JULY 19, 1983

NOTE TO DOCKETING:

THIS DOCUMENT, TRANSMITTED TO THE QUAD CITIES PM, ~~TRANSMITTED~~ ON 6/22/83, SHOULD BE DOCKETED ON THE QUAD CITIES DOCKET, 50-254/265

ROBY BEVAN,
PM FOR QUAD CITIES

A001
1/1

ID/TS1-I

QUAD-CITIES STATION

PROCESS CONTROL PROGRAM

FOR

SOLIDIFICATION OF RADIOACTIVE WASTE

REVISION 3

MARCH 1983

I. PURPOSE

The purpose of this Process Control Program is to insure that all low level radioactive wastes solidified at Quad-Cities Nuclear Power Station are void of any free standing water. This manual sets forth the steps used to solidify radioactive waste and to verify the final product is free of water. Both the cement and DOW solidification systems are covered by this Program. Solid wastes at Quad-Cities Station consist of filter media (powdered resin and fiber) and bead resin. When expended, these wastes are transferred to various storage tanks.

II. SOLID WASTE SYSTEM DESCRIPTION

The resin slurry is transferred to one of two centrifuges for dewatering. The centrifuges have a capacity of 25 gpm. The solids are separated from the water and drop into a hopper associated with each centrifuge. The water is routed back to a storage tank.

Each hopper has a 40 cubic foot capacity. At the bottom of the hopper there is a hopper discharge valve. This is a remotely operated, air operated, fail closed valve. Connected to the hopper discharge valve is the sludge chute and the drum feed valve. The sludge chute is 8 inches in diameter and 6 feet 5 inches long, with a capacity of 2.2 cubic feet. The drum feed valve is also remotely operated, air operated, and fail-closed. The hopper discharge valve and the drum feed valve are interlocked to prevent both valves from being open simultaneously.

Cement is added to a drum from the cement silo. The cement silo has a capacity of 620 cubic feet. Cement is fed through a

rotary feeder down a transfer tube through the mixer head, into the drum. The mixer goes into the drum and forms a seal to prevent dispersion of cement dust or spillage during mixing. The mixer has two speeds, 100 rpm and 200 rpm, that are programmed into the mix cycle.

Drums are capped at the load-out conveyor area before loading into a shipping cask. A cap is set in place and a seal ring is snapped over it. A threaded bolt is used to tighten the seal ring.

Drum storage consists of three conveyor lines, with room for 25 drums on each line.

III. OPERATION OF THE CEMENT SOLID WASTE SYSTEM

In order to insure solidification of spent resins with no free water, tests were conducted at Quad-Cities Station using unspent resin. Fresh resins were mixed up in the proportions that would be expected to be normally processed. These resins were then put into a drum and the drum was processed through the cement system. The drum was capped as normal and allowed to set in storage for 24 hours. After 24 hours, the drum was cut open lengthwise and inspected. The results of the inspection resulted in a change of the proportions of water and cement until the final product was solid and free of water. A series of drums were processed using spent resins, and the drums were visually inspected for no free water prior to shipping. No free water was observed.

The general procedure that is followed to process spent resins is described below. Specific plant operating procedures are followed by the operator.

A. The empty drum is covered with a plastic bag and taped in place to prevent external contamination.

B. A half of a bag of dry cement is added to the empty drum.

C. The empty drums are loaded on a conveyor.

D. One empty drum from the conveyor is loaded on a transfer cart (remote operation).

E. The transfer cart is advanced to the selected hopper station (remote operation).

F. Water is added (remote operation). Normally 12 gallons of water are added to each drum. This amount can be varied if necessary for complete solidification. The amount of water required is selected, and a flow integrator gives the inlet valve a closed signal when that amount is delivered.

G. The drum is filled with resins to a prescribed level (remote operation). The resin is transferred from the hopper to the drum through the sludge chute. The discharge valve on the sludge chute is a manually operated remote valve. The operator views the drum through a mirror and fills the drum to the first roll hoop from the top of the drum. Although this method of adding resin to the drum is not precise, it can be controlled to a high degree. If an operator determines that the quantity of resins varies from the prescribed level, he can compensate with water and/or cement.

H. The drum is transferred to the mixing station (remote operation).

I. The cement timer is set.

J. The mixer cycle (remote operation) is started. The mixer lowers into the drum and forms a tight seal. The mixer will begin to

rotate at slow speed. The air slide blower and dust collector are started. The cement feeder and vibrators start and cement is metered to the drum. The mixer increases to fast speed. The cement feeder stops and the air slide blower and dust collector stop. When the mixer completes the cycle, the RPM meter will start to decrease. At this point, the mixer control switch is moved from AUTO to FAST and the mixer is given an additional 5 minutes on fast speed. The switch is then returned to AUTO, and the mixer cycle is complete.

K. The drum is transferred to the inspection station (remote operation).

L. The mixed drum contact radiation reading are logged and the contents of the drum are observed. If it is determined that more cement is required, the drum is returned to the mixer and additional cement is added. When the mix is satisfactory, the drum is transferred to the drum storage lines.

IV. VERIFICATION OF CEMENT SYSTEM SOLIDIFICATION

The solidified drum is verified to be void of free water prior to loading into a shipping cask. The drum is transferred from the storage lines to the load-out conveyor. At this point, the drum is visually verified to be void of free water, the protective plastic bag is removed, and the drum is capped. The drum is then surveyed for smearable contamination and dose rate. The drum is then loaded into the shipping cask.

If a drum is found to contain free water, it will be noted as such. Dry cement will be added such that all of the free water is absorbed or the drum will be recycled through the mixing line as required. The drum will not be shipped until all free water is absorbed.

V. DOW SOLIDIFICATION SYSTEM DESCRIPTION

The DOW System is utilized at the Station to augment and supplement the cement system. It offers the advantage of reduced radiation exposure to operators involved with performing the necessary package handling operations.

The DOW System basically consists of a series of chemical additions to radwaste sludge in a disposable mixing liner that also serves as the shipping container. These chemicals, namely the binder, CMC-7M filler material, Tamol, catalyst, and promotor, are mixed with the radwaste and a water-free solidified mass is produced. Some radwaste may not need CMC-7M for solidification, such as Cleanup Sludge. Additions to the liner are made through a fill head that fits over the liner.

A batching tank is utilized to collect the radwaste to be solidified. The tank can be filled from any of the following:

A. Condensate Phase Separators.

B. Cleanup Phase Separators.

C. Spent Resin Tanks.

D. Waste Sludge Tank.

E. Floor Drain Demineralizer.

After the tank is filled with radwaste, a decant pump is used to remove water from the top of the settled sludge. When the decanting operation is completed, the tank contains about 1,900 gallons of sludge.

The mixing tank is operated on recirculation in order to allow a tank sample to be taken for analysis and sample solidification tests.

A binder tank is located underground west of the Unit 2 L.P. Heater Bay. A binder pump is used to pump the binder from the tank to the liner. Radwaste is transferred to the liner from the mixing tank by means of a radwaste pump. Flushing capability exists on these lines. Air-driven pumps are used to pump catalyst Tamol, and promoter to the liner. CMC-7M is a solid that is manually added to the liner, if needed.

A temperature monitor in the liner is used to note the maximum temperature during the exotherm. At this point the waste is solidified, and the liner is prepared for shipment.

VI. OPERATION OF THE DOW SOLIDIFICATION SYSTEM

A liner is prepared for use by installing a thermocouple and adding CMC-7M (if necessary). The fill head is placed over the liner and locked in-place. The fill head off-gas ventilation blower is started.

Binder is added to the liner. A batcher is set for the proper amount, and the binder is pumped from the tank. The CMC (if added) and binder are then mixed for about 15 minutes, and Tamol is then added. The proper amount to be added is set on the batcher.

The radwaste is then added to the liner. The mixing tank is first mixed for about 10 minutes. The proper amount of radwaste to be pumped is set on the counter on the radwaste pump. Waste flow to the liner is monitored by a TV camera, and the liner is mixed for about 5 minutes after radwaste has been added to the liner. The radwaste pipe lines and waste transfer hose to the fill head are then flushed.

Catalyst is added to the liner. The proper amount is set on the batcher. The liner is then mixed for about 15 minutes. Promoter is added after having set the proper amount on the batcher. After mixing, the temperature of the emulsion is monitored and the maximum temperature is noted. After the temperature begins to decrease, the fill head is removed.

The liner is then covered with a lid, secured, surveyed, and shipped.

VII. VERIFICATION OF DOW SYSTEM SOLIDIFICATION

Verification of solidification first involves sampling the radwaste prior to solidification in order to determine the proper proportions of the chemical ingredients that will produce an acceptable, water-free solid. A representative laboratory sample of waste is taken from the sampling line. Small, scaled-down amounts of chemicals are added in the lab in proper quantities. The quantities depend on DOW Co. recommendations and on the type of radwaste to be solidified. Station procedures shall specify these quantities. The following process is then performed:

A. Weigh CMC (if to be used) and binder into a disposable container.

B. Start mixer. Adjust to good vortex.

C. Add Tamol. Observe color change from amber to silvery white.

D. Mix.

E. Slowly add radioactive waste while maintaining a good vortex. Observe the mixing action to ensure emulsification has occurred.

F. Continue adding remaining radioactive waste to the mix. As the mix gets more viscous, lower the container to maintain a good vortex.

G. When all the waste has been added, continue mixing. Emulsion should be light-colored, high viscosity and homogeneous.

H. Add catalyst and mix.

I. Add promoter. Start stopwatch and mix.

J. Remove sample from mixer.

K. Insert temperature monitoring probe. Determine gel time by probing periodically.

L. Record appropriate amounts of chemical used on data sheet.

M. Stop timer when gelation has occurred.

N. Record maximum exotherm on data sheet. If the gel time and temperature change are acceptable, write up appropriate formulas and scale-up numbers for use in the plant. Solidification of the sample is hereby verified. If solidification is not acceptable, take another radwaste sample and adjust concentration of ingredients such that solidification is verified.

The scale-up numbers are those quantities and proportions of CMC-7M, (if needed) Tamol, radwaste, binder, promoter, and catalyst that are to be actually used in the process of solidification. These numbers are converted to settings to be placed on the batchers and pump counters.

To further verify solidification, a quality check of the liner is performed prior to installing the lid. Both a visual inspection and a penetration probe are performed. The visual inspection verifies no free-standing water, and the surface resistance to penetration verifies a solid mass.