FOR INFORMATION ONLY

QUAD-CITIES STATION

PROCESS CONTROL PROGRAM

FOR

PROCESSING OF RADIOACTIVE WET WASTE

REVISION 11

SEPTEMBER 1993

01530/0229Z

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I. PURPOSE

The purpose of this Process Control Program (PCP) is to insure that the Radwaste System is used as applicable to process all low level radioactive wet wastes solidified or dewatered at Quad-Cities Nuclear Power Station. The Process Control Program shall contain the current formulas, sampling, analyses, test, and determinations to be made to ensure that processing and packaging of solid radioactive waste based on demonstrated processing of actual or simulated wet solid wastes will be accomplished in such a way as to assure compliance with 10 CFR Parts 20, 61, and 71, State regulations, burial ground requirements, and other requirements governing the disposal and shipping of solid radioactive waste. If the provisions of this Process Control Program are not satisfied the station will suspend shipments of the defectively processed or defectively packaged waste. This program covers the in-plant cement, vendor cement, vendor dewatering and vendor encapsulating systems. Wet wastes at Quad-Cities Station consist of filter media (powdered resin and fiber), bead resin, sump sludges, tank residues, and higher activity cartridge filters. When expended, these wastes are transferred to various storage tanks or storage containers and in some cases these wastes are transferred directly into a burial container for processing. Vendor processing of the waste is normally done with the waste container in either a transportation cask or a process shield which offers the advantage of reduced radiation exposure to personnel involved in performing the necessary package handling operations. In some cases where radiation exposure would be minimal, processing of the waste is done with the container placed on an unshielded flatbed trailer.

II. IN-PLANT CEMENT SOLID WASTE SYSTEM

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A. Description

(In-plant cement solid waste system is limited to use for Class A unstable waste forms only)

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 vehicle. 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. Drums stored on the storage lines are removed and either shipped, stored in storage bins located in the radwaste facility, or stored in the Interim Radwaste Storage facility.

B. Operation of the In-Plant 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. Based on these tests, specific station procedures were written to assure that solidified barrels produced by the in-plant cement system fall within the test results. Since all of the barrels made on the in-plant system are classified as Class A unstable, per 10 CFR 61, no additional testing outside of the initial station tests are required.

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

1. The empty drum is covered with a plastic bag and taped in place to prevent external contamination.
2. A half of a bag of dry cement is added to the empty drum.
3. The empty drums are loaded on a conveyor.
4. One empty drum from the conveyor is loaded on a transfer cart (remote operation).
5. The transfer cart is advanced to the selected hopper station (remote operation).

6. 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 between the first and second 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.
7. Water is added (remote operation). Normally 16-20 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.
8. The drum is transferred to the mixing station (remote operation).
9. The cement timer is set.
10. 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.

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

12. 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.

C. Verification of In-Plant Cement System Solidification

Each solidified drum is verified to be void of free water prior to shipping or storage. The drum is transferred from the storage lines to the load-out conveyor. At this point, each drum is visually inspected to verify it is void of free water and the contents solidified. 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 vehicle or placed in storage.

If a drum is found to contain free water, dry cement will be added to solidify the free water or the drum will be recycled through the mixing line as required. The drum will not be shipped with more than 0.5 percent freestanding water.

III. VENDOR SUPPLIED SOLIDIFICATION SYSTEM

A. Description

Contractor solidification services are utilized at the Station for wastes which are required to be classified as stable waste per 10 CFR 61 and/or burial site licenses. Additionally, in certain circumstances, contractor services may also be used to process wastes which are not required to be stable per 10CFR61 and/or burial site licenses. The contractor must have procedures or other support documents as necessary to produce a waste form which meets all the requirements of 10CFR61 and applicable burial site criteria. A copy of the vendor's procedures (which states station interface requirements), and other support documents are submitted to an on-site review prior to use to assure compatability with Station Systems, procedures, and Technical Specifications. Specific station procedures are then developed from this vendor information and approved prior to use.

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

1. Condensate Phase Separators.
2. Cleanup Phase Separators.
3. Spent Resin Tanks.
4. Waste Sludge Tank.

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 can be operated on recirculation to allow a tank sample to be taken for analysis and sample solidification tests as required.

In certain cases, for example, wastes resulting from chemical decontaminations, the waste is sent directly to a liner in which the solidification will take place. In this case a sample is taken out of the liner after it has been properly mixed prior to adding solidification chemicals. The recipe for solidification will be determined based on a successful solidification demonstration using the sample taken from the liner.

A temperature monitor in the liner is used to note the maximum temperature during the exotherm. After sufficient cooling the liner is prepared for shipment or storage.

B. Operation of the Vendor Solidification System

A liner is prepared for use by installing a thermocouple and tubing for level indication. The fill head is placed over the liner and locked in-place.

The radwaste is added to the liner. The mixing tank, if used, is first mixed for about 10 minutes. The proper amount of radwaste is delivered by a radwaste pump or slurried from portable processing equipment. Waste flow to the liner is monitored by a TV camera. The radwaste pipe lines and waste transfer hose to the fill head are then flushed.

After the radwaste has been put into the liner the process is completed by the contractor. The contractor adds cement and additives in accordance with their approved PCP. After final mixing the temperature is monitored and the maximum temperature is noted. When the solidified liner has sufficiently cooled, the contractor and Station personnel visually inspect the product and verify that it is an acceptable product. The liner is then covered with a lid, secured, surveyed and shipped or stored in the Interim Radwaste Storage Facility.

C. Verification of Vendor Supplied Solidification System

Verification of solidification first involves sampling the radwaste prior to solidification in order to determine the proper proportions of the ingredients that will produce an acceptable product. A representative laboratory sample of waste is taken. In accordance with the vendor's PCP program, small, scaled-down amounts of cement and additives are added in the proper quantities. Based on an acceptable lab sample solidification, scale-up factors are developed for the full scale solidification. The full scale solidification will not be done until a satisfactory lab sample solidification has been verified.

A visual inspection of each liner is performed by both the vendor and station personnel prior to installing the lid. The visual inspection further verifies that the product is acceptable per the contractors PCP. If the visual inspection does not verify solidification, the contractor will be required to provide the station an acceptable resolution.

IV. VENDOR SUPPLIED DEWATERING SYSTEM

A. Description

Contractor dewatering services may be utilized at the Station in lieu of solidification for stable waste forms as directed by station operating personnel. Additionally, in certain circumstances, contractor dewatering may also be used to process wastes which are not required to be stable per 10CFR61 and/or burial site licenses. The contractor must have procedures or other support documents to produce a waste form which meets all the requirements of 10CFR61 and the applicable burial site criteria. A copy of the vendor's

procedures (which states station interface requirements) and other support documents are submitted to an on-site review prior to use to assure compatability with Station Systems, procedures, and Technical Specifications. Specific station procedures are then developed from this vendor information and approved prior to use.

Normally a mixing tank is utilized to collect the radwaste to be dewatered. The tank can be filled from any of the following:

1. Condensate Phase Separators
2. Cleanup Phase Separators
3. Spent Resin Tanks
4. Waste Sludge Tank

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 can be operated on recirculation in order to allow a tank sample to be taken for analysis if required. In certain cases when it is not possible or desirable to use the mixing tank, for example, wastes resulting from chemical decontaminations, waste from spent Resin tanks, waste from sump cleaning or waste from portable process equipment. This waste is sent directly to a High Integrity Container (HIC) or steel liner, as required, in which the dewatering will take place.

B. Operation of the Vendor Dewatering System

A High Integrity Container (HIC) or steel liners, as required, is prepared for use by installing a thermocouple, if not already installed, and inspecting dewatering elements and thermocouple leads, if installed. The fill head is placed over the HIC or steel liner, as required, and secured in-place.

The mixing tank, if utilized, is first mixed for approximately 10 minutes. The proper amount of radwaste is delivered to the HIC or steel liner using the installed radwaste pump, portable waste pumps or with air pressure for decontamination system equipment and portable processing equipment. Waste flow to the HIC is monitored by a TV camera. The radwaste pipe lines and waste transfer hose used for the waste transfer to the fill head are flushed after each transfer. .

After the radwaste has been put into the HIC or steel liner, the balance of the dewatering process is completed by the contractor. The contractor dewaters in accordance with their approved procedures or other support documents until the acceptance criteria is met. When the process is complete, the contractor and Station personnel verify that each HIC is an acceptable product and samples are taken from the HIC. The HIC is then covered with a lid, secured, surveyed and shipped or stored in the Interim Radwaste Storage Facility.

C. Verification of Vendor Supplied Dewatering System

Verification of an acceptable dewatered product is delineated in the contractors procedures. The acceptance criteria is dependent upon the type of dewatering system used and the material dewatered.

V. VENDOR ENCAPSULATION OF WASTE

A. Description

Contractor encapsulation services may be utilized by the Station for cartridge filters and other wastes which are required to be classified as stable waste per 10CFR61 and/or burial site licenses. The contractor must have procedures or other support documents as necessary to produce a waste form which meets all the requirements of 10CFR61 and the applicable burial site criteria. Vendor procedures

used to prepare specific Station procedures which are submitted to an on-site review prior to use to assure compatibility with station systems procedures and Technical Specifications.

B. Vendor Encapsulation Method

A liner is prepared by the vendor which has a prepoured bottom and partial sides. The item to be encapsulated is placed inside the prepour and the remaining portion of the liner is filled with a stable formula of cement.

When the encapsulation has sufficiently cooled, the contractor and Station personnel visually inspect the product and verify that it is an acceptable product. The liner is then covered with a lid, secured, surveyed and shipped or stored in the Interim Radwaste Storage Facility.

C. Verification of Vendor Encapsulation

To verify encapsulation, a visual inspection of each liner is performed prior to installing the lid. The visual inspection verifies that the product meets to acceptance criteria of the contractors procedures. If the liner is not an acceptable product, the vendor will be required by the station to provide an acceptable resolution.

VI. HIGH INTEGRITY CONTAINER USAGE

High Integrity container (HIC's) are used at the Station for packaging higher activity cartridge filters and other various approved waste packaging. The vendor which supplies the HIC must provide the Station with a copy of the Certificate of Compliance for the HIC which details specific limitations on use of the HIC.

VII. WASTE CLASSIFICATION

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Station wastes will be classified as Class A, Class B, or Class C to determine the acceptability for near-surface disposal and for the purpose of segregation at the disposal site. The waste class will be based on the concentration of certain radionuclides in the waste as outlined in 10CFR61.55.

Radionuclide concentrations will be determined based on the volume or weight of the final waste form as discussed in Section C.2 of the Branch Technical Position Paper on Waste Classification.

Of the four suggested methods for determining radionuclide concentration, the one most commonly used is the direct measurement of individual radionuclides (gamma emitters) and the use of scaling factors to determine the radionuclide concentration of difficult to measure radionuclides (normally non-gamma emitters). The use of the other suggested methods; material accountability, classification by source or gross radioactivity measurements may occur if the situation best fits the use of that methodology.

Approved Station procedures are used in the determination of radionuclide concentration for difficult to measure nuclides (normally non-gamma emitters) and for the classification of radioactive waste for near-surface burial.

VII. SHIPMENT MANIFEST

Each shipment of radioactive waste to a licensed land disposal facility will be accompanied by a shipment manifest as required by 10CFR20.311(b) and 10CFR20.311(c). The manifest will contain the name, address, and telephone number of the waste generator. The manifest will also include the name, address, and telephone number or the name and EPA hazardous waste identification number of the person transporting the waste to the land disposal facility.

The manifest will also indicate to the extent practicable: a physical description of the waste; the volume; radionuclide identity and quantity; the total radioactivity; and the principal chemical form. The solidification agent, if applicable, will be identified.

Waste containing more than 0.1% chelating agents by weight will be identified and the weight percentage of the chelating agent estimated. Waste classification, Class A, B, or C, will be clearly indicated on the manifest. The total quantity of the radionuclides H-3, C-14, Tc-99, and I-129 will be shown on the manifest.

Each manifest will include a certification by the waste generator that the transported materials are properly classified, described, packaged, marked, and labeled, and are in proper condition for transportation according to the applicable regulations of the Department of Transportation and the NRC. A representative of the Station will sign and date the manifest. Approved Station procedures are used for the preparation of burial site radioactive shipping manifests.

The Station will maintain a manifest recordkeeping and tracking system that meets the requirements of 10CFR20.311(d).

IX. ADMINISTRATIVE CONTROLS

A. Training

A training program will exist to ensure that waste processing will be performed according to Station procedures and in accordance with the requirements of the Station PCP. An individual's training record will be maintained for audit and inspection. The processing and shipment of radioactive material will be performed by qualified and trained personnel.

B. Record Retention

Records of processing data, test and analysis results, documents, results of training, inspections and audits will be retained in accordance with company quality verification requirements for record retention. Records of reviews performed for changes made to the PCP shall be retained for the duration of the Unit Operating License.

C. Documentation Control

Licensee initiated changes may be made to the PCP provided that the change:

1. Is documented and records of reviews performed shall be retained for the duration of the Unit Operating License. This documentation shall contain:

   a. Sufficient information to support the change together with the appropriate analyses or evaluations justifying the change(s) and

   b. A determination that the change will maintain the overall conformance of the solidified waste product to existing requirements of Federal, State, or other applicable regulations.

Changes to the PCP shall become effective after review and acceptance by the Onsite Review Function and the approval of the Plant Manager. Changes to the PCP shall be submitted to the Commission in the Semi-Annual Radioactive Effluent Release Report for the period in which the changes were made.

Radioactive waste that does not fall within previous waste processing experience will be evaluated and, if necessary, included in the PCP prior to final processing and disposal.

D. Quality Control

Licensee procedures ensure that a vendor processing radioactive waste, for burial, adhere to their procedures and that an acceptable product that meets regulatory requirements and burial site criteria results. This procedure addresses the requirement to assess the impact of changes in a vendor's PCP or the Station's PCP and requires a 10CFR50.59 safety evaluation for any changes in the vendor's PCP.

E. Major Changes to Radioactive Waste Treatment Systems

Major changes to the Solid Radioactive Waste Treatment Systems may be made provided:

1. The change is reported in the Monthly Operating Report for the period in which the evaluation was reviewed by the On-site Review Function. The discussion of each change shall contain:
   a. A summary of the evaluation that led to the determination that the change could be made in accordance with 10 CFR 50.59.
   b. Sufficient detailed information to support the reason for the change.
   c. A detailed description of the equipment, components, and process involved and the interfaces with other plant systems.
   d. An evaluation of the change which shows the predicted quantity of solid waste that differs from that previously predicted in the license application and amendments.

e. A comparison of the predicted volume of radioactive solid waste to the actual volume for the period in which the changes were made.

f. An estimate of the exposure to plant operating personnel as a result of the change.

g. Documentation of the fact that the change was reviewed and found acceptable by the On-site Review Function.

2. The change shall become effective upon review and acceptance by the On-Site Review Function.