PROCESS CONTROL PROGRAM

FOR

WOLF CREEK GENERATING STATION

B006L
1/1

1.0 SCOPE

1.1 PURPOSE

The purpose of the process control program is to provide reasonable assurance that the final solidified products produced by the installed cement solidification system at the Wolf Creek Generating Station (WCGS) meet or exceed all federal, state and local requirements pertaining to the solidification, transportation and disposal of low-level radioactive waste.

1.2 APPLICABILITY

The process control program is applicable to all solidification evolutions involving the installed cement solidification system at WCGS.

2.0 REFERENCES AND DEFINITIONS

2.1 REFERENCES

2.1.1 NUREG-0800: Standard Review Plan Section 11.2 Liquid Waste Management Systems

2.1.2 NUREG-0800: Standard Review Plan Section 11.4 Solid Waste Management Systems

2.1.3 Branch Technical Position 11-3, "Design Guidance for Solid Radioactive Waste Management Systems Installed in Light Water Cooled Nuclear Power Reactor Plants"

2.1.4 10CFR20, "Standards for Protection against Radiation"

2.1.5 10CFR61, "Licensing Requirements for Land Disposal of Radioactive Waste"

2.1.6 10CFR71, "Packaging of Radioactive Material for Transport and Transportation of Radioactive Materials under Certain Conditions"

2.1.7 NUREG-0472, Revision 3, "Standard Radiological Effluent Technical Specifications for Pressurized Water Reactors"

2.1.8 Technical Position on Waste Form, March 3, 1983

2.1.9 Stock Equipment Company, Technical Manual for the Wolf Creek Generating Station's Installed Cement Solidification System - M-135.0454-03.

2.1.10 Reg. Guide 1.143 Rev. 0, Design Guidance for Radioactive Waste Management Systems, Structures, and Components Installed in Light-Water-Cooled Nuclear Power Plants.

2.2 DEFINITIONS

2.2.1 FSW - Free standing water is water which is not chemically or mechanically combined with the solidification binder. A solidification product which meets the FSW criteria of the dry product applicable low level radioactive waste disposable facility will be termed a dry product.

2.2.2 Structural Stability - The ability of the solidified product to withstand the pressure normally exerted on radioactive waste disposed of by shallow-land burial.

2.2.3 Verification Sample - A small sample of the waste stream to be solidified which is used to check that proper cement, waste, chemical additives are being utilized in the full-scale solidification to produce acceptable solidified products.

2.2.4 Batch - The finial recirculated volume prior to injection into the solidification system.

3.0 DETAILED SYSTEM DESCRIPTION

3.1 SOLIDIFICATION SYSTEM DESCRIPTION

The installed cement solidification system is designed to solidify the three primary waste streams generated at WCGS: boric acid concentrates, sodium sulfate concentrates and spent bead resins.

The system consists of three major subsystems:

3.1.1 Cement storage and filling systems which include the bulk storage silo, day tank and required support equipment.

3.1.2 Drum conveying system which includes the necessary equipment to locate the drums at the cement filling station and to safely move the cement loaded drums to the radwaste filling station.

3.1.3 Decanting station which includes the necessary controls and monitoring devices required to deliver properly decanted resin slurries to the radwaste filling station.

3.2 PROCESS PARAMETERS

3.2.1 PROCESS DESCRIPTION

Prior to the first soldification of a particular type of radioactive waste in a full-size container, process control verification test(s) will be performed. The purpose of the verification test(s) will be to determine the proper quantities of cement, and additives required to be placed in each 55-gallon drum. The verification test(s) will also indicate the required amount of pH additive required to be added to the waste tank to insure the proper pH is obtained.

Once a satisfactory verification test has been performed, the radwaste operator will begin the solidification evolution. The required quantities of additives will be placed in the 55-gallon drum prior to placing the container on the drum conveying system.

Once the additives have been placed in the container, the container will be placed on the drum conveying system and moved to the cement fill station, where the required quantity of Portland Type III cement will be placed in the drum. A mixing weight will be placed in the drum following concrete addition. The drum conveying system will then move the cement-filled drum to the loaded drum storage area.

The installed overhead crane system will transfer the cement-filled drum to the radwaste fill station where the wet radioactive waste will be metered into the drum. The drum will then be placed in the drum tumbler and tumbled for the required time.

3.2.1.1 Binder

The solidification binder used in the installed solidification system is Portland Type III hydraulic cement.

3.2.1.2 Lime

A predetermined quantity of lime is added to react with the boric acid to form insoluble boron salts. This prevents the boron from retarding the hydration of the cement.

3.2.1.3 Calcium Chloride

Calcium chloride is added to the solidification binder to accelerate the hydration of the cement.

3.2.1.4 Lithium Hydroxide

Lithium hydroxide is added to the influent waste stream as required to insure pH will be at least 10.5.

3.2.2 WASTE BOUNDARY CONDITIONS

In order for radioactive waste solidified with Portland cement to meet the stability requirements, certain boundary conditions must be achieved.

3.2.2.1 pH

The waste stream pH affects the ability of the cement to hydrate. The solidification process at WCGS incorporates the addition of calcium hydroxide and lithium hydroxide as pH control additives.

3.2.2.2 Boric Acid

Boric acid affects the ability of the cement to properly solidify the waste stream by providing an acidic environment. The boron present in the waste stream also affects the hydration process of the binder. The solidification process at WCGS incorporates the use of lime ($Ca(OH)_2$) to react with boron to form insoluble salts.

3.2.2.3 Sodium Sulfate

The presence of sodium sulfate in the waste stream can cause a flash set of the solidification binder producing excessive heat from the hydration of the cement binder.

3.2.2.4 Bead Resin

When solidifying depleted bead resin, care must be taken to insure the active sites have been pretreated to prevent the removal of divalent or trivalent ions from the cement/waste slurry.

3.2.2.5 Oil

Waste stream containing greater than 2% oil will be solidified with an acceptable oil solidification binder and process control program for the solidification of oil waste.

3.3 DETAILED SYSTEM DESCRIPTION

3.3.1 CEMENT STORAGE SYSTEM DESCRIPTION

The STOCK solid radwaste system for WCGS begins with a cement filling system for onsite storage of large quantities of cement as well as the control equipment and instrumentation to accurately transfer measured quantities of cement to standard 55-gallon drums. Although the entire cement filling process is carried out in safe areas of the plant, the equipment has been precision engineered for dust-free operation so that no cement dust will enter the plant atmosphere or cause deposits on the outside surface of the drums which might subsequently become contaminated.

The entire cement filling system is operated from its own control console located adjacent to the cement filling station and the conveyor system. Controls, monitoring devices and alarm indicators have been centralized in this location for ease of operation and to keep the operator informed of system status and operation.

Incoming cement is transferred into the storage silo utilizing the fluidizing equipment and blowers mounted on the cement delivery truck. Cement is again fluidized and transferred in small increments on operator command to the inside cement filling station day tank as needed. Mounted above the day tank is a dust collection system interconnected to the day tank, the drum feeder assembly fill nozzle and to the storage silo to maintain vacuum conditions and dust containment at all times.

Standard 55-gallon drums from a clean storage area enter the cement filling station on a STOCK roller conveyor and are individually positioned beneath the cement fill nozzle. A predetermined amount of cement is placed into each drum by the action of a screw feeder located at the day tank discharge hopper. The weight of cement per drum is determined in accordance with the process sample verification which is performed on each batch of radioactive waste to be processed.

Once a drum has been filled with cement and sealed, it is conveyed to the drum staging area for pickup by the bridge crane. The crane may transfer the drum either to a drum storage area or to the drum processing enclosure where the decanting and drumming equipment remotely apply measured quantities or specified proportions of radioactive slurries and concentrates.

An air compressor system is included in the cement filling system and is housed in an environmentally-controlled room located at the base of the storage silo to provide process air free of oil and water contaminants. STOCK-supplied transfer piping supplies air to the pneumatic conveyor, the fluidizing jets in both the silo discharge zone and in the day tank discharge hopper, the automatic filter cleaning equipment in the dust collection system, the bell-type shut-off valve in the cement fill nozzle orifice and to the air-oil cylinder operating the drum scale platform.

The cement filling system performs a number of related functions: inspection of drums and caps for damage and proper thread line, long-term storage of large quantities of cement under controlled conditions, application of the specified quantity of cement and the mixing weight to the drum, recording of drum tare weight and filled weight and drum sealing. It is recommended that a drum control number be assigned to each drum and recorded, and that a label or stencil be applied to the drum head in this safe location.

Numbering will facilitate positive identification for subsequent process control; therefore, the labels or stencils used should be of sufficient size and contrast to permit viewing by means of the traveling bridge crane grab TV and surveillance cameras located a considerable distance above the drum storage area. The cement filling system has been provided with the following systems and components.

3.3.1.1 Cement Storage Silo

The cement storage silo is of cylindrical construction with a dished head and conical discharge section, fabricated from 1/4" ASTM A-283-C steel. Double-welded construction throughout assures dust-tight integrity and vacuum maintenance. Storage capacity is 1,530 cubic feet of cement.

The silo is filled from self-unloading delivery trucks through a 4" diameter fill line. The fill line includes a clean-out port at its highest elevation and is connected to a discharge box centered on the top of the silo. The discharge box allows the cement to fall evenly inside the tank during filling.

Also located at the top of the silo is an inspection manhole and a 5" diameter vent line which is connected to the dust collection system located on the cement filling station day tank. Access to the top of the silo is provided by a hand ladder with safety cage and a maintenance platform with perimeter railing--all designed and constructed to OSHA standards.

Cement is discharged from the bottom of the silo to a pneumatic conveying system. The pneumatic conveying system is mounted to the inlet chute. The pneumatic conveying system connects to the cement silo via a dust-tight inlet chute and a manually-operated shut-off valve. The sides of the discharge cone of the silo directly above the shut-off valve are sloped at a 50^{0} angle from horizontal. Ten automatically controlled air fluidizing nozzles are installed in the perimeter of the discharge cone to prevent packing of the cement powder.

3.3.1.2 Silo Pressure Relief Valve

A mechanical pressure relief valve is mounted at the top of the silo to prevent possible pressurization of the silo. It is set to open at 10" of water and, through a limit switch, energizes a red alarm.

3.3.1.3 Silo High-Level Controls

The cement storage silo is equipped with a sonic high-level sensor located at the normally filled level of the silo. When activated by abnormally high cement levels, the control energizes two red lights located at the cement filling station electrical console and located on the exterior wall of the silo.

The high-level control also activates an audible alarm located at the top of the silo.

During normal filling of the silo, placing the ON/OFF switch to the ON position will energize two green lights located on the exterior side wall of the silo and in the rear of the cement filling station console. Placing the ON/OFF switch into ON position also energizes the dust collector.

3.3.1.4 Silo Cement Level Indicator

A mechanical level indicator is provided for monitoring the amount of cement remaining in the silo.

A 4-figure digital readout located in the air compressor room displays in tenths of feet the level of cement remaining in the silo.

3.3.1.5 Silo Fluidizing System

Transfer of cement from the storage silo to the air conveyor equipment is facilitated by an air fluidizing system. The air fluidizing system consists of an air filter with automatic drain, an accumulator tank for air storage, a pulsator motor with cycle timer and ten fluidizing nozzles. The nozzles are deployed at various levels around the perimeter of the silo discharge cone.

All nozzles are connected by a common manifold to a pulsator solenoid valve located next to the silo discharge cone downstream of the accumulator tank. The cement conveying system controls are interlocked to the fluidizing system, permitting a pulsator motor and cycle timer to open for several brief intervals before the start of each conveying cycle. Short bursts of high pressure air through the fluidizing nozzles aerate the cement in the discharge cone area of the silo facilitating its passage to the cement chute for controlled application to the fluidizing vessel.

3.3.1.6 Air Compressor System

An air compressor system is installed in a separate room attached to the base of the cement storage silo to supply process air to the cement filling system. The pneumatic equipment is an independent and self-contained system including all necessary components to provide the required delivery of air for the cement filling system free of any oil or water contamination. The air system is equipped with two air compressors, coalescing filters, air dryers and pressure regulators.

3.3.2 CEMENT FILLING SYSTEM

The cement filling system includes all the equipment necessary to transfer cement from the storage silo into the drum. The four principal items of equipment are: an air conveyor unit to transfer cement to the day tank, the day tank, a screw feeder assembly which precisely meters the applicaton of cement into each drum and a dust collector assembly designed to remove the cement dust generated at each point in the process.

3.3.2.1 Air Conveyor System

An air conveyor system is utilized to transfer cement from the cement storage silo to the cement day tank. The system has an operating capacity of transferring 150 lbs/1.5 minutes. Compressed air at 80-100 psi (30 SCFM) is required to operate the system.

Cement in the silo discharge cone is fluidized by the continuous application of high-pressure air. This allows the cement to drop into the fluidizing vessel of the air conveyor system without packing. Once the fluidizing vessel is filled with cement, unregulated air at 80-100 psi is introduced into the vessel. The unregulated air aerates the cement and causes the pressure in the vessel to increase. When pressure in the fluidizing vessel reaches 15 psi, the unregulated air is stopped. Regulated air then forces the aerated cement from the fluidizing vessel into the transfer line. The transfer line is connected to the day tank. The regulated air forces the cement in the transfer line into the day tank.

The conveying cycle is complete when the transfer line is empty.

3.3.2.1.1 Air Conveyor Booster Jet

The air conveyor discharge piping into the day tank contains a pneumatic booster jet to impart additional accelerating force and mixing action to the cement flow. Air application to the booster jet is regulated at the pneumatic control panel by an air service valve.

3.3.2.1.2 Conveying Fault Timer

The conveying fault timer is included to automatically stop the conveying process if a batch of cement is not completely evacuated from the fluidizing vessel to the day tank within a specified interval.

3.3.2.2 Cement Filling Station Day Tank

The day tank of the cement filling station is located inside the radwaste building and is designed to hold sufficient cement for one day's operation. The tank has a net storage capacity of 50 cubic feet. The air conveyor system is capable of filling the day tank in 1.25 hours.

The day tank is rectangular in shape with all four sides tapered sharply into an integral discharge hopper. The entire assembly is fabricated from 1/4" ASTM A-283-C steel utilizing double-welded construction for strength and dust-tight integrity. The tank itself and equipment mounted thereon is accessible by a welded steel service ladder and a bar-grating maintenance platform surrounded by OSHA specified double handrailing.

Fluidized cement from the air conveyor enters the day tank through a discharge box which distributes the cement evenly inside the tank.

The day tank is equipped with a mechanical pressure-relief valve. The pressure-relief valve is set to open at 10 inches of water to prevent the possible over pressurization of the day tank.

A sonic high-level sensor located at the normally filled level of the day tank provides indication of day tank level. The day tank has sufficient capacity to complete the transfer of a batch of cement should the high-level set point be reached during transfer. The day tank is equipped with an interlock to prevent the transfer of cement to the day tank once the day tank high-level alarm has been reached.

The transferring of cement from the day tank to the drum screw feeder assembly is facilitated by four fluidizing nozzles located in the wall of the discharge hopper. The nozzles are connected by a common manifold to a solenoid valve and the compressed air supply.

3.3.2.3 Screw Feeder Assembly

The screw feeder assembly is used to transfer cement from the day tank discharge hopper to the fill nozzle. The fill nozzle is placed inside the 55-gallon drum. The screw feeder consists of a tapered, rolled, steel screw driven at 25.7 rpm. This provides a cement delivery rate of 110 cubic feet per hour.

The screw feeder discharges to a vertical exit hopper. The drum fill nozzle is attached to the base of the exit hopper. The walls of the exit hopper are installed at a steep angle to prevent the accumulation of cement in the exit hopper.

3.3.2.4 Dust Collection System

A Torit filter cartridge-type dust collector is installed with the cement filling system to provide vacuum conditions within the system and to eliminate area contamination from airborne cement dust. The dust collection equipment is mounted to the top of the day tank for direct dust collection from the day tank but, is also interconnected throughout the cement filling system. The dust collection system takes a suction on the cement filling system at the following points:

a. Cement silo,

b. Silo fluidizing vessel, and

c. Exit hopper.

Air is drawn in by the system vent fan through nine filter cartridges housed within the dust collector. Dust is captured on the exterior surface of the elements while filtered air passes out through the filters to the exhaust discharge port and into the radwaste building ventilating system. The capacity of the ventilation system at the dust collector is 1,200 SCFM @ 6" $H_{2}O$.

The filter elements are alternately cleaned in groups of three. Each group of filters is equipped with a solenoid valve and will admit high-pressure air to the center of the filter elements. At ten-second intervals a pulse of low-volume, high-pressure air is directed into the center of the selected elements. The dislodged dust falls into the day tank where it is utilized for drum filling.

The dust collector is electrically interlocked to operate automatically whenever any of the following operations are initiated:

a. Drum Filling - by moving console selector switch SS57 to either the AUTOMATIC or MANUAL drum fill position.

b. Storage Silo Filling - by moving selector switch SS28 at the silo to the ON position.

c. Cement Conveying to the Day Tank - by depressing the AIR START pushbutton at the electrical console.

3.3.3 DRUM CONVEYING SYSTEM

The drum conveying system consists of the roller conveyor used to transport drums through the cement filling station area and the integral lift assembly and scale platform which raise the drums to the cement fill nozzle for filling.

3.3.3.1 Roller Conveyor

The roller conveyor is divided into four distinct sections. The first section is a flat drum staging area seven feet in length for drum inspection, numbering and cap removal. The second section is the scale platform and drum lift area which hydraulically elevates one drum at a time for filling and weighing. The third section is a long, flat receiving area for inserting the mixing weight and replacing the cap. The fourth section is a floating storage area approximately 22 feet in length for conveying filled drums to the traveling bridge crane pickup point. The length of the storage area is designed to hold enough prefilled drums for one day's normal needs.

All individual rollers in the conveyor are provided with dust-proof sealed bearings. Five brake rollers are spaced throughout the storage area of the conveyor.

3.3.3.2 Scale Platform

A scale platform is installed for weighing individual drums. It is located beneath the elevating section of the roller conveyor. It consists of three 500-pound capacity load cells. The outputs of the three cells are added by the load cell summing junction in the electrical console and the total is displayed on one of two LED-type, three-figure digital readouts on the electrical console. The readout labeled DRUM TARE displays the weight of the empty drum when the scale platform is in its lowered position. This tare weight is retained in a memory circuit of the electronic weighing system. The readout labeled DRUM NET displays the continuously changing net weight of cement as it is being injected into a drum.

When the desired net weight of cement is reached and the feed screw is deactivated, the operator will depress the CLEAR TARE pushbutton on the electrical console. This allows the tare weight to be added to the net weight of cement. This is the net weight of the drum.

3.3.3.3 Mixing Weights

The mixing weight is a reinforcing bar bent at its midpoint to an inclined angle. The device is inserted into each drum at the cement filling station after the cement has been applied to the drum. The mixing weight imparts mixing action to the contents in the drumming operation.

3.3.4 CEMENT FILLING STATION CONTROLS

The electrical control console contains all controls for operating the cement filling station. The controls and instrumentation are located at various points in the console and are listed below by area.

3.3.4.1 Console Control Panel

The operations and control panel is mounted on the desk top of the control console. The operations and control panel contains the following system indications.

3.3.4.1.1 Control On/Off

The two-position selector switch energizes the complete cement filling station and all control circuitry.

3.3.4.1.2 Main Tank High Level

A red indicator light informs the operator of high cement level in the main storage silo. Input is provided by the silo high-level sensor.

3.3.4.1.3 Day Tank High Level

A red indicator light informs the operator of high cement level in the day tank. Input is provided by the day tank high-level sensor. In a high-level condition, cement conveying to the day tank will cease as soon as the current cycle is completed.

3.3.4.1.4 Emergency Stop

A red pushbutton immediately de-energizes the cement filling station control circuitry including any operations in progress.

3.3.4.1.5 Air Compressor

A red pushbutton energizes the control and power circuits to the air compressor system, including the desiccant dryers and electric drain trap. The pushbutton will light the red AIR COMPRESSOR indicator light on the control panel.

3.3.4.1.6 Vent Fan

A red pushbutton energizes the control and power circuits to the dust collector system ventilation fan. Operation of the dust collector system is automatic whenever drum filling operations are initiated or when cement is being loaded into the storage silo or transferred to the day tank. However, this pushbutton is provided to enable the operator to activate the dust collection system independently as needed. The pushbutton will light the red VENT FAN indicator light on the control panel.

3.3.4.1.7 Feed Screw Running

A red indicator light informs the operator that the day tank feed screw conveyor is operating. Input is provided by the DRUM FILL PERMIT pushbutton located on the right side wall of the console.

3.3.4.1.8 Air Conveyor On/Off

The two-position selector switch energizes the complete air conveyor process and circuitry.

3.3.4.1.9 Air Start

A black pushbutton starts the air conveyor transferring cement. The process will continue until the day tank high-level is reached or SS73 is turned off.

3.3.4.1.10 Scale Zero

A black pushbutton enables the operator to recalibrate the platform scale after each drum filling operation.

3.3.4.1.11 Clear Tare

A black pushbutton releases the drum's tare weight from storage in the electronic memory circuit and adds it to the net weight of the cement in the drum. The total weight is then displayed as DRUM TARE weight.

3.3.4.1.12 Fluidize Day Tank

A black pushbutton opens a solenoid valve permitting air injection into the day tank discharge hopper. This promotes cement flow to the feed screw and will continue as long as PB100 is depressed.

3.3.4.1.13 Conveying

A red indicator light informs the operator that a batch of cement has been fluidized in the air conveyor and is en route to the day tank. Input is provided by the fluidizer vessel pressure switch.

3.3.4.1.14 Auto/Manual Fill Drum

A spring-return toggle switch enables the operator to selectively fill drums with cement by setting the desired weight on the thumbwheel switch or by visually monitoring the weight as it appears on the DRUM NET readout.

3.3.4.1.15 Drum Raise/Lower

A spring-return toggle switch is provided to raise and lower the drum on the scale platform. The switch lever must be held in the appropriate position for the control to be energized. Automatic circuitry prevents overtravel in either direction.

3.3.4.1.16 Drum Tare

An LED-type digital readout displays the empty weight of a drum moved into position on the scale platform.

3.3.4.1.17 Drum Net

An LED-type digital readout displays the net weight of cement in the drum as it is being filled. When filling is complete and the CLEAR TARE pushbutton is depressed, this weight is blanked and the combined weight of the cement and the drum weights are displayed at the DRUM TARE display.

3.3.4.1.18 Set Net Weight

A thumbwheel switch is provided to permit the operator to program into the electronic weighing system the required amount of cement to be added to the drum. In the manual drum filling mode, this switch is not utilized.

3.3.4.1.19 Drum Fill Permit

A pushbutton located alone near the top of the right side of the electrical console enables the operator to initiate the drum filling operation, as long as the scale platform has been completely raised.

3.4 SYSTEM CONTROL

3.4.1 SYSTEM CONTROL PANEL

The system control console is a free-standing, desk-type enclosure for single unit control of the overhead traveling bridge crane, the decanting station, the cement drumming station and the operations section for radwaste feed system control of tanks, pumps and valves.

All control and indication devices required for remote operation of the STOCK traveling bridge crane, decanting/drumming stations, and the spent resin/evaporator bottoms tanks and associated system valves and pumps are located on the vertical front face and operator's writing table of the console. The control console consists of three modularized sections, each approximately 24" wide, which comprise the operational controls of the radwaste system.

The drum processing control section contains a graphics display panel of the system and all manual switches and visual indicators for operating the decanting/drumming stations. An annunciator panel, process selection panel, status display and control panel and operations panel comprise the control sector for this section of the control console.

Located in the bridge crane control section are the TV monitors with their control units conveniently grouped for operator surveillance while operating the crane. Spring loaded, toggle-type control handles are provided to operate the crane, in addition to a crane control panel with indicators and controls for grab elevation, crane operation/status, lighting, grab operation/status and crane/TV circuit selection.

The control section contains an annunciator panel, meter panel, tank/pump status display and control panel and valve operations panel for spent resins and evaporator bottoms waste control.

Removable front panels and hinged doors on the lower front and entire rear of the console provide for easy access to equipment for maintenance and replacement. A graphics display panel provides a visual process flow schematic for the decanting and drumming stations.

3.4.1.1 Process Selection Panel

The process selection panel is positioned below the graphics display. The process selection panel contains the following control and instrumentation:

a. Evaporator Bottoms Waste Operations Select,

b. Decant Tank Gallons - 0-530 gallons full range,

c. Machinery Air psig - 0-150 psig full range (PI2),

d. Flush Water psig - 0-100 psig full range (PI1),

e. Evaporator Bottoms Primary Feed Temp ^{O}F - 0-240^{O}F. full range, and

f. Evaporator Bottoms Secondary Feed Temp ^{O}F - full range.

3.4.1.2 Status Display and Control Panel

The status display and control panel is below the process selection panel and contains digital readout displays which serve as both status displays and controls. The following readouts are functionally grouped on the status display and control panel:

a. Evaporator Bottoms/Chemical Waste Metering Pump Gallons - Indicates the total number of gallons of waste material metered into a drum. The readout is displayed in half-gallon increments to correspond to the delivery rate of the metering pump.

b. 1st Count/2nd Count - A pair of thumbwheel switches are provided with which to select the amount of waste, in gallons, to be metered into the drum. The switches can be used in three different combinations: 1ST COUNT only, 2ND COUNT only, or 1ST COUNT and 2ND COUNT combination for double filling. Each switch is set to the nearest half gallon increment. Also, both the decant metering pump and evaporator bottoms/chemical waste metering pump can be set to fill a drum simultaneously or in any 1st and 2nd count combinations, such as setting the 1st fill from the decant tank and the 2nd fill from the evaporator bottoms metering pump.

c. Drumming Station On/Off - A separate two-position selector switch is used as an ON/OFF switch to energize the relay logic for the drumming station controls.

d. Drum or Tank Radiation Level/Roentgens Per Hour - The 1,000R radiation monitor consists of a scintillator detector and its associated electronics and display package. The system is designed as a dual-channel system with an operating range of 1,000R to 10 mr. A three-position selector switch, with DRUM RADIATION/OFF/TANK RADIATION clockwise indicators is provided to display the radiation signal from either the decant tank or the drumming station scale, via the radiation level display.

e. Drum Gross Weight/Lbs. - A readout provides the weight of a processed drum via an electronic weighing system.

f. Zero Scale - A black zero scale push button is provided to reset the drum gross weight display to zero before or after weighing a drum.

3.4.1.3 Operations Panel

The operations panel is positioned immediately below the status display and control panel and mounted on the desk top of the control console. The operations panel contains pushbuttons or pushbutton/indicator light combinations for additional operator-controlled functions.

The operations panel contains the following controls and instrumentation:

3.4.1.3.1 Flush Drum Fill Line

Energizes valve operators to open the proper valves to allow flush water through the decant metering pump, decant to drum fill line and the slurry filling nozzle to clean the line.

3.4.1.3.2 Flush Evaporator Bottoms/Chemical Waste Feed Line

Energizes valve operators to open the proper valves to allow flush water through the evaporator bottoms metering pump and into the select evaporator bottoms waste feed line. The chemical waste feed line is flushed independent of the evaporator bottoms metering pump.

3.4.1.3.3 Enclosure Washdown

Energizes valve operators and a rotating spray drive motor to allow flush water through a revolving manifold to clean the inside of the drum processing enclosure.

3.4.1.3.4 Drum Washdown

Energizes valve operators to open proper valves to allow flush water through a manifold within the drum processing enclosure to wash down the exterior surfaces of a drum. The washdown can be energized when the drum is either tumbling or at rest.

3.4.1.3.5 Auto On

Energizes the automatic mode of the drum processing cycle. Assuming all conditions are satisfied, the drum will proceed through a complete cycle automatically.

3.4.1.3.6 Hatch Open

Energizes a solenoid valve which causes a pneumatic actuator to raise the drum processing enclosure hatch cover to the fully open position.

3.4.1.3.7 Manual Advance

Permits step-by-step advancement through the drum processing cycle rather than automatic advancement.

3.4.1.3.8 Hatch Closed

Energizes a solenoid valve which causes the same actuator to lower the drum processing enclosure hatch cover to the fully closed position. The light indicates that the hatch is fully closed.

3.4.1.3.9 Skip Operation

Depressing the red <u>SKIP OPERATION</u> push button will cause the drumming sequence programmer to cycle through the steps in the automatic cycle without the equipment actually performing the operation. The lights on the right side of the graphic display panel will flash on as the programmer cycles through each step in the automatic sequence, letting the operator know which steps are being by-passed. The programmer will continue to cycle until the buttons are released. Drum processing may be continued from any point in the sequence as long as the permissives are satisfied.

3.4.1.3.10 Emergency Stop

De-energizes the drumming cycle circuit immediately. This button is independent of the decanting operation.

3.4.1.4 <u>Graphics Display</u>

A graphics display panel, located below the annunciator panel on the left vertical section of the control console, represents the decanting and drumming stations, with associated interconnecting piping, valves, pumps and equipment. The symbols on the left represent the decanting station, with the decant tank, mixer, decant arm and decant pump. Red lights indicate mixer running, arm movement up or down, decant pump running, and high- or low-level tank status. The circle under the tank represents the decant metering pump with a piston in the center and four valves which can be opened in various combinations of opened or closed depending upon the mode of operation and direction of flow through the pump. The pump port valves light (red) when open, turn off when closed. The pump piston will light (amber) when intake is complete and turn off upon discharge. The pump valve and piston lights visually indicate that the pump is in operation and show which valves and lines are in use. The shut-off valves, for flush/spray lines and for tank feed loops, have red (open) and green (closed) indicating lights, which are operated from valve actuator limit switches, to give positive indication of valve position. The metering pump and process valving along with the piping flow indications (amber), verify to the operator which process lines are in use for a particular station operation.

The symbols at the center of the mimic represent the drumming station, showing the drumming enclosure and evaporator bottoms metering pump, along with associated piping and valves. In addition to the valve, pump and flow indicators, there are two rotational arrows in the center of the drum symbol which light (red), after each revolution of the DRUM TUMBLE cycle, giving positive indication that the drum is being tumbled.

On the right side of the mimic is a vertical row of indicator lights that identifies each sequence of the drumming operation cycle. The drumming cycle is initiated and completed at the Load Position sequence. During the drumming operation, the operator knows the status and position of the drum by referencing the glowing (amber) indicator light, which identifies the drumming cycle sequence occurring. The indicator lights provide greater flexibility in operation by allowing the operator to change from the automatic mode to MANUAL ADVANCE at any stage in the sequence or to skip sequences, for example, advancing the step programmer to the CLAMP 2nd step from the CAP/TUMBLE POSITION for a contaminated drum washdown, and returning the operation to the automatic mode to complete the drumming cycle. The drumming cycle sequence indicator lights also serve as a troubleshooting aid by indicating which sequence the drumming cycle was in when a fault trip occurs, thus allowing the operator to manually reset the sequence programmer at the desired step for restarting the drumming operation.

3.4.1.5 Annunciator Panel

Annunciator windows above the graphics display panel provide the following fault or status indication to the radwaste operator:

a. demineralizer water pressure,

b. machinery air pressure,

c. decant tank high-level,

d. select feed loop valve,

e. motor overload tripped,

f. drum process cycle complete,

g. no cap in drum,

h. no fill selection (gallons of fill),

i. drum overfill,

j. drum process fault, and

k. evaporator bottoms feed line temperature high.

3.4.3 DECANTING STATION CONTROLS

The decanting station is functionally controlled by the operator from the control console decanting and drumming section by means of selector switches and pushbuttons, with indicators and indicator lights supplementing the controls. Controls and monitoring devices have been provided to allow for ease of operation and to inform the operator of station status and operation.

The decanting station has been provided with the STOCK solid radwaste system to accurately decant slurries prior to drum filling. This station is a compact assembly of components attached to both sides of a 12" thick steel shield wall. Mounted on the maintenance side of the shield wall are all motors, pneumatic valves, actuators and as many of the gear reducers as is practical. On the process side of the wall are the decanting tank and the pumping ends of the metering and decanting pumps.

Incoming waste slurries are transferred from the liquid radwaste system storage tanks to the decanting tank through the piping manifold. During this filling operation, the decant tank mixer is automatically operated to ensure that the slurry is a uniform mixture. Upon completion of the filling operation, an automatic flush operation is initiated to flush the fill line to the decant tank and the feed line back to the liquid system storage tank. After this flush operation has been completed, the slurry is allowed to settle for a predetermined period of time. This settling time allows for the separation of solids and water to a uniform level bed-of-solids.

Once this settling period has elapsed, the water level and water-solid interface level are accurately measured with sensors mounted on the decanting arm and STOCK designed solid state equipment. These readings are displayed on the control console and inform the operator as to whether excess water is to be removed or if water is to be added to the decant tank. This is done in accordance with the process control program in order to achieve the correct solid/water ratio consistent with the pretested solidification formula for the waste stream. Excess water is removed with decanting equipment and returned to the liquid radwaste system storage tanks by means of a specially designed decanting pump. This minimizes the amount of water requiring disposal.

After the decant tank has been prepared with the correct solid/water ratio, the mixer is then automatically started and operated for a predetermined period of time to ensure that the slurry is again uniform. While the slurry is being mixed, the operator is then able to record the radiation level of the slurry to be processed with the radiation detector provided with the decanting station. The STOCK metering pump is used to transfer the prepared decant tank slurry to the drumming station for drum processing. The pump and its associated controls allow the operator to program accurate pump quantities to be processed in each drum. Once programmed, the pumping operation becomes part of the automatic processing cycle at the drumming station. The metering pump is also used for transferring decant tank contents back to the waste stream storage tank.

3.4.4 DRUMMING STATION CONTROLS

All controls for operation of the drumming station are located immediately adjacent to the decanting station controls. A single selector switch on the front face of the control console energizes the drumming station control circuits. Complete monitoring of operation of the drumming station can be accomplished by watching the graphics display panel while the drumming station is in use. The operator has the option of drumming either decanted wastes or concentrator wastes as well as any combination of the two.

The drumming station is a compact assembly of components to drum radioactive slurries and solutions in 55-gallon drums with cement solidification binder. For safety in operation and for maintenance, the equipment is attached to both sides of a 12-inch thick steel shield wall. On the safe side of the wall are mounted all motors, pneumatic valves, actuators and as many of the gear reducers as is practical. On the hot side of the wall are the pumping ends of the metering pump and the drum processing enclosure. The 12-inch thick steel shield wall provides the equivalent of 39 inches of concrete shielding, allowing personnel to be present on the safe side of the wall during operation for maintenance or for other purposes.

The drumming station is remotely operated from the console which is provided with the control station. Controls and monitoring devices have been provided to allow automatic or manual operation and to inform the operator of station status and operation.

The drumming station allows drums to be filled with either evaporator concentrates or resin slurries. Prior to drumming operations process control verification tests are performed in accordance with the requirements of the process control program. Once a satisfactory verification sample has been performed, the required quantity of waste is programmed into the waste meter pump controls. The metering pump will automatically transfer the required quantity of waste to the disposal container.

Disposable containers which have been prefilled with concrete at the cement filling station are transferred to the drum positioning platform inside the drum processing enclosure. Once the drum is inside the drum processing enclosure, the station operator shuts the drum processing enclosure hatch isolating the drum processing enclosure from the station's environment.

With the metering pumps and the appropriate feed controls setup for the correct quantity of waste(s), drum processing can then be initiated. The movement of the drum through the drumming station cycle is automatic, once the drum has been loaded into the drum processing enclosure and the hatch has been closed. The drum is uncapped, filled, recapped, clamped, tumbled and unclamped. This operational sequence may be repeated in the automatic cycle to permit the drum to be filled twice.

Upon completion of the automatic process cycle, the drum is returned to the load/unload position within the drum processing enclosure. The operator then initiates remote opening of the hatch and lowers the crane's drum grab into the enclosure. The drum grab is equipped with a downward viewing camera, which allows the operator to inspect the drum.

After the operator has verified that the top head of the drum is free from contamination, he then raises it out of the drum processing enclosure and positions it upon the scale platform. Once the drum has been released, the drum's weight and radiation level are then measured and recorded. Displays for these functions are provided at the control console and provide valuable information as to the decay pit and location at which the drum should be stored.

3.5 SOLIDIFICATION SAMPLE VERIFICATION

3.5.1 RECIRCULATION OF WASTE STREAMS

3.5.1.1 Prior to sampling radioactive waste hold up tanks for process control sample verification, each tank shall be recirculated until a representative sample can be obtained.

3.5.1.2 No waste should be added to or removed from a batch tank after sampling has been performed. Should waste be added or removed from the tank prior to completing the solidification of the tank, solidification activities will be secured and the tank placed in the recirculation mode until representative samples are obtained.

3.5.1.3 The radioactive waste tank shall remain in the recirculation mode during actual solidification operations.

3.5.2 VERIFICATION SAMPLE REQUIREMENTS

3.5.2.1 Solidification sample verification will be performed on each batch of each type radioactive waste until standard cement-to-waste ratios have been developed and proven to produce acceptable products on a minimum of ten consecutive batches.

3.5.2.2 Once the standard ratios have been proven to produce acceptable solidified products for ten consecutive batches of each type radioactive waste, solidification sample verification requirements will be decreased to at least once every tenth batch of each type of radioactive waste.

3.5.2.3 Should any solidification verification sample prove to produce unsatisfactory solidified products, solidification verification sampling requirements will be increased to every batch of each type radioactive waste until the criteria of Step 3.5.2.1 are met.

3.5.3 WASTE IDENTIFICATION

3.5.3.1 Each verification sample shall be analyzed for the following minimum characteristics:

3.5.3.1.1 Oil

3.5.3.1.2 pH

3.5.3.1.3 Temperature

3.5.3.1.4 Percent by weight boric acid or sodium sulfate

3.5.3.1.5 Isotopic analysis

3.5.3.2 The results of each sample verification will be recorded on the appropriate sample worksheets.

3.5.4 SOLIDIFICATION SAMPLE ACCEPTANCE CRITERIA

3.5.4.1 Visual inspection of the end product after solidification must indicate a free standing, monolithic structure which meets the free standing water criteria of the appliciable low level radioactive waste disposal facility.

3.5.4.2 The end product must resist penetration when probed with a spatula or comparable firm object.

3.5.5 SOLIDIFICATION SAMPLE VERIFICATION DOCUMENTATION

3.5.5.1 Calculate and record all required information on either the concentrates solidification work sheet or the resin solidification worksheet.

3.5.5.2 The Radwaste Coordinator or his designee shall inspect and verify the results of each sample verification.

3.6 PRIMARY CONCENTRATES VERIFICATION

3.6.1 Based on the sample analysis, determine the quantities of calcium hydroxide, calcium chloride, and lithium hydroxide required for satisfactory solidification. Record these quantities on the concentrates solidification worksheet.

3.6.2 Ensure temperature of the waste sample is greater than 140 F. Record waste sample temperature on the solidification sample verification.

3.6.3 Transfer the waste stream to the disposable container. Measure and record pH.

3.6.4 Add the required quantity of calcium hydroxide to the waste sample. Mix for five minutes.

3.6.5 Measure and record pH. If pH is less than $10.5 \pm .5$ add LiOH H_2O increments of 2 grams until pH is $10.5 \pm .5$. Record the additional $LiOH \cdot H_2O$ required to adjust pH.

NOTE: Because of the difference in the quantity of heat of hydration released in the test sample and the full scale solidification, the test sample will not demonstrate the quantity of hardness of the full scale sample.

3.6.6 Mix sample for approximately 1 minute.

3.6.7 Record sample weight and volume on the solidification sample verification form.

3.6.8 Place a lid on the disposable beaker and allow to stand for a maximum of 24 hours at 130 F in a convection oven.

3.6.9 Inspect each sample for free standing water and product integrity. Record sample results on the solidification sample verification form.

3.6.10 If the solidification sample is satisfactory, determine the quantities of waste, thumb wheel settings, cement, calcium chloride, and lithium hydroxide to be placed in each 55 gallon drum and the quantity of calcium hydroxide to be placed in the batch tank by performing the calculations described in Section D of the concentrates solidification sample verification form.

3.6.11 If the solidification sample is not satisfactory, adjust the waste: binder ratio (Formula C.4.1.) downward in increments of .5 until a satisfactory sample verification is obtained.

3.6.12 Perform Step 3.6.10.

3.6.13 Perform full scale solidification in accordance with the system operating procedure using the boundary parameters recorded in Section D of the concentrates solidification sample verification form.

3.7 SOLIDIFICATION OF SPENT ION EXCHANGE RESIN

NOTE: If radiation levels do not permit the verification testing of the actual depleted resin, depleted non-radioactive resin may be used.

3.7.1 Determine pH, boron content, and resin to water ratio of the resin stream to be solidified and record results on the resin solidification worksheet.

3.7.2 Based on sample analysis results, determine the quantities of cement, calcium chloride, and lithium hydroxide required to obtain a satisfactory solidification. Record these quantities on the resin solidification worksheet.

3.7.3 Transfer the required quantity of waste to a disposable container.

3.7.4 Measure and record waste stream temperature.

3.7.5 Add the required quantity of calcium hydroxide to the waste stream. Mix for 5 minutes prior to adding the waste to the disposable container.

3.7.6 Measure and record pH. If pH is less than 10.5±.5, add lithium hydroxide to the waste stream to increase pH to 10.5±.5. Record the additional $LiOH\ H_2O$ required to increase pH to 10.5±.5.

3.7.7 Transfer the required quantities of cement and calcium chloride to the disposable container.

3.7.8 Mix sample for 1 minute.

3.7.9 Record waste sample final pH on the resin solidification worksheet.

3.7.10 Record weight and volume of the waste sample on the resin solidification worksheet.

3.7.11 Place a lid on the disposable beaker and allow to stand for a maximum of 24 hours at 130 F in an convection oven.

3.7.12 Inspect each sample for free standing water and product integrity. Record sample results on the resin solidification worksheet.

3.7.13 If the solidification sample is satisfactory, determine the quantities of cement, calcium hydroxide, calcium chloride, lithium hydroxide and waste to be placed in each 55 gallon drum or batch tank by performing the calculations described in section D of the resin solidification worksheet.

3.7.14 If the solidification sample is not satisfactory, adjust the waste: binder ratio (Formula B.2) downward in increments of .5 until a satisfactory sample v' ᶠication is obtained.

3.7.15 Perform Step 3.7.13.

3.7.16 Calculate the quantities of waste, thumb wheel settings, cement, calcium hydroxide, lithium hydroxide and calcium chloride required for each container.

3.7.17 Perform full scale solidification in accordance with the system operating procedure using the boundry parameters recorded in Section D of the solidification sample verification form.

3.8 <u>SECONDARY CONCENTRATES AND SECONDARY SPENT RESIN VERIFICATION</u>

3.8.1 Secondary concentrates and secondary system spent resins will be processed through the bulk waste disposal station. This waste will not be solidified in the in-plant solidification system.

3.8.2 Secondary spent resin will be discharged through the secondary bulk waste disposal station to 55 gallon drums. Secondary resins will be dewatered in the 55 gallon drums. The dewatered resins will be transported to a sanitary landfill for disposal. Sluice water will be returned to the clean floor drains.

3.8.3 Should secondary spent resins exceed the activity levels for unrestricted release, they will be processed in accordance with Section 3.7.

3.9 SYSTEM INTERFACING

3.9.1 The installed solidification system interfaces with the liquid radioactive waste system, solid radwaste decanting station, chemical drains, reactor make up water system, and the radwaste building ventilation system.

3.9.2 Liquid wastes are transferred from the primary evaporator bottoms tank, chemical drain tank, or the secondary evaporator bottoms tanks by installed pumps. All piping used to transfer the concentrates to the solid radwaste drumming station and for recirculation of the bottoms tanks is heat traced to prevent crystallization of the concentrates prior to reaching the solid radwaste drumming station. The solid radwaste drumming station also receives liquid waste from the chemicl drain tank.

3.9.3 The primary and secondary bottoms tanks and the chemical drain tanks are equipped with recirculation capability to insure satisfactory samples may be obtained and analyzed.

3.9.4 The installed resin sluicing system transfers spent resin and depleted charcoal to the spent resin storage tanks (primary and secondary). Resin slurries are then transferred to the solid radwaste decanting station. The solidification system operator can maintain the required amount of liquid in the resin slurry and decant and transfer all excess liquid to the spent resin hold up tanks.

3.9.5 All exhaust from the decanting station and the solid radwaste drumming station is processed by the radwaste building ventillation system.

3.9.6 The reactor make up water system is used to wash down and decontaminate processed drums as necessary to remove external contamination from the drums due to spillage.

3.10 CORRECTIVE ACTIONS

3.10.1 At predetermined intervals a portion of the solidified containers will be inverted and allowed to stand for a period of time. Each of these containers will then be inspected for free standing water. The results of each inspection shall be recorded. Should any container be found to exhibit free standing water greater than the FSW criteria established by the low level radioactive waste disposal facility, the following actions shall be taken:

3.10.1.1 Secure solidification activities until new solidification ratios can be determined and proven.

3.10.1.2 Inspect all available containers from the same batch of radioactive waste solidified using the formulas which provided the unsatisfactory results.

3.10.2 Drums that exhibit free standing water shall either be dewatered or reprocessed by determining the quantity of water and adding proper quantities of cement and additive chemicals as required by a sample verification test.

CONCENTRATE SOLIDIFICATION WORKSHEET

A. Waste Identification

Boron Content	________ ppm	Test #	____________
Sodium Sulfate Content	________ ppm	Batch #	____________
pH	________	Waste Type #	____________
Temperature	________ ^{O}F	Tank Id #	____________
Oil (% by volume)	________ %		

DATE ____________________ CHEMISTRY ________________________

B. Sample Preparation

1. Waste Sample Volume (V_{WS}) 200 ml
2. Waste Sample Volume to Concrete Volume Ratio

$$\frac{\text{Waste Volume } (V_{WS})}{\text{Concrete Volume } (V_{CS})} = \underline{\ \ 0.75\ \ } \text{ or } \underline{\qquad\quad}$$

3. Weight of concrete (W_{CS}) = $\frac{1}{0.75 \text{ or } \underline{\text{Step 2B}}}$ x V_{WS} x 0.93 $\frac{gm}{ml}$ = ______gm
4. Weight of Lime ($Ca(OH)_2$)

   ________ppm Boron x 6.66×10^{-5} = ________________ gm $Ca(OH)_2$
5. Weight of LiOH H_2O

   200 ml of Waste (V_{WS}) x 0.083 = 16.6 gm LiOH H_2O
6. Weight of $CaCl_2$

   (W_{CS}) gms Concrete x 0.04 = ________________ gm $CaCl_2$
7. pH following Addition ________ pH

8. Additional LiOH H_2O required to increase pH to 10.5 ±.5

_____________gm LiOH H_2O

9. Total LiOH H_2O required _____________gm LiOH H_2O

10. Final Product Volume (V_{FP}) _________ ml

11. Final Product Weight (W_{FP}) _________ gm

C. Solidification Sample Results

1. Free Liquid (Free Standing H_2O) ____________ % _____________ ml

2. General Appearance ____

____

3. Test Acceptable ☐ Yes ☐ No ____________________ / ____________
Shift Chemist Date

4. Rad Waste Coordinator Review ____________________ / ____________
Date

5. Comments ____

____

D. Full Scale Solidification

1. Volume of Container (Vc) ______________ ft^3 ______________ gal.

2. Useful Volume (Vu) ______________ ft^3 ______________ gal.

3. Waste Volume to Concrete Volume Ration (Waste to Binder Ratio)

0.75 or From Step B.2 ____________________

4. Waste Volume (V_W) in gallons.

V_{WS} (from B.1 in ml.) = 200 ml.

V_{FP} (from B.10 in ml.) = ___________ ml.

V_U (from D.2 in gal.) = ___________ gal.

$[V_{WS} / V_{FP}] \times V_U$ = ________________ Waste Volume in Gallons (V_W)

5. Weight of concrete (W_C)

V_W (from D.4 in gal.) ____________ gal.

$W_C = V_W \times 10.344$ = ________________ pounds of concrete

6. Lime---$Ca(OH)_2$

$$\frac{\_\_\_\_\_\_ \text{ppm Boron} \times 0.333 \times V_W \text{(gal)} \times 3.785 \frac{\text{liters}}{\text{gal}}}{4.536 \times 10^5 \text{ mg/lb}} = \_\_\_\_\_\_\_\_ \text{lb Lime}$$

7 $LiOH\ H_2O$ (weight in pounds)

V_W (gal) X 0.6926 = ________________pounds $LiOH\ H_2O$

8. $CaCl_2$ (weight in pounds)

W_C (lb) X 0.04 = __________________pounds of $CaCl_2$

9. THUMB WHEEL SETTINGS

a. (Container Volume x 0.95) - $V_{CONCRETE}$ = First Thumb Wheel Setting

First Thumb Wheel Setting __________________ Gallons

b. (V_{WASTE} - $V_{FIRST\ THUMB\ WHEEL\ SETTING}$) = Second Thumb Wheel Setting

Second Thumb Wheel Setting _________________ Gallons

10. Operation Verified Thumb Wheel Setting ___________________/__________

Operator Date

a. Waste Container Id #'s ____

____

11. A. Radwaste Operator ___ ____

Date ____

B. Review by Rad Waste Coordinator

____________________________ ____________________

Rad Waste Operator Date

RESIN SOLIDIFICATION WORKSHEET

A. Waste Identification

% Resin Slurry $\frac{\text{Volume of Resin}}{\text{Total Volume}}$ X 100% = ______% Resin-Test #__________

Boron Content ______ppm Boron-Batch #________

pH ______pH-Waste Type __________

Temperature ______°F - Tank Id # __________

Oil(% by volume) ______%

DATE ______________________ CHEMISTRY __________________________

B. Sample Preparation

1. Waste Sample Volume (V_{WS}) [Volume of Resin] = 200 ml

2. Waste Volume to Concrete Volume Ratio

   $\frac{\text{Waste Volume } (V_{WS})}{\text{Concrete Volume } (V_{CS})}$ = ____0.75____ or __________

3. Weight of Concrete (W_{CS}) = $\frac{1}{0.75 \text{ or } \frac{\_\_\_}{\text{Step 28}}}$ x V_{WS} x 0.93 $\frac{gm}{ml}$ = ______gm

4. Weight of Lime ($Ca(OH)_2$)

   ________ppm Boron x 3.33×10^{-4} = ______________grams of $Ca(OH)_2$

5. Weight of $CaCl_2$

   _________ W_{CS} weight of concrete x 0.04 = ______________ gm $CaCl_2$

6. pH following Lime Addition ________ pH

7. Final Product Volume (V_{FP}) ________ ml

13. Final Product Weight (W_{FP}) ________ gms

C. Solidification Sample Results

1. Free Liquid (Free Standing water) ________ % ________ ml

2. General Appearance ________

____

3. Test Acceptable ☐ Yes ☐ No ________ / ________
Shift Chemist Date

4. Rad Waste Coordinator Review ________ / ________
Date

5. Comments ________

____

D. Full Scale Solidification

1. Volume of Container (V_C) ________ ft^3 ________ gal.

2. Useful Volume (V_U) ________ ft^3 ________ gal.

3. Waste Volume to Concrete Volume Ration (Waste to Binder Ratio)

0.75 or From Step B.2 ________

4. Waste Volume (V_W) in gallons.

Waste Volume (V_W) ml.

________ / Final Volume (V_{FP}) ml X Useful Volume (V_U) = ________ Waste Volume gallons

5. Weight of concrete (W_C)

________ V_W X 10.344 = ________ pounds of concrete

6. Weight of Lime--$Ca(OH)_2$

______ppm Boron X 2.779 X 10^{-6} X V_W (gal) = ________pounds of Lime

7. Weight of $CaCl_2$

Weight of Concrete (W_C) in pounds X 0.04 = ________ pounds of $CaCl_2$

8. THUMB WHEEL SETTINGS

A. (Container Volume x 0.95) - $Volume_{CONCRETE}$ = First Thumb Wheel Setting (gallons)

First Thumb Wheel Setting ____________________ gallons

B. Volume Waste (V_W)-$Volume_{FIRST\ THUMB\ WHEELSETTING}$ = Second Thumb Wheel Setting

Second Thumb Wheel Setting ___________________ gallons

9. (a) Operation Verified Thumb Wheel Setting ______________/__________
Operator Date

(b) Waste Container Id #'s _____________ ___________________________

____

10. (a) Rad Waste Operator ______________________________/__________
Operator Date

11. (b) Review by Rad Waste Coordinator ______________________/__________
Rad Waste Coordinator Date

Rev. 1
7/84

KG&E THE ELECTRIC COMPANY
KANSAS GAS AND ELECTRIC COMPANY

GLENN L. KOESTER
VICE PRESIDENT - NUCLEAR

July 2, 1984

Mr. Harold R. Denton, Director
Office of Nuclear Reactor Regulation
U.S. Nuclear Regulatory Commission
Washington, D.C. 20555

KMLNRC 84-101
Re: Docket No. STN 50-482
Ref: Letter KMLNRC 83-145 dated 11/14/83 from GLKoester, KG&E, to HRDenton, NRC
Subj: Process Control Program (PCP)

Dear Mr. Denton:

The Referenced letter transmitted the Wolf Creek Generating Station Process Control Program (PCP). Transmitted herewith are five (5) copies of Revision 1 to the Wolf Creek Generating Station PCP.

This revision to the PCP should supersede the previously supplied PCP in its entirety. The PCP is being submitted in accordance with Technical Specification 6.13.1 for NRC review and approval.

Yours very truly,

Glenn L Koester

GLK:bb
xc: PO'Connor
HBundy

B001
1/1

201 N. Market — Wichita, Kansas — Mail Address: P.O. Box 208 / Wichita, Kansas 67201 — Telephone: Area Code (316) 261-6451

OATH OF AFFIRMATION

STATE OF KANSAS)
) SS:
COUNTY OF SEDGWICK)

I, Glenn L. Koester, of lawful age, being duly sworn upon oath, do depose, state and affirm that I am Vice President - Nuclear of Kansas Gas and Electric Company, Wichita, Kansas, that I have signed the foregoing letter of transmittal, know the contents thereof, and that all statements contained therein are true.

KANSAS GAS AND ELECTRIC COMPANY

ATTEST:

By Glenn L. Koester
Glenn L. Koester
Vice President - Nuclear

E.D. Prothro
E.D. Prothro, Assistant Secretary

STATE OF KANSAS)
) SS:
COUNTY OF SEDGWICK)

BE IT REMEMBERED that on this 28th day of June, 1984, before me, Evelyn L. Fry, a Notary, personally appeared Glenn L. Koester, Vice President - Nuclear of Kansas Gas and Electric Company, Wichita, Kansas, who is personally known to me and who executed the foregoing instrument, and he duly acknowledged the execution of the same for and on behalf of and as the act and deed of said corporation.

IN WITNESS WHEREOF, I have hereunto set my hand and affixed my seal the date and year above written.

EVELYN L. FRY NOTARY PUBLIC STATE OF KANSAS

Evelyn L. Fry
Evelyn L. Fry, Notary

My Commission expires on August 15, 1984.