding Tank to the Stock System Drumming Station.
10. BOP-WX-37, Preparation and Shipment of Radioactive Material.