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WEST VALLEY DEMONSTRATION PROJECT

SAFETY ANALYSIS REPORT

VOLUME IV

REV. 1

CEMENT SOLIDIFICATION SYSTEM

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SAFETY ANALYSIS FOR

CEMENT SOLIDIFICATION SYSTEM

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VOLUME IV, REV. 1

CEMENT SOLIDIFICATION SYSTEM

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The components of the Cement Solidification System (CSS) associated with processing of radioactive wastes will be contained within the 01-14 Building; the only part of the system outside of the 01-14 Building is the cement silo, and it contains dry cement. The accidents analyzed therefore occur within the 01-14 Building, and the resulting radioactivity is released through a stack on top of the 01-14 Building (airborne), or through the existing Low-Level Waste Treatment Facility (LLWTF).

The 01-14 Building is situated adjacent to the main plant at an elevation well above potential flooding. Other natural phenomena (earthquakes, tornadoes, high winds and snow loading) and site characteristics were determined not to affect the conclusions presented herein. The dose to the maximally exposed off-site individual in the complete absence of engineered barriers, will be only a small fraction of the DOE limits.

G.2.1.3 EFFECT OF NEARBY INDUSTRIAL, TRANSPORTATION, AND MILITARY FACILITIES

See Section G.2.1.3 of Volume I.

G.2.2 RADIOLOGICAL IMPACT OF NORMAL OPERATIONS

Both on-site and off-site dose assessments were performed in order to determine the radiological impact of normal operations (Section G.8.0). The dose to on-site personnel is due to work in areas of elevated radiation levels (gamma levels) relative to background. The annual collective occupational dose was estimated to be 10 person-rem (Section G.8.4).

To estimate off-site doses, two pathways were considered: the airborne pathway (radionuclides released from a stack on top of the 01-14 Building during normal operations) and the pathway from normal liquid releases (Section G.8.6). An atmospheric dispersion code was used to estimate the atmospheric transport and diffusion of radioactive particulates. The resulting concentrations were coupled with models to estimate the dose to off-site individuals. The resulting dose to the maximally exposed individual was calculated to be 3.0E-04 mrem per year. The dose to the maximally exposed off-site individual was calculated as 0.58 mrem per year. It should be noted that all CSS liquid wastes will be routed to the new Liquid Waste Treatment System (LWTS) once this system becomes operational. This is expected to reduce the maximum predicted off-site dose.

G.2.3 RADIOLOGICAL IMPACT FROM ABNORMAL OPERATIONS

Abnormal operations are events which could occur from malfunctions of systems, operating conditions, or operator error. Abnormal events are only of consequence for those systems in the CSS which process, control, or confine radioactivity. The abnormal events considered (Section G.9.1) are of little consequence and do not result in a release of radioactive or hazardous material.

G.2.4 ACCIDENTS

Four accidents associated with operation of the CSS were analyzed (Section 9.2). The first accident is a spill of 1,900 L of liquid waste from the waste dispensing vessel; the second is associated with the addition of caustic to the uranyl nitrate solution; the third is a failure of a bank of HEPA filters. For the first two accidents, the material was assumed to become airborne, transported by the 01-14 Building Heating and Ventilation (HV) System, and ultimately discharged through a stack on top of the 01-14 Building. For the last two accidents, the released radioactivity is assumed to be discharged directly from the stack on top of 01-14 Building. The doses from these accidents to the maximallly exposed off-site individual were calculated to be: 5.9E-04 and 4.6E-05 mrem for a spill from the waste dispensing vessel (the first value is associated with a spill of waste having a radionuclide distribution similar to that of the wastes in tank 8D-2 and the second value is associated with a spill of uranyl nitrate solution); 2.8E-06 mrem for the neutralization of uranyl nitrate solution accident; 40 mrem for failure of the HEPA filters; and 22 mrem for the HEPA filter fire accident.

G.2.5 CONCLUSIONS

This safety analysis report was prepared to meet the requirements of DOE/ID Order 5481.1, "Safety Analysis and Review System for DOE/ID Managed Activities" and WVNS Policy and Procedure WV-906, "Safety Review Program". The analysis indicates that the Facility as designed can be operated safely. The Facility has been designed to reduce hazards to minimum levels by reducing the amount of waste in the process at any one time commensurate with process requirements and by conducting operations remotely within a sealed, shielded cell. The analyses contained herein show no doses of consequence to either on-site or off-site individuals. Conservative assumptions lead to an estimated normal worker collective dose of 10 person-rem/yr, in keeping with the philosophy of ALARA. Calculated doses to the maximally exposed off-site individual were determined for both normal and accident conditions. In both cases, the doses are well within the requirements of DOE Order 5480.1A.

G.3.0 SITE CHARACTERISTICS

G.3.1 GEOGRAPHY AND DEMOGRAPHY OF WEST VALLEY DEMONSTRATION PROJECT ENVIRONS

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G.3.2 NEARBY INDUSTRIAL, TRANSPORTATION, AND MILITARY FACILITIES

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G.3.8. SUMMARY OF CONDITIONS AFFECTING FACILITY CONSTRUCTION AND OPERATING REQUIREMENTS

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G.4.0. PRINCIPAL DESIGN CRITERIA

G.4.1. PURPOSE OF THE CEMENT SOLIDIFICATION SYSTEM (CSS) FACILITY

The purpose of the CSS is to solidify liquid and wet solid low-level and transuranic (TRU) radioactive wastes generated from WVDP activities. The WVDP activities expected to generate the bulk of the waste streams to be processed by the CSS include supernatant processing, High-Level Waste (HLW), Vitrification, Decontamination and Decommissioning. These activities result in a variety of liquid and wet solid wastes including decontaminated supernatant, secondary waste streams from HLW vitrification, spent solutions from decontamination operations, and spent resin slurries, Solidified wastes produced by operation of the CSS will meet all of the waste form criteria of US DOE Order 5820.2 and the intent of the 10 CFR Part 61 Sections 61.55 and 61.56 for low-level wastes.

G.4.1.1. CSS FUNCTIONS

The CSS performs the following functions:

- o Waste Encapsulation - mixing low-level or TRU radioactive waste with cement (and chemical additives when necessary); packaging the resulting mixture in 269-L square drums or 208-L round drums.
- o Cement Storage and Transfer - bulk storage of dry cement powder and transfer of batch quantities to solidify the waste; and
- o Materials Handing - remote handling of empty and filled drums with temporary storage in the 01-14 Building; loading filled drums onto vehicles for transport to the RTS Drum Cell.

G.4.1.2. FEEDS TO THE CSS

Three feeds will be input to the CSS: Portland Type I cement, chemical additives (when necessary), and liquid and wet solid waste streams, During batch operations, cement will be fed from a dry cement storage silo to the gravimetric feeder at the rate of approximately 4,500 kg/hr. Chemical additives make up the second feed. These will be mixed with the waste streams to increase or decrease the mixture setting time and their feed rate will therefore vary. The waste streams to be solidified constitute the third feed. A description of the waste streams is given in Figure G.4.1.-1.

G.4.1.3. CSS PRODUCTS AND BYPRODUCTS

The principal product of the CSS will be 269-L square and 208-L round drums of solidified low-level and TRU wastes. Byproducts produced will be radioactively contaminated mixer flush solutions, spent HEPA filters, roughing filters, and swipes. These wastes will either be processed back through the CSS to produce a stable waste form of will be handled per existing WVDP procedures. In the short term, mixer flush solutions will be processed in the existing Low-Level Waste Treatment Facility (LLWTF) prior to discharge from the site. Once the new Liquid Waste Treatment System (LWTS) becomes operational, mixer flush solutions will be routed back through the LWTS.

G.4.2. STRUCTURAL AND MECHANICAL SAFETY CRITERIA FOR THE CSS

The CSS will be installed in the existing 01-14 Building. The only new construction for the CSS is the cement silo, the steel building immediately south of the 01-14 Building which will house the empty drum storage area, the control room, an airlock and a concrete truck pad at the west end of the 01-14 Building.

The cement silo and support structure is designed for a site wind of 160 km/hr at 9.1 m above grade in accordance with ANSI A58.1 Exposure C distributed on the full projected area of the tank. No increase in the allowable stresses has been allowed in the tank design for normal wind loading. Since the tank is outdoors, no allowance has been made for the wind shielding effects of other buildings.

The steel building to the south of the 01-14 Building and the airlock and truck pad to the west have been constructed in compliance with the New York State Building Code and applicable ACI standards.

G.4.3. SAFETY PROTECTION SYSTEMS

G.4.3.1. GENERAL

The CSS has been designed in a manner to allow for its safe operation. Control of radioactivity is the primary safety concern. Specific safety protection systems are described in the following subsections.

G.4.3.2. PROTECTION BY MULTIPLE CONFINEMENT BARRIERS AND SYSTEMS

The solidification of radioactive wastes will take place in a shielded cell within the 01-14 Building. The cell atmosphere will be maintained under a slight negative pressure relative to surrounding areas by the 01-14 Building Heating and Ventilation (HV) System to ensure that air leakage will be into rather than out of the cell. The exhaust blower that maintains this negative pressure is backed up with a diesel-powered blower that automatically takes over if the primary blower fails. These multiple barriers will provide for positive control of radioactivity.

G.4.3.3. PROTECTION BY EQUIPMENT AND INSTRUMENTATION SELECTION

All equipment and instrumentation will be selected and purchased in compliance with WVNS's Quality Assurance program which is described in Section A.12.0. of Volume I. The quality levels of the individual components for the CSS are given in Section G.12.2.1.

G.4.3.4. NUCLEAR CRITICALITY SAFETY

Because a nuclear criticality associated with the operation of the CSS is not considered to be a credible event (see Section G.9.2.2.), design criteria associated with preventing a nuclear criticality are not appropriate. However, all batches of liquid wastes will be sampled and analyzed for fissile material concentration prior to processing in the CSS (see Section G.11.4.3.).

G.4.3.5. RADIOLOGICAL PROTECTION

Radiological protection systems consist of those systems that ensure the confinement of radioactivity and reduction of general exposure rates. The three major radiological protection systems are the shield walls, the CSS Vessel Off-Gas System, and the 01-14 Building HV System. These systems have been designed to provide positive containment of radioactivity.

G.4.3.6. FIRE AND EXPLOSION POTENTIAL

The CSS has fire detection equipment, alarm systems, and suppression equipment commensurate with the fire hazards in the 01-14 Building. The following fire protection equipment will be installed as a minimum:

- An engineered Halon fire supression system in the CSS Control Panels;
- A fire alarm system that alarms in both the CSS Control Room and guard house; and
- Portable fire extinguishers and fire hoses at various locations throughout the 01-14 Building.

The CSS will not process any substances which have an explosion potential.

G.4.3.7. RADIOACTIVE WASTE HANDLING AND STORAGE

Filled drums will be stored on conveyors in the filled Drum Storage Area which is located immediately to the west of the process room. This storage area is separated from the process room by an air lock. Means will be provided to allow for remote determination of drum locations within the storage area. The filled drums will be loaded onto a transport truck with line roller conveyors for transport to the Drum Storage Area.

Filled drums with a contact exposure rate exceeding 100 mR/hr will be remotely handled.

G.4.3.8. INDUSTRIAL AND CHEMICAL SAFETY

The administrative controls for industrial and chemical safety to be implemented are presented in the WVNS Industrial Hygiene and Safety Manual, WVDP-011. Effects of a potential chemical accident (the vigorous reaction of a caustic with an acidic waste solution such as uranyl nitrate) is discussed in Section G.9.2.

G.4.4. CLASSIFICATION OF STRUCTURES, COMPONENTS AND SYSTEMS

Table G.4.4-1 presents safety classifications for the structures, systems and components associated with the CSS. The criteria and procedures used to determine class design are presented in Section A.4.4. of Volume I.

Since the dose to the maximally exposed off-site individual as a result of accidents does not exceed 500 mrem (see Section G.9.2.), none of the structures, systems of components require a safety class of A or B. Because the CSS will produce drums of solidified waste that have contact exposure rates in excess of 1 R/hr, any item whose failure could result in workers coming in close contact with either the radioactive waste streams or solidified drums of waste will require a safety classification of C. Components in the vessel off-gas and 01-14 Building HV Systems are safety classified C to ensure confinement of radioactivity, and radiation monitors are safety classified C because their failure could result in undetected exposures. All other items are classified as N.

G.4.5. DESIGN CONSIDERATIONS FOR DECONTAMINATION AND DECOMMISSIONING

The CSS Facility has been designed in a manner to facilitate eventual decontamination and decommissioning. Specific design details include the following:

- The CSS Process Room floor slopes to a sump to allow for use of liquid decontamination solutions on the cell walls and exterior of vessels;

- All sumps are lined;

- The Waste Dispensing Cell is lined with stainless steel up to a height of 46 cm above the floor;

- The CSS Process Room is coated with a smooth epoxy paint, covered with a strippable coating; and

- All process equipment and piping is designed to be flushable.

TABLE G.4.4-1 (1 OF 3)

SAFETY CLASSIFICATION OF IMPORTANT STRUCTURES, SYSTEMS AND COMPONENTS ASSOCIATED WITH THE CEMENT SOLIDIFICATION SYSTEM

COMPONENT OR SYSTEM	SAFETY CLASS
STRUCTURES	
01-14 Building (Modified)	C
Shield Walls	C
Shield Doors and Partitions	C
Shielded Viewing Window	C
Maintenance Access Doors	N
Air Lock Doors	N
Stainless Steel Liner	N
Sumps and Associated Drainage Lines	N
Floor Drains and Associated Drainage Lines	N
Pipe Supports	N
Conduit Supports	N
HVAC Supports	N
WASTE PROCESSING	
Cement/Additives Preparation and Delivery	
Cement Fill Station	N
Cement Silo	N
Cement Tra[illegible] Machine	N
Additive Tanks (2)	N
Cement Bin	N
Cement/Additives Transport Lines	N
Cement/Additives Transport Pumps	N
Cement/Additives Transport Valves	N
Loss-in-Weight Feeder	N
Liquid Radioactive Waste Preparation and Delivery	
Waste Dispensing Vessel	N
Waste Transport Lines (Note 1)	N
Waste Transport Pumps (Note 1)	N
Waste Transport Valves (Note 1)	N
Mixer Flush System	
Flushwater Decant Pumps	N
Sump Pumps	N
Cement Solidification	
High-Shear Mixers (2)	N
Cement Transport Lines	N

Note 1: This classification applies t[illegible] waste transport lines, pumps, and valves within 01-14 Building.

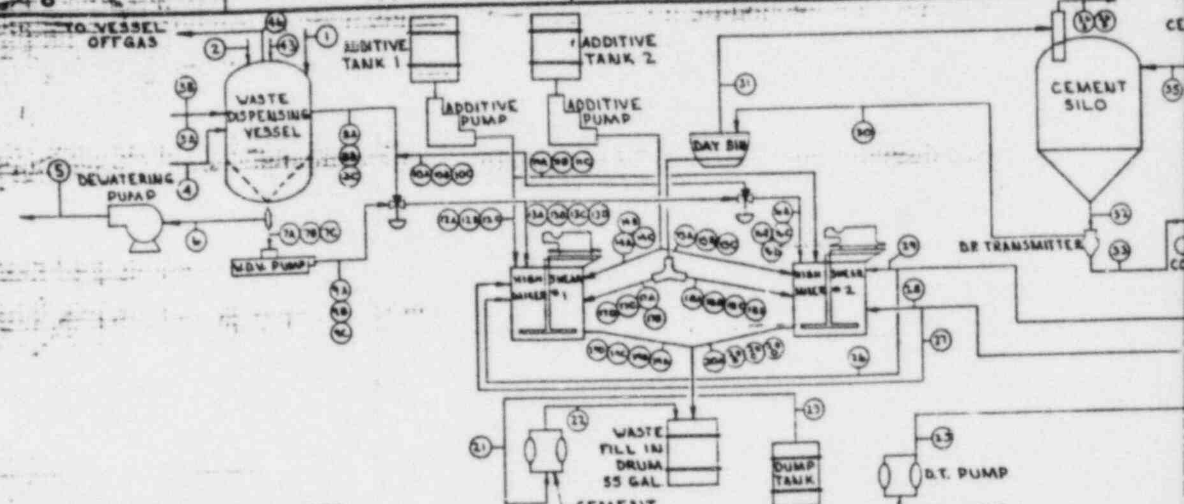
TABLE G.4.4-1 (2 OF 3)

SAFETY CLASSIFICATION OF IMPORTANT STRUCTURES, SYSTEMS AND COMPONENTS ASSOCIATED WITH THE CEMENT SOLIDIFICATION SYSTEM

COMPONENT OR SYSTEM	SAFETY CLASS
Cement Solidification (Continued)	
Fill Nozzle	N
Drums	N
Lid Crimper	N
LOADOUT HANDLING EQUIPMENT	
Air Lock Door Engaging System	N
Drum Feed Conveyors	N
Manipulator	N
Transfer Drawer	N
In-Cell Crane	N
Drum Lift Table	N
Drum Overpack Conveyor	N
Smear Station	
Automated Swipe/Label Robot	N
Swipe Tool(s)	N
Overpack Station	N
Drum Transporter	
Shielded Cask	C
Truck	N
MONITORING SYSTEMS, CONTROLS AND INSTRUMENTATION	
Area Radiation Monitors	C
Airborne Particulate Monitors	C
Ventilation Monitoring System and Alarms	C
Liquid Radioactive Waste Sampling System	N
In-Cell TV Camera	N

SAFETY CLASSIFICATION OF IMPORTANT STRUCTURES, SYSTEMS AND COMPONENTS ASSOCIATED WITH THE CEMENT SOLIDIFICATION SYSTEM

COMPONENT OR SYSTEM	SAFETY CLASS
MONITORING SYSTEMS, CONTROLS AND INSTRUMENTATION (continued)	
In-Cell Radiation Monitors	C
Communications Equipment	N
Electronic Instruments and Controls	C
In-Cell Alpha/Beta Swipe Counter	N
Pneumatic, Hydraulic Instrumentation and Controls	C
UTILITIES AND SUPPORTING SYSTEMS	
Electrical Power Systems	
01-14 Building Supply	C
Panels, Transformers and Motor Control Center	C
Conduits	C
Engine Drive	C
Steam	N
Utility Air	N
Instrument Air	N
Demineralized Water	N
Utility Water	N
Fire Detection and Protection	C
VESSEL OFF-GAS SYSTEM	
Ducting	C
Blowers	C
Exhaust Filtration	C
HEATING AND VENTILATION (HV) SYSTEM	
01-14 Building HV System	
Ducting	C
Blowers	C
Exhaust Filtration	C



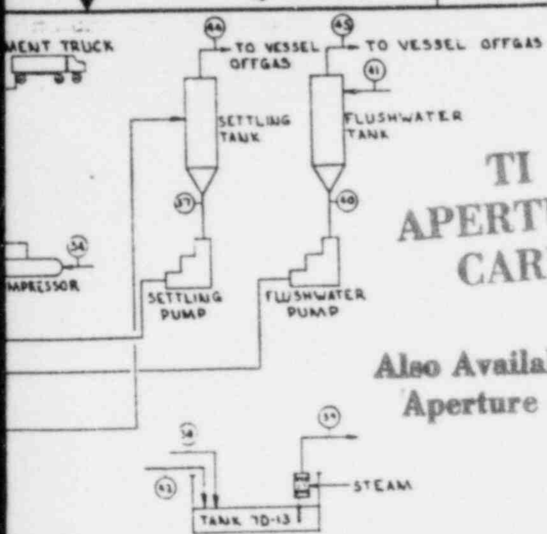
BASIS: 6 DRUMS/HR. OF SOLIDIFIED WASTE.

STREAM NO.	1	2	3A	4	5	6	7A	7B
STREAM DESIGNATION	EVAPORATOR BOTTOM	FILTER BACK-WASH SLURRY	ORGANIC RESIN SLURRY	URANYL NITRATE SOLUTION	MAX. WATER REMOVED FROM WET SOLIDS	DEWATER SUCTION	PROPERLY RATIOED RESIN SLURRY	PROPERLY RATIOED FILTER MEDIA SLURRY
FLOW RATE (LBS./HR.)	2539	10185.3	4382.8	2507.5	9486.55	9486.55	42112.3	41550.8
FLOW RATE (GALLONS/HR.)	210.2	1205.3	504.5	219.0	1138.84	1138.84	4200.0	4200.0
AIR (SCUFT/MIN.)	—	—	—	—	—	—	—	—
PRESSURE (PSIG)	10.0	15.0	15.0	15.0	15.0	0.0	0.0	0.0
TEMPERATURE (°F)	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0
WATER (LBS./HR)	1141	9676	3792.9	1668.2	9486.55	9486.55	31372.0	30955.0
SOLIDS SUSPENDED (LBS/HR) / SOLIDS DISSOLVED (LBS/HR)	2027 / 145.3	509.3 / —	589.9 / —	— / 839.3	— / —	— / —	10740.3 / —	10595.8 / —
CEMENT (LBS./HR.)	—	—	—	—	—	—	—	—
Na SALTS (LBS/HR)	1361.67	—	—	—	—	—	—	—
OTHER SALTS (LBS./HR.)	36.33 (K-SALT)	—	—	839.3 OF URANYL NITRATE	—	—	—	—
LINE VELOCITY (FT/SEC)	** 3.4	** 3.4	** 3.4	** 3.4	(-) 5.8	(4) 2.6	(B) 0.8	(B) 0.8

STREAM NO.	7C	8A	8B	8C	9A	9B	9C	10A	10B
STREAM DESIGNATION	PROPERLY RATIOED EVAPORATOR BOTTOM	RECIRCULATION OF STREAM 7A	RECIRCULATION OF STREAM 7B	RECIRCULATION OF STREAM 7C	SAME AS 7A	SAME AS 7B	SAME AS 7C	SAME AS 9A	SAME AS 9B
FLOW RATE (LBS./HR.)	50669	42112.3	41550.8	50669	42112.3	41550.8	50669	42112.3	41550.8
FLOW RATE (GALLONS/HR.)	4200.0	4200.0	4200.0	4200.0	4200.0	4200.0	4100.0	4200.0	4200.0
AIR (SCUFT/MIN.)	—	—	—	—	—	—	—	—	—
PRESSURE (PSIG)	0.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0	15.0
TEMPERATURE (°F)	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0
WATER (LBS./HR)	22801	31372	30955	22801	31372	30955	22801	31372	30955
SOLIDS SUSPENDED (LBS/HR) / SOLIDS DISSOLVED (LBS/HR)	4180.0 / 23688	10740.3 / —	10595.8 / 23688	4180.0 / 23688	10740.3 / —	10595.8 / —	4180.0 / 23688	10740.3 / —	10595.8 / —
CEMENT (LBS./HR.)	—	—	—	—	—	—	—	—	—
Na SALTS (LBS/HR)	27143	—	—	27143	—	—	27143	—	—
OTHER SALTS (LBS./HR.)	725	—	—	725	—	—	725	—	—
LINE VELOCITY (FT/SEC)	(B) 0.8	(A) 6.15	(A) 6.15	(A) 6.15	(A) 6.15	(A) 6.15	(A) 6.15	(A) 6.15	(A) 6.15

STREAM NO.	18B	18C	19A	19B	19C	20A	20B	20C
STREAM DESIGNATION	CEMENT FEED FOR FILTER MEDIA	CEMENT FEED FOR EVAPORATOR BOTTOM	SOLIDIFIED RESIN	SOLIDIFIED FILTER MEDIA	SOLIDIFIED EVAPORATOR BOTTOM	SOLIDIFIED RESIN	SOLIDIFIED FILTER MEDIA	SOLIDIFIED EVAPORATOR BOTTOM
FLOW RATE (LBS/HR)	1075.6	815.95	2111.62	2094.2	2085.45	2111.62	2094.2	2085.45
FLOW RATE (GALLONS/HR)	86.1	65.3	154.0	150.0	150.0	154.0	150.0	150.0
AIR (SCUFT/MIN.)	—	—	—	—	—	—	—	—
PRESSURE (PSIG)	0.0	0.0	5.0	5.0	5.0	5.0	5.0	5.0
TEMPERATURE (°F)	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0
WATER (LBS/HR)	—	—	861.72	763.95	570.5	861.72	763.95	570.5
SOLIDS SUSPENDED (LBS/HR) / SOLIDS DISSOLVED (LBS/HR)	— / —	— / —	294.95 / —	254.65 / —	101.35 / 597.65	294.95 / —	254.65 / —	101.35 / 597.65
CEMENT (LBS/HR)	1075.6	815.95	954.95	1075.6	815.95	954.95	1075.6	815.95
Na SALTS (LBS./HR)	—	—	—	—	680.83	—	—	680.83
OTHER SALTS (LBS./HR.)	—	—	—	—	18.165	—	—	18.165
LINE VELOCITY (FT/SEC)	(C) 0.24	(C) 0.24	(D) 13.2	(D) 13.2	(D) 13.2	(D) 13.2	(D) 13.2	(D) 13.2

STREAM NO.	21	22	23	24	25	26	27	28	29
STREAM DESIGNATION	CEMENT REMOVAL PUMP SUCTION	CEMENT REMOVAL PUMP DISCHARGE	MIXER FLUSH TO DUMP TANK	DUMP TANK PUMP SUCTION	DUMP TANK PUMP DISCHARGE	DECANTED CEMENT TO MIXER NO. 1	FLUSH-WATER TO MIXER NO. 1	FLUSH-WATER TO MIXER NO. 2	DECANTED CEMENT TO MIXER NO. 2
FLOW RATE (LBS/HR)	695 LBS. TO EMPTY THE MIXERS IN 2 MINUTES	695 LBS. TO EMPTY THE MIXERS IN 2 MINUTES	422.5 LBS. IN 2 MINS. FOR EACH 8 HRS.	422.5 LBS. IN 2 MINS. FOR EACH 8 HRS.	→	12.8 LBS. IN ½ MIN. EVERY 8 HRS.	209 LBS. IN 2½ MINS.	→	12.8 LBS. IN ½ MIN. EVERY 8 HRS.
FLOW RATE (GALLONS/HR)	50 GALS. TO EMPTY THE MIXERS IN 2 MINUTES	50 GALS. TO EMPTY THE MIXERS IN 2 MINUTES	50 GALS. IN ½ MIN. EVERY 8 HRS.	50 GALS. IN 2 MINUTES EVERY 8 HRS.	→	1 GAL. IN ½ MIN. EVERY 8 HRS.	@10 GPM FOR 2½ MINS.	→	1 GAL. IN ½ MIN. EVERY 8 HRS.
AIR (SCUFT/MIN.)	—	—	—	—	—	—	—	—	—
PRESSURE (PSIG)	0.0	15.0	5.0	0.0	15.0	15.0	15.0	15.0	15.0
TEMPERATURE (°F)	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0
WATER (LBS/HR)	232 LBS. IN 2 MINUTES	232 LBS. IN 2 MINUTES	409.8 LBS. FOR EACH 8 HRS.	409.8 LBS. FOR EACH 8 HRS.	→	6 LBS. IN ½ MIN. FOR EVERY 8 HRS.	209 LBS. IN 2½ MINS.	209 LBS. IN 2½ MINS.	6 LBS. IN ½ MIN. EVERY 8 HRS.
SOLIDS SUSPENDED (LBS/HR) / SOLIDS DISSOLVED (LBS/HR)	43 LBS. IN 2 MINUTES	43 LBS. IN 2 MINUTES	[illegible] / —	[illegible] / —	→ / —	[illegible] / —	— / —	— / —	[illegible]
CEMENT (LBS/HR)	300 LBS. IN 2 MINUTES	300 LBS. IN 2 MINUTES	12.8 LBS. EVERY 2 MINS. IN EACH 8 HRS.	12.8 LBS. EVERY 2 MINS. IN EACH 8 HRS.	→	6 LBS. IN ½ MIN. EVERY 8 HRS.	—	—	6 LBS. IN ½ MIN. EVERY 8 HRS.
Na SALTS (LBS./HR)	158 LBS. IN 2 MINUTES	158 LBS. IN 2 MINUTES	—	—	—	—	—	—	—
OTHER SALTS (LBS./HR.)	5 LBS. IN 2 MINUTES	5 LBS. IN 2 MINUTES	—	—	—	—	—	—	—
LINE VELOCITY (FT/SEC)	(E) 3.6	(E) 3.6	(D) 13.2	(E) 3.6	(E) 3.6	(F) 0.75	(4) 3.4	(4) 3.4	(F) 0.75



* Detail breakdown of evaporator bottom, for each waste stream, is available in Westinghouse R/D Report No. [illegible] dated [illegible]

** This is based on batch waste transfer at 40 gpm and 2" line

[illegible]

GENERAL NOTE: The Cement Solidification operation is batch. All the above flow rates are totalized/averaged out [illegible] hour or one set or one minute whatever the unit time may be of operation.

NOTE 1: All the flow rates for these streams are based on a recirculation rate of 30 gpm.

10C	11A	11B	11C	12A	12B	12C	13A	13B	13C	14A	14B	14C	15A	15B	15C	16A	16B	16C	17A	17B	17C	18A
SAME AS 9C	ADDITIVE FOR RESIN SLURRY	ADDITIVE FOR URANYL NITRATE	ADDITIVE FOR EVAPORATOR BOTTOM	ADDITIVE FOR RESIN SLURRY	ADDITIVE FOR URANYL NITRATE	ADDITIVE FOR EVAPORATOR BOTTOM	RESIN SLURRY FEED TO 1st MIXER	FILTER MEDIA FEED TO 1st MIXER	EVAPORATOR BOTTOM FEED TO 1st MIXER	ADDITIVE FOR RESIN SLURRY	ADDITIVE FOR FILTER MEDIA SLURRY	ADDITIVE FOR EVAPORATOR BOTTOM	ADDITIVE FOR RESIN SLURRY	ADDITIVE FOR FILTER MEDIA SLURRY	ADDITIVE FOR EVAPORATOR BOTTOM	RESIN SLURRY FEED TO 2nd MIXER	FILTER MEDIA FEED TO 2nd MIXER	EVAPORATOR BOTTOM FEED TO 2nd MIXER	CEMENT FEED FOR RESIN SLURRY	CEMENT FEED FOR FILTER MEDIA	CEMENT FEED FOR EVAPORATOR BOTTOM	CEMENT FEED FOR RESIN SLURRY
50669	—	26.7 OF 50 W/O NaOH	—	—	26.7 OF 50 W/O NaOH	—	1156.67	1018.6	1269.5	—	—	—	—	—	—	1156.67	1018.6	1269.5	954.95	1075.6	815.95	954.95
4200.0	—	2.11	—	—	2.11	—	115.75	106.5	105.1	—	—	—	—	—	—	115.75	106.5	105.1	76.4	86.1	65.5	76.4
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—
15.0	—	5.0	—	—	5.0	—	15.0	15.0	15.0	—	—	—	—	—	—	15.0	15.0	15.0	0.0	0.0	0.0	0.0
77.0	—	77.0	—	—	77.0	—	77.0	77.0	77.0	—	—	—	—	—	—	77.0	77.0	77.0	77.0	77.0	77.0	77.0
22801	—	13.35	—	—	13.35	—	861.72	763.95	570.5	—	—	—	—	—	—	861.72	763.95	570.5	—	—	—	—
61800 / 13488	— / —	— / 13.35	— / —	— / —	— / 13.35	— / —	294.95 / —	254.65 / —	101.35 / 591.65	— / —	— / —	— / —	— / —	— / —	— / —	294.95 / —	254.65 / —	101.35 / 591.65	— / —	— / —	— / —	— / —
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	954.95	1075.6	815.95	954.95
27145	—	—	—	—	—	—	—	—	680.85	—	—	—	—	—	—	—	—	680.85	—	—	—	—
725	—	—	—	—	—	—	—	—	18.165	—	—	—	—	—	—	—	—	18.165	—	—	—	—
(A) 6.15	—	(B) 0.9	—	—	(B) 0.9	—	(A) 6.15	(A) 6.15	(A) 6.15	—	—	—	—	—	—	(A) 6.15	(D) 6.15	(A) 6.15	(C) 0.24	(C) 0.24	(C) 0.24	(C) 0.24

30	31	32	33	34	35	36A	36B	37	38	39	40	41	42	3B	43	15D OR 16D	19D OR 20D	17D OR 18D		44	45	46
CEMENT AIR FLOW TO DAY BIN	AIR RETURN TO SILO FILTER	CEMENT FOR CONVEYING	AIR FOR CONVEYING	COMPRESSOR AIR IN TAKE	AIR CEMENT LOADING TO SILO	AIR DISCHARGE FOR CONVEYING	AIR DISCHARGE FOR SILO FILLING	SETTLING PUMP SUCTION	EQUIP'T. DRAINS TO TD-13	TD-13 DISCHARGE TO LOW/HIGH PROCESSING	FLUSH-WATER PUMP SUCTION	FLUSH-WATER IN	DRUM DECON TO TD-13	ZEOLITE SLURRY	MAX WATER ADDED FOR RECEIPE ADJUSTMENT	U-NITRATE FEED TO MIXERS	SOLIDIFIED U-NITRATE PRODUCT	CEMENT TO U-NITRATE SOLIDIFICATION		SETTLING TANK VENT	F.W. TANK VENT	W.D. V. VENT
1448.6 LBS. IN 5 MINS.	38.6015 LBS. IN 5 MINS.	1410 LBS. IN 5 MINS.	386 LBS. IN 5 MINS.	386 LBS. IN 5 MINS.	240420 LBS. IN 5 HRS.	38.60 LBS. IN 5 MINS.	14820 LBS. IN 5 HRS.	256 LBS. IN 7½ MIN. EVERY 8 HRS.	—	137.6	418 LBS. IN 5 MINS.	833 LBS. IN 10 MINS.	137.6	12,924.5	574.5	1255.75	2472	1196.51		3.19	6.11	4.56
2175 GALS. IN 5 MINS.	3199.2 GALS. IN 5 MINS.	112.2 GALS. IN 5 MINS.	1240.4 GALS. IN 5 MINS.	3773.3 GALS. IN 5 MINS.	358836 GALS. IN 5 HRS.	3773.3 GALS. IN 5 MINS.	1458600 GALS. IN 5 HRS.	2 GALS. IN 7½ MIN. EVERY 8 HRS.	—	16.2	8.0 GPM FOR 5 MINS.	8.0 GPM FOR 10 MINS.	16.2	1520.5	69.0	109.5	156	95.36		—	—	—
101 (505 SCFT IN 5 MINS.)	101 (505 SCFT IN 5 MINS.)	—	101 (505 SCFT IN 5 MINS.)	←	650.0	101.0	650.0	—	—	—	—	—	—	—	—	—	—	—		0.7	1.36	1.0
12.5	0.0	0.0	30.0	0.0	12.5	0.0	0.0	0.0	—	15.0	0.0	5.0	3.0	15.0	15.0	15.0	13.0	0.0		0.0	0.0	0.0
60.0	60.0	60.0	60.0	60.0	60.0	60.0	60.0	77.0	—	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0	77.0		60.0	60.0	60.0
—	—	—	—	—	—	—	—	12 LBS. IN 7½ MIN. EVERY 8 HRS.	—	137.24	418.0	833.0	137.24	12,334.5	574.5	834.1	834.1	—		—	—	—
— / —	— / —	— / —	— / —	— / —	— / —	— / —	— / —	[illegible] / —	—	0.32 / 0.02	— / —	— / —	0.32 / 0.02	590.0 / —	— / —	— / 419.65	— / 419.65	— / —		— / —	— / —	— / —
1410 LBS. IN 5 MINS.	.0015 LBS. IN 5 MINS.	1410 LBS. IN 5 MINS.	—	—	225600 LBS. IN 5 HRS.	—	—	12.8 LBS. IN 7½ MIN. EVERY 8 HRS.	—	0.16	—	—	0.16	1910.0	—	—	1194.55	1194.55		—	—	—
—	—	—	—	—	—	—	—	—	—	0.02	—	—	0.02	—	—		—	—		—	—	—
—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	419.65 OF U-NITRATE	419.65 OF U-NITRATE	—		—	—	—
(G) 38.19	(H) 66.72	(I) 0.13	(J) 21.8	(K) 66.6	(L) 2693	(M) 4.38	(N) 28.0	(O) 0.35	—	(P) 1.42	(+) 3.4	(G) 8.1	(P) 1.42	* * 3.4	(+) 2.9	(A) 6.15	(D) 13.2	(C) 0.24		(R) 2.52	(S) 4.83	(T) 2.18

PARTS LIST

FOR West Valley Nuclear Services Co., Inc.
West Valley, New York

TOLERANCES - DO NOT SCALE

CSS
PROCESS FLOW DIAGRAM

DWG NO 900E-587

8611210386-01

Figure 6.4.1-1

G.5.0 CSS FACILITIES DESIGN

G.5.1 SUMMARY DESCRIPTION OF THE CSS

G.5.1.1 LOCATION AND FACILITY LAYOUT

The CSS is located in the 01-14 Building. Figure G.5.1-1 presents the location of this building in relation to the rest of the WVDP site. The radioactive operations of the CSS will be confined to three areas of the building; the Waste Dispensing Cell (WDC), the process room and the filled Drum Storage and Loadout Area. CSS operations conducted on the second floor (35.5 m elevation) outside the WDC and operations in the clean Drum Storage Area will be nonradioactive.

G.5.1.2 PRINCIPAL FEATURES OF THE CSS

The site boundary, exclusion area, restricted area and site utility supplies are presented in Section B.5.1.2 (Volume II). CSS utility supplies, electrical, compressed air, and water will be directed from the main plant systems (Section G.5.4). The stack for the 01-14 Building HV System will be located on top of the 01-14 Building.

G.5.2 THE CSS BUILDING

G.5.2.1 STRUCTURAL SPECIFICATIONS

G.5.2.1.1 Building Modifications

The following major modifications were made to the 01-14 Building to prepare it for installation of the CSS:

- o Pump niches removed;

- o Ground floor slabs removed and replaced with a thicker slab in the Process Room;

- A 0.35 m thick concrete shield wall added between the support columns of the east and south walls of the Process Room;

- Relocated stairway between the first and second floor;

- A concrete shield wall 0.46 m thick at the base narrowing to 0.36 m added to the south end of the existing stairwell;

- Added an internal 0.61 m thick shield wall to the Waste Dispensing Cell;

- Standard steel under the second floor reinforced; 0.15 m of concrete shielding added to the floor;

- Metal building and steel supports added to the south side of the 01-14 Building for the concrete storage silo; and

- Metal building added to the east side of the 01-14 Building to house t e Motor Control Center.

- Added an airlock on the north side of the Waste Dispensing Cell for personnel entry.

- Added a 0.3 m thick shield wall to the west end of the Drum Storage/Loadout Area.

- Added a truck pad outside the west end of the Drum Storage/Loadout Area.

- Added an airlock on the west end of the Drum Storage/Loadout Area for personnel entry.

The design basis for these modifications are presented below.

Design Considerations

The following load conditions were considered in modifying the 01-14 Building:

- o Dead load;

- o Live load;

- o Wind velocity of 160 km/hr; wind loads for silo supports per ANSI A58.1 importance factor of 1.0;

- o Snow load of 1.9 KPa; and

- o Seismic loads for shield walls per UBC Zone III, importance factor of 1.5 (horizontal loads only). Seismic loads for silo and equipment supports have not been considered.

Applicable Codes and Specifications

Reinforced concrete design per American Concrete Institute (ACI) 318-71; structural steel design is per American Institute of Steel Construction (AISC), Eighth Edition; all structural steel welding is per American Welding Society (AWS) D1.1; maximum allowable soil bearing stress of 240 KPa. Maximum stresses for load combinations of steel and concrete design are per AISC and ACI codes respectively.

G.5.2.2 LAYOUT OF THE CSS

The layout of equipment and facilities associated with the CSS is given in Figures G.5.2-1 through G.5.2-6. Figures G.5.2-1 through G.5.2-4 give the general arrangements of equipment and facilities on the first through fourth floors and Figures G.5.2-5 and G.5.2-6 show these facilities by elevation. The equipment mentioned in this section is more fully described in Section G.6.0.

G.5.2.2.1 Radioactive Operations

Radioactive operations will be confined to the Waste Dispensing Cell, the Process Room, and the filled Drum Storage Area. All three areas are maintained at a negative pressure in relation to clean process areas by the 01-14 Building Ventilation System described in Section G.5.4.1. Liquid spills in these areas will be collected in one of three sumps and pumped to a hold tank buried in the ground north of the building for sampling and subsequent treatment. In the short term, treatment will be in the existing LLWTF. Treatment will be transferred to the LWTS once it becomes operational.

The Waste Dispensing Cell contains the Waste Dispensing Vessel, the resin dewatering pump, and two sump pumps on the 98-ft elevation. The basic functions of this vessel is to feed radioactive waste to the cement mixers and to dewater ion exchange resins.

The Process Room contains the Waste Dispensing Pump, the two High-Shear Mixers, the Drum Fill Head, the Cement Removal Pump, the Dump Tank Pump, the Drip Pan/Dump Tank Assembly, the empty Drum Air Lock, the Drum Lid Removal Crane, the Drum Capper, the Drum Smear Station, the Drum Overpack Station and the Waste Dispensing Vessel sample valve. This equipment is designed to sample the liquid waste streams, mix low-level radioactive waste with cement, fill 269-L drums, cap the drums, survey the drums for contamination, weight drums, overpack drums (if necessary), and label drums.

Immediately to the west of the process room is the Drum Shielded Area (DSA) which is used to house the drums received from the CSS during handling operations. This is part of the RTS Drum Loadout Facility which also consists of the Drum Loadout Handling and Monitoring Equipment (DLH/ME) and the Drum Transporter (DT).

The DLH/ME consists of a conveyor, crane, drum handling equipment, overpacks, shields, smear station, overpack station, CCTV system, swipe tools, associated instrumentation, controls, etc. used to handle, monitor, and remove the drums.

The DT consists of a shield (transporter cask), truck and drive vehicle to transport the drums from the Drum Shielded Area to the Drum Cell.

G.5.2.2.2 Nonradioactive Operations

Nonradioactive (clean) operations will be conducted on the second floor (elevation 116.5 ft) and in the clean drum storage area. These areas are maintained at a higher pressure than the Waste Dispensing Cell or the Process Room by the 01-14 Building Ventilation System described in Section G.5.4.1.

The second floor contains the gravimetric cement feeder which is used to feed cement to the waste encapsulation system in the Process Room. Also located on the second floor is the 01-14 Building HV System inlet air heater (discussed in Section G.5.4) and all the solenoid valves controlling the air flow to the process equipment and valves.

The clean Drum Storage Area contains the empty Drum Storage Conveyor, the empty Drum Entrance Conveyor, the Swipe Station Operating Area and the Hydraulic System. This equipment feeds empty drums to the process and provides a shielded area for an operator loading the empty drum conveyors.

The building housing the clean drum storage area also houses all the control panels required to operate the CSS. Located above the building on a steel platform is the Cement Bulk Storage Silo and transfer equipment required to supply cement to the Gravimetric Feeder.

G.5.3 CSS SUPPORT SYSTEMS

G.5.3.1 DEVELOPMENT OF SUPPORT REQUIREMENT FOR THE CSS

G.5.3.1.1 Building Ventilation

The 01-14 Building HV S,stem (fully described in Section G.5.4.1) is designed to maintain a constant air flow from clean areas with higher potential for contamination. The air is filtered through two stages of HEPA filters to remove contaminants before it is released from a stack.

Areas of potential higher contamination are kept at a lower pressure than clean areas to ensure an air flow in the proper direction through ventilation ducts and controlled leakage through air locks. To prevent backflow into clean areas ducts are fitted with dampers that automatically close when the pressure differential between different areas drops below a set value. A minimum pressure differential of 1.3 cm w.c. is maintained between routinely occupied areas and potentially contaminated cell areas.

The exhaust blower that maintains the negative pressure is backed up with a diesel-powered blower that automatically takes over if the primary blower fails.

G.5.3.1.2 Emergency Power

Approximately 28 KVA and 73 kW at 480V, 3-phase, is required for approximately fifteen minutes to dump and flush the mixers.

The most severe consequence of a power failure would be the possible solidification of a cement/waste batch in a mixer (see Section G.5.4.2). Replacing the mixer would cause a period of lost production and exposure to maintenance personnel doing the work, but neither loss of power nor replacement of the mixer would result in a breach of containment and release of contamination into the environment.

G.5.3.1.3 Monitoring System

The CSS will have a Radiation Monitoring System to measure radiation levels and airborne contamination in various locations in the 01-14 Building. Monitors will alarm both locally and in the control room to alert operators of hazardous conditions.

G.5.4 DESCRIPTION OF SERVICE AND UTILITY SYSTEM

G.5.4.1 01-14 BUILDING HEATING AND VENTILATION SYSTEM

Redispersed contamination, contamination resulting from maintenance activities, and contamination present in cells and pump niches, are the sources of airborne radioactive materials for the 01-14 Building. The 01-14 Building HV System is designed to prevent airborne contamination in routinely occupied operating aisles by routing ventilation air from areas of low contamination potential to areas of higher contamination potential. There are at least seven air changes per hour in all potentially contaminated areas of the building. A minimum differential pressure of 1.3 cm w.c. is maintained between routinely occupied areas and potentially contaminated cell areas. Except for air infiltration, inlet air is filtered and, if necessary, heated for personnel comfort.

Control of contamination within designated areas is accomplished by maintaining these areas at a negative pressure relative to clean areas. Air locks provide for entry into the contaminated areas and assure that the negative pressures are maintained and ventilation flow continues from the clean areas to the contaminated areas.

A pressure differential indicator that opens a butterfly valve controls the ventilation interfaces between the clean areas and cells. During normal operation air flows through a filter into the cell. If the pressure differential between the cell and the clean area falls below the set point, the valve closes to isolate the cell from the clean operating aisle. Filtered supply air is introduced into the stairwells, air locks, control room, and clean Drum Storage Area. Transfer grills between the stairwells and the operating areas are protected by fire dampers. Sixty-eight m^3/min of ventilation air in the operating aisles is routed directly to a roughing and HEPA filter in series. The balance of the supply air plus planned infiltration is drawn into the process cells. The building ventilation balance is shown below (in m^3/min).

	Intake	Exhaust
Filtered Supply Air	238	
CTS/01-14 Building Trench	17	
Air Infiltration	20	
Operations Aisle Exhaust		
Roughing and HEPA Filters		68
Process Room Exhaust		207
TOTAL	275	275

Ventilation air leaving the process cells will be filtered by six parallel sets of two HEPA filters in series located on the third floor of the building. Each stage of filters is sized to allow one filter to be shut off for changing without overloading and remaining filters. The ventilation air then flows to two ventilation exhaust fans located on the fourth floor of the building. One fan is powered by an electric motor; the other is a diesel-driven backup fan designed to start automatically under the following conditions:

- o Loss of suction pressure,
- o Slow speed of electric motor (as indicated by a zero speed switch), and
- o Loss of electrical power

All HV system components are designed to be maintained in areas free of airborne or surface contamination. Permanent or temporary air locks will maintain proper air flow during maintenance operations involving the pump niche, Waste Dispensing Cell, or CSS Process Room.

During shutdown of the supply air system for regular maintenance or because of failure, gravity dampers in the clean Drum Storage Room will open and allow outside air to enter the area and the CSS Process Room. Air infiltration and induced air flow through the air supply unit will provide air for the Off-Gas Cell.

G.5.4.1.1 Major Components and Operating Characteristics

Air Supply System

The Air Supply System consists of an air inlet damper, preheat coil with bypass damper, prefilter, reheat coil, blower, ductwork, and controls. The system is designed to maintain a 21°C inside air temperature with a design outdoor dry bulb (DB) temperature of -29°C. The unit is sized to deliver 238 m^3/min of heated and filtered air to the building.

Air is distributed from the supply to the stairwells and operating areas through galvanized steel ductwork sized and constructed according to standards of the American Society of Heating, Refrigerating and Air-Conditioning Engineers (ASHRAE).

Ductwork

Except for the supply air ductwork, all metal components that come into contact with the process ventilation air are constructed of either 304 or 304L stainless steel. Potentially contaminated ductwork is completely contained within the process cells.

Filters

The portion of the ventilation air flow which is not drawn into the process cells (68 m^3/min) is exhausted through two parallel sets of two filters in series (the first filter is a roughing filter and the second filter is a HEPA filter). Each filter is contained in individual filter housings located on the third floor of the 01-14 Building.

The air flow which has ventilated the process cells (207 m^3/min) is exhausted through six parallel sets of two HEPA filters in series. The first stage of HEPA filters is located in a glove box constructed of 1.3 cm stainless steel and provides for both containment of contamination and shielding to reduce radiation levels in the filter room. The second stage of filters is located in individual filter housings. Provisions have been made to DOP test the filters.

Process Cell Inlet Filters and Dampers

Except for design air infiltration through air locks and 17 m^3/min of air ventilating the CTS/01-14 Building Trench, all air enters the Process Cells through a filter and 0.2 m butterfly damper assembly. During normal operations, air flows through the filter and damper into the process room. In the event that the differential pressure between the Process Room Area and the Operating Aisle falls below 0.6 cm w.c., the damper will close to seal off the cell. If a cell of pump niche is opened for maintenance purposes the dampers will also close and allow more air to flow through the maintenance area.

Exhaust Fans

Two exhaust fans located on the fourth floor provide the system draft. Each fan is rated for 100 percent flow capacity of the HV system with all of the filters at the changeout pressure drop.

The main exhaust blower is driven by an electric motor. The second exhaust blower is driven by a standby diesel engine and serves as a backup during maintenance of the primary fan or under emergency conditions.

Both fans are equipped with suction and discharge dampers. The discharge dampers are used only during maintenance operations on the fans and are normally locked open; when a fan is on-line its suction damper is open. The fan and dampers are constructed of 304 or 304L stainless steel.

Discharge Ductwork

After the ventilation air has passed through the fan, it is routed to the stack on top of the 01-14 Building via a duct.

G.5.4.1.2 Safety Considerations and Control Interfaces Between Clean and Contaminated Areas

Designated areas are maintained at a lower negative pressure than clean areas to control contamination within them. Air locks provide for entry into the contaminated areas, assuring that the negative pressures are maintained and ventilation flow continues from clean to contaminated areas.

A pressure differential indicator operating a butterfly valve controls ventilation interfaces between the clean areas and cells. During normal operation air flows through a filter into the cell. If the pressure differential between the cell and the clean area falls below the set point, the valve closes to isolate the cell from the clean operating aisle. The dampers are designed to fail in the closed position in the event of loss of electrical power or loss of utility air pressure. The diesel-drive fan will automatically come on-line should electrical power be lost or the electric fan fail.

Air Supply Unit

The air supply system is designed so that on fan startup, the normally closed outdoor air damper will open fully. A room thermostat will modulate a normally open steam valve to maintain space temperature. A low-limit thermostat mounted in the discharge will override the space thermostat to maintain a minimum discharge temperature. An outside air thermostat, located in the outdoor air will modulate a normally open steam valve toward the open position as air temperature drops from 5.6° to 1.7°C. A discharge sensor mounted after the preheat coil will modulate the face and bypass dampers to maintain a 4.4°C discharge temperature. A freeze stat and a fire stat, located after the filter will stop the fan and sound an alarm when their set points are exceeded. On fan shutdown, the electric-pneumatic switch will turn off the main air supply to the system.

Exhaust Filters

All air leaving contaminated areas will be filtered by two sets of HEPA filters in series.

The first state HEPA filters will be enclosed within a glove box to provide contamination control during changeout. The existing glove box is constructed of a 1.3 cm steel plate that provides shielding to reduce radiation levels in the Changeout Room (not a normally occupied operating area). The second stage of HEPA filters is located in individual filter housings.

The differential pressure is measured across each filter holder in the 01-14 building HV system. Each filter holder also has a local low pressure alarm which sound a trouble annunciation in the Control Room. A high differential pressure alarm in the control room records the differential pressure across each bank of filters.

If a first-stage absolute filter fails, the activity and media will be caught on the second stage absolute filters. It is doubtful that a failure of this type would release any measurable activity. Failure of a second-stage filter would not be expected to result in a significant release of activity as the bulk of the entrained activity will be on the first-stage filters.

Fans

Two fans are provided for the Ventilation System. One is driven by an electric motor, the other by a diesel engine. Each fan is rated at 100 percent system capacity.

Under normal operating conditions, the electric driven fan is on-line. During maintenance of the electric fan or during any one of the following conditions, the diesel starting circuit will be energized and the diesel-drive fan brought on-line:

- o loss of site power for more than four seconds;
- o loss of suction pressure; and

- o slow speed of electrically driven fan as indicated by a zero speed switch located on the fan shaft.

The exhaust fans are controllable both from a locally mounted panel on the fourth floor and from the control room.

Once the diesel-driven fan has been started, only operator intervention can restart the electric fan.

Diesel fuel for the emergency diesel is supplied from a local 120-L day tank. The supply to the day tank is from the site Fuel Oil Storage Tank.

A pressure recorder and controller located in the Control Room controls the transfer from the electrically driven fan to the diesel driven fans. when the controller senses a loss of suction pressure, it closes the normally closed suction dampers of the electrically driven fan and opens the normally open suction damper to the diesel driven fan. At the same time it engages the starting circuit of the diesel fan. This arrangement of normally open/normally closed suction dampers allows the diesel fan to operate when there is a loss of electric power and utility air. The starting circuitry of the diesel fan is 12 volts DC supplied by batteries. An emergency power circuit operates a battery charger that maintains the battery at full charge.

G.5.4.2 ELECTRICAL

The Facility primary, secondary, and emergency power systems are described in Volume II of the SAR.

The power for the CSS is carried from the utility room approximately 9.1 m east of the 01-14 Building to a Motor Control Center (MCC) on the east end of the 01-14 Building. From the MCC, the power is distributed to CSS equipment and control panels through conduits embedded in the Process Room floor or running along the walls of the various areas. Normal electrical power requirements for operation of the CSS are 190 to 200 kW.

The CSS is designed so that all valves and equipment fail in a safe condition to prevent overfilling of vessels or otherwise spilling radioactive solutions. The severest consequence from a power failure would be the solidification of a cement/waste batch in one or both mixers. The mixer(s) would contain the solidified waste and contamination would not be released into the Process Room, but a loss of production, equipment, and unplanned maintenance exposure would result. The system would be shutdown to replace the mixer(s) in which the cement/waste mixture had solidified. This maintenance operation is a contact operation and would result in exposure to the maintenance personnel. The mixers are shielded to minimize such exposure.

The CSS is tied into the emergency power system to provide power to empty the mixers and bring the CSS to a safe shutdown condition. Approximately 28 KVA and 73 kW at 480V, 3-phase, would be required for approximately fifteen minutes to dump and flush the mixers.

G.5.4.3 COMPRESSED AIR

Utility air and instrument air are required in the CSS to operate instruments, control valves, and several air operated pumps. This air is supplied by the main plant systems which are described in Section B.5.4.3 of Volume II.

The CSS is designed to fail safe during a loss of air pressure. All valves in radioactive service fail closed to stop transfers of radioactive waste except the mixer discharge valves. This allows any waste/cement mix in the mixers to continue to flow to the drum at the fill station.

G.5.4.4 STEAM SUPPLY AND DISTRIBUTION

Steam is used in the CSS for heating the 01-14 Building and for heating the air from the CSS Vessel Off-Gas System prior to discharge through the HV filters. This steam will be supplied by the plan steam supply system which is discussed in Section B.5.4.4 of Volume II.

G.5.4.5 WATER SUPPLY

The plant water supply system and the plant demineralized water systems are described in Section B.5.4.5 of Volume II. Flushing and seal water for the Waste Dispensing Vessel Pump are the two primary requirements for plant water in the CSS. Flush water is used for periodic flushing of the mixers during normal operation and for pipeline and vessel flushing for maintenance purposes.

Deionized water is required in the CSS only to dilute, dissolve, or slurry chemicals in the Chemical Addition System and to flush the Waste Dispensing Vessel sample line. Failure of the Deionized Water System would have no safety impact.

G.5.4.6 COOLING WATER

Not applicable to this SAR.

G.5.4.7 SEWAGE TREATMENT

There are no sanitary facilities within the 01-14 Building. Operators will use facilities in the Main Process Building.

There are no chemical effluents from the CSS. The only liquid effluents are mixer flush water and ion exchange resin transport water, both of which will be discharged to the LLWTF in the near term. These liquids will be processed in the LWTS once this system becomes operational.

G.5.4.8 SAFETY COMMUNICATIONS AND ALARMS

The cement solidification system is provided with instrumentation to monitor flow, pressure, level, weight and temperature to ensure system operations are proceeding as expected and system limitations are not exceeded. The equipment is principally operated from control panels located in the Control Room. In the event of off-normal conditions, the process equipment can be manually shut off. Safety related systems such as the 01-14 Building HV System are designed to achieve a safety condition automatically should off-normal conditions occur (e.g., cell dampers close, diesel-drive fan starts). Automatic controls for the material handling subsystem and the cement storage and transfer subsystem are provided with manual override capabilities.

The CSS has instrumentation and controls that allow it to be started, operated, monitored, and shutdown from a remote-control area. The instrumentation indicates or alarms, or both indicates and alarms abnormal or undesirable conditions that could adversely affect system releases or equipment performance.

During emergency conditions, external communications will use the plant telephone system. There are no CSS process alarms at any locations other than the CSS Control Room. The Building HV System alarms sound in the Main Plant Control Room, and the fire alarms sound in the guard house.

G.5.4.9 FIRE PROTECTION SYSTEM

A fire in the CSS is considered highly unlikely. The Waste Dispensing Cell and the Process Room are constructed of concrete and steel, and the materials processed in the CSS are nonflammable. The only potential fire hazards are the electrical wire insulation in the building and the hydraulic oil in the material handling hydraulic system; neither is a high risk hazard.

The CSS has fire detection equipment, alarm systems, and suppression systems commensurate with its needs as determined by WVNS Radiation and Safety Group. Fire fighting procedures for the CSS will be per existing WVDP procedures.

G.5.4.10 MAINTENANCE SYSTEMS

The CSS has been designed as a contact maintenance Facility. All equipment not absolutely required in radioactive processing areas (such as solenoid valves on air lines) is located in clean areas for maintenance purposes. As much as practical, valves and pumps are separated from high radiation fields by distance and/or shield walls. All equipment and piping is remotely drainable and flushable to reduce radiation levels prior to manned entry. The High-Shear Mixers will be shielded to reduce radiation exposure to maintenance personnel if a mixer full of waste/cement mixture needs to be changed.

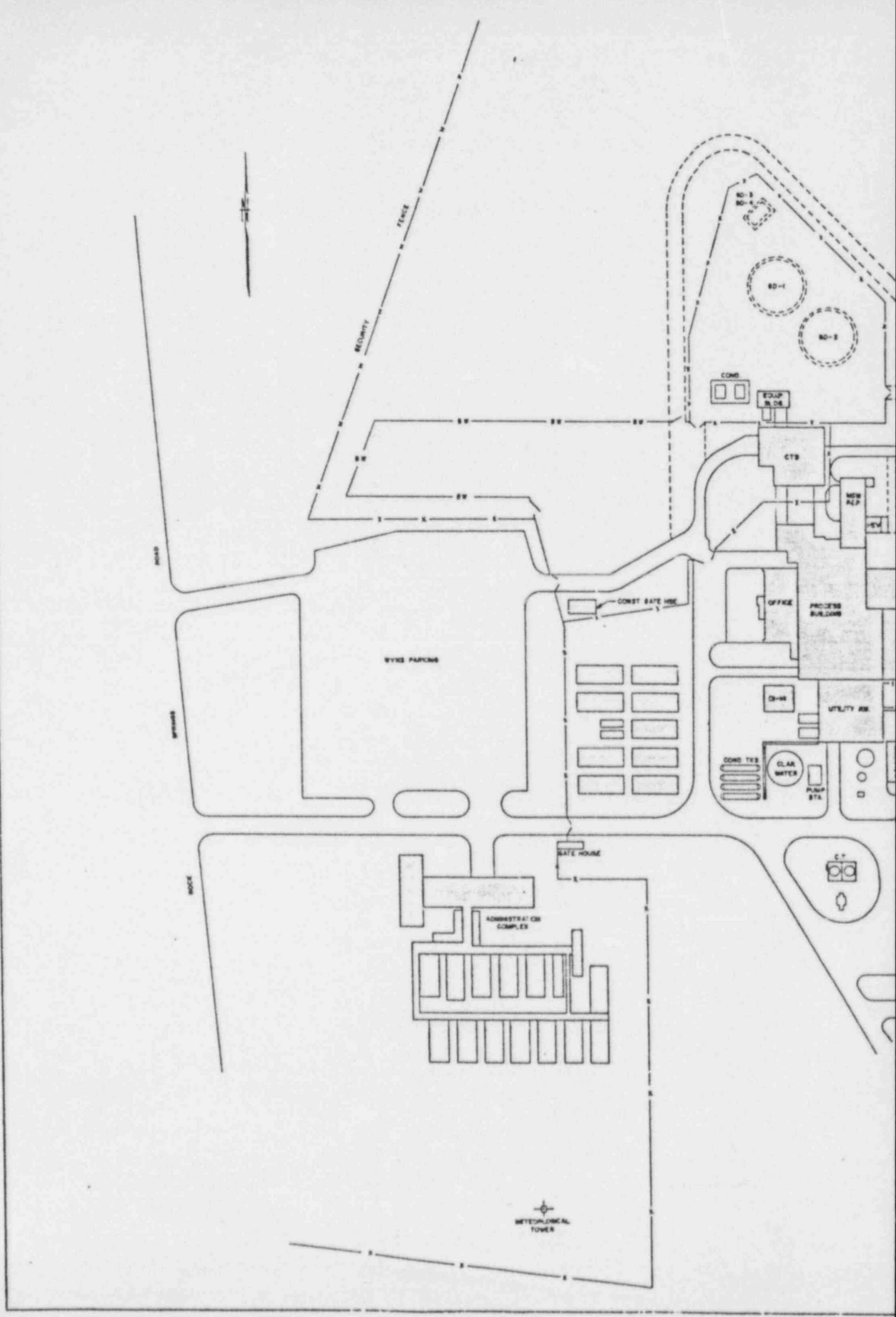
G.5.4.11 COLD CHEMICAL SYSTEMS

The CSS Cold Chemical Systems are described in Section G.6.1.1.1 under Chemical Additive Subsystem, G.6.1.1.3 Cement Transfer and Storage Subsystems, and G.6.3.1 Cold Chemical Receiving, Handling and Transfer.

TABLE G.5.4-1

CSS UTILITY REQUIREMENTS

1.72×10^5 Pa Steam	545 kg
Plant Water	132 L/min (intermittent)
Demineralized Water	1.9 L/min (intermittent)
Electrical Power	190 to 200 kW at 480V, 3-phase
Utility Air 3.8 m^3/min (continuous)	1.9 m^3/min (intermittent)
Instrument Air 0.71 m^3/min (continuous)	0.85 m^3/min (intermittent)



SECURITY
FENCE
ROAD
SPRINGS
ROCK
WVNS PARKING
CONST GATE HSE
COND
EQUIP BLDG
CTS
OFFICE
PROCESS BUILDING
UTILITY RM.
COND TKS
CLAR WATER
PUMP STA.
GATE HOUSE
ADMINISTRATION COMPLEX
METEOROLOGICAL TOWER

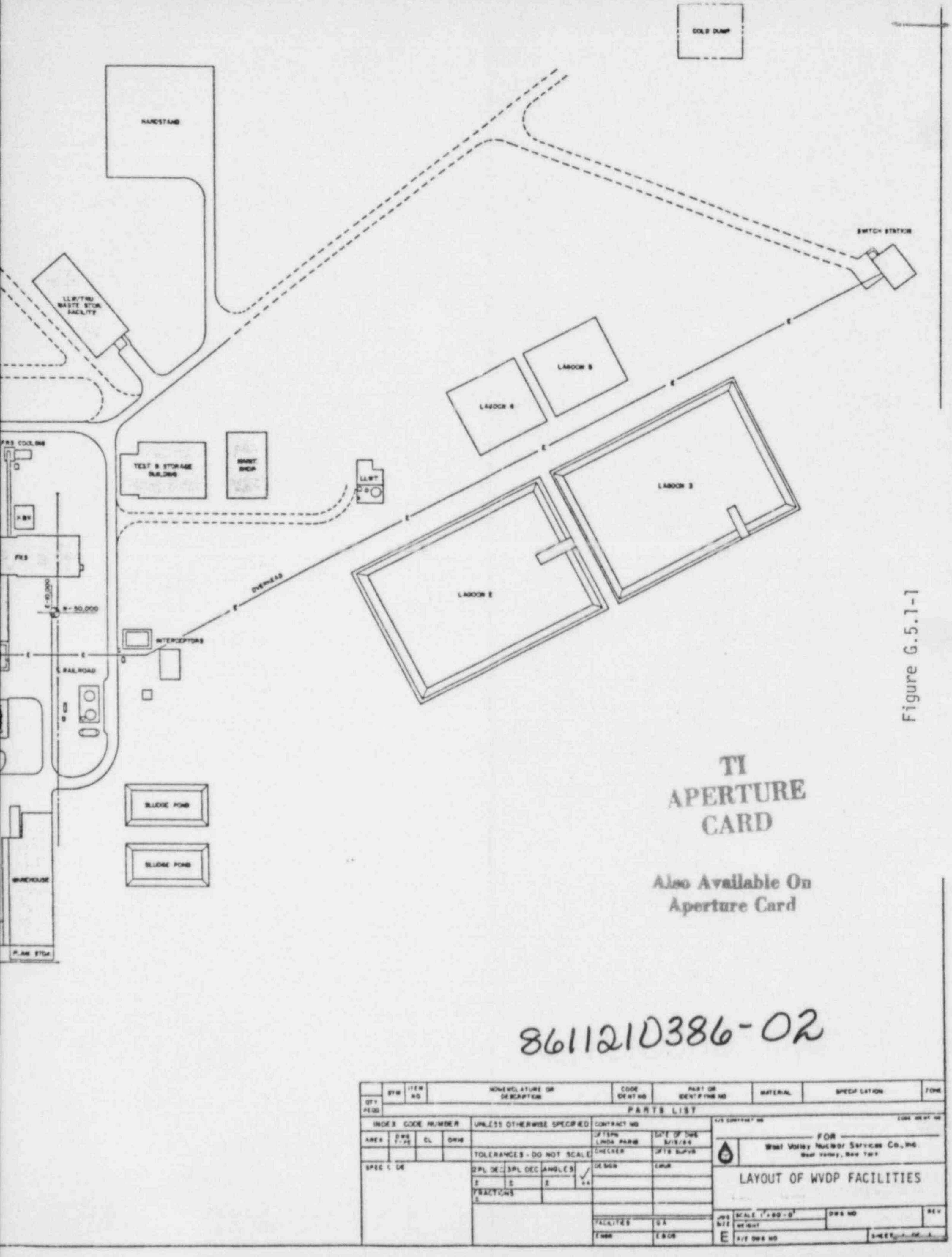


Figure G.5.1-1

TI
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CARD

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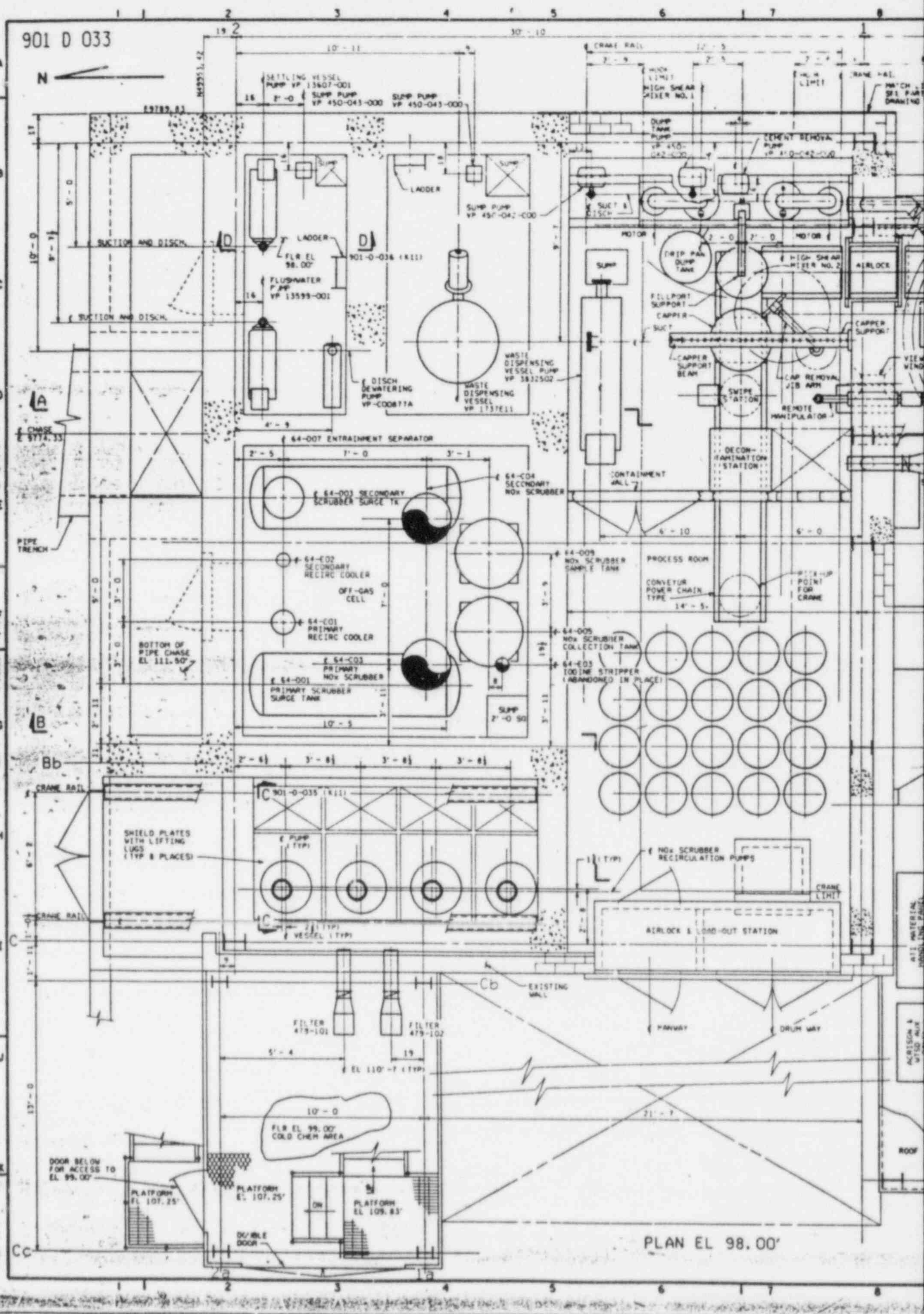
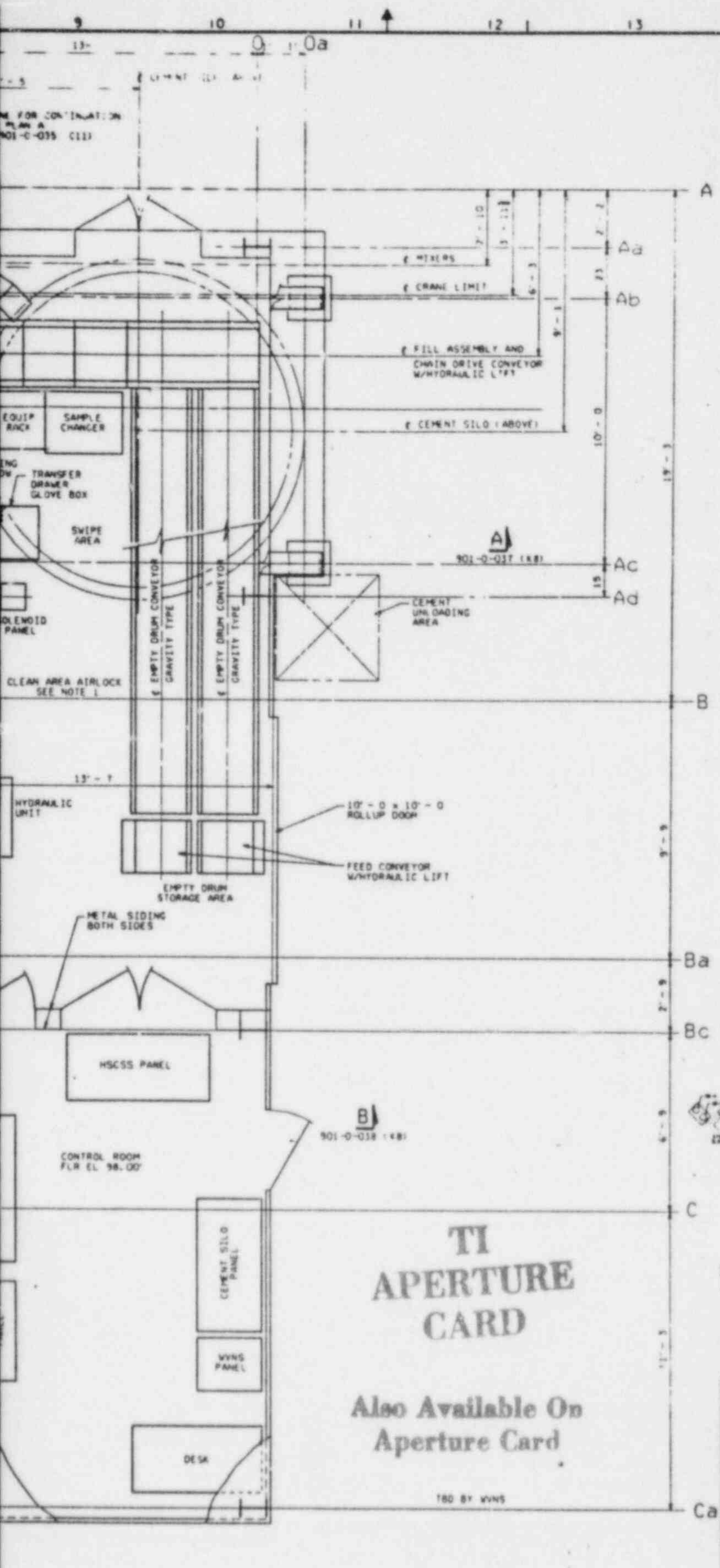
Aperture Card

8611210386-02


901 D 033
PLAN EL 98.00'
SETTLING VESSEL PUMP VP 13607-001
SUMP PUMP VP 450-043-000
LADDER
SUCTION AND DISCH.
FLUSHWATER PMP VP 13599-001
DISCH DEWATERING PUMP VP-C00877A
WASTE DISPENSING VESSEL PUMP VP 3832502
WASTE DISPENSING VESSEL
64-007 ENTRAINMENT SEPARATOR
64-D01 SECONDARY SCRUBBER SURGE TK
64-C04 SECONDARY NOx SCRUBBER
64-E02 SECONDARY RECIRC COOLER
OFF-GAS CELL
64-E01 PRIMARY RECIRC COOLER
64-C01 PRIMARY NOx SCRUBBER
64-001 PRIMARY SCRUBBER SURGE TANK
64-009 NOx SCRUBBER SAMPLE TANK
64-005 NOx SCRUBBER COLLECTION TANK
64-E03 IODINE STRIPPER (ABANDONED IN PLACE)
BOTTOM OF PIPE CHASE EL 111.50'
PIPE TRENCH
CRANE RAIL
SHIELD PLATES WITH LIFTING LUGS (TYP 8 PLACES)
NOx SCRUBBER RECIRCULATION PUMPS
AIRLOCK & LOAD-OUT STATION
PROCESS ROOM
CONVEYOR POWER CHAIN TYPE
CONTAINMENT WALL
DECON-TAMINATION STATION
SWIPE STATION
REMOTE MANIPULATOR
CAP REMOVAL JIB ARM
CAPPER SUPPORT BEAM
CAPPER
FILLPORT SUPPORT
DRIP PAN DUMP TANK
HIGH SHEAR MIXER NO. 1
HIGH SHEAR MIXER NO. 2
CEMENT REMOVAL PUMP
AIRLOCK
EXISTING WALL
FILTER 479-101
FILTER 479-102
MANWAY
DRUM WAY
FLR EL 99.00' COLD CHEM AREA
DOOR BELOW FOR ACCESS TO EL 95.00'
PLATFORM EL 107.25'
PLATFORM EL 109.83'
DOUBLE DOOR
ROOF

NO.	DATE	REVISION	DR	CH	APPROVED
B	4-4-85		CH		
C	10/29/86	GENERAL REVISION PER TA 347	DH		
0	12/5/86	ER 568			



TI APERTURE CARD

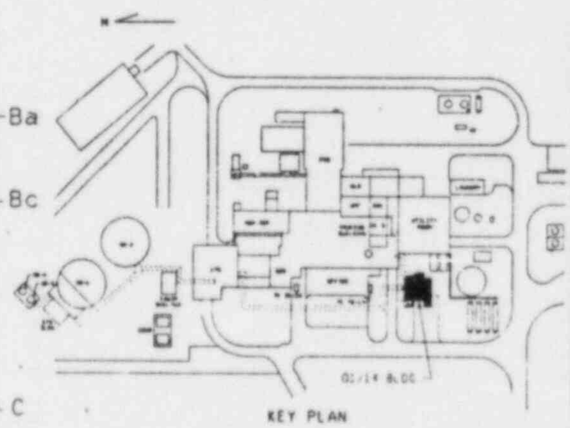
Also Available On Aperture Card

NOTES

1. THERE ARE TO BE NO RADIOACTIVE OPERATIONS IN THIS AREA.
2. THESE GENERAL ARRANGEMENTS 901-D-033 THRU 038 SUPERSEDE EBASCO GENERAL ARRANGEMENTS 901-C-030 THRU 032 IN THEIR ENTIRETY.

REFERENCE DRAWINGS

GENERAL ARRANGEMENT-01/14 BUILDING PLAN EL 116.50'	901-D-034
GENERAL ARRANGEMENT-01/14 BUILDING PLAN EL 130.00' & SECTIONS	901-D-035
GENERAL ARRANGEMENT-01/14 BUILDING PLAN EL 144.00' & SECTIONS	901-D-036
GENERAL ARRANGEMENT-01/14 BUILDING SECTIONS	901-D-037
GENERAL ARRANGEMENT-01/14 BUILDING SECTIONS	901-D-038



KEY PLAN

0 4 8' 3/8"=1'-0

8611210386-03

FOR DRAWING INDEX SEE DRAWING NO.

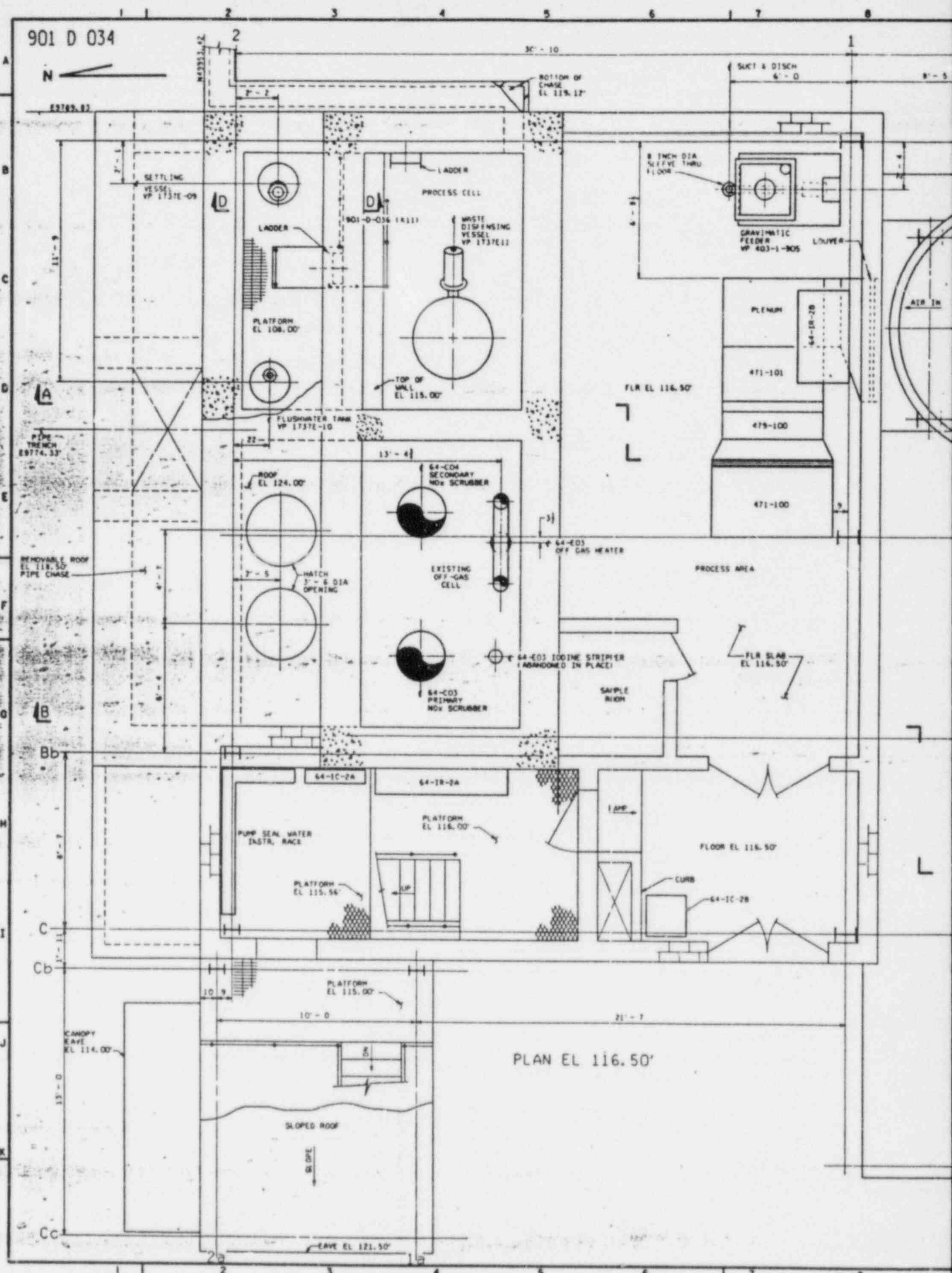
EBASCO SERVICES INCORPORATED
A/E O.F.S. NO. 2388 TASK ORDER 014
FOR
WEST VALLEY NUCLEAR SERVICES COMPANY, INC
WEST VALLEY, NEW YORK
WEST VALLEY DEMONSTRATION PROJECT

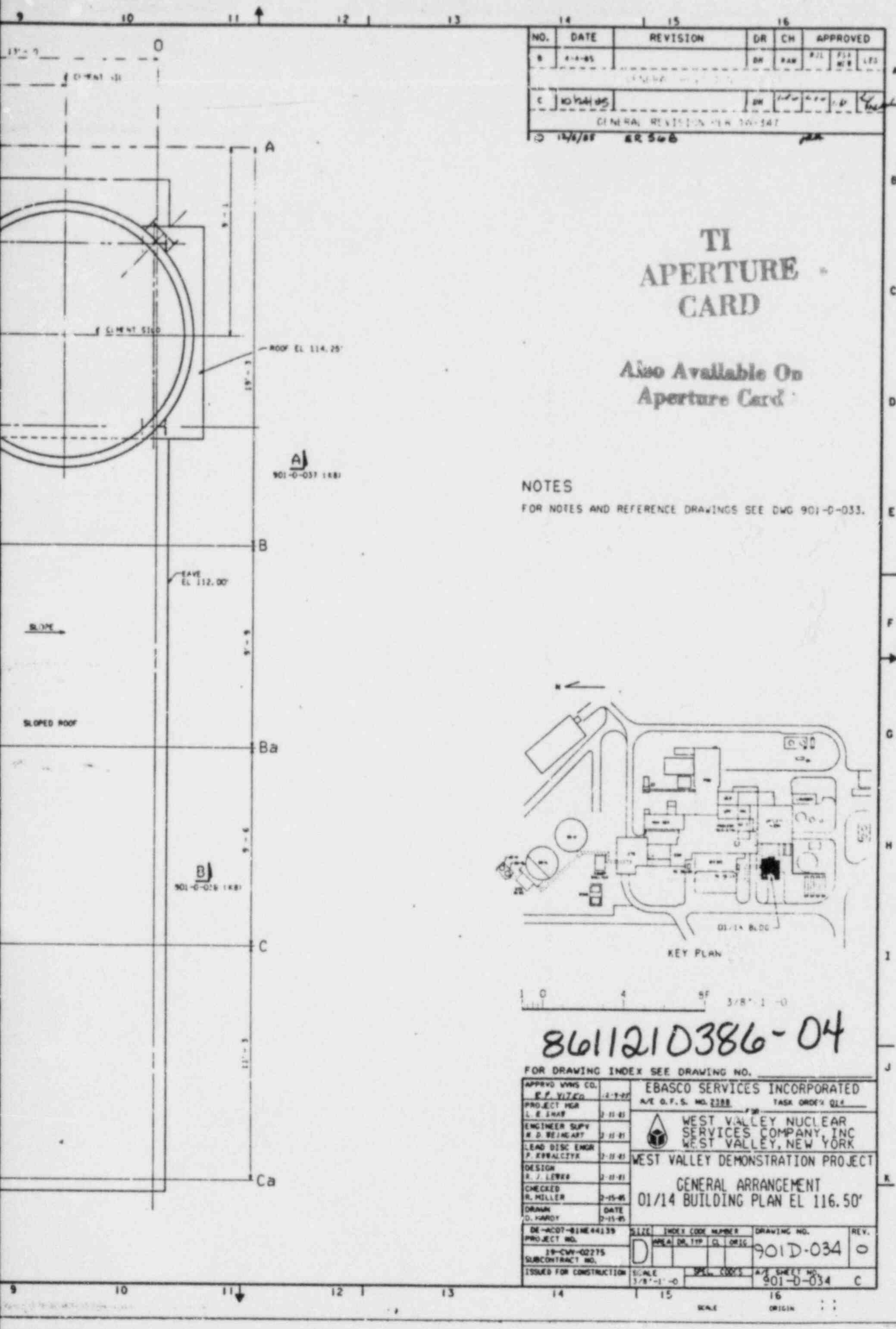
GENERAL ARRANGEMENT
01/14 BUILDING PLAN EL 98.00'

APPRVD WVNS CO.	
PROJECT MGR L. E. IHAB	2-11-85
ENGINEER SUPV R. D. REINHART	2-11-85
LEAD DISC ENGR F. KOWALCZYK	2-11-85
DESIGN R. J. LEWKO	2-11-85
CHECKED R. MILLER	2-15-85
DRAWN D. HARDY	2-15-85
06-ACOT-01NE44139 PROJECT NO.	
19-CVW-02275 SUBCONTRACT NO.	
ISSUED FOR CONSTRUCTION	

SIZE D | DRAWING NO. 901-D-033 | REV. 0
SCALE 3/8"=1'-0 | A/E SHEET NO. 901-D-033 C

FIGURE G.5.2-1

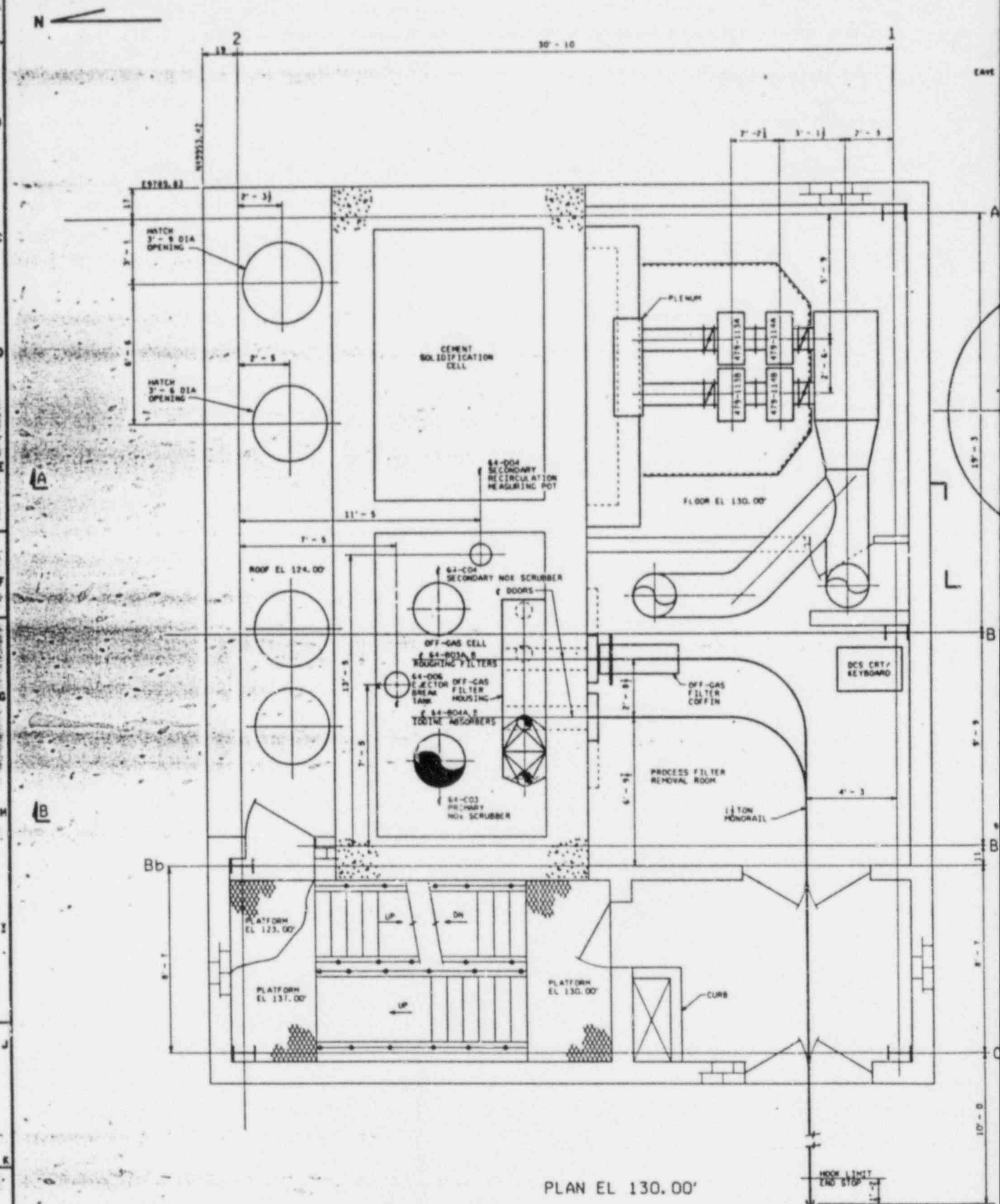

901 D 034
N
SETTLING VESSEL VP 1737E-09
PROCESS CELL
LADDER
WASTE DISPENSING VESSEL VP 1737E11
PLATFORM EL 108.00'
TOP OF WALL EL 115.00'
FLUSHWATER TANK VP 1737E-10
BOTTOM OF CHASE EL 115.17'
SUCT & DISCH
8 INCH DIA SLEEVE THRU FLOOR
GRAVIMATIC FEEDER VP 403-1-905
LOUVER
PLENUM
64-IR-2B
471-101
479-100
471-100
AIR IN
FLR EL 116.50'
PIPE TRENCH
ROOF EL 124.00'
64-C04 SECONDARY NOx SCRUBBER
64-E03 OFF GAS HEATER
EXISTING OFF-GAS CELL
HATCH 3'-6 DIA OPENING
REMOVABLE ROOF EL 118.50 PIPE CHASE
64-E03 IODINE STRIPPER (ABANDONED IN PLACE)
64-C03 PRIMARY NOx SCRUBBER
PROCESS AREA
FLR SLAB EL 116.50'
SAMPLE ROOM
64-IC-2A
64-IR-2A
PUMP SEAL WATER INSTR. RACK
PLATFORM EL 116.00'
PLATFORM EL 115.56'
UP
RAMP
FLOOR EL 116.50'
CURB
64-IC-2B
PLATFORM EL 115.00'
CANOPY EAVE EL 114.00'
PLAN EL 116.50'
SLOPED ROOF
SLOPE
EAVE EL 121.50'



NO. | DATE | REVISION | DR | CH | APPROVED
B 4-4-85
C 10/14/85 GENERAL REVISION PER
ROOF EL 114.25'
EAVE EL 112.00'
SLOPE
SLOPED ROOF
A
B
Ba
C
Ca
901-D-037 (K8)
901-D-036 (K8)
TI
APERTURE
CARD
Also Available On
Aperture Card
NOTES
FOR NOTES AND REFERENCE DRAWINGS SEE DWG 901-D-033.
01/14 BLDG
KEY PLAN
3/8"=1'-0
8611210386-04
FOR DRAWING INDEX SEE DRAWING NO.
EBASCO SERVICES INCORPORATED
WEST VALLEY NUCLEAR SERVICES COMPANY, INC
WEST VALLEY, NEW YORK
WEST VALLEY DEMONSTRATION PROJECT
GENERAL ARRANGEMENT
01/14 BUILDING PLAN EL 116.50'
DE-AC07-81NE44139 PROJECT NO.
ISSUED FOR CONSTRUCTION
DRAWING NO. 901D-034
REV. 0
A/E SHEET NO. 901-D-034 C

FIGURE G.5.2-2

901 D 035



PLAN EL 130.00'

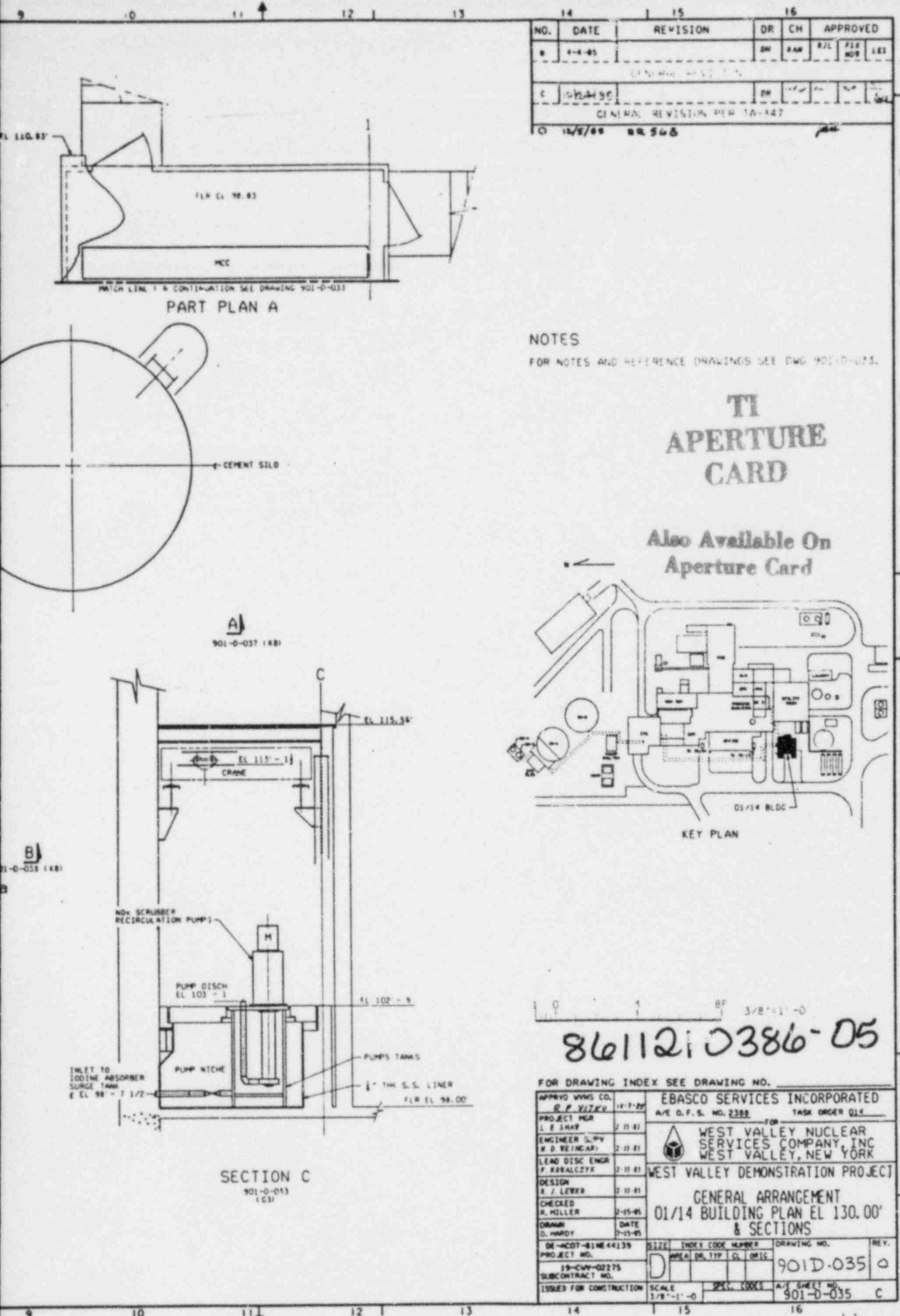
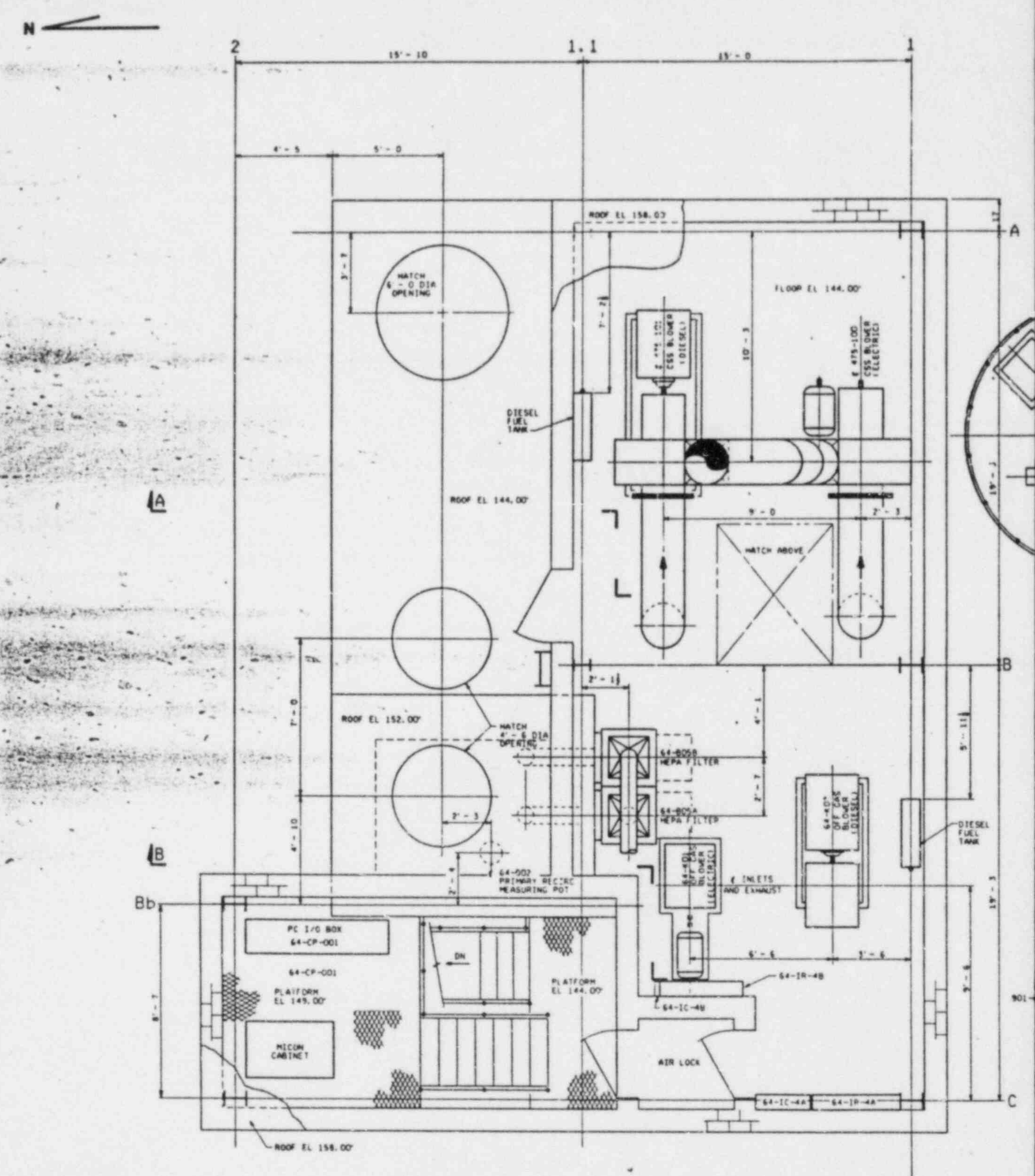

NO.
DATE
REVISION
DR
CH
APPROVED
GENERAL REVISION PER TA-347
PART PLAN A
FLR EL 98.03
MCC
CEMENT SILO
NOTES
TI
APERTURE
CARD
Also Available On
Aperture Card
EL 115.56'
CRANE
NOx SCRUBBER
RECIRCULATION PUMPS
M
PUMP DISCH
PUMP NICHE
PUMPS TANKS
INLET TO
IODINE ABSORBER
SURGE TANK
FLR EL 98.00'
SECTION C
01/14 BLDG
KEY PLAN
8611210386-05
FOR DRAWING INDEX SEE DRAWING NO.
EBASCO SERVICES INCORPORATED
WEST VALLEY NUCLEAR
SERVICES COMPANY, INC
WEST VALLEY, NEW YORK
WEST VALLEY DEMONSTRATION PROJECT
GENERAL ARRANGEMENT
01/14 BUILDING PLAN EL 130.00'
& SECTIONS
ISSUED FOR CONSTRUCTION
901D-035
901-D-035

FIGURE G.5.2-3

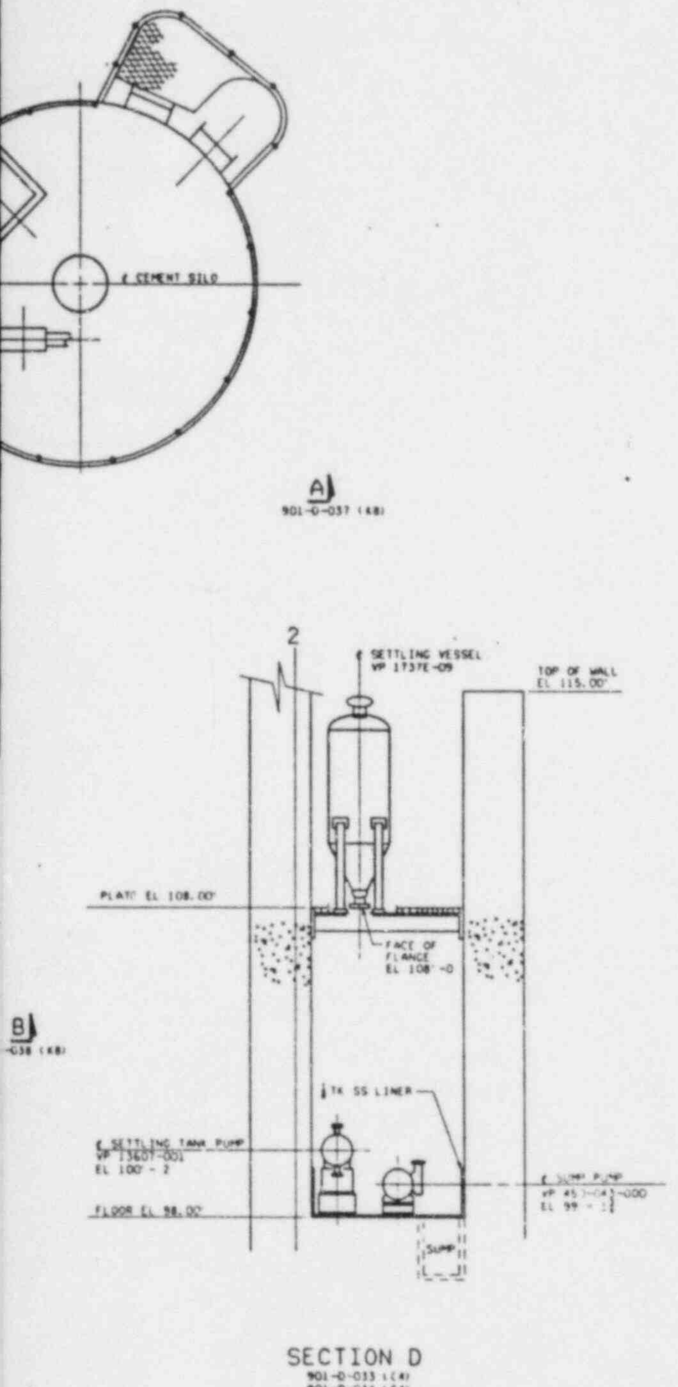
901 D 036



PLAN EL 144.00'

NO.	DATE	REVISION	DR	CH	APPROVED		
B	4-4-85		DH	RAM			
C		GENERAL REVISION PER TA-347	DH				

0 11/5/85 AR 508



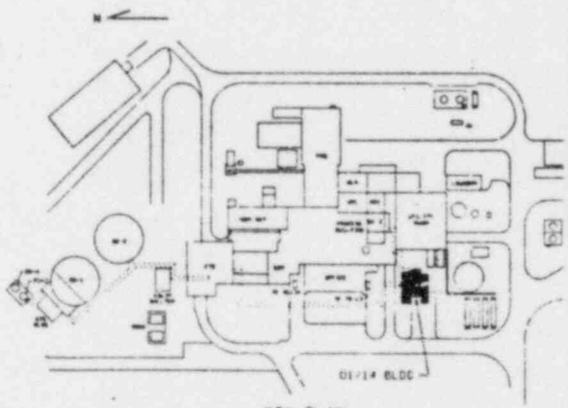
SECTION D
901-0-033 (C4)
901-0-034 (C4)

NOTES

FOR NOTES AND REFERENCE DRAWINGS SEE DWG 901-D-033.

TI APERTURE CARD

Also Available On Aperture Card



KEY PLAN

3/8"=1'-0

8611210386-06

FOR DRAWING INDEX SEE DRAWING NO.

APPRVD WVNS CO. R.P. VITKO	10-9-85
PROJECT MGR L.E. SHAW	2-11-85
ENGINEER SUPV W.D. WEINGART	2-11-85
LEAD DISC ENGR P. KOWALCZYK	2-11-85
DESIGN R.J. LEWKO	2-11-85
CHECKED R. MILLER	2-15-85
DRAWN D. HARDY	DATE 2-15-85
DE-AC07-81NE44139 PROJECT NO.	
19-CWV-02275 SUBCONTRACT NO.	
ISSUED FOR CONSTRUCTION	

EBASCO SERVICES INCORPORATED
A/E O.F.S. NO. 2388 TASK ORDER 014

FOR

WEST VALLEY NUCLEAR SERVICES COMPANY, INC
WEST VALLEY, NEW YORK

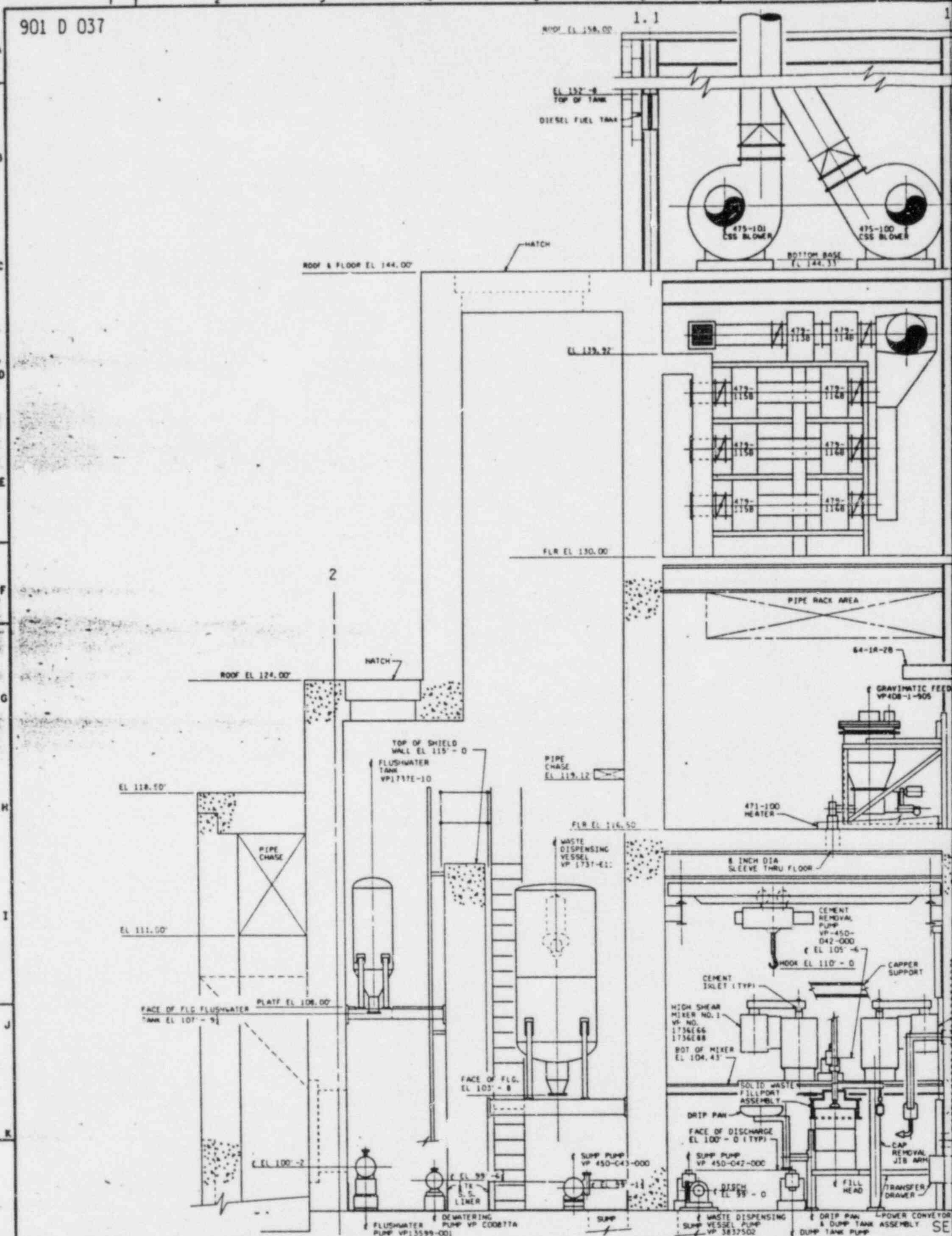
WEST VALLEY DEMONSTRATION PROJECT

GENERAL ARRANGEMENT
01/14 BUILDING PLAN EL 144.00'
& SECTIONS

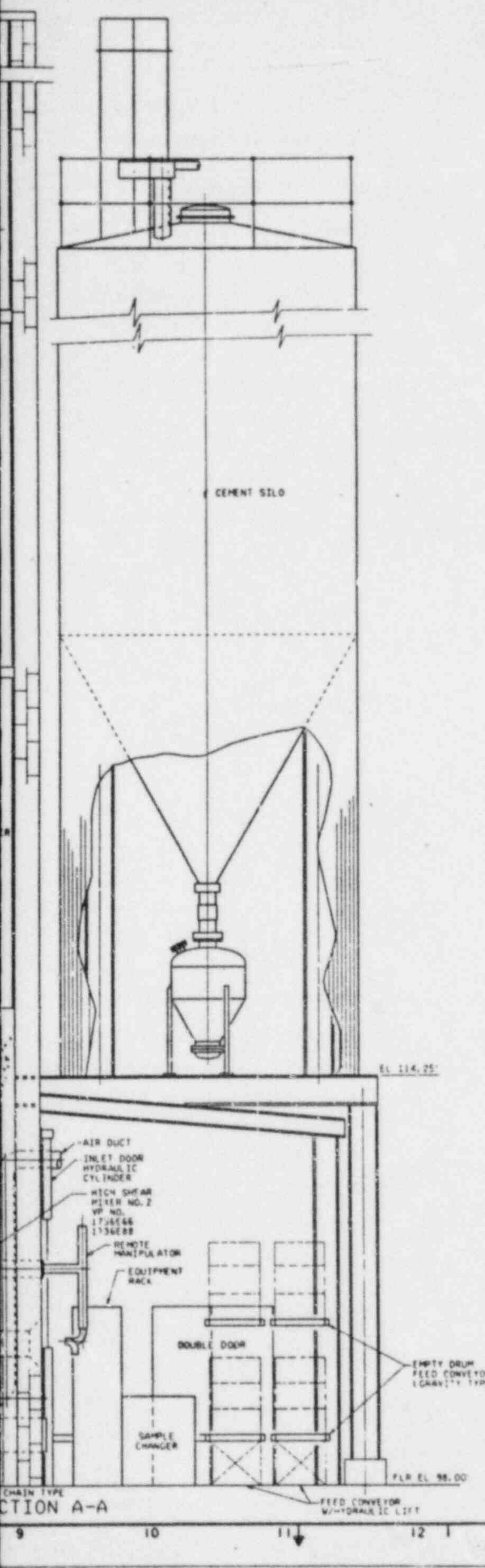
SIZE	INDEX CODE NUMBER	DRAWING NO.	REV.
D		901D-036	0
SCALE 3/8"=1'-0	SPEC. CODES	A/E SHEET NO. 901-0-036	C

FIGURE G.5.2-4

901 D 037



ROOF EL 158.00'
EL 152'-6 TOP OF TANK
DIESEL FUEL TANK
475-101 CSS BLOWER
475-100 CSS BLOWER
BOTTOM BASE EL 144.33'
HATCH
ROOF & FLOOR EL 144.00'
EL 139.92'
FLR EL 130.00'
PIPE RACK AREA
ROOF EL 124.00'
HATCH
GRAVIMATIC FEED
TOP OF SHIELD WALL EL 115'-0
FLUSHWATER TANK
PIPE CHASE
EL 118.50'
471-100 HEATER
FLR EL 116.50
WASTE DISPENSING VESSEL
8 INCH DIA SLEEVE THRU FLOOR
PIPE CHASE
CEMENT REMOVAL PUMP
EL 111.00'
HOOK EL 110'-0
CAPPER SUPPORT
CEMENT INLET (TYP)
HIGH SHEAR MIXER NO. 1
PLATF EL 108.00'
FACE OF FLG FLUSHWATER TANK EL 107'-9
BOT OF MIXER EL 104.43'
FACE OF FLG. EL 103'-8
SOLID WASTE FILLPORT ASSEMBLY
DRIP PAN
FACE OF DISCHARGE EL 100'-0 (TYP)
SUMP PUMP VP 450-042-000
SUMP PUMP
CAP REMOVAL JIB ARM
EL 100'-2
FILL HEAD
TRANSFER DRAWER
S.S. LINER
DISCH EL 99'-0
FLUSHWATER PUMP VP13599-001
DEWATERING PUMP VP C00877A
SUMP
WASTE DISPENSING VESSEL PUMP VP 3832502
DRIP PAN & DUMP TANK ASSEMBLY
DUMP TANK PUMP
POWER CONVEYOR



NO.	DATE	REVISION	DR	CH	APPROVED
B	4-4-85		DH	RAW	
C	11/24/85	GENERAL REVISION PER TA 14	DH		
0	11/5/86	ER 568			

NOTES

FOR NOTES AND REFERENCE DRAWINGS SEE DWG 901-D-033.

TI APERTURE CARD

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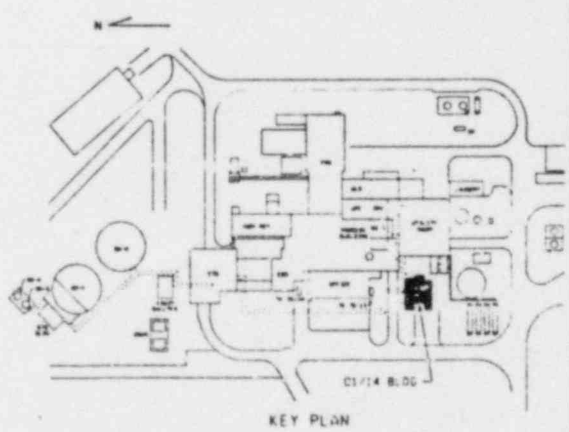
FIGURE G.5.2-5



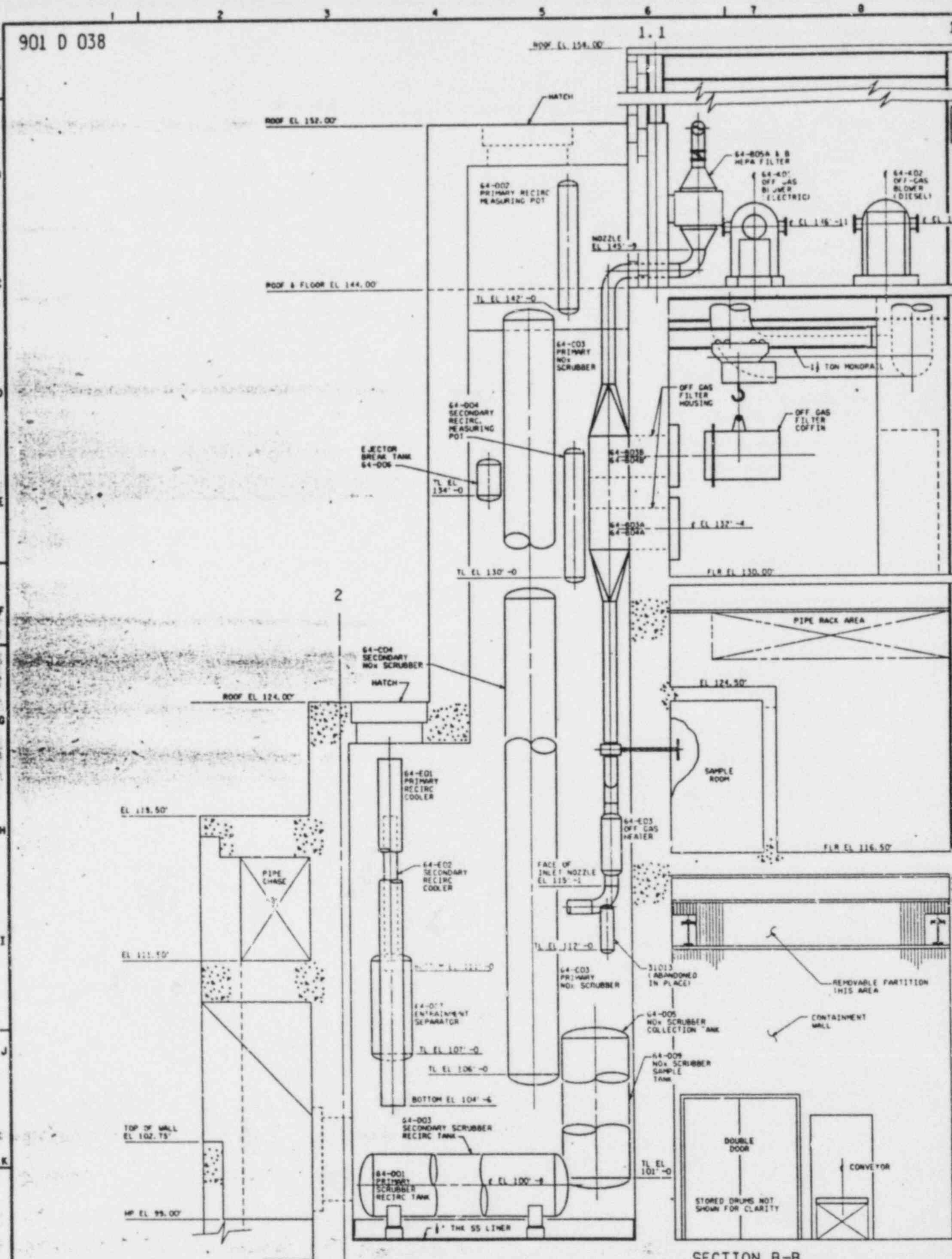
KEY PLAN

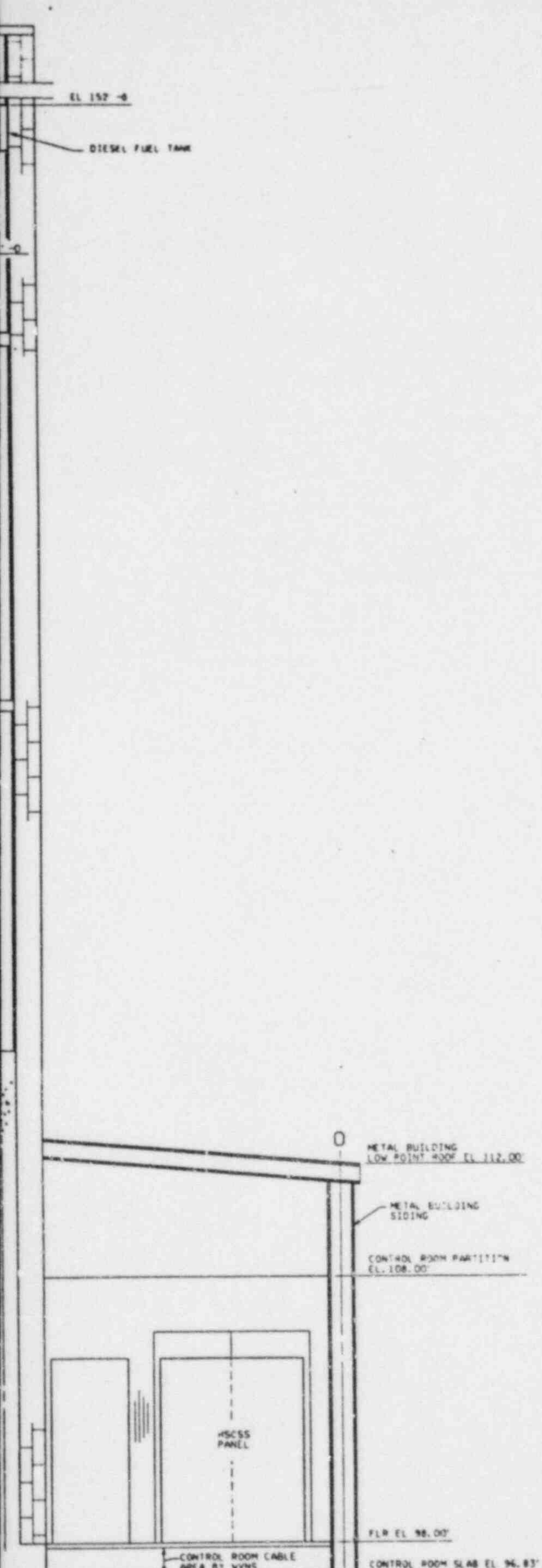
3/8"=1'-0

8611210386-07

FOR DRAWING INDEX SEE DRAWING NO.

APPRVD WVNS CO. R. P. VITKU	12-9-85	EBASCO SERVICES INCORPORATED A/E O.F.S. NO. 2388 TASK ORDER 014
PROJECT MGR L. E. SHAW	2-11-85	FOR WEST VALLEY NUCLEAR SERVICES COMPANY, INC WEST VALLEY, NEW YORK
ENGINEER SUPV W. D. WEINGART	2-11-85	
LEAD DISC ENGR F. KOWALCZYK	2-11-85	WEST VALLEY DEMONSTRATION PROJECT
DESIGN R. J. LEWKO	2-11-85	GENERAL ARRANGEMENT 01/14 BUILDING SECTIONS
CHECKED R. MILLER	2-15-85	
DRAWN D. HARDY	DATE 2-15-85	
DE-AC07-81NE44139 PROJECT NO.		SIZE D / INDEX CODE NUMBER: AREA, DR. TYP, CL, ORIG / DRAWING NO. 901D-037 / REV. 0
19-CWV-02275 SUBCONTRACT NO.		
ISSUED FOR CONSTRUCTION		SCALE 3/8"=1'-0 / SPEC. CODES / A/E SHEET NO. 901-D-037 C


901 D 038
1.1
ROOF EL 154.00'
HATCH
ROOF EL 152.00'
64-B05A & B HEPA FILTER
64-401 OFF GAS BLOWER (ELECTRIC)
64-402 OFF-GAS BLOWER (DIESEL)
64-002 PRIMARY RECIRC MEASURING POT
NOZZLE EL 145'-9
ROOF & FLOOR EL 144.00'
TL EL 142'-0
64-C03 PRIMARY NOx SCRUBBER
1½ TON MONORAIL
OFF GAS FILTER HOUSING
OFF GAS FILTER COFFIN
64-004 SECONDARY RECIRC. MEASURING POT
EJECTOR BREAK TANK 64-006
TL EL 134'-0
TL EL 130'-0
FLR EL 130.00'
2
PIPE RACK AREA
64-C04 SECONDARY NOx SCRUBBER
HATCH
ROOF EL 124.00'
EL 124.50'
64-E01 PRIMARY RECIRC COOLER
SAMPLE ROOM
EL 119.50'
64-E03 OFF GAS HEATER
FLR EL 116.50'
64-E02 SECONDARY RECIRC COOLER
PIPE CHASE
FACE OF INLET NOZZLE EL 115'-1
TL EL 112'-0
EL 111.50'
31013 (ABANDONED IN PLACE)
REMOVABLE PARTITION THIS AREA
64-C03 PRIMARY NOx SCRUBBER
64-007 ENTRAINMENT SEPARATOR
64-005 NOx SCRUBBER COLLECTION TANK
CONTAINMENT WALL
TL EL 107'-0
TL EL 106'-0
64-009 NOx SCRUBBER SAMPLE TANK
BOTTOM EL 104'-6
64-003 SECONDARY SCRUBBER RECIRC TANK
TOP OF WALL EL 102.75'
DOUBLE DOOR
CONVEYOR
64-001 PRIMARY SCRUBBER RECIRC TANK
EL 100'-6
TL EL 101'-0
STORED DRUMS NOT SHOWN FOR CLARITY
HP EL 95.00'
¼" THK SS LINER
SECTION B-B



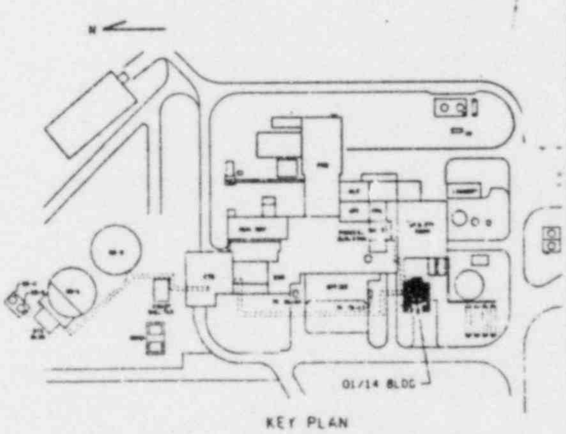
NO.	DATE	REVISION	DR	CH	APPROVED		
B	4-4-85	GENERAL REVISION	DH	RAR			
C	10-4-85	GENERAL REVISION PER TA-347	DH				
0	12/5/85	ER 568					

NOTES

FOR NOTES AND REFERENCE DRAWINGS SEE DWG 901-D-033.

TI APERTURE CARD

Also Available On Aperture Card



KEY PLAN

0 4 8F 3/8"=1'-0

8611210386-08

FOR DRAWING INDEX SEE DRAWING NO.

APPRVD WVNS CO. R P VITKO	12-9-85	EBASCO SERVICES INCORPORATED A/E O.F.S. NO. 2388 TASK ORDER 014
PROJECT MGR L E SHAW	3-11-85	FOR WEST VALLEY NUCLEAR SERVICES COMPANY, INC WEST VALLEY, NEW YORK
ENGINEER SUPV H D REINGART	3-11-85	
LEAD DISC ENGR P KOWALCZYK	3-11-85	WEST VALLEY DEMONSTRATION PROJECT
DESIGN R J LEWKO	3-11-85	GENERAL ARRANGEMENT 01/14 BUILDING SECTIONS
CHECKED R. MILLER	2-15-85	
DRAWN D. HARDY	DATE 2-15-85	
DE-AC07-81NE44139 PROJECT NO.		SIZE D · DRAWING NO. 901D-038 · REV. 0
19-CWV-02275 SUBCONTRACT NO.		
ISSUED FOR CONSTRUCTION		SCALE 3/8"=1'-0 · A/E SHEET NO. 901-D-038 C

FIGURE G.5.2-6

G.6.0 CSS PROCESS SYSTEMS

G.6.1 PROCESS DESCRIPTION

The Cement Solidification System (CSS) includes all piping, valves, instruments, controls, tanks, and equipment required to encapsulate waste in cement, store and transfer cement, and remotely move drums of waste and cement within the 01-14 Building. The Drum Handling Equipment will also move the drums to the RTS Drum Loadout Facility within the 01-14 Building, and on to a vehicle which will transport the drums either to temporary storage or to waste disposal. The sections that follow describe this system in detail.

G.6.1.1 NARRATIVE DESCRIPTION

The CSS is divided into three primary subsystems:

[1] the Waste Encapsulation Subsystem;

[2] the Material Handling Subsystem; and

[3] the Cement Transfer and Storage Subsystem.

G.6.1.1.1 Waste Encapsulation Subsystem

The Waste Encapsulation Subsystem (WES) features in-line batch, High-Shear Mixing of radioactive liquid and wet solid waste with cement. The WES is an ensemble of subsystems designed around the High-Shear Mixing Subsystem. Other subsystems deal with the manner in which cement and waste liquids are delivered to the mixer. These include the Waste Storage and Dispensing Sub-System, the Mixer Flush Subsystem, the Chemical Additive Subsystem, and the Cement Metering Subsystem.

Waste Storage and Dispensing Subsystem

Composed of the Waste Dispensing Vessel and the Waste Dispensing Vessel Pump, the Waste Storage and Dispensing Subsystem is the beginning of the treatment process. The waste liquid is collected and stored here before being mixed with cement, If the wastes to be encapsulated are ion exchange resins, the resins are dewatered at this stage so that the transport water may be returned to the plant's liquid waste system for treatment or reuse. Recirculation through the Waste Metering Pump maintains homogeneity of the waste.

This part of the system is an acceptable point from which samples of the waste can be taken for chemical testing and used to determine if any chemical additives are needed. Samples will normally be taken upstream of the Waste Dispensing Vessel; the sampling system at this point in the process would serve as a backup. The Waste Dispensing Vessel Metering Pump discharges the waste slurry from this subsystem into the High-Shear Mixers.

Mixer Flush Subsystem

This subsystem provides for easy regular maintenance of the encapsulation system, primarily the High-Shear Mixer and its vessel. The flushing procedure described below prevents cement from hardening within the mixing subsystem. (If cement solidifies within the mixer, the vessel's small overall dimensions facilitate removal and disposal.)

Whenever the CSS needs to be shutdown, or at least once a day, the High-Shear Mixers will be flushed to prevent residue cement/waste mixture from hardening inside the mixing vessel.

This process is controlled by the operator from the Control Panel (discussed in Section G.6.5.2.2). When flushing is required, 57 kg of utility water is transferred to each mixer through a spray nozzle with the mixers off. The amount transferred is controlled by weight. The mixers are then started on high speed, creating a highly turbulent transient wave which provides good flushing action. (Waste is also added to the mixers with the mixers not running to reduce residue buildup between flushes). After two or three minutes of agitation at high speed, the flush solutions are dumped to a 208-L round drum at the fill station. The procedure is repeated with 114 kg of rinse water, except the waste is dumped directly to the underground storage (7D-13) tank used to collect CSS liquid wastes. The initial flush removes the residue from the mixers, transferring it to a drum, and the rinse ensures clean mixers.

The Flush Drum at the Fill Station is transferred to the Flush Drum Storage Station where the residue is allowed to settle out and the drum is dewatered, to the underground storage tank. This drum is reused until it is half-full of residue (~102 litres). The drum is then filled with a water/cement mix and overpacked in a high integrity container for disposal.

Chemical Additive Subsystem

This subsystem can be activated in a variety of circumstances. For example, when the mixture setting time must be increased or decreased, chemical additives would be applied while the waste/cement mixture was in the mixing vessel. In this subsystem, additive lines join waste lines carrying stream from the Waste Dispensing Vessel Valve. Chemical addition can be performed prior to mixing the slurry with cement if neutralization of acids (resulting in salts) is required. For flexibility, the chemical additives can also be added directly to the Waste Dispensing Vessel.

The Cement Metering Subsystem

This subsystem uses a gravimetric (loss-in-weight) feeder to dispense metered amounts of dry cement from the Acrison day bin (the temporary location of the dry cement) into the mixing subsystem to be mixed with the waste as the system's solidification medium. A bulk dry cement storage silo is located near the CSS to facilitate the filling of the day bin and minimize free cement dust inside the facility (Section G.6.1.1.3).

The High-Shear Mixing Subsystem

Batch control for the High-Shear Mixer is automatic. The operator sets the panel controls for the type of waste to be drummed and initiates the process. The process parameters are controlled automatically. The waste feed and the cement are metered into the mixer, which runs continuously during operation. The batch is mixed (the time period of high-shear mixing depends upon the type of waste) and discharged into the container. The process is repeated until the container is filled. Approximately 85 L of waste/cement mixture are processed per batch.

G.6.1.1.2 Drum Handling and Loadout System

The Drum Handling and Loadout System provides a means of remotely providing empty drums to the WES, remotely processing drums for disposal after they are filled with a waste/cement mixture and loading the full drums onto a transport vehicle. This system is a series of subsystems centered around several gravity and chain-driven roller conveyors, These subsystems are the empty drum feed and positioning subsystem, the Full Drum Processing Subsystem and RTS Loadout Facility.

G.6.1.1.2.1 Empty Drum Feed and Positioning Subsystem

Empty 71-gallon square drums are manually loaded onto gravity conveyors (M01, M02) which are permanently installed on the platform of a hydraulic scissors lift (M03). Pneumatic pin stops hold the drum in position. A 16.5 cm drum lid is manually positioned on the empty drums.

The movement of the scissors lift and subsequent discharge of the drums is manually initiated by pendant mounted push buttons and a frame mount release lever. The drums are discharged onto the upper and lower series of parallel gravity conveyors (M04, M05, M06, M07) as determined by the operator. From this point on, the subsystem is automatically controlled by a Programmable Controller.

Drums on the gravity conveyors are automatically pulled onto a conveyor (M08), mounted on another hydraulically operated scissors lift (M10) by a pneumatic drum grabber. The flow is controlled by means of pneumatic stop pins.

The scissors lift discharges the drums onto a chain-driven roller conveyor (M12) at the 100 ft elevation. By means of photoelectric sensors, the drums are indexed towards the Shield Door Air Lock.

The Shield Door Air Lock is composed of two carbon steel (18 cm thick) plates, one on the hot side and the other on the cold side. The shield doors are hydraulically actuated and interlocked such that only one may be opened at a time.

Inside the air lock is a short chain-driven roller conveyor (M13) with a photoelectric sensor for sensing that a drum is present. The empty 71-gallon drum with lid is indexed through the air lock and onto the drum staging conveyor (M14) in the Process Room, and from there to the Fill Station Conveyor (M15).

The Fill Station Conveyor (M15) receives the empty drum and provides an indication in the Control Room to show that the drum is properly positioned. Once the drum is positioned and the lid removed, the conveyor holds the drum in place for filling. After a signal from the HSCSS control system that the drum is filled, the fill nozzle removed and the cap put in place, the conveyor then transfers the drum to the crimp station (M16).

The Fill Station is also capable of receiving and returning round 55-gallon drums from the Flush Drum Station (M15A).

The Flush Drum Station Conveyor accepts a flush drum of standard 55-gallon size and shuttles that drum back and forth from M15. An indication in the control room is provided to show that the flush drum is properly positioned. Once the drum is positioned, the conveyor holds the flush drum in place for nozzle placement.

The Contact Dose/Crimping Station conveyor accepts a filled drum from M15 or conveys it to the Smear/Overpack Station (M20). When the drum reaches the M16 Station it stops and indication is provided in the Control Room that the drum is in place. The conveyor holds that drum in position for lid crimping and radiation measurement. After the lid is crimped the conveyor then conveys that drum to M20 (Drum Smear/Overpack Station).

The Drum Smear/Overpack Station (M20/20A) accepts capped drums from M16 and conveys it to the Airlock Station. The Airlock Station Conveyor (M25/25A) accepts drums or overpacks from M20/20A, and conveys them to the Shuttle Conveyor through an airlock. The Shuttle Station Conveyor (M40) accepts a drum or drum overpack from the Airlock Conveyors (M25 and M25A) and conveys that drum/overpack to the Staging Conveyor (M41) to alternating sides. The shuttle table also accepts an empty overpack from the remote crane and conveys that drum into the airlock to conveyor M25A. The Staging Conveyor (M41) accepts a drum or overpack, one at a time and places them into a two-by-two four drum array, then delivers them to the Lift Table (M45). Indication is provided in the Control Room for each drum location.

The Lift Table Conveyor accepts four drums at one time from M41 (Staging Conveyor) and places them in a proper array to load the Truck Conveyor (M100). The Lift Table Conveyor accepts the first four drums, places them at the west end of the conveyor, then accepts four more and places them on the east end of the conveyor. Mechanical stops assure that a proper array is delivered to the Drum Cask. Indication is provided in the Control Room that all drums are properly placed. After lifting, the conveyor dispenses drums onto the Truck Conveyor.

The Transport Vehicle Conveyor (M10) is capable of handling twelve (12) loaded drums and is mounted on a 4.3-metre long stake truck bed. To prevent the drums from falling off the truck, a two (2) foot high rail is installed around the conveyor. The truck is loaded from the Lift Table. The first load is eight (8) drums and then four (4) drums are added. Stops and limits are provided to allow this loading to be compatible with the Lift Table Conveyor. The truck conveyor is powered electrically with a 480V, 3-phase plug located in the area of the loading dock. This conveyor also has reverse drive for unloading.

G.6.1.1.3 Cement Transfer and Storage Subsystem

The Cement Storage and Transfer System provides bulk storage capacity of 70 m^3 for dry cement and transfers this cement to the Cement Metering Subsystem. Dry cement is delivered from off-site by truck and transferred pneumatically to the Bulk Storage Silo. The transfer air exits the silo through a dust filter on the top of the silo. A blower is used to pneumatically transfer cement to the 0.42-m^3 Acrison day bin in the Cement Metering Subsystem on demand. The transport air is vented back to the Bulk Storage Silo where it vents through the dust filter.

G.6.1.2 FLOW SHEETS

The P/IDs applicable to the CSS are shown in Figure G.6.1-1 (Sheets 1 through 5).

G.6.1.3 IDENTIFICATION OF ITEMS FOR SAFETY ANALYSIS CONCERN

Operation of the CSS involves the transfer of liquid and wet solid radioactive wastes to the Process Room, solidification of these wastes with cement, and loadout of the solidified wastes onto transport vehicles. The three major items of safety analysis concern are:

- o maintaining occupational doses As Low As Reasonable Achievable (ALARA);
- o ensuring the confinement of radioactivity; and

- o maintaining the releases of radioactivity from the site in compliance with ALARA and below the limits specified in DOE Order 5480.1A.

There are no unique chemical hazards introduced with the operation of this system.

The CSS has been designed to be remotely operated and contact maintained. Occupational doses will be maintained ALARA through use of shielding; all routinely occupied areas will have exposure rates less than 0.25 mR/hr. Proper safety precautions for maintenance activities will be specified in Radiation Work Permits (RWPs) and Industrial Work permits (IWPs) as appropriate.

The major mechanism for ensuring the confinement of radioactivity is the 01-14 Building HV System. This system will maintain process areas at a slight negative pressure relative to surrounding areas to ensure that air leakage will be into, rather than out of, potentially contaminated areas. Two fans are provided for this system. One is driven by an electric motor; the backup fan is run by a diesel engine. Each fan is rated at 100 percent system capacity.

Effluents from the site are monitored to ensure that releases are in compliance with DOE Order 5480.1A. This monitoring program is described in Section A.8.6 of Volume 1.

G.6.2 PROCESS CHEMISTRY AND PHYSICAL CHEMICAL PRINCIPLES

Encapsulation of wastes in cement will result in a waste form which has the radioactive material evenly dispersed in a monolithic, stable, and solid medium. Solidified wastes produced by operation of the CSS will meet the waste form criteria of US DOE Order 5820.2 and the intent of 10 CFR Part 61 Section 61.55 and 61.56 for low-level wastes.

G.6.2.1 THE ENCAPSULATION MEDIUM

After evaluating the candidate medium materials currently available, WVNS selected solidified cement, a chemically inert and noncorrosive compound, as the best material for long-term radioactive waste storage when contained in steel drums (Knabenschuh, 1983). Some of the reasons for this choice are: (1) the noncombustibility of the final product, (2) long-term experience with concrete materials, and (3) the great availability of dry cement.

Specifically, Portland Type I cement will be used because its properties and composition are defined within a narrow, well established range. As a dry powder, this type of cement has a bulk density of 1,500 kg/m^3 and a proven shelf life of at least twenty-five years in dry, moisture tight environments. Waste forms produced using this medium have demonstrated compressive strengths as high as 33.58 MPa (see Table G.6.2.1). Encapsulated resins have been shown to have compressive strengths up to 13.62 MPa.

G.6.2.2 CEMENT CHEMISTRY AND THE EFFECT OF WASTE MATERIALS

The central technical task in designing a cement encapsulation system is selecting the manner in which the waste liquor and the cement are mixed. In the encapsulation process, the water in a subject waste material itself serves as the hydration medium. Though the radioactive attributes of waste have no appreciable effect on solidification, problems arise in the formation of the cement matrix because other chemicals in the waste actively interfere with the hydration process. The chosen method of mixing cement with the waste must overcome the effects that the extraneous (nonhydrating) waste components have on the hydration of the cement.

In the first minutes of contact with water, the calcium sulfate and the easily hydratable free lime in the cement dissolve. The surface of the clinker particles (the physically and chemically interacting cement grains) react with water to release calcium, alkali, and hydroxyl ions into the liquid phase. After about eight hours, the surfaces of the clinker particles become "blocked" by coats of hydration products. Thereafter, the reaction rate becomes diffusion-controlled; it reduces continuously as water diffusion into and calcium diffusion out of the coating are hindered by the thickening hydration coat. Any extraneous material or procedure that affects the coating formation will affect the rate of hydration and thus affect the changes that take place in the physical, rheological, and bonding characteristics of the water-cement paste.

Waste liquids in the mixture retard the reaction in the crucial liquid phase and cause such undesirable effects as increased in bleeding, increases in setting time, and delays in strength development.

Additives such as thickening agents to hinder settlement in cement pastes prone to bleeding and hydration accelerators to offset the waste chemistry-induced retardation have been used in conventional mixing to improve resultant waste forms. These may also be used to enhance the performance of the High-Shear System for the encapsulation of particular wastes, but high-shear mixing alone overcomes most of the undesirable effects caused by waste liquids.

G.6.2.3 HIGH-SHEAR TECHNOLOGY

It has been demonstrated (Grant 1980, Smeltzer 1980a, Smeltzer 1980b, Smeltzer 1981a, Smeltzer 1981b, Smeltzer 1984) that the retardation effects of adverse feed chemistries, the bulk mixing problems, and the occurrence of free liquids can e overcome by highly shearing the cement/waste mixture. The result of high-shear mixing is that much more clinker particle surface area is exposed to hydration.

In this system, High-Shear Mixers provide the appropriate mechanical action. In each mixer, a high-speed electric motor (with two speeds, 3000 and 1500 rpm) drives a discar-shaped blade through a close-fitting housing. shearing results from the action between the blade and the cement particles (mechanical shear) as well as between adjacent cement particles with different velocities (hydraulic shear).

The ability of high-shear to overcome the adverse effects of various waste chemistries was extensively tested. A prototype unit was constructed and tested at the Westinghouse Research and Development Center. Afterward, successful trials were conducted on a full-scale unit at the Westinghouse Pensacola Plant in Pensacola, Florida. These tests established the mixer's durability, the effects of additives, and various setting times for different waste "recipes" that act as simulated wastes in the material testing of the solidified product. Results of such testing can be seen in Table G.6.2-1. Waste encapsulation recipes have been developed at Westinghouse R/D on West Valley specific wastes, and results of tests run on these wastes are given in Table G.6.2-2 (Smeltzer, 1984).

It was found that the highly sheared cement product is tolerant to large variations in waste/cement mix ration (up to plus or minus ten percent), to a wide pH range (as low as 5 and as high as 12), and to chemical additives that may be used where desired to adjust the properties of the end product.

In addition, a process was developed for the encapsulation of ion exchange resins whereby the waste product can be immersed in water without impairing its structural integrity.

G.6.3 MECHANICAL PROCESS SYSTEMS

G.6.3.1 COLD CHEMICAL RECEIVING, HANDLING AND TRANSFER

The only cold chemical required on a routine basis is Type I Portland cement. However, provision is made to add other chemicals as needed. This section describes the subsystems required to accomplish these additions.

G.6.3.1.1 Cement Receiving, Handling and Transfer

Type I Portland cement is used as a binder in this system. The cement is stored and metered into the Waste Encapsulation Subsystem using the following equipment.

G.6.3.1.1.1 Cement Storage Silo

The Cement Storage Silo is a shop-welded silo 3.7-m diameter by 12-m overall height with a cylinder height of 6.1 m providing 70-m^3 usable capacity. It is designed for material weighing 1,600 kg/m^3. The silo is fabricated from carbon steel, the interior is epoxy coated, and the exterior is painted with one coat of primer and a top coat. The silo is supported on a bin skirt which is an extension of the storage silo steel to the platform with a 0.81-m by 2.0-m louvered steel door.

Various features and accessories of the silo include:

- o 60 degrees included angle concentric hopper with a 2.4-m diameter outlet providing 1.8-m clearance above the platform;
- o handrail and kick plate assembled around the deck;
- o bin vent filter flange;
- o four-level indicator openings;
- o a 0.51 m diameter combination quick opening manhole and pressure/vacuum relief valve in the deck, and a 0.51-m diameter bolted manhole in the hopper;
- o a ladder and and safety cage assembly with landing platforms at maximum 9.1 m spacing;
- o stub.inlets, as required, and
- o one set of pipe standoff brackets.

The Storage Silo is fitted with a bin vent filter (Model No. 84BV9) with 8.8 m^2 of dacron felt cloth area, a continuous cleaning reverse air mechanism for maintaining porosity of the filter media (0.14 m^3/min at 6.90 kPa plant air required), and an access door to the filter bags. The filter is carbon steel construction. The filter includes a differential pressure switch to shutdown the conveying system if filter bags become plugged. A pilot light on the smoot control panel will be activated so the operator will know what happened.

The Storage Silo is filled with cement through a four inch schedule 40 carbon steel truck fill line and a convey target box located on the top of the silo. A delivery truck connects up to the fill line and uses a truck mounted blower to convey cement to the target box after the operator starts the bind filter.

G.6.3.1.1.2 Cement Transfer Mechanism

The transfer mechanism is a dense phase system. To transfer cement to the gravimetric feed system, the airslide discharge assembly is first activated to fluidize cement in the silo. An 0.2-m discharge butterfly valve is then opened to allow cement to flow through the 0.2-m expansion sock assembly to the dense phase transmitter located below the silo.

The dense phase transmitter is a 6.4-m^3 bin 0.76-m in diameter by 1.4-m high designed to operate at 690 kPa. The bin has a 0.05-m top outlet connection, a 0.2 m material inlet, and a 60 degree included angle hopper bottom. The transmitter is gravity fed from the storage silo through the 0.2-m material inlet until the proper weight of material has entered the transmitter. The inlet valve, the outlet valve, and the vent valve are closed, and the air inlet valve is opened to aerate the cement in the transmitter and to pressurize the transmitter. When the transmission pressure is reached, the outlet valve is opened, and the cement is conveyed through 0.05 m schedule 40 carbon steel pipe to a convey target box, and into the Acrison day bin.

Air for the dense phase transmitter is supplied by a 7,460 watt reciprocating air compressor unit with an after cooler. The compressed air is stored in 2.5-m^3 air received after being dried in an automatic regenerative dual tower dryer. Air pressure in the transmitter is maintained constant during the conveying operation by an air pressure regulator.

G.6.3.1.1.3 Gravimetric Feed Mechanism

Cement is moved pneumatically from the outside Storage Silo to the Acrison day bin, a hopper with usable volume of 0.42-m^3. It is mounted on top of the gravimetric feeder and provides for batch sizes up to 180 kg and a possible continuous feed rate from the Acrison day bin of approximately 4,500 kg/hr.

The feeder uses a positive flow, dry solid metering mechanism which precisely controls the discharge rate on a cement weight loss basis. The control principle at work has proven to be the most accurate and reliable approach for continuous weighing of dry cement.

As the cement feeds down into the mixer, the resultant decrease in weight is monitored by the feeder's Digital Weight Resolving System. Data is then fed to the microprocessor-based controller. Since the metering system must discharge a specific weight of cement in a specific amount of time, the controller adjusts the rate of feed continuously by increasing or decreasing the speed of the electric drive motor.

G.6.3.1.1.4 The Cement Feed Diverter Valve

This bulk material valve is mounted vertically below the gravimetric feeder and directs dry cement into each of the mixers alternately. It is a two-way nonjamming gate valve with a 0.15-m square opening size, constructed of 0.5-cm thick stainless steel with reinforcing in selected spots. The pneumatically operated gate valve consists of a flanged bifurcated chute, an operator blade, and a curved gate blade. The inlet is vertically aligned and its discharge legs are each 30 degrees from the vertical (a 60 degree included angle) and connected to the 0.10-m lines (a square-to-round outlet transition fitting was required) that carry the cement directly to the High-Shear Mixers. The diverter valve is controlled and monitored at the control panel.

The cement enters the mixers through a hydraulically operated ram valve. The cement inlet is vertical and the ram enters the opening at an angle. This valve closes off the opening when cement is not being added to prevent vapor from rising into the cement feed lines. This ram can also be fully extended into the mixing vessel if necessary to remove any cement pluggage.

G.6.3.1.2 Chemical Additive Receiving, Handling and Transfer

The only chemical additive identified for use in the CSS at this time is sodium hydroxide required to neutralize uranyl nitrate prior to solidification. It is anticipated, however, that chemical set accelerators or retardants may be required for as yet unidentified waste streams. Provisions have therefore been made to add a wide variety of chemicals.

Because anticipated usage is small, chemicals will be metered from 208-L stainless steel drums using two pulsafeeder metering pumps, one with a range of 0 to 3.8 L/min and a second with a range of 0 to 7.6 L/min.

Chemical drums will be brought to the cold chemical area where the contents will be transferred to the stainless steel drums with a drum pump. The stainless steel drums rest on load cells with remote readouts in the Control Room. The metering pump output rate can be controlled from the Control Room, and once the rate is set, the total amount of chemical added is controlled by a timer whose setting will be dictated by the waste recipe involved. The amount of added chemical is also verified by the load cells under the drums and by load cells under the mixers.

G.6.3.2 FEED TRANSFER, PREPARATION AND HANDLING

Radioactive waste from various sources is collected in the Waste Storage and Dispensing Subsystem where it is metered into the High-Shear Mixing Subsystem with the following equipment.

G.6.3.2.1 The Waste Dispensing Vessel

The Waste Dispensing Vessel has a usable volume of about 1,900 L. It has spray-headers and a conical bottom to ensure complete emptying of the waste and is designed to accept spent resin slurry, concentrated waste evaporator bottoms, chemical drains, and other liquid wastes. A Johnson screen inside and near the bottom of the vessel permits drainage of the resin transport water. Water drained from the waste dispensing vessel is pumped back to the LWTS through a side connection in the conical bottom.

G.6.3.2.2 The Waste Dispensing Vessel and Dewatering Pumps

The Waste Dispensing Vessel Pump is a Moyno progressing cavity pump which provides a predictable, accurate, and uniform measure of waste into the mixer. The pump principle at work is one that employs a single helic rotor revolving eccentrically within a double helix stator of twice the rotor pitch length. As the rotor turns within the stator, cavities form which progress toward the discharge end of the pump, carrying the waste material with the rotor as it moves. This pump recirculates waste to the WDV continuously during waste processing operations at 300 L/min to ensure a homogenous waste is contained in the WDV.

The progressing cavity pump is more durable than conventional pumps and requires less servicing. It is easily disassembled for cleaning and can e repaired on-site. Moreover, it is equipped with an electronic fluid detector that can alert the operator or shut the pump down in the event that no waste material is reaching the pump.

The dewatering pump is provided to remove transport water from spent resin slurries. This centrifugal pump is powered by a three-phase, 746-watt electric motor. Resin transport water is pumped to the 7D-13 tank for treatment in the LWTS.

G.6.3.2.3 Vessel to Mixer Valves

A three-way ball valve connects the Waste Dispensing Vessel to the two mixers and a second determines which mixer is connected at any given time. These valves are mounted above the High-Shear Mixers and allow alternate waste filling into the mixing vessels. The positions of the valves (open/closed) are constantly indicated on the control panel (see Section G.6.5.2). They are controlled by the batch program.

G.6.3.3 MATERIAL HANDLING SUBSYSTEM

G.6.3.3.1 Empty Drum Feed and Positioning System

G.6.3.3.1.1 Empty Drum Loading and Storage

This system has the capacity to store and automatically feed 40 drums into the process. Empty drums with lids are manually loaded onto one of two 0.6-m wide by 0.6-m long Gravity Drum Loading Conveyors on a hydraulic scissors lift. This lift is powered by a 560-watt motor and has the capacity to move 60 drums per hour to one of two levels. The drums roll off the drum loading conveyors onto one of four 0.6-m wide by 4.9-m long, gravity feed, Drum Storage Conveyors (two racks at two levels per rack). Total capacity of the storage racks is 32 drums.

At the opposite end of the storage racks, a second 560-watt hydraulic scissors lift lowers drums at the rate of six drums per hour onto a Chain-Driven Roller Conveyor capable of moving drums at a velocity of 12 m/min. The drums are pulled from the gravity conveyors, onto the Chain-Driven Roller Conveyors with a Hydraulic Drum Puller. This device utilizes a suction cup at the end of a mechanical arm to grab drums. The hydraulic cylinder is then retracted to pull the drum onto the Chain-Driven Roller Conveyor.

The conveyor is made up of four sections 0.6-m wide by 0.6-m long, one section 0.6-m wide by 0.6-m long with a pneumatic pin stop, and one section 0.6-m wide by 1.4-m long, each section driven by a 373-watt motor. Drum storage capacity of these conveyors is four (including one inside the air lock). With two drums of storage capacity on each hydraulic lift, the system total is 40.

Figure G.6.3-1 shows the conveyor layout at the 100-foot elevation of the 01-14 Building. Empty drums enter at the southeast and filled drums exit out the west wall.

This series of conveyors transfers drums through an air lock to a Drum Staging Station and on to the Fill Position Conveyor, a 0.6-m wide by 0.8-m long chain-driven, bidirectional reversing, roller conveyor powered by a 190-watt motor in the north/south direction and a 560-watt motor in the east/west direction. This conveyor is located 90 degrees to the Empty Drum Conveyor, and when a drum reaches this conveyor, it is positioned precisely with a fixed stop. The drum position is confirmed and a permissive is transmitted to the WES to start a waste batch. This station is equipped with load cells to obtain a weight on the filled drum.

The air lock consists of two shield doors, each 0.18 m thick. These doors are interlocked to prevent opening both doors simultaneously. The section of conveyor between the doors has a photoelectric sensor that detects the presence of a drum. When a drum is transferred through the clean-side door and sensed by the detector, the clean-side door closes, and the hot-side door opens, allowing the drum to pass to the Drum Staging Station.

At this station, the drum stops until it is needed at the Fill Position Conveyor previously described. The lid is then removed from the empty drum and by a vacuum lifter until the drum is filled.

G.6.3.3.2 Full Drum Processing Subsystem

After a drum is filled by the WES, the lid is replaced, and the drum is weighed. It advances to the Capping Conveyor, (12 m/min at 560 watts), chain-driven, roller-type conveyor 0.6-m wide by 0.84-m long. The drum travels at 12 m/min until it trips a proximity switch for final positioning of the drum under the Capper. When the filled drum is in position, the Capper Assembly is lowered to the crimp position. A commercial-type pneumatic crimper widely used in the drum manufacturing industry, crimps the lid on the drum. In addition, the contact dose rate of the drum is determined with a GM survey instrument.

When the Capper is retracted, a 560-watt motor drives the rollers to move the drum to the Swipe Overpack Station. The capped drum is then lifted and two swipes are taken to determine the extent of surface contamination.

Swiping is accomplished by lifting and separating the capped drum from the Roller Conveyor and circumferential swipes are taken from the top and bottom of the drum.

If the smear reading is within limits, the drum is passed through the airlock for loadout. If the smear exceeds limits, the drum is overpacked, and an overpack surface contamination check is performed.

G.6.3.3.3 Drum Storage and Loadout Subsystem

Drums/overpacks are passed through the airlock to the shuttle table which then places drums in a 4-drum array on the staging conveyor. The 4-drum array on the staging conveyor are then transferred to the lift table and accumulated for an 8-drum array. The lift table lifts the accumulated 8-drum array to the drum cask elevation (31.0 m). The lift speed of the table is 2.6 m/min. Once the table reaches the drum cask elevation, the drums are then conveyored to the Drum Cask for shipment to the Drum Cell.

In addition to the two CCTV cameras mounted on the bridge crane, there are two more cameras in the Process Room, one near the Fill Station, and one near the swipe station. Both of these cameras have remote pan tilt and zoom, and can be monitored from the Main Control Panel in the Control Room and from an auxiliary panel located at the Swipe Operator's Station.

Operation of the Drum Storage and Loadout Subsystem will be in two phases. The first phase will take place before the west shield wall has been constructed. During this phase, ventilation control will be maintained by a temporary wall which will eventually be replaced by a shield wall. During the period, no waste streams will be processed that could produce drums of solidified waste having contact exposure rates in excess of 100 mR/hr. All drums will be contact smeared before release.

The west shield wall will be constructed prior to processing waste streams that could produce drums of solidified waste having contact exposure rates in excess of 100 mR/hr. During this phase, drum loadout will occur via a remotized, Shielded Loadout Subsystem.

G.6.4 WASTE ENCAPSULATION SYSTEM

G.6.4.1 PROCESS SYSTEM

The WES uses two mixing vessels, mounted vertically and set side-by-side. Each is a 200-L carbon steel vessel that houses a High-Shear Cast Iron Impeller. The vessels are small to minimize the amount of flush water required and to facilitate disposal at the end of their service life. A level switch (a detector that will automatically discontinue the filling process if too high a level is attained) is provided to ensure that safe levels are maintained within the vessel and that overfill conditions never develop. A load all is also provided for each mixer to monitor the amount of each component metered into the mixer to ensure that acceptable waste forms are produced. The mixer outlet valve is connected to a special fill assembly designed to descend into the container, and seal the opening in order to prevent splashing. The fill assembly is normally vented to the Process Room and contains an integral drip tray to prevent spillage of radioactive materials. The mixing vessel has a flanged top through which passes the impeller shaft. Additionally, the top has three inlets, one for the liquid waste, one for the cement, and one for flush water as well as a vent. (The mixer is vented through a roughing filter to the Process Room to minimize amount of dust release.) The flushwater enters the mixer through a rotating spray nozzle which flushes the top and side walls of the mixer.

At the end of the vertically aligned impeller shaft near the bottom of the mixing vessel in a close-fitting housing is the High-Shear Impeller itself. Its shape is that of a disc cut into a deformed, four-pointed star called a discar. This unique shape together with the high rotational speed (3000 rpm) imparts high shear to the mix. The impeller is driven by a vertically mounted two-speed 30-kW induction motor. Shearing takes place in the small gap between the discar and the housing. A sufficient discharge head is produced to pump the mix out at the low mixing speed (1500 rpm).

G.6.4.2 COMPONENT/EQUIPMENT SPARES

Spare components will be retained on-site to minimize down-time in the event of equipment failures or malfunctions. Two complete spare mixers and mixer tops will be kept in the warehouse to avoid unnecessary downtime should a mixer fail. For the other components, spare parts recommended by the supplier will be purchased and retained on-site. Examples of such items include spare parts for pumps, compressors, valves, conveyors, and hydraulic cylinders.

G.6.5 PROCESS SUPPORT SYSTEMS

G.6.5.1 MIXER FLUSH SUBSYSTEM

The Mixer Flush Subsystem is designed to provide flush water to flush the High-Shear Mixers.

This subsystem includes the following components:

A. Tanks

(1) 208-L Flush Water Dump Tank, and a 30-gallon, cone bottom, carbon steel tank.

B. Pumps

(1) Decant Pump (top ported air-operated diaphragm type operates at 0-340 L/min).

(2) Spare Decant Pump - same as B (1).

G.6.5.2 INSTRUMENTATION AND CONTROL SYSTEMS

G.6.5.2.1 Waste Encapsulation Subsystem Controls

From the CSS Control Panel, the operator can remotely monitor and control all aspects of the system. The panel (which uses the Westinghouse Numa Logic 700 Series Programmable Logic Controller) provides for complete automatic control. This leaves the operator with the tasks of selecting the desired operations mode, selecting values to control the discharge of cement and waste, and selecting the mixing time.

The Control Panel provides for safe operation with an alarm system that alerts the operator to up to forty different conditions (including Data Acquisition System Alarms) and various electrical interlocks that ensure safe system operation during automatic batching. All electric motors and solenoid-operated valves in the system can be operated in the manual mode. Like the automatic, the manual mode provides for operator monitoring of all process conditions through panel-mounted instrumentation. This includes a panel-mounted graphic display flow diagram which indicates the positions of all solenoid-activated valves and the status of all motors.

The main panel is 2.3-m high, 1.7-m wide, and 0.76-m deep. Some of the key panel components include:

A. Westinghouse Numa Logic 700 Programmable Controller,
B. Westinghouse Numa Logic Input/Output Modules,
C. Servo-powered Current Indicating Controllers,
D. Tachometer Signal Conditioner Modules,
E. Panagraphic Indicating Display Cabinets,
F. Remote Logic Annunciator,
G. Westinghouse Veritrak Level Setpoint Station,
H. Westinghouse Veritrak DC Regulated Power Supply,
I. Westinghouse Veritrak Power Distribution Panel, and
J. Westinghouse Veritrak Signal Conditioner.

In addition to the main panel, there are two smaller wall-mounted panels. One controls the Cement Feed System, the other regulates the pumps for auxiliary systems (that is, the two chemical additive tank pumps and sump pumps). These panels facilitate manual control. Each measures 0.91-m high, 0.91-m wide, and about 0.46-m deep.

G.6.5.2.2 Material Handling Subsystem Controls

The Material Handling Subsystem will use two control panels to support all Drum Handling Equipment. The Main Control Panel will be a conventional sloping front design approximately 1.8-m wide by 1.2-m deep by 1.5-m high. The bench section will represent the system graphically by indicators and controls mounted in the positions of the equipment they control. The upper section will contain TV monitors, crane controls, scale readout, and radiation monitoring equipment.

Inside the panel will be a Westinghouse Numa Logic Series 900 Programmable Controller, an Allen-Bradley Programmable Controller, motor starters, DC motor controls and terminal strips for interconnection. This panel will be located in the Control Room and will be capable of controlling the majority of the equipment including the bridge crane.

A second, panel will also be located in the Control Room and will control the Swipe Labeling Robot.

G.6.5.2.3 Cement Storage and Transfer System Control

The Cement Storage and Transfer System Control will use a prewired control panel in a NEMA 12 dust-tight enclosure with the main disconnect operable from the panel exterior. It will be located in the Control Room and used to control flow of cement to the gravimetric feed system. The panel will have legend plates as required to identify all controls, all required motor starters, relays, switches, and lights, and all other required control and monitoring devices. Hand-off-auto controls will allow each electrically-controlled system component to be operated manually, turned off independent of the rest of the system, or left to operate automatically with other components.

A second control panel in a watertight NEMA 4 box will be located at the Truck Receiving Station. This panel has all the logic required to operate the components of the Cement Silo Filling System and provide an audible alarm when the silo reaches a high level.

The Storage Silo has a top-mounted continuous level probe with a sensing element, slack adjuster, bottom anchor, and insertion length down to the top of the cone to provide continuous level indications at the Main Control Panel. The Silo also has high-, intermediate-, and low-level controls. The high-level control shuts down the system when the Acrison day bin is full and triggers a pilot light in the main control panel. The intermediate- and low-level controls merely trigger indicator lights on the control panel.

G.6.5.3 SYSTEM AND COMPONENT SPARES

The entire system will not be duplicated and stored. Vendor recommended spares of selected components, i.e., logic circuits, specific modules, etc. will be maintained on-site.

G.6.6 CSS CONTROL ROOM

Figure G.6.6-1 shows the Control Room instrumentation layout. Figure G.6.6-2 shows an elevation view of the Control Room equipment.

G.6.7 CSS SAMPLING AND ANALYTICAL REQUIREMENTS AND PROCEDURES

Samples of the waste streams will be taken from the holding tanks in the main plant building before being transferred to the 01-14 Building. In addition, a sampling unit is provided in the 01-14 Building to obtain a sample of the Waste Dispensing Vessel under an unusual occurrence.

The sampler for the Waste Dispensing Vessel was specifically selected for handling materials and plant design conditions to assure that samples can be taken safely. This sampler will be installed in the Waste Dispensing Vessel recirculation line to ensure that a representative sample is obtained. The sampler unit is capable of operating in process lines having pressures up to 2.07 MPa. Pressure equalization capabilities in the body provide an effective means of transferring waste portions from the process stream to the sample container without degradation normally involved in rapid decompression. The sampler body design provides for a straight-through sampling for more discrete sample collection and control. A solvent flush can be directed downward directly in line with critical waste-contact areas of the sample chamber and discharge port to remove residual carryover of liquid and/or solids during sample container changeovers.

Waste recipes developed at Westinghouse R/D are based on tests using synthetic waste formulated to closely approximate actual waste streams. To ensure compliance with these recipes, it is important to have a complete chemical analysis of all waste streams, as well as a radioisotope analysis that includes transuranic isotopes. To minimize the number of samples taken, it is desirable to take the samples in the sending vessels which have a larger capacity than the Waste Dispensing Vessel.

The waste recipes have been selected so that any characteristic hazardous waste (as defined by 40 CFR 261) processed by CSS will result in a nonhazardous final product.

REFERENCES FOR SECTION G.6.0

Grant, D. C., November 19, 1980, Leaching Studies on Simulated Radwastes.

Knabenschuh, J. L., 1983, letter to W. H. Hannum, dated March 8, 1983, "Selection of the West Valley Demonstration Project Low-Level and Transuranic Waste Form, Rev. 1," WD:83:0118.

Smeltzer, E. E., Grant, D. C., Mueey, A. P., Camp, F. E., Schneider, G. N., Skriba, M. C., January 15, 1981, Radwaste Volume Reduction and Solidification System Programs-September-October 1980a Process Memo 1.

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Smeltzer, E. E., Grant, D. C., Skriba, M. C., July 30, 1984, Report on Work Release No. 7 Low-Level Radioactive Waste Solidification.

TABLE G.6.2-1

COMPRESSIVE TEST RESULTS

WESTINGHOUSE HIGH-SHEAR MIXER

RESULTS OF COMPRESSIVE STRENGTH TESTING
(15 cm diameter by 30 cm long cylinders)

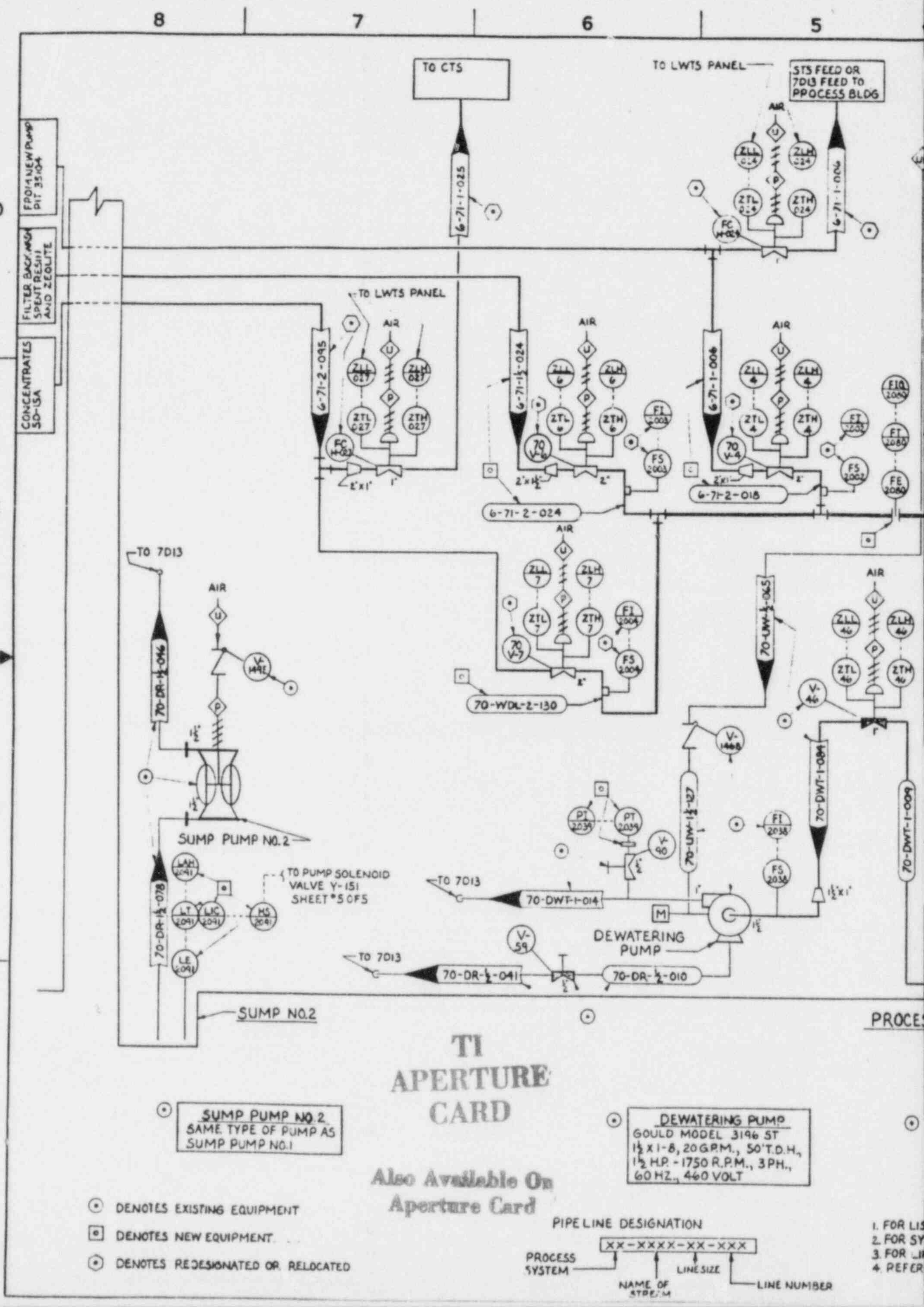
					Comparison Data		
TEST NO.	COMPOSITION	NO. OF SAMPLES TESTED	LENGTH OF CURE DAYS	AVERAGE COMPRESSIVE STRENGTH, MPa (psi)	TEST NO.	LENGTH OF CURE DAYS	AVERAGE COMPRESSIVE STRENGTH, MPa (psi)
20	18.5 w/o Borax	4	146	27.9 (4051)	--	--	--
22	12 w/o H_3BO_3 + 2 percent NaOH + Resin	4	124	19.6 (2840)	--	--	--
24	12 w/o H_3BO_3 + 2 percent NaOH	4	122	33.6 (4870)	19	105	28.4 (4122)
27	12 w/o H_3BO_3 + 1.3 percent NaOH + 10 percent Oil	4	96	22.7 (3291)	--	--	--
28	12 w/o H_3BO_3 + 2 percent NaOH	4	91	30.3 (4391)	19 24	105 122	28.4 (4122) 33.6 (4870)
29	22 w/o Na_2SO_4	2	90	28.9 (4195)	9	159	19.3 (2802)

TABLE G.6.2-2

WESTINGHOUSE R/D TEST RESULTS ON SUPERNATANT AND LLWTF SLUDGE WASTE FORMS

WESTINGHOUSE HIGH-SHEAR MIXER

WASTE FORM	COMPRESSION MPa (psi)	RADIATION STABILITY MPa (psi)	THERMAL DEGRADATION MPa (psi)	IMMERSION MPa (psi)	LEACH INDEX	BIODEGRADATION
39 w/o Supernatant	3.1 (450)	4.1 (640)	3.9 (570)	5.1 (740)	6.6	No Visible Growth
53 w/o Supernatant	2.6 (380)	2.6 (370)	2.9 (420)	2.8 (400)	6.8	No Visible Growth
LLWTF Sludge	10.1 (1,470)	10.0 (1,450)	12.7 (1,840)	9.7 (1,410)	6.9	No Visible Growth
Requirements of 10 CFR Part 61 Sections 61.55 and 61.56	0.3 (50 min.)	0.3 (50 min.) (after 10^8 rads)	0.3 (50 min.) (after 30 cycles -40°C +60°C)	0.3 (50 min.) (after 90 days)	6.0 min.	No Visible Growth


8
7
6
5
D
C
B
A
TO CTS
TO LWTS PANEL
STS FEED OR 7D13 FEED TO PROCESS BLDG
AIR
FP014 NEW PUMP PIT 35104
FILTER BACKWASH SPENT RESIN AND ZEOLITE
CONCENTRATES 30-15A
6-71-1-025
6-71-1-026
6-71-2-095
6-71-1½-024
6-71-1-006
6-71-2-024
6-71-2-018
70-UW-½-065
70-WDL-2-130
TO 7D13
70-DR-1½-096
SUMP PUMP NO.2
TO PUMP SOLENOID VALVE Y-151 SHEET 5 OF 5
70-DR-1½-078
70-DWT-1-014
70-UW-1½-127
70-DWT-1-084
70-DWT-1-009
DEWATERING PUMP
70-DR-½-041
70-DR-½-010
SUMP NO.2
PROCES
SUMP PUMP NO.2
SAME TYPE OF PUMP AS SUMP PUMP NO.1
DEWATERING PUMP
GOULD MODEL 3196 ST
1½ X 1-8, 20 G.P.M., 50' T.D.H.,
1½ H.P. - 1750 R.P.M., 3 PH.,
60 HZ., 460 VOLT
DENOTES EXISTING EQUIPMENT
DENOTES NEW EQUIPMENT
DENOTES REDESIGNATED OR RELOCATED
PIPELINE DESIGNATION
XX-XXXX-XX-XXX
PROCESS SYSTEM
NAME OF STREAM
LINE SIZE
LINE NUMBER
1. FOR LIS
2. FOR SY
3. FOR LI
4. REFER

900-D-397 SH. 1

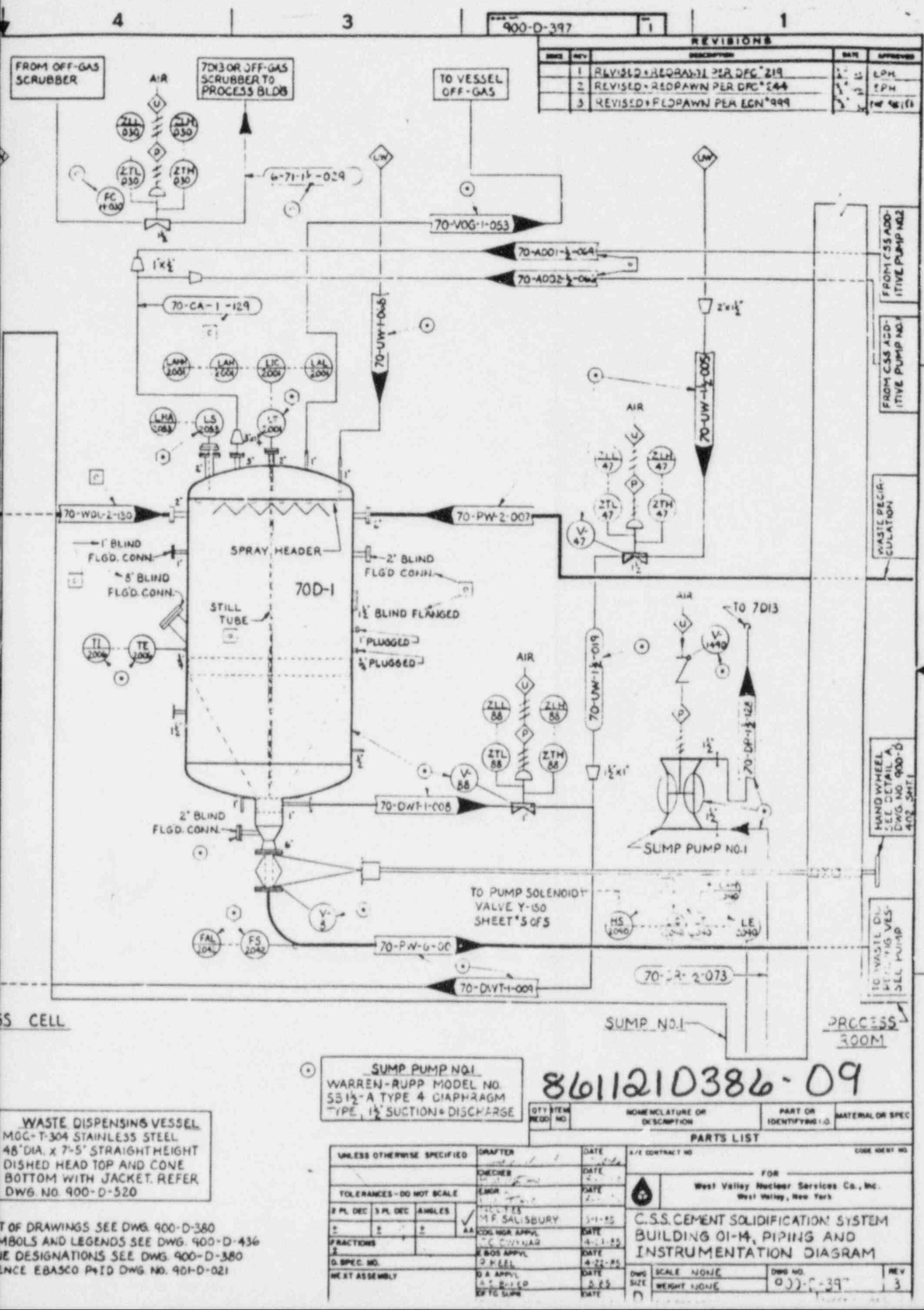


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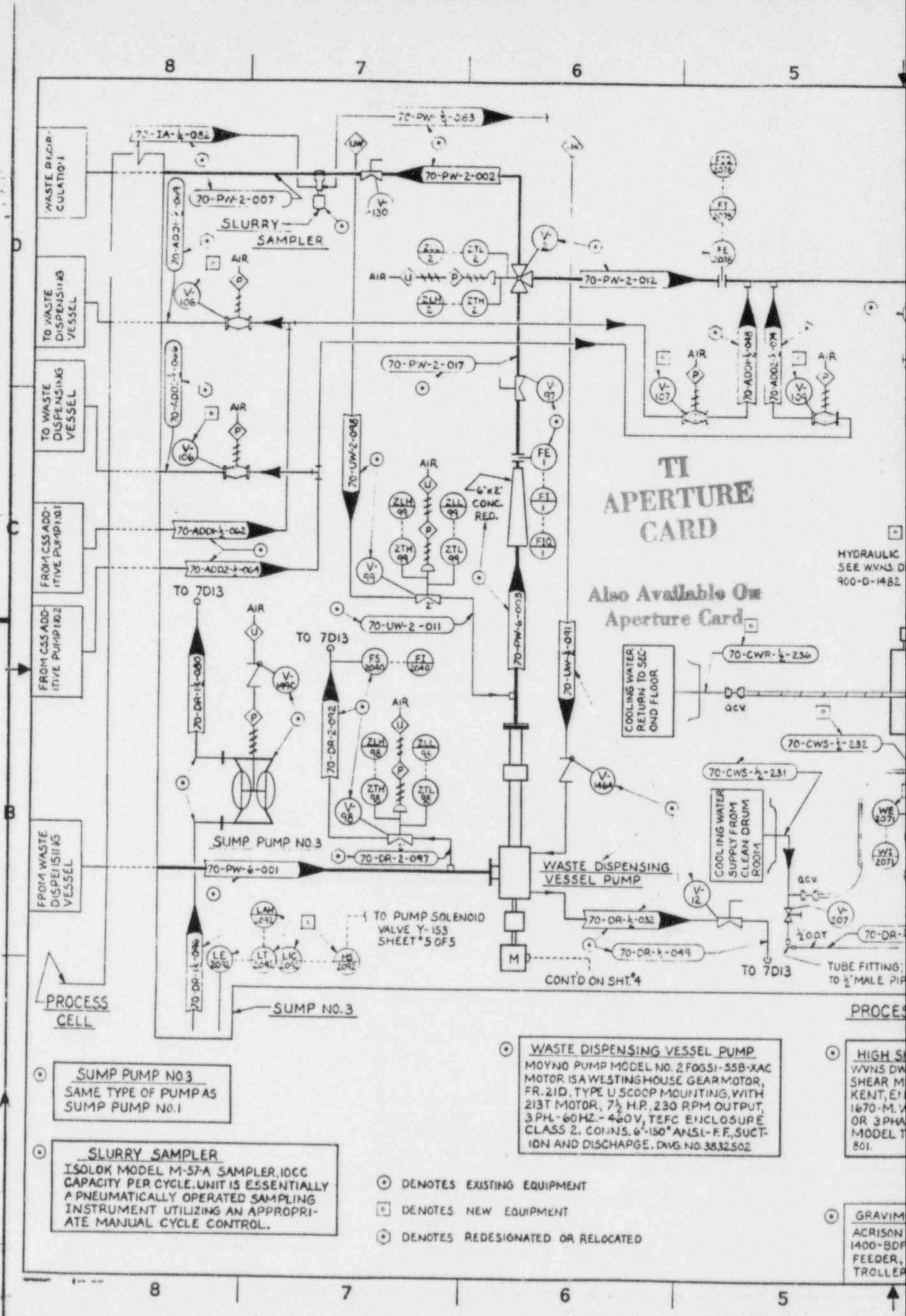
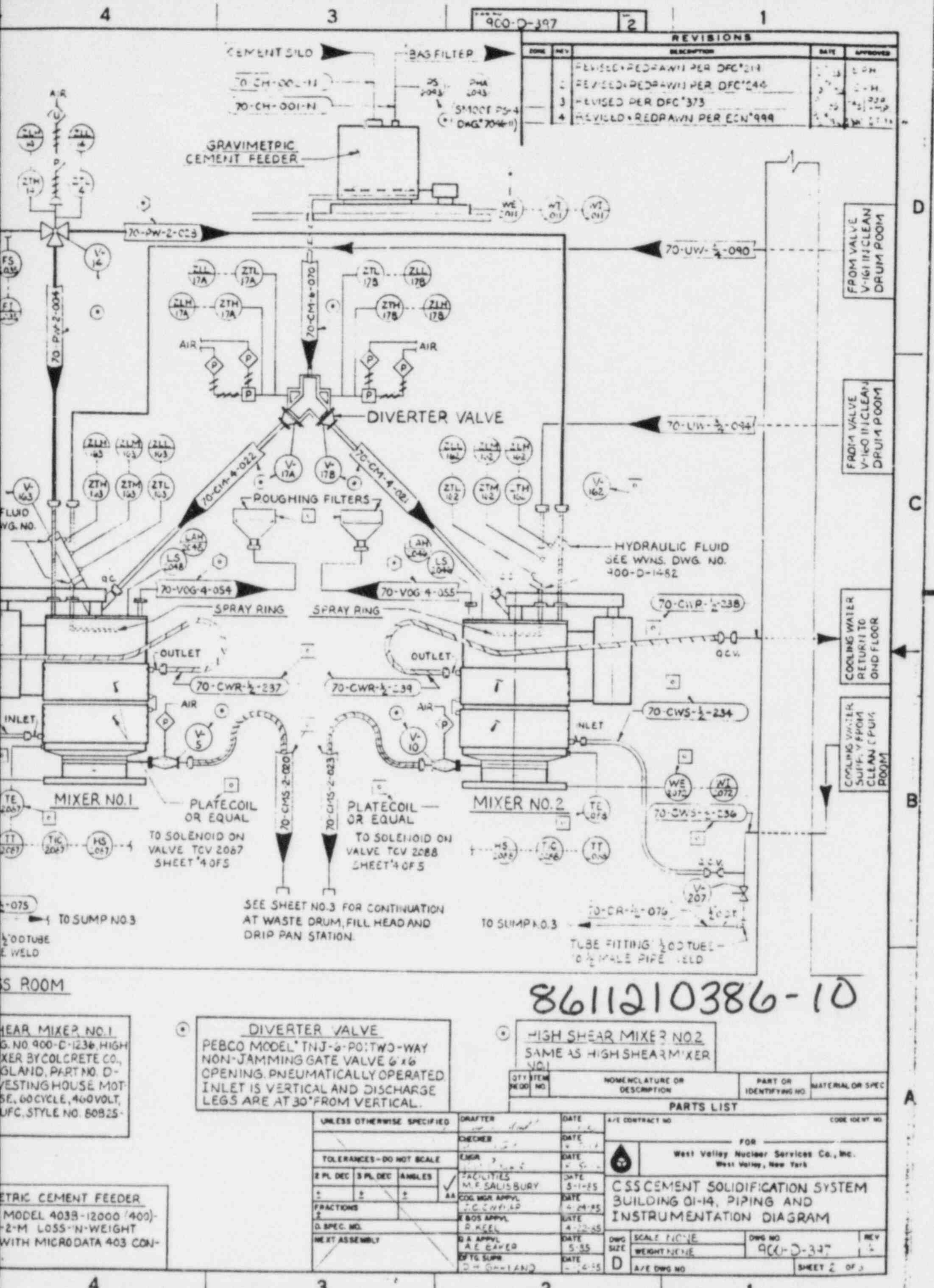
FIGURE G.6.1-1



8
7
6
5
WASTE RECIR-CULATION
TO WASTE DISPENSING VESSEL
TO WASTE DISPENSING VESSEL
FROM CSS ADD-ITIVE PUMP NO.1
FROM CSS ADD-ITIVE PUMP NO.2
FROM WASTE DISPENSING VESSEL
70-IA-½-082
70-PW-½-063
70-PW-2-002
70-PW-2-007
SLURRY SAMPLER
V-130
V-2
V-106
AIR
70-PW-2-012
FE 2076
FI 2076
70-PW-2-017
V-97
V-107
AIR
70-UW-2-098
FE 1
FI 1
FIQ 1
6"x2" CONC. RED.
ZLH 99
ZLL 99
ZTH 99
ZTL 99
V-99
70-ADD1-½-062
70-ADD2-½-064
TO 7D13
70-UW-2-011
70-PW-6-003
70-UW-½-091
HYDRAULIC
SEE WVNS D
900-D-1482
TO 7D13
V-149C
FS 2040
FI 2040
70-DR-½-080
70-DR-2-092
ZLH 98
ZLL 98
ZTH 98
ZTL 98
V-98
COOLING WATER RETURN TO SECOND FLOOR
70-CWR-½-236
QCV
70-CWS-½-232
70-CWS-½-231
V-146A
COOLING WATER SUPPLY FROM CLEAN DRUM ROOM
WE 2071
WI 2071
SUMP PUMP NO.3
70-PW-6-001
70-DR-2-097
WASTE DISPENSING VESSEL PUMP
V-12
QCV
V-207
70-DR-½-032
70-DR-½-049
LAH 2092
LE 2092
LT 2092
LIC 2092
HS 2092
TO PUMP SOLENOID VALVE Y-153 SHEET 5 OF 5
M
CONT'D ON SHT. 4
TO 7D13
½" O.D.T.
70-DR-
TUBE FITTING; TO ½" MALE PIP
70-DR-1½-096
PROCESS CELL
SUMP NO.3
PROCES
SUMP PUMP NO.3
SAME TYPE OF PUMP AS SUMP PUMP NO.1
WASTE DISPENSING VESSEL PUMP
MOYNO PUMP MODEL NO. 2 FOGSI-SSB-XAC MOTOR IS A WESTINGHOUSE GEARMOTOR, FR. 21D, TYPE U SCOOP MOUNTING, WITH 213T MOTOR, 7½ H.P., 230 RPM OUTPUT, 3 PH.-60HZ.-460V, TEFC ENCLOSURE CLASS 2. CONNS. 6"-150# ANSI-F.F., SUCTION AND DISCHARGE. DWG. NO. 3832502
HIGH S
WVNS DW
SHEAR M
KENT, E
1670-M.
OR 3 PHA
MODEL T
801.
SLURRY SAMPLER
ISOLOK MODEL M-57-A SAMPLER, 10CC CAPACITY PER CYCLE. UNIT IS ESSENTIALLY A PNEUMATICALLY OPERATED SAMPLING INSTRUMENT UTILIZING AN APPROPRIATE MANUAL CYCLE CONTROL.
DENOTES EXISTING EQUIPMENT
DENOTES NEW EQUIPMENT
DENOTES REDESIGNATED OR RELOCATED
GRAVIM
ACRISON
1400-BDF
FEEDER,
TROLLER

900-D-397 2



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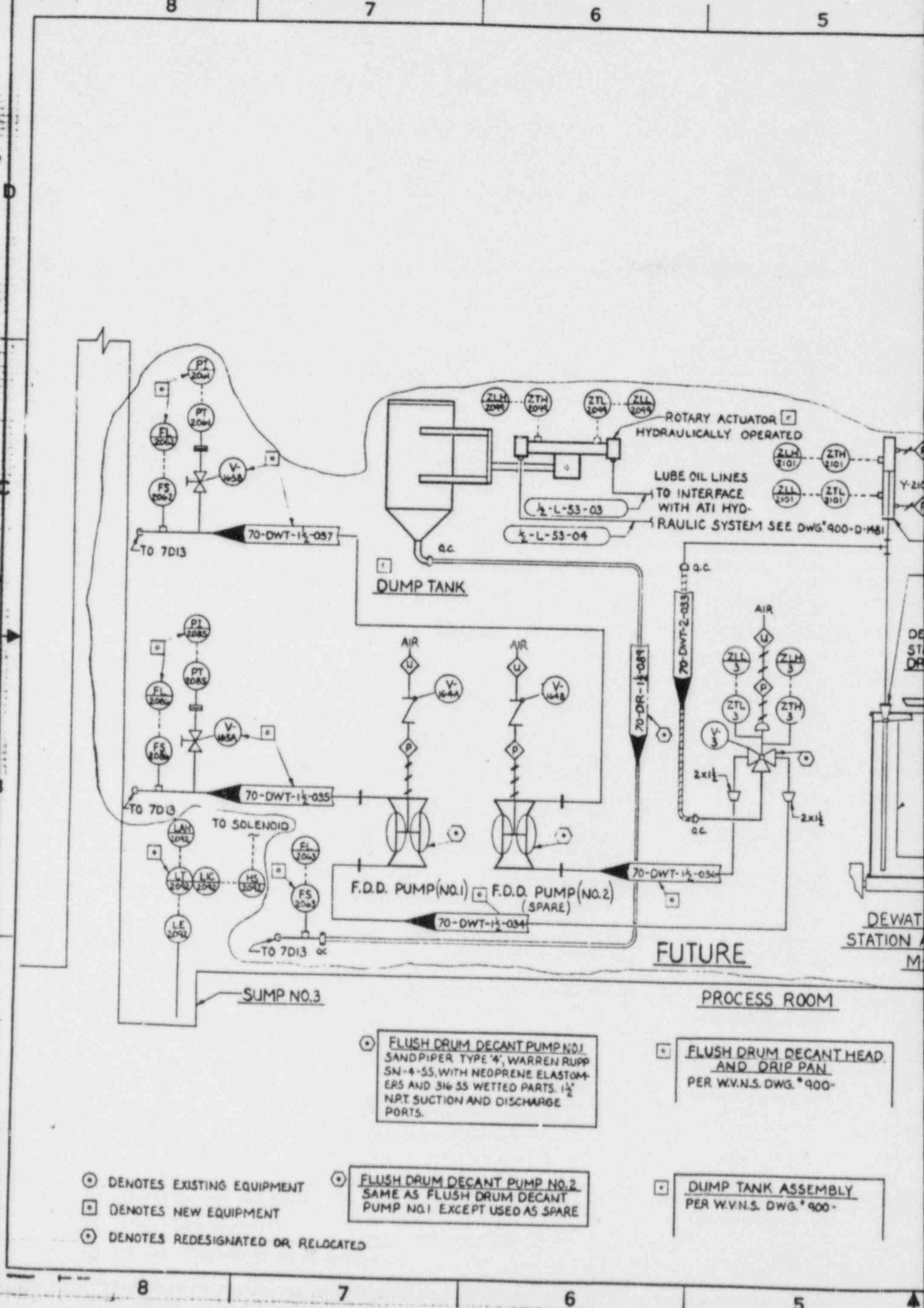

8
7
6
5
D
C
B
A
PT 2041
PT 2041
FL 2062
FS 2062
V-165B
70-DWT-1½-037
TO 7D13
ZLH 2099
ZTH 2099
ZTL 2099
ZLL 2099
ROTARY ACTUATOR
HYDRAULICALLY OPERATED
ZLH 2101
ZTH 2101
ZLL 2101
ZTL 2101
LUBE OIL LINES
TO INTERFACE
WITH ATI HYD-
RAULIC SYSTEM SEE DWG.# 900-D-1481
½-L-53-03
½-L-53-04
Q.C.
DUMP TANK
PI 2085
PT 2085
FL 2064
FS 2084
V-165A
70-DWT-1½-035
TO 7D13
AIR
V-164A
V-164B
70-DR-1½-089
70-DWT-2-033
ZLL 3
ZLH 3
ZTL 3
ZTH 3
V-3
2x1½
LAH 2042
LT 2042
LIC 2042
HS 2042
LE 2042
TO SOLENOID
FL 2063
FS 2063
F.D.D. PUMP (NO.1)
F.D.D. PUMP (NO.2)
(SPARE)
70-DWT-1½-036
70-DWT-1½-034
TO 7D13
FUTURE
DEWAT
STATION A
SUMP NO.3
PROCESS ROOM
FLUSH DRUM DECANT PUMP NO.1
SANDPIPER TYPE '4', WARREN RUPP SN-4-55, WITH NEOPRENE ELASTOMERS AND 316 SS WETTED PARTS. 1½" N.P.T. SUCTION AND DISCHARGE PORTS.
FLUSH DRUM DECANT HEAD AND DRIP PAN
PER W.V.N.S. DWG.# 900-
DENOTES EXISTING EQUIPMENT
DENOTES NEW EQUIPMENT
DENOTES REDESIGNATED OR RELOCATED
FLUSH DRUM DECANT PUMP NO.2
SAME AS FLUSH DRUM DECANT PUMP NO.1 EXCEPT USED AS SPARE
DUMP TANK ASSEMBLY
PER W.V.N.S. DWG.# 900-

900D-397 Sh 3

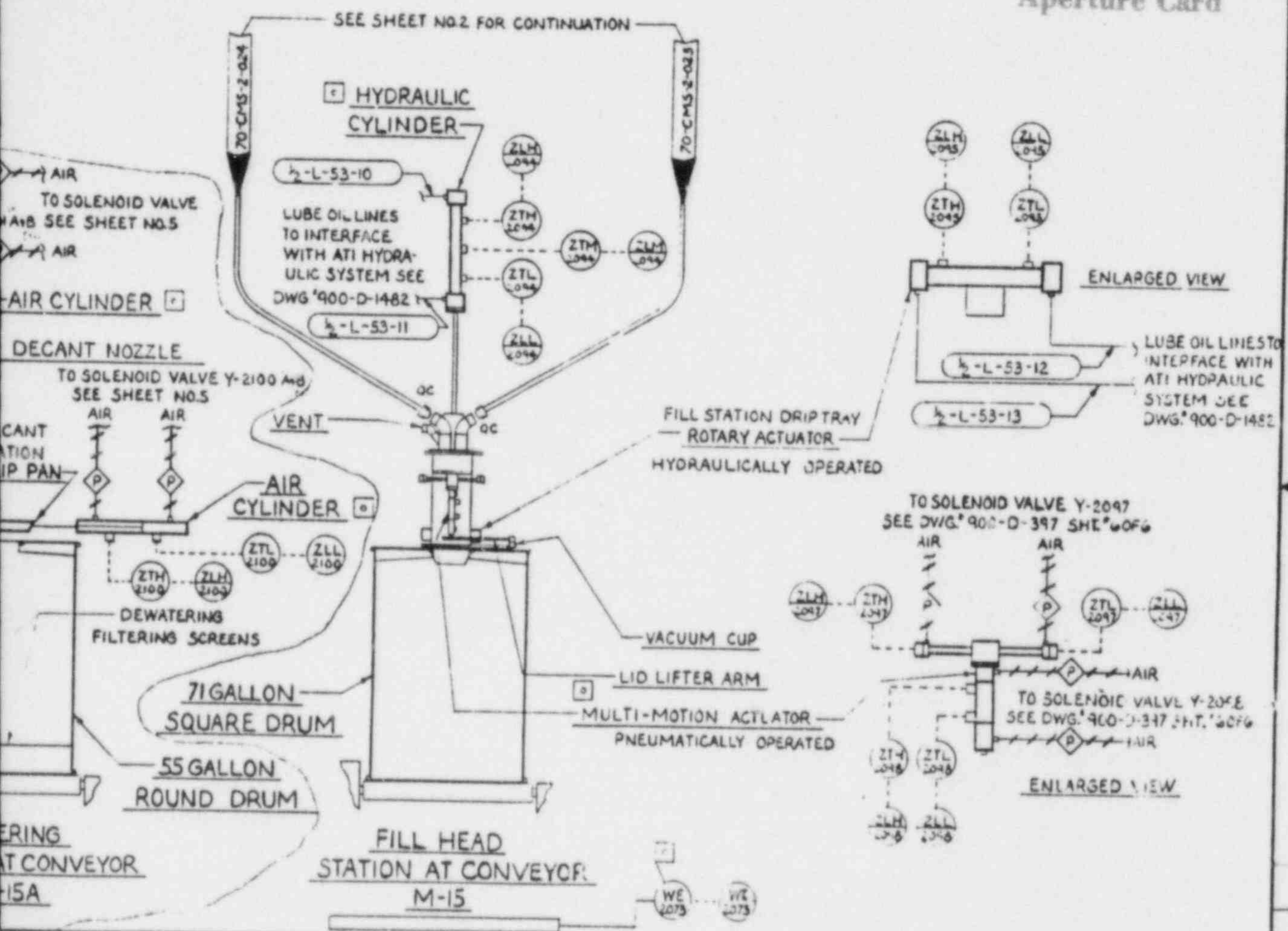
DWG NO	SHEET
900-D-397	3

REVISIONS

ZONE	REV	DESCRIPTION	DATE	APPROVED
	4	REVISED - REDRAWN PER ECN 999	[illegible]	[illegible]

TI
APERTURE
CARD

Also Available On
Aperture Card



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FILL HEAD ASSEMBLY
PER W.V.N.S. DWG. 900-D-1394

LID TRANSFER ASSEMBLY
PER W.V.N.S. DWG. 900-D-1394

NOTE:
1. SEE NOTE 3 ON A.T.I. DWG. 172-PI-01

QTY REQD	ITEM NO	NOMENCLATURE OR DESCRIPTION	PART OR IDENTIFYING NO	MATERIAL OR SPEC

PARTS LIST

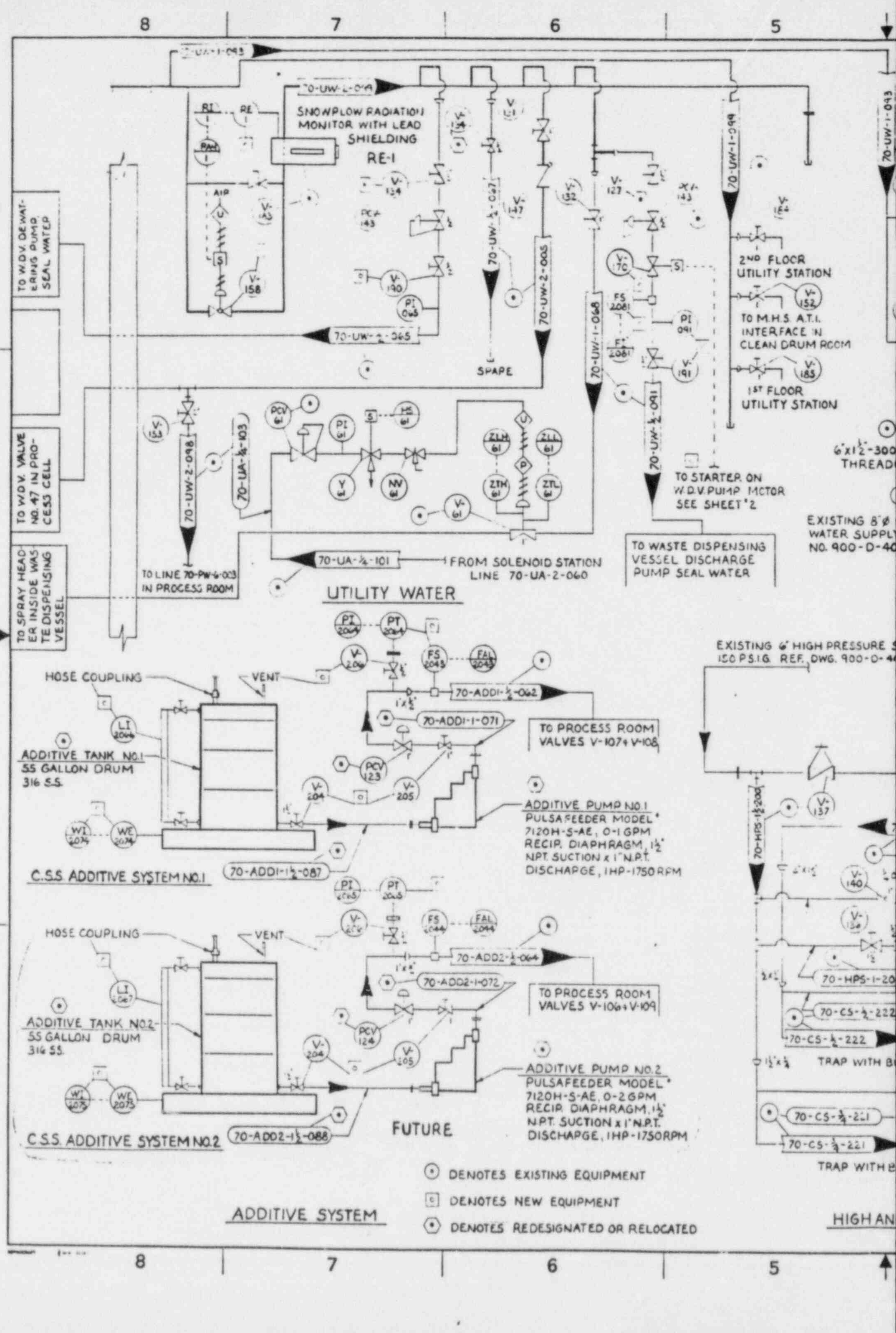
UNLESS OTHERWISE SPECIFIED
TOLERANCES - DO NOT SCALE

FOR
West Valley Nuclear Services Co., Inc.
West Valley, New York

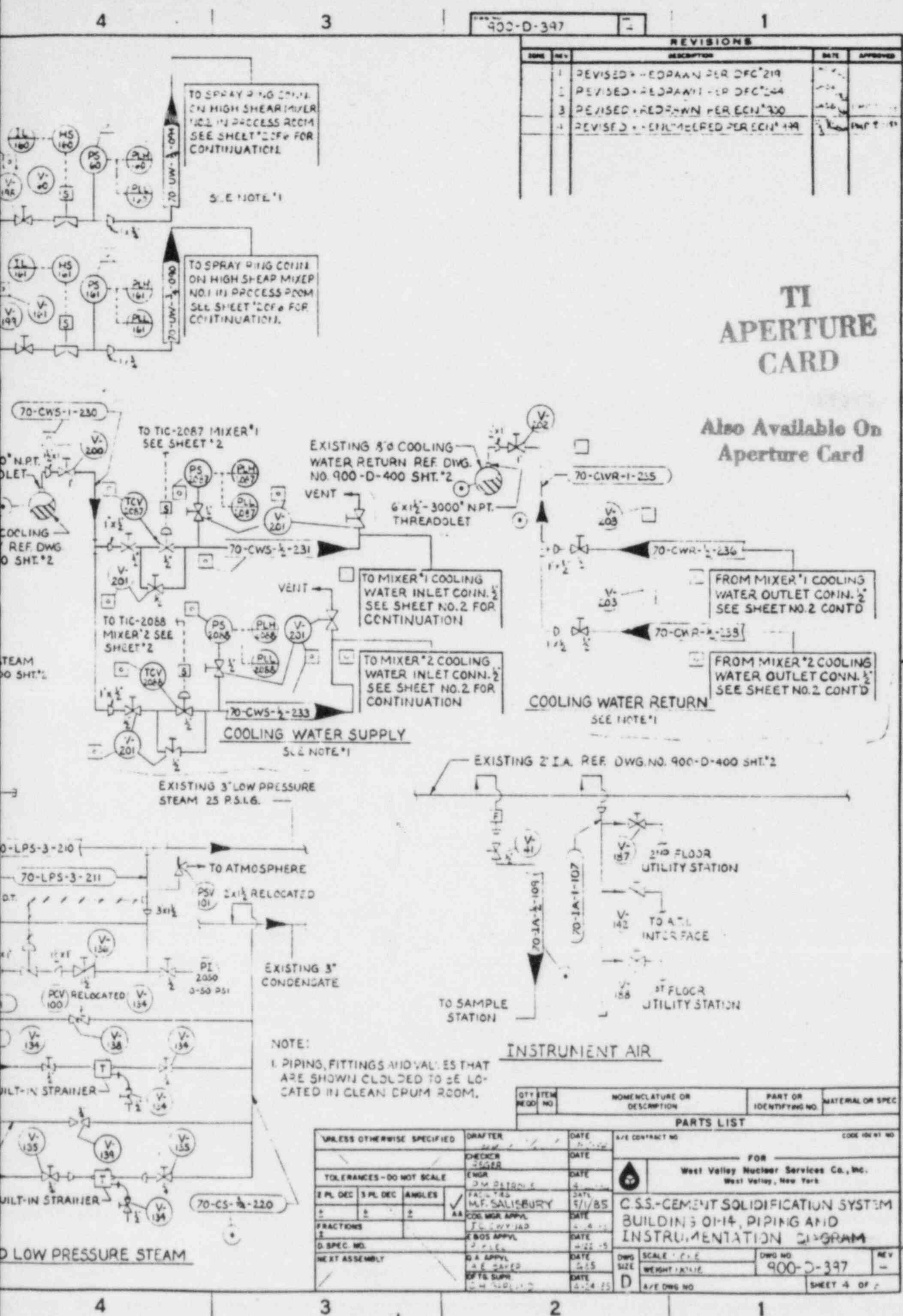
C.S.S. CEMENT SOLIDIFICATION SYSTEM
BUILDING 01-14, PIPING AND
INSTRUMENTATION DIAGRAM

DWG SIZE D | SCALE NONE | WEIGHT NONE | DWG NO 900-D-397 | REV 4 | SHEET 3 OF 6

FIGURE G.6.1-1



UTILITY WATER
SNOWPLOW RADIATION MONITOR WITH LEAD SHIELDING
RE-1
TO W.D.V. DE-WATERING PUMP SEAL WATER
TO W.D.V. VALVE NO. 47 IN PROCESS CELL
TO SPRAY HEADER INSIDE WASTE DISPENSING VESSEL
70-UW-2-049
70-UW-1-093
70-UW-1-099
70-UW-2-065
70-UW-2-005
70-UW-1-068
70-UW-2-098
70-UA-1/4-103
70-UA-1/4-101
FROM SOLENOID STATION LINE 70-UA-2-060
TO LINE 70-PW-6-003 IN PROCESS ROOM
SPARE
2ND FLOOR UTILITY STATION
TO M.H.S. A.T.I. INTERFACE IN CLEAN DRUM ROOM
1ST FLOOR UTILITY STATION
TO STARTER ON W.D.V. PUMP MOTOR SEE SHEET 2
TO WASTE DISPENSING VESSEL DISCHARGE PUMP SEAL WATER
EXISTING 8" Ø WATER SUPPLY NO. 900-D-40
EXISTING 6" HIGH PRESSURE S 150 P.S.I.G. REF. DWG. 900-D-4
HOSE COUPLING
VENT
ADDITIVE TANK NO.1 55 GALLON DRUM 316 S.S.
70-ADD1-1/2-062
70-ADD1-1-071
TO PROCESS ROOM VALVES V-107 + V-108
ADDITIVE PUMP NO.1 PULSAFEEDER MODEL 7120H-S-AE, 0-1 GPM RECIP. DIAPHRAGM, 1 1/2" NPT. SUCTION x 1" N.P.T. DISCHARGE, 1HP-1750 RPM
70-ADD1-1 1/2-087
C.S.S. ADDITIVE SYSTEM NO.1
ADDITIVE TANK NO.2 55 GALLON DRUM 316 S.S.
70-ADD2-1/2-064
70-ADD2-1-072
TO PROCESS ROOM VALVES V-106 + V-109
ADDITIVE PUMP NO.2 PULSAFEEDER MODEL 7120H-S-AE, 0-2 GPM RECIP. DIAPHRAGM, 1 1/2" N.P.T. SUCTION x 1" N.P.T. DISCHARGE, 1HP-1750 RPM
70-ADD2-1 1/2-088
FUTURE
C.S.S. ADDITIVE SYSTEM NO.2
ADDITIVE SYSTEM
DENOTES EXISTING EQUIPMENT
DENOTES NEW EQUIPMENT
DENOTES REDESIGNATED OR RELOCATED
70-HPS-1 1/2-200
70-CS-1/2-222
70-CS-1/2-221
TRAP WITH B
HIGH AN



TI APERTURE CARD

Also Available On Aperture Card

FIGURE G.6.1-1

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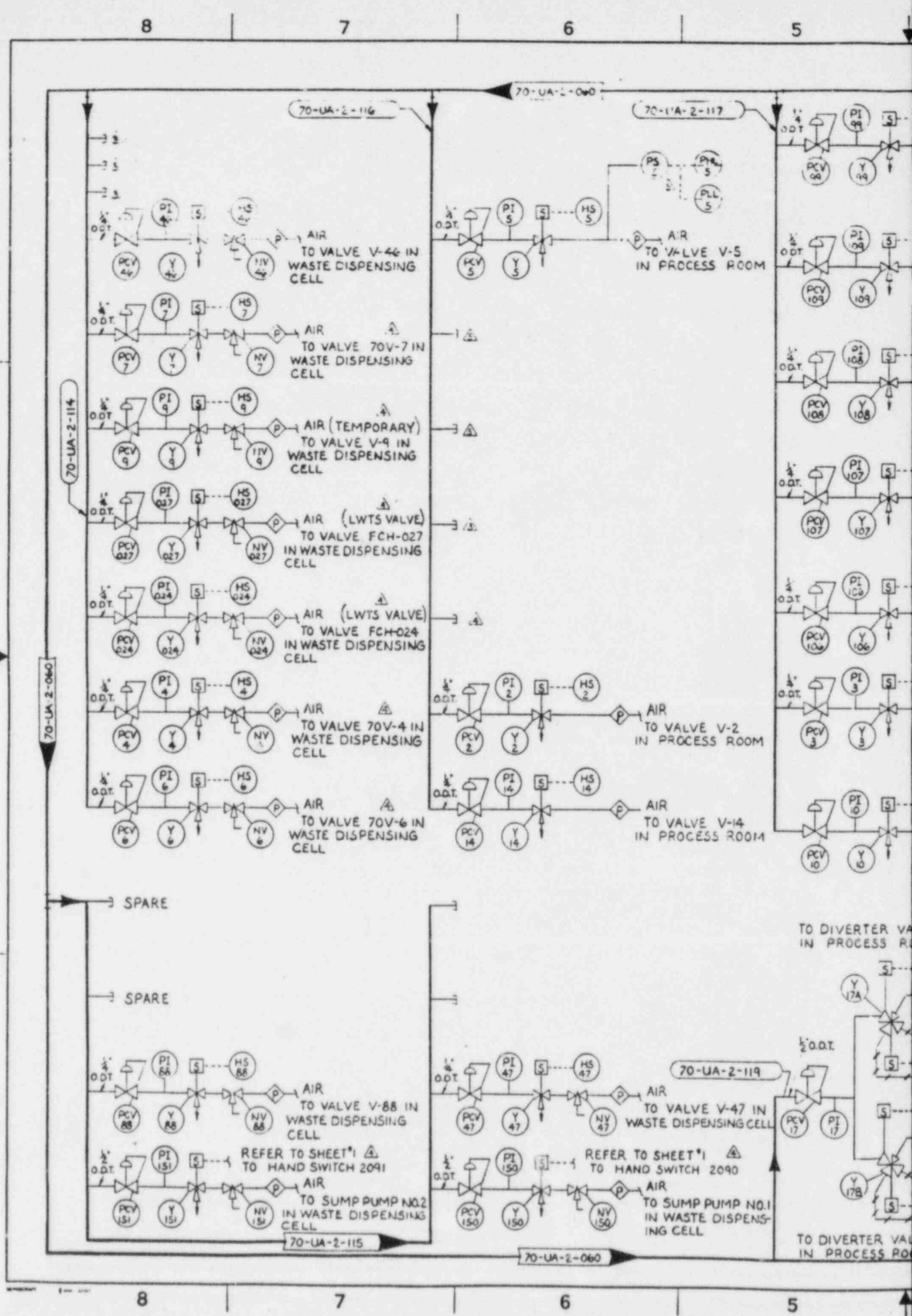


8
7
6
5
D
C
B
A
70-UA-2-060
70-UA-2-116
70-UA-2-117
70-UA-2-114
AIR TO VALVE V-46 IN WASTE DISPENSING CELL
AIR TO VALVE V-5 IN PROCESS ROOM
AIR TO VALVE 70V-7 IN WASTE DISPENSING CELL
AIR (TEMPORARY) TO VALVE V-9 IN WASTE DISPENSING CELL
AIR (LWTS VALVE) TO VALVE FCH-027 IN WASTE DISPENSING CELL
AIR (LWTS VALVE) TO VALVE FCH-024 IN WASTE DISPENSING CELL
AIR TO VALVE 70V-4 IN WASTE DISPENSING CELL
AIR TO VALVE V-2 IN PROCESS ROOM
AIR TO VALVE 70V-6 IN WASTE DISPENSING CELL
AIR TO VALVE V-14 IN PROCESS ROOM
SPARE
SPARE
TO DIVERTER VA IN PROCESS R
70-UA-2-119
AIR TO VALVE V-88 IN WASTE DISPENSING CELL
AIR TO VALVE V-47 IN WASTE DISPENSING CELL
REFER TO SHEET #1 TO HAND SWITCH 2091
AIR TO SUMP PUMP NO.2 IN WASTE DISPENSING CELL
REFER TO SHEET #1 TO HAND SWITCH 2090
AIR TO SUMP PUMP NO.1 IN WASTE DISPENSING CELL
70-UA-2-115
70-UA-2-060
TO DIVERTER VA IN PROCESS RO

900D-397 5

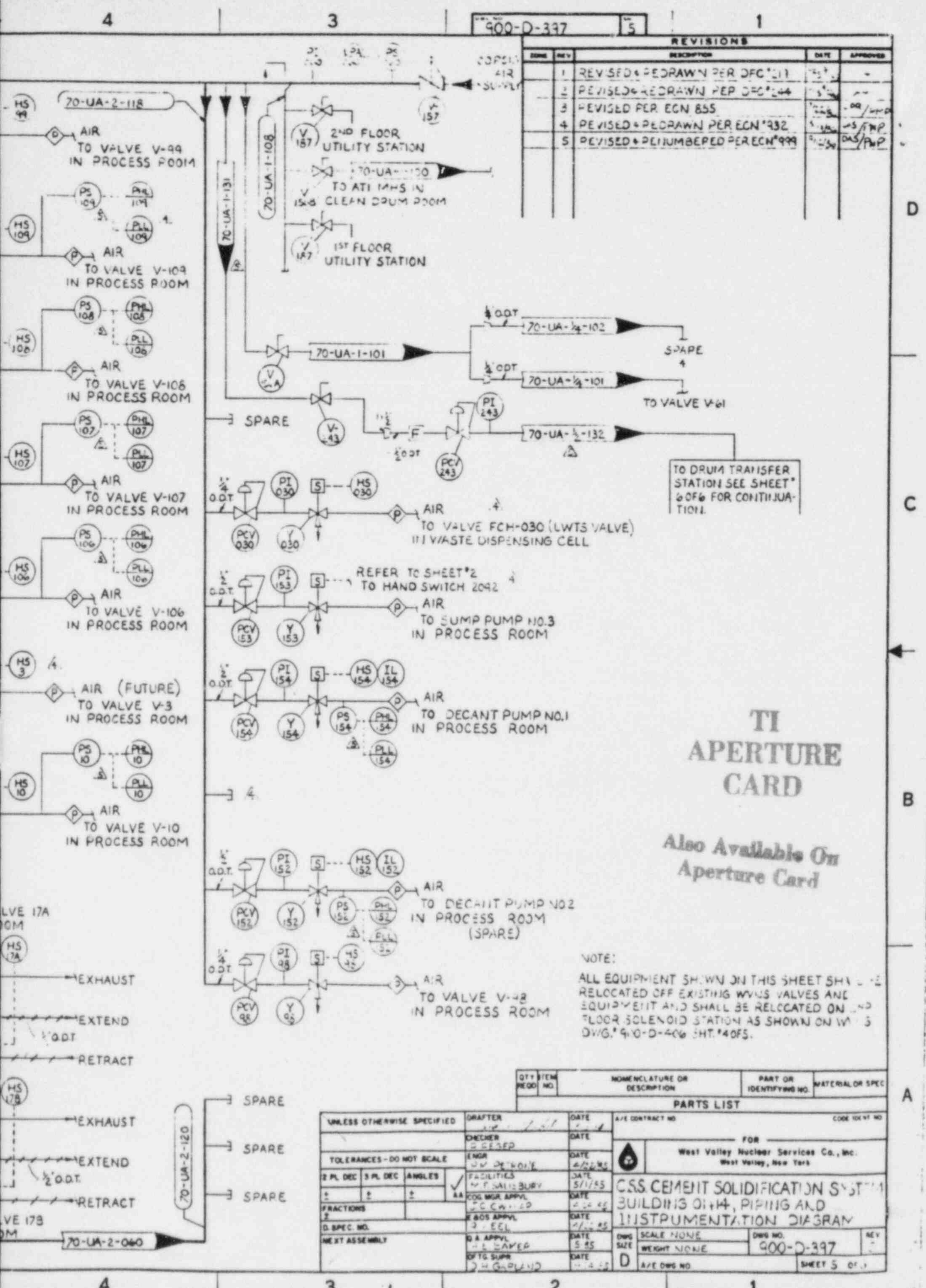
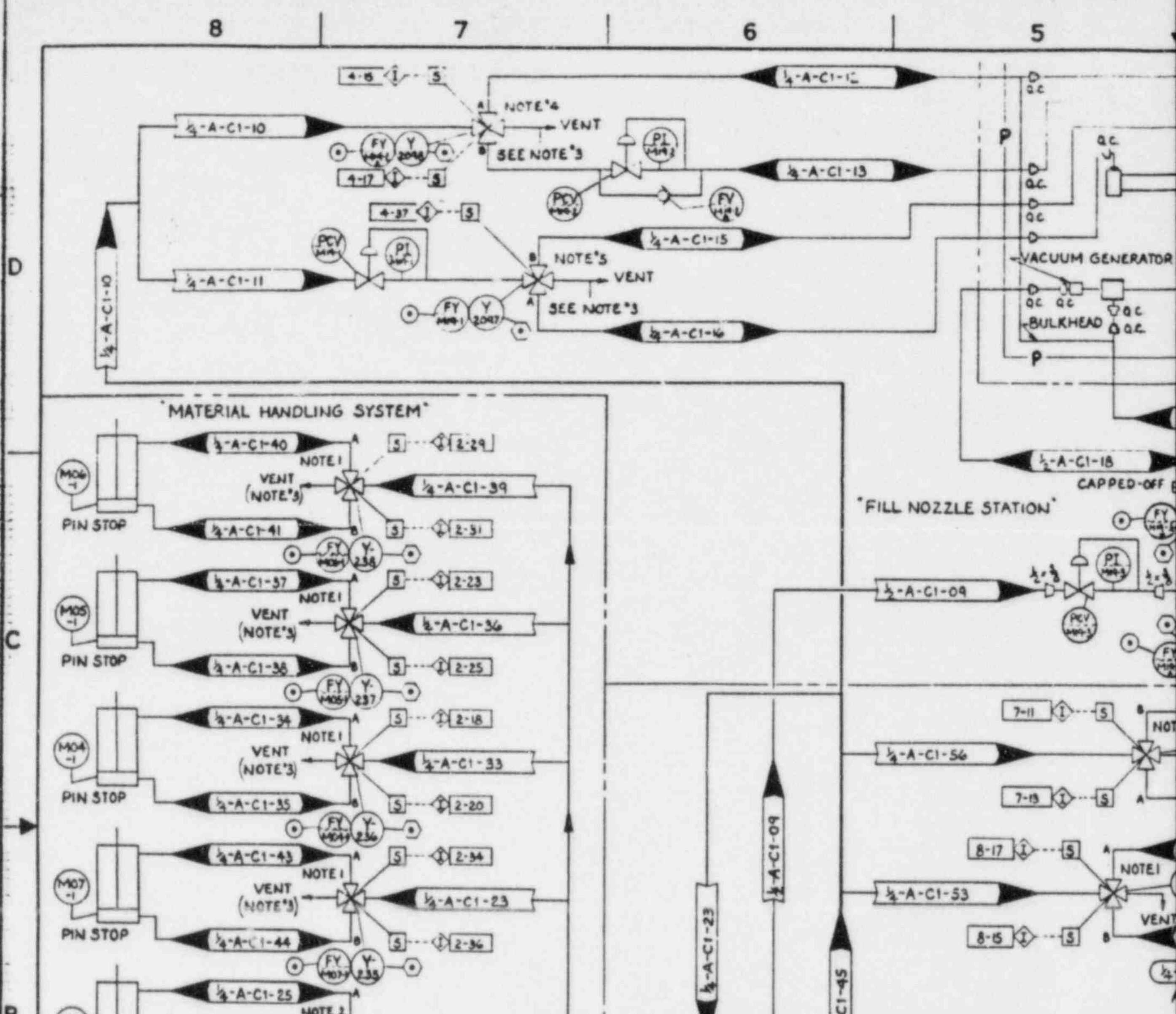


FIGURE G.6.1-1

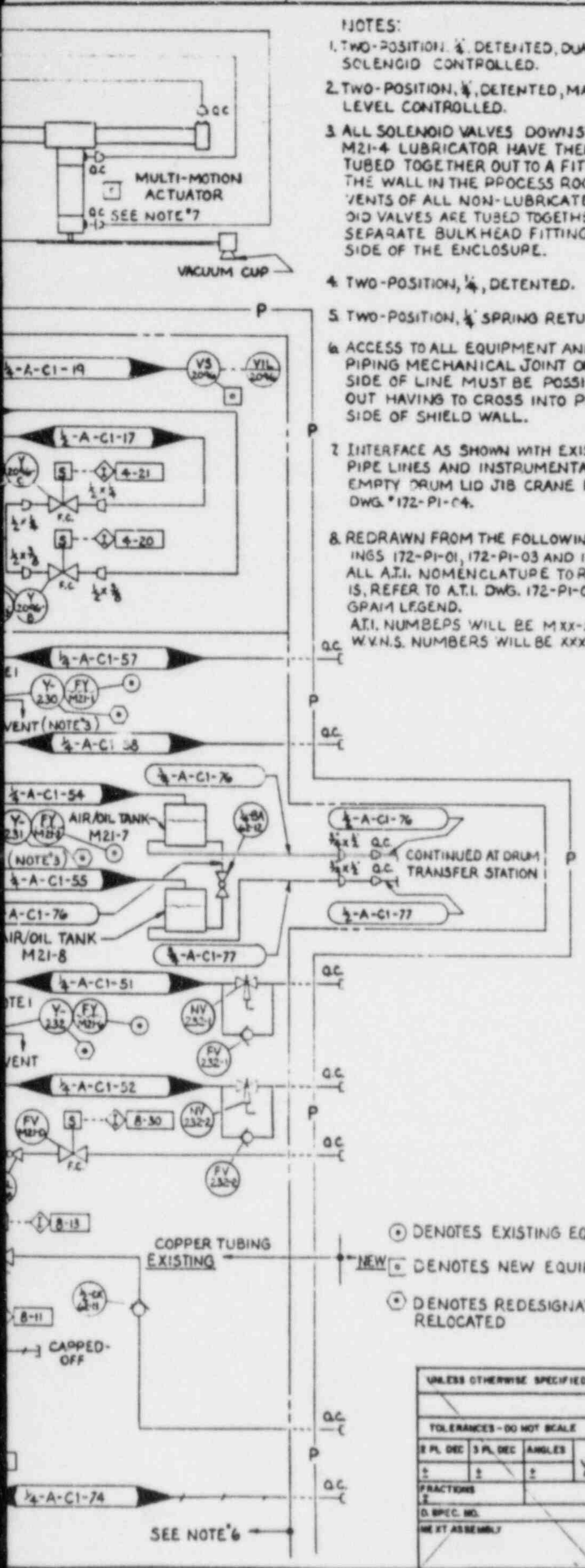
8611210386-13



"MATERIAL HANDLING SYSTEM"
"FILL NOZZLE STATION"
VACUUM GENERATOR
BULKHEAD
CAPPED-OFF
PIN STOP
VENT (NOTE 3)
NOTE 1
NOTE 2
NOTE 4
NOTE 5
SEE NOTE 3
NOTE: LOCATED IN CLEAN DRUM ROOM
AIR CYLINDER
AIR EJECTOR
VACUUM CUP
DRUM TRANSFER STATION
REF. DWG. NO. 900-D-397 SHT. 5 OF 5 UTILITY AIR
REF. DWG. NO. 900-D-397 SHT. 4 OF 5 INSTRUMENT AIR
REF. DWG. NO. 900-D-397 SHT. 4 OF 5 UTILITY WATER
WVNS
ATI
UTILITY AIR
70-UA-1-108
70-UA-1-100
70-UA-½-132
70-UA-½-134
70-UA-¼-133
70-IA-1-107
70-UW-1-099
1-A-C1-45
1-C-C1-46

900D-397 0

400-D-397 | 0



REVISIONS

ZONE	REV	DESCRIPTION	DATE	APPROVED
	0	THIS DRAWING CREATED BY ECN*779 AND LR* 659		

NOTES:

1. TWO-POSITION, ¼, DETENTED, DUAL SOLENOID CONTROLLED.
2. TWO-POSITION, ¼, DETENTED, MANUAL LEVEL CONTROLLED.
3. ALL SOLENOID VALVES DOWNSTREAM OF M21-4 LUBRICATOR HAVE THEIR VENTS TUBED TOGETHER OUT TO A FITTING ON THE WALL IN THE PROCESS ROOM. THE VENTS OF ALL NON-LUBRICATED SOLENOID VALVES ARE TUBED TOGETHER TO A SEPARATE BULKHEAD FITTING ON THE SIDE OF THE ENCLOSURE.
4. TWO-POSITION, ¼, DETENTED.
5. TWO-POSITION, ¼ SPRING RETURN.
6. ACCESS TO ALL EQUIPMENT AND FIRST PIPING MECHANICAL JOINT ON ARROW SIDE OF LINE MUST BE POSSIBLE WITHOUT HAVING TO CROSS INTO PROCESS SIDE OF SHIELD WALL.
7. INTERFACE AS SHOWN WITH EXISTING PNEU-PIPE LINES AND INSTRUMENTATION OF EMPTY DRUM LID J18 CRANE REF. A.T.I. DWG.*172-P1-04.
8. REDRAWN FROM THE FOLLOWING A.T.I. DRAWINGS 172-P1-01, 172-P1-03 AND 172-P1-04. ALL A.T.I. NOMENCLATURE TO REMAIN AS IS, REFER TO A.T.I. DWG. 172-P1-00 FOR DIAGRAM LEGEND. A.T.I. NUMBERS WILL BE Mxx-x. W.V.N.S. NUMBERS WILL BE xxx OR xxxx.

⊙ DENOTES EXISTING EQUIPMENT

⊡ DENOTES NEW EQUIPMENT

⊙ DENOTES REDESIGNATED OR RELOCATED

TI APERTURE CARD

Also Available On Aperture Card

FIGURE G.6.1-1

QTY REQD	ITEM NO.	NOMENCLATURE OR DESCRIPTION	PART OR IDENTIFYING NO.	MATERIAL OR SPEC

PARTS LIST

UNLESS OTHERWISE SPECIFIED; TOLERANCES - DO NOT SCALE; 2 PL DEC ±; 3 PL DEC ±; ANGLES ±; FRACTIONS ±; D. SPEC. NO.; NEXT ASSEMBLY

DRAFTER; CHECKER; ENGR.; COG. MGR. APPVL. N/A; E&OS APPVL. N/A; Q.A. APPVL. N/A

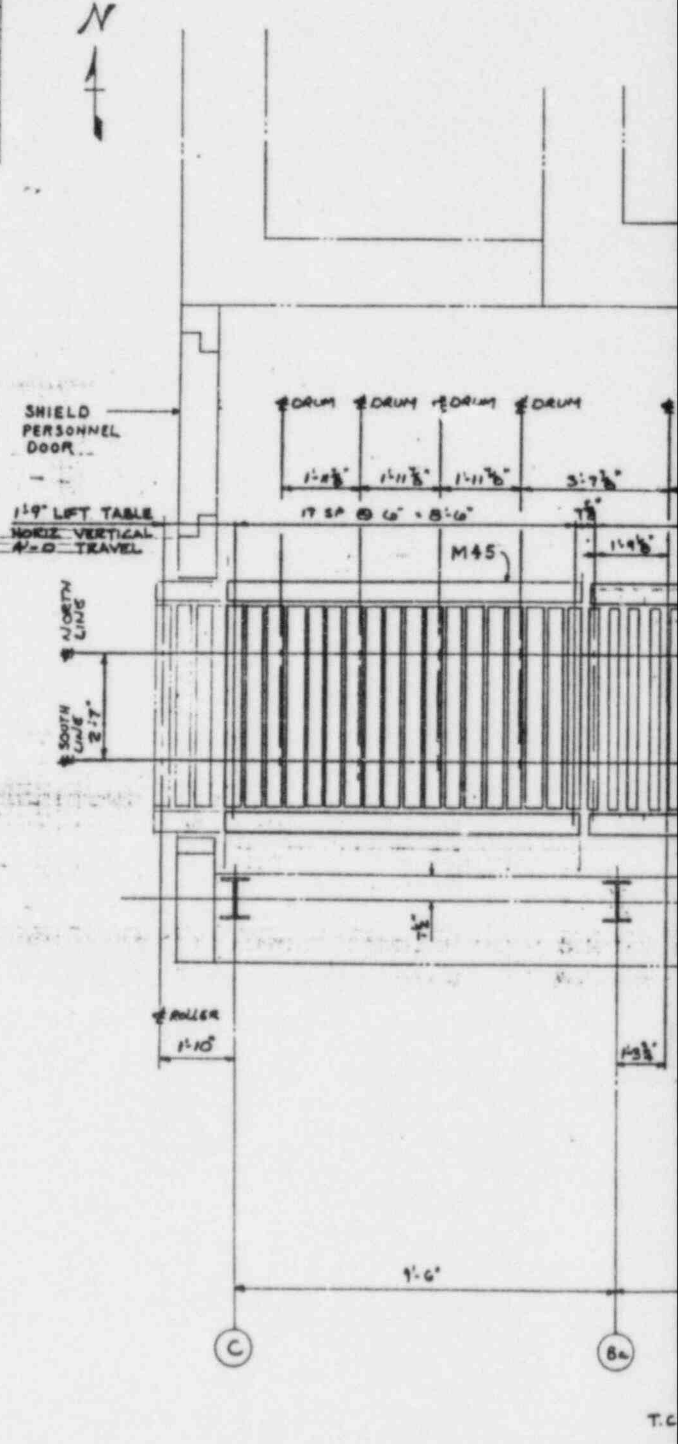
FOR West Valley Nuclear Services Co., Inc. West Valley, New York

C.S.S. CEMENT SOLIDIFICATION SYSTEM BUILDING 01-14, PIPING AND INSTRUMENTATION DIAGRAM

DWG SIZE D | SCALE NONE | WEIGHT NONE | DWG NO. 900-D-397 | REV 0 | SHEET OF

8611210386-14

DWG. NO.	DESCRIPTION
900D-1365-(1 SHT.)	RTS - DRUM LOAD OUT - CONVEYOR LAYOUT
900D-1330-(1 SHT.)	RTS - SWIPE/OVERPACK - ASSEMBLY
900D-1331-(3 SHT.)	RTS - SWIPE/OVERPACK - ENCLOSURE
900D-1332-(2 SHT.)	RTS - SWIPE/OVERPACK - AIRLOCK DOOR DET.
900D-1333-(2 SHT.)	RTS - SWIPE/OVERPACK - AIRLOCK CONV. DET.
900D-1334-(5 SHT.)	RTS - SWIPE/OVERPACK - TURNTABLE DETAIL
900D-1335-(1 SHT.)	RTS - SWIPE/OVERPACK - SHROUD DETAIL
900D-1336-(1 SHT.)	RTS - SWIPE/OVERPACK - DRIP PAN DETAIL
900D-1337-(1 SHT.)	RTS - SWIPE/OVERPACK - LID LIFT DETAIL
900D-1374	RTS-DRUM LOADOUT FILL STATION CONVEYOR



DRAWING NUMBER 900D-1365

DRAWING NUMBER

DRAWING

900D-1365 1

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Also Available On Aperture Card

REVISIONS				
ZONE	REV	DESCRIPTION	DATE	APPROVED
	0	ER 860	7/15/86	
	1	ECN 925-RELOCATED DOSE & CRIMPER STA.	8/11/86	

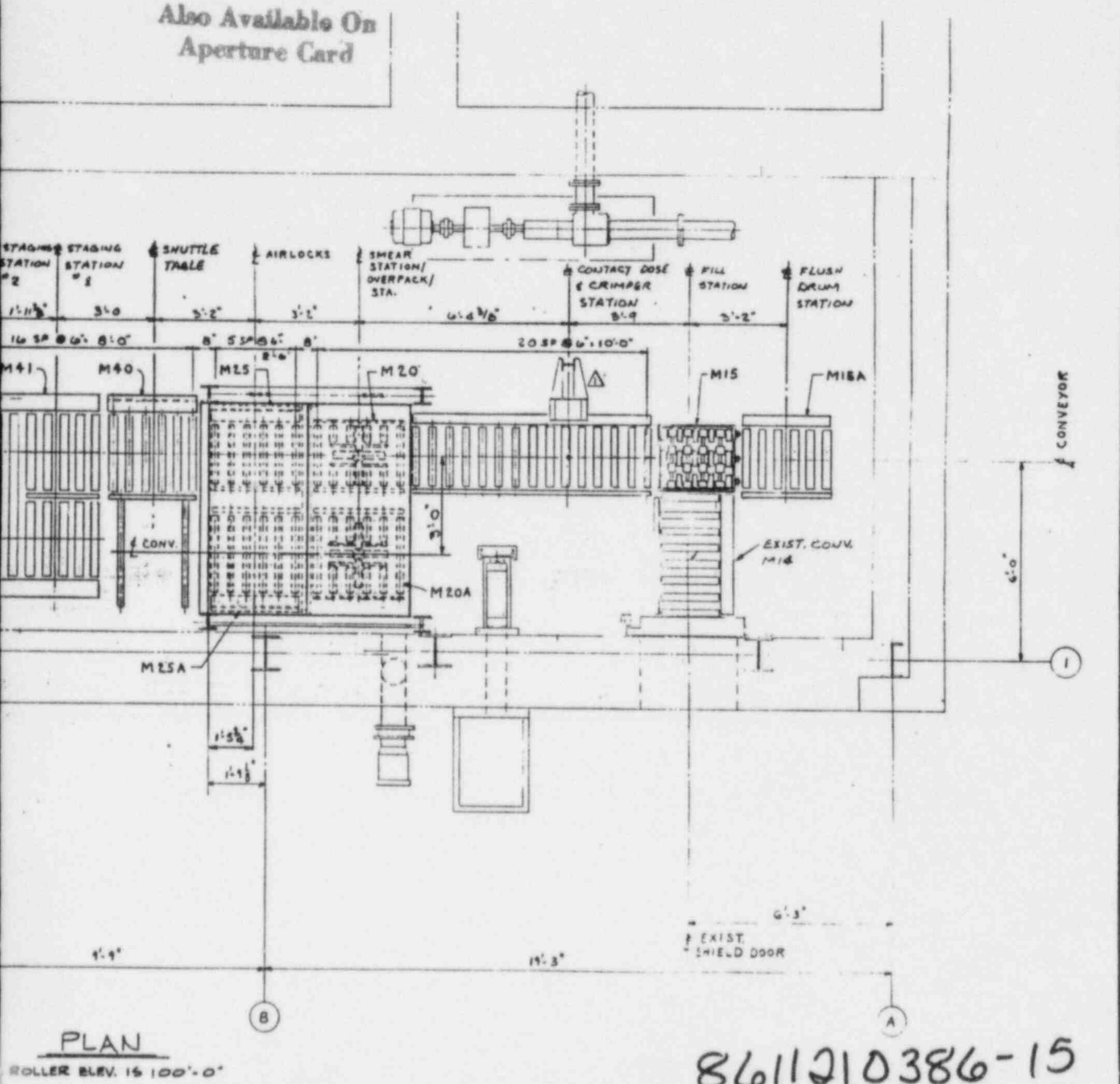


FIGURE G.6.3-1

8611210386-15

PARTS LIST

QTY. REQD.	SYM	ITEM NO.	NOMENCLATURE OR DESCRIPTION	CODE IDENT NO.	PART OR IDENTIFYING NO.	MATERIAL	SPECIFICATION	ZONE

INDEX CODE NUMBER — AREA, DWG TYPE, CL., ORIG. — SPEC CODE

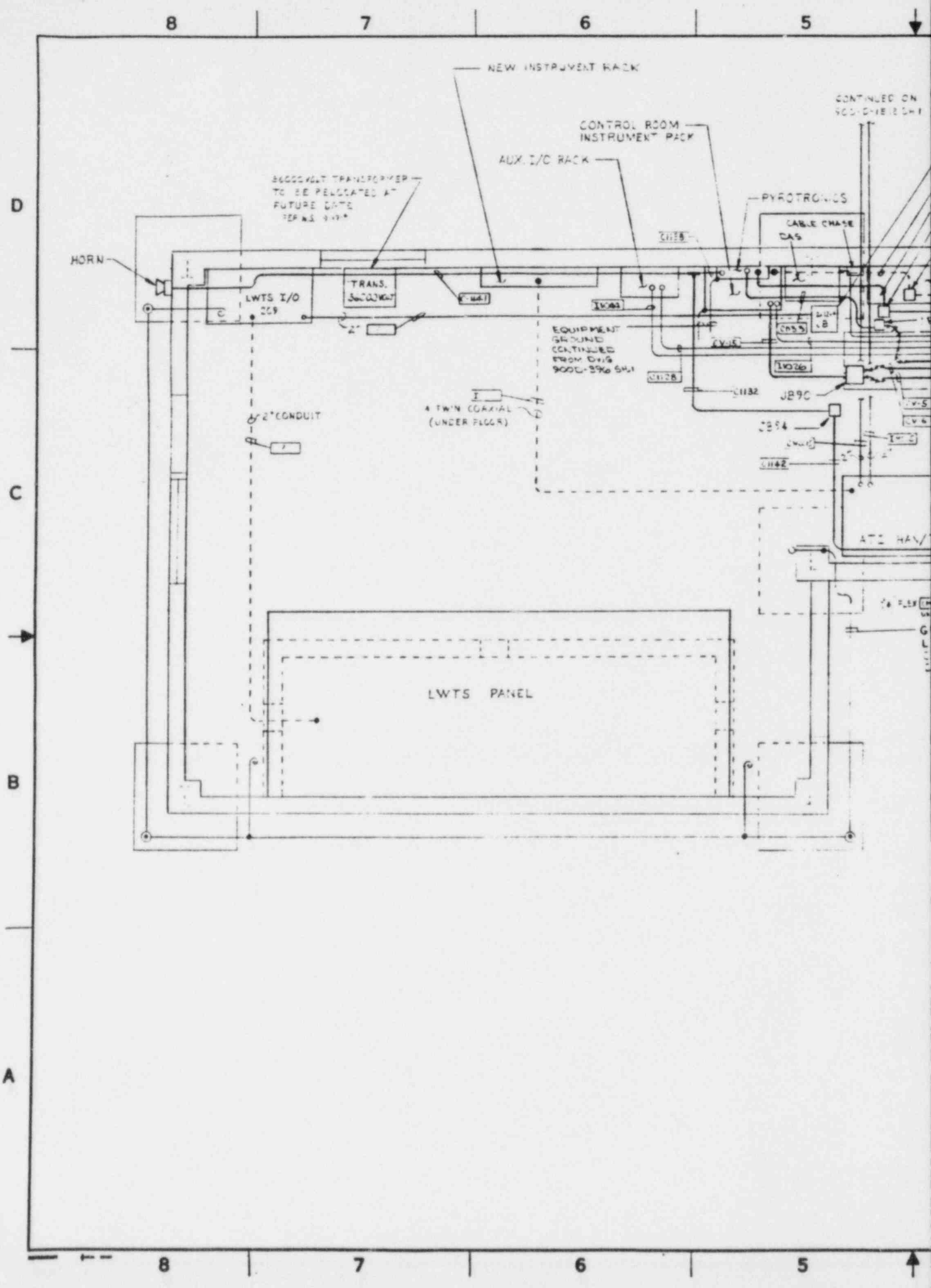
UNLESS OTHERWISE SPECIFIED — TOLERANCES - DO NOT SCALE — 2PL DEC ± 1/16, 3PL DEC ± 1/16, ANGLES ± 1/16 — FRACTIONS ± 1/16

CONTRACT NO. — DFTSMN R. Reher — DATE OF DWG. 6-19-86

FOR West Valley Nuclear Services Co., Inc. West Valley, New York

RTS-RADWASTE TREATMEN SYSTEM
DRUM LOADOUT
CONVEYOR LAYOUT

DWG SIZE D — SCALE 1/2"=1'-0 — WEIGHT — — DWG NO. 900D-1365 — REV 1 — SHEET 1 OF 1



NEW INSTRUMENT RACK
CONTROL ROOM INSTRUMENT RACK
AUX. I/O RACK
PYROTRONICS
CABLE CHASE
DAS
HORN
LWTS I/O
TRANS.
EQUIPMENT GROUND CONTINUED FROM DWG
JB9C
1/2" CONDUIT
4 TWIN COAXIAL (UNDER FLOOR)
LWTS PANEL
8
7
6
5
D
C
B
A

900D-389
SH. 4

DWG NO	SH
900D-389	4

REVISIONS

ZONE	REV	DESCRIPTION	DATE	APPROVED
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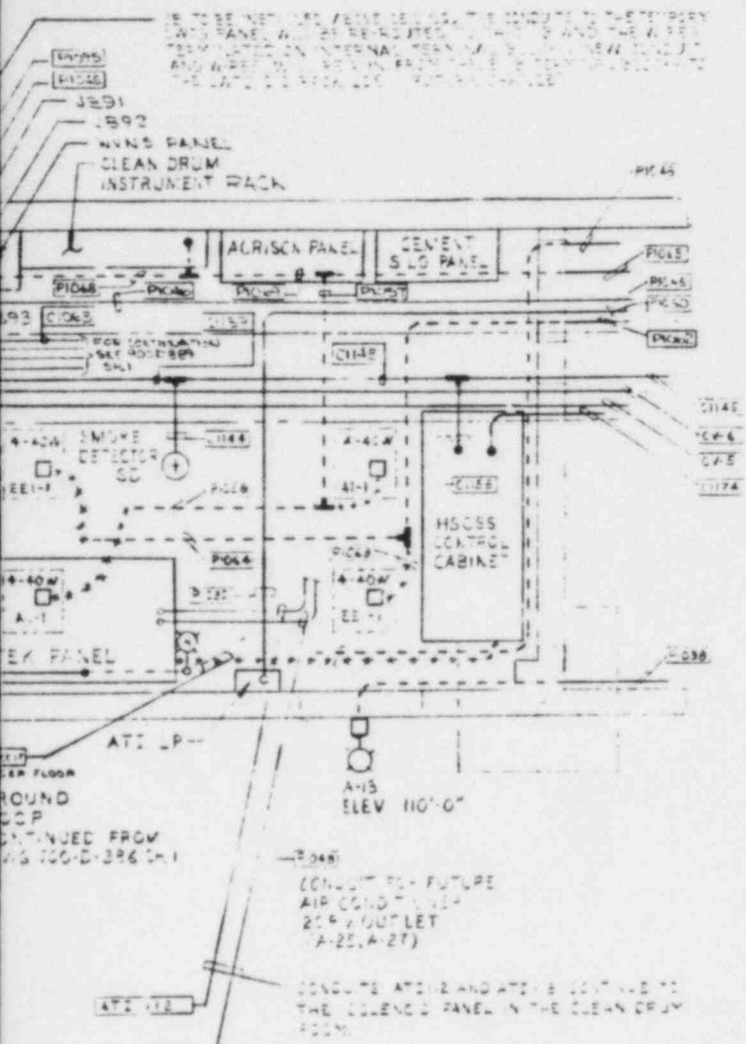


TI
APERTURE
CARD

Also Available On
Aperture Card

8611210386-16

Figure 6.6-1

QTY REQD	ITEM NO	NOMENCLATURE OR DESCRIPTION	PART OR IDENTIFYING NO.	MATERIAL OR SPEC

PARTS LIST

UNLESS OTHERWISE SPECIFIED

TOLERANCES - DO NOT SCALE

2 PL DEC | 3 PL DEC | ANGLES

FRACTIONS

Q. SPEC. NO.

NEXT ASSEMBLY

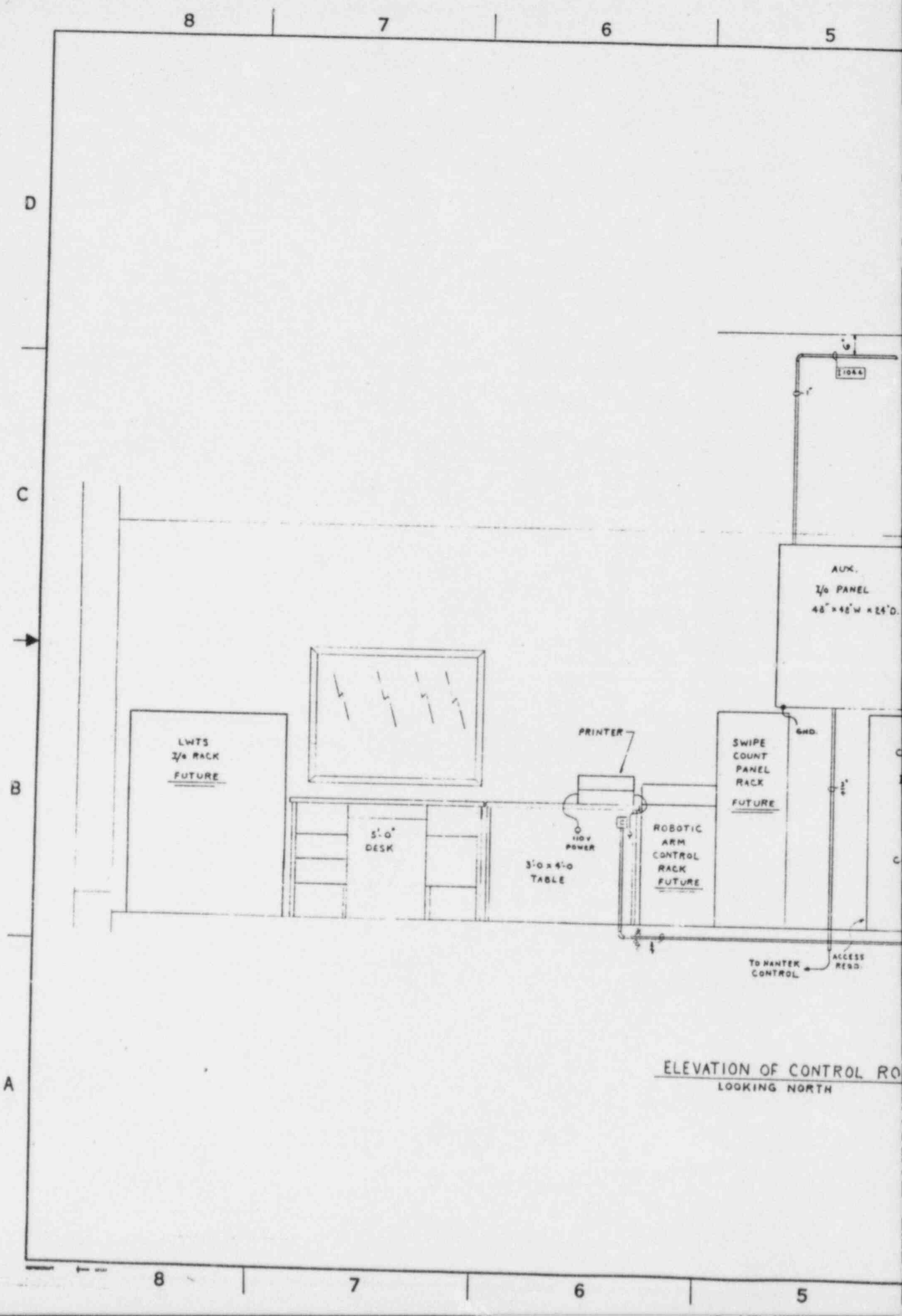
DRAFTER: CADMUS — DATE
CHECKER — DATE
ENGR — DATE
COG MGR APPVL — DATE
E SOS APPVL N/A — DATE
Q.A. APPVL N/A — DATE
APTS & SUPR — DATE

A/E CONTRACT NO — CODE IDENT NO

FOR
West Valley Nuclear Services Co., Inc.
West Valley, New York

CSS-CEMENT SOLIDIFICATION SYSTEM
BUILDING 01-14 CONTAMINATION EQUIPMENT LAYOUT

DWG SIZE: D — SCALE 1/2" = 1'-0" — WEIGHT — A/E DWG NO
DWG NO. 900-D-389 — REV 0
SHEET 4 OF



ELEVATION OF CONTROL RO
LOOKING NORTH

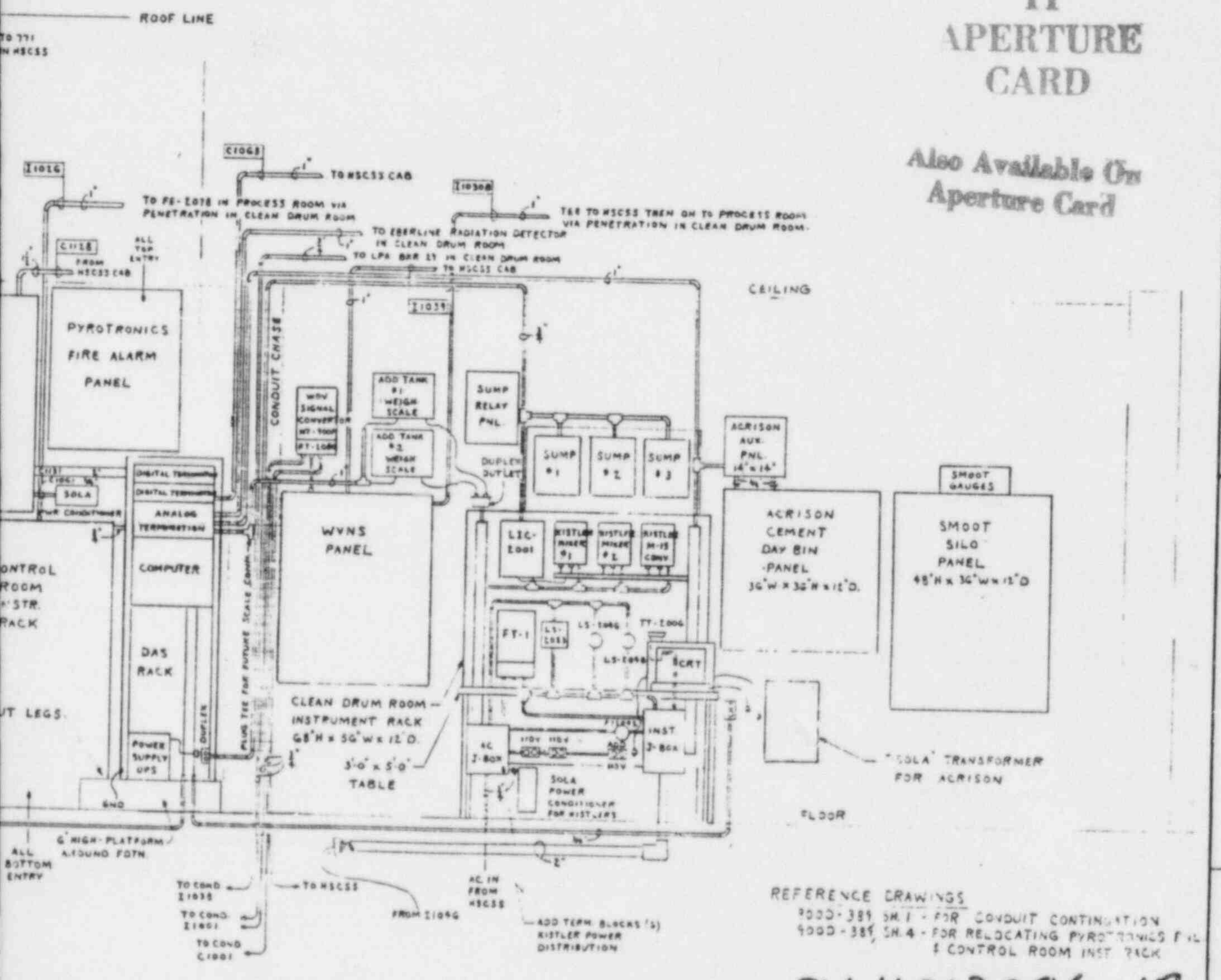
DWG NO. 900D-1437	SH 1

REVISIONS

ZONE	REV	DESCRIPTION	DATE	APPROVED
	0	ER 877	7/30/86	

TI APERTURE CARD

Also Available On Aperture Card



REFERENCE DRAWINGS
900D-389 SH. 1 - FOR CONDUIT CONTINUATION
900D-389 SH. 4 - FOR RELOCATING PYROTRONICS PNL & CONTROL ROOM INST. RACK

8611210386-17

PARTS LIST

QTY REQD	ITEM NO.	NOMENCLATURE OR DESCRIPTION	PART OR IDENTIFYING NO.	MATERIAL OR SPEC

UNLESS OTHERWISE SPECIFIED
TOLERANCES - DO NOT SCALE

DRAFTER WM. ZIMMERMAN — DATE 9-25-86

FOR West Valley Nuclear Services Co., Inc. West Valley, New York

CSS/LWTS CONTROL ROOM ELEVATION

DWG SIZE D — SCALE 1/4" = 1'-0" — DWG NO. 900D-1437 — REV 0 — SHEET 1 OF 1

Figure G.6.6-2

G.7.0 WASTE CONFINEMENT AND MANAGEMENT

G.7.1 WASTE MANAGEMENT CRITERIA

Criteria for the management of radioactive waste generated by the CSS and accompanying systems are described in the WVDP Long-Term Radioactive Waste Management Plan (WVDP, 1985). The guiding principles followed in the preparation of this plan are:

- Minimize all waste generation as much as possible,
- Provide as much flexibility as possible in designed facilities to accommodate future uncertainties (e.g., liquid and solid waste volumes, storage, process equipment, etc.),
- Segregate uncontaminated from contaminated waste as early as possible to minimize additional storage, disposal, and transportation requirements,
- Minimize occupational exposures,
- Minimize costs,
- Protect the worker, public health, and the environment, and
- Conform to applicable DOE Orders and guidance from other regulations provided by DOT, EPA, NRC, and New York State.

G.7.2 RADIOLOGICAL WASTES

The CSS and accompanying systems will generate minor amounts of radioactive wastes: spent roughing and HEPA filters, drum swipes and system flushwater. Solid wastes will be disposed of per existing procedures; liquid wastes will be directed to the LWTS (once it becomes operational).

Because the CSS is a Waste Processing Facility, the product itself is a radiological waste from other Project systems. The cement stabilized waste form will be suitable for either on-site disposal. Cemented TRU waste will be suitable for on-site storage and for transport to an off-site disposal location.

G.7.3 NONRADIOLGGICAL WASTES

Nonradiological wastes that will be generated by operation of the CSS include failed drums and caps, paper, and miscellaneous trash. The total volume of such wastes is estimated to be 30 m^3/yr. This waste will be transported off-site for disposal.

G.7.4 OFF-GAS TREATMENT AND VENTILATION

G.7.4.1 OPERATING CHARACTERISTICS

The 01-14 Building Heating and Ventilation (HV) System is schematically depicted in Figure G.7.4-1. Outside air is supplied to the operating aisles from the second floor supply fan (238 m^3/min) and through infiltration (20 m^3/min). A portion of this air (68 m^3/min) vents the operating aisles and is ultimately processed through a roughing and HEPA filter to a blower to be vented from a stack on the 01-14 Building. The remainder of the inflow is directed to: the CSS Process Room (38 m^3/min), the Waste Dispensing Cell (59 m^3/min), directly to two HEPA filters (6.5 m^3/min), and to the Off-Gas Cell (86 m^3/m). Air exiting the Process Room is directed to the Waste Dispensing the CTS/01-14 Building trench. Air exiting the Waste Dispensing Cell (115 ^{3}/min) is combined with 86 m^3/min from the Off-Gas Cell and 6.5 m^3/min from the operating aisles and exits through a series of two HEPA filters to be vented from a stack on top of the 01-14 Building.

The CSS vessel off-gas that vents the Waste Dispensing Tank, is heated and directed to the 01-14 Building HV System prior to being discharged from the stack on top of the 01-14 Building.

The ventilation systems generate minimal solid waste. Currently, the two HEPA filters in series and the roughing and HEPA filter are expected to be changed yearly.

G.7.4.2 SAFETY CRITERIA AND ASSURANCE

The roughing and final HEPA filters ensure adequate removal of radioactive particulate matter before venting to the surrounding environment. HEPA filters typically have a mass removal efficiency of greater than 99 percent. The ventilation for nonradioactive areas should not contain radioactive particulate matter. As a safety feature, however, this air is also directed through a series of HEPA filters.

G.7.5 LIQUID WASTE TREATMENT AND RETENTION

Spent vessel flushwater will be drained to the laundry and analytical drain catch tank (7D-13) and routed for processing to the LWTS.

G.7.6 LIQUID WASTE SOLIDIFICATION

Liquid wastes generated by the CSS will be treated and volume reduced in the LWTS. Concentrates, spent resins, and filter sludges from the LWTS will be solidified with cement in the CSS. Solidification, packaging, and storage procedures of these wastes are the same as for the primary feeds (Section G.6.0).

G.7.7 SOLID WASTES

Solid wastes generated by operation of the CSS consist of 208-L and 269-L drums of solidified waste, and the other radiological and nonradiological wastes identified in Sections G.7.2 and G.7.3. Handling of such wastes will be in accordance with procedures contained within the WVNS Radiological Controls Manual and WVNS Waste Management Plan.

REFERENCES FOR SECTION G.7.0

WVDP, 1986, "WVDP Long-Term Radioactive Waste Management Plan," WVDP-019, Rev. 5.

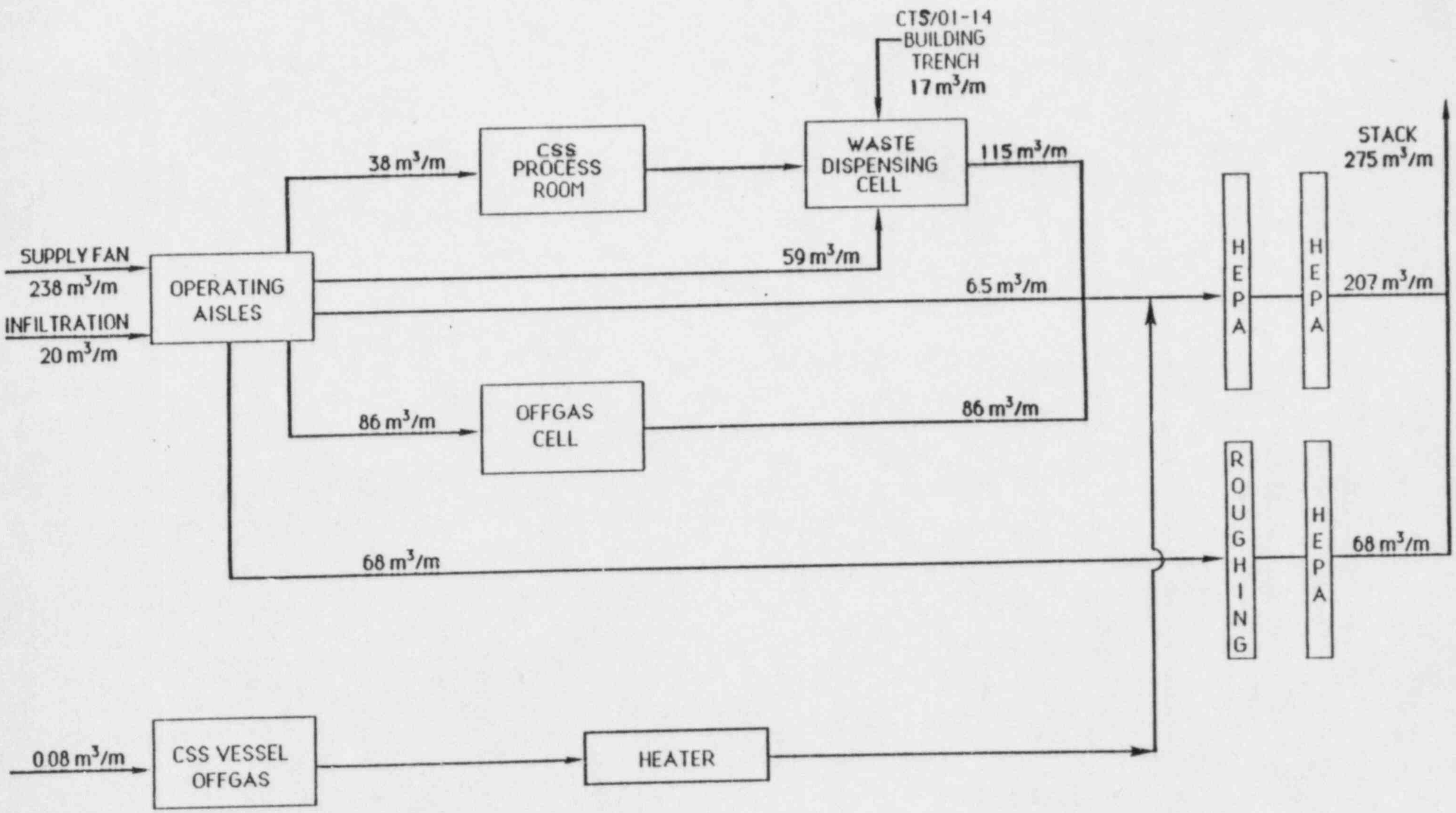


FIGURE G.7.4-1 FLOW DIAGRAM FOR THE 01-14 BUILDING VENTILATION SYSTEM

G.8.0 RADIATION PROTECTION

G.8.1 ASSURING THAT OCCUPATIONAL RADIATION EXPOSURES ARE AS LOW AS REASONABLY ACHIEVABLE (ALARA)

G.8.1.2 DESIGN CONSIDERATIONS

The key design consideration to maintain exposures ALARA is to ensure the control of radioactivity. Design features that ensure the confinement of radioactivity include:

- O The CSS will be remotely operated within a sealed, shielded cell;
- O The cell atmosphere will be maintained under a slight negative pressure relative to surrounding areas to ensure that air leakage will be into, rather than out of, the cell;
- O The radioactive liquids are transported between tanks via remotely operated and instrumented piping systems;
- O The radioactive liquids are processed in sealed vessels which are vented in a controlled manner;
- O Any contamination that gets into the cell air will be processed by the 01-14 Building HV System prior to being discharged through a stack;
- O Any liquid spills will drain to sumps where they can be collected for further processing;
- O Remote indicating radiological instrumentation will be used to monitor the product as well as cell and process conditions to provide verification that the facility is operating within design conditions;

- Use is made of a remotely operated Material Handling System to move drums through the process; and

- Use is made of shield walls and shield windows to reduce the dose to operators to less than 500 mrem/yr.

Additional design mitigative measures include:

- Use of solid state electronic instrumentation and control equipment to provide high reliability;

- Use of redundancy in critical aspects of the operation;

- Ability to monitor the process via control panel indications; and

- Use of a Closed Circuit Television System (CCTV) to provide a clear and unobstructed view of critical areas.

These design mitigative measures should provide a high degree of reliability in confinement of radioactivity.

G.8.1.3 OPERATIONAL CONSIDERATIONS

The CSS operation methods were developed to ensure that occupational exposures are in conformance with ALARA. These methods include automatic and remote operations and remote viewing.

Waste is transferred from the Waste Dispensing Vessel to the High-Shear Mixers through two three-way ball valves. The positions of the valves (open/closed) are constantly indicated on the control panel (see Section G.6.3.2.3) and are automatically controlled by the batch program. The operator sets the panel controls for the type of waste to be solidified and initiates the process. Process parameters are automatically selected. The waste feed and cement are metered into the High-Shear Mixers.

Empty drums are remotely positioned for fill by the Programmable Logic Controller (see Section G.6.1.1.2). Drum position is confirmed and a permissive is given for filling. After a drum is filled, a permissive is required for drum removal.

A remotely operated Automatic Drum Capping Device caps the drums. Remote indication of lid engagement is provided.

The Swipe Station allows the entire circumference of a drum to be smeared without direct radiation to the operator and allows the operator to remotely retrieve and read radioactive smear papers. The contact radiation dose rate can be measured in the range from 1 to 10,000 mR/h.

Contaminated drums are remotely overpacked at the Drum Overpack Station.

Drums are removed to an interim storage location by a conveyor remotely operated from the Control Room (see Section G.6.3.3.3).

G.8.2 RADIATION SOURCES

G.8.2.1 CONTAINED SOURCES

The CSS will process a large volume of liquid wastes having a wide range of activity levels. Preliminary estimates of the properties of these waste streams have been made (Henshaw and Saha, 1984; Saha, 1984, Saha, 1985, Saha, 1986). A summary description of these waste streams is given in Table G.8.2-1.

Isotopic composition and concentrations for these waste streams are not available, but have been estimated based on: (1) the distribution radionuclides in Tank 8D-2 (Rykken, 1984) and (2) measurements of the uranyl nitrate solution. The first distribution is assumed to be representative of all waste streams being processed in the CSS with the exception of the uranyl nitrate solution. This radionuclide distribution is shown in Table G.8.2-2. The uranyl nitrate distribution, shown in Table G.8.2-3, was based on radiochemical analyses performed in 1984.

The radionuclide inventory in the various waste streams (with the exception of the uranyl nitrate solution) was estimated from the Cs-137 inventory (Ci/drum) for the various waste streams given in Table G.8.2-1 and the Tank 8D-2 radionuclide distribution. The concentration of Cs-137 in these waste streams is calculated by noting that 6.0 μCi of Cs-137 per mL in the waste stream will result in 1 Ci of Cs-137 in a 269-L drum (using the reference waste loading value of 168L per drum). Thus, the concentration of Cs-137 (in μCi/m) in the waste streams is estimated by multiplying the curies of Cs-137 per drum by 6.0. Once the concentration of Cs-137 is known, the concentration of the other radionuclides is estimated using the radionuclide distribution given in Table G.8.2-2. The concentration of the radionuclides in the uranyl nitrate solution is given directly in Table G.8.2-3.

G.8.2.2 AIRBORNE RADIOACTIVE MATERIAL SOURCES

Air venting the operating aisles is supplied from outside the 01-14 Building by a supply fan and through infiltration (238 m^3/min and 20 m^3/min respectively; see Section G.7.4). This air is drawn through the operating aisles to a roughing and HEPA filter. Air venting the cells is separately supplied. Thus negligible radionuclide concentrations are expected in areas occupied by operating personnel.

G.8.3 RADIATION PROTECTION DESIGN FEATURES

G.8.3.1 FACILITY DESIGN FEATURES

Facility design features ensuring that occupational exposures are ALARA include shielding, remote handling of radioactive material and ventilation.

Waste dispensing takes place in the shielded Waste Dispensing Cell. Cement mixing and drum filling and capping take place in the Process Room. These operations and movement of the drums in the Process Room are remotely controlled operations.

Ventilation is provided to all areas of the facility. Air is vented separately into the operating aisles and the cells. In addition, air venting the cells moves from areas of low expected radioactivity to areas of higher expected activity. This air is routed through two HEPA filters in series for particulate removal prior to outside discharge.

G.8.3.2 SHIELDING

Shielding analyses were performed or various locations and sources for the CSS. Figure G.8.3-1 shows a schematic of the locations of sources and the locations where exposure rates were estimated. The estimated exposure rates at these various locations are given in Figure G.8.3-2. These elevations were performed assuming that the waste being processed in the CSS had radionuclide concentration of 6 μCi of Cs-137 per mL of waste.

These evaluations were performed using the computer code QADMOD, a point kernel gamma ray shielding code (Radiation Research Associates, 1979). The calculational method used by this computer code involves representing a volume distributed source of radiation by a number of point isotropic sources and computing the distances through all regions traversed by line-of-sight from the source points to a receiver point of interest. Energy dependent exponential attenuation factors and energy dependent buildup factors are determined from the distances through the regions and the characteristics of the materials within them and applied to calculate the direct gamma ray exposure and the exposure with buildup. The gamma ray exposure with buildup represents the exposure from unscattered plus scattered gamma rays.

The exposure rate in normally occupied areas south of the Process Room is less than the 0.25 mR/hr design criteria limit except for exposure point 17 located opposite the center of the drum storage area. The exposure rate is 3.3E-02 mR/hr adjacent to the shield window and will be lower than in the Control Room. The exposure rate at the drum load-in air lock is 3.2E-02 mR/hr with the inner door closed and the outer door open. The predicted total exposure rate through the south wall and the east wall for points 8 through 15 will exceed 2.5 mR/hr under the original maximum design limit of 100 μCi/mL. It may therefore be necessary to post these areas as Radiation Areas if waste is processed at the system design limit.

Access to this area behind the east wall will only be required to maintain the Motor Control Center which is located behind this wall. During such periods, the inventory of radioactive waste in the Process Room will be reduced to maintain occupational doses ALARA. Compliance with the 2.5/t mR/hr limit, where "t" is the maximum average time in hours per day that the area is expected to be occupied by any one individual, will be achieved by the reduction of radioactive waste inventory in the Process Room. The area south of the drum storage is not expected to be occupied. Additional shielding will be added to this area if needed.

Similar exposures are calculated for the west wall; they vary from 0.01 mR/hr to 0.075 mR/hr. The latter (maximum) value is about 30 percent of the design criteria exposure rate of 0.25 mR/hr.

The west shield wall will not be in place when the CSS begins hot operations. Ventilation control will be maintained during this period by a temporary wall which will eventually be replaced by a shield wall. During this period, no waste streams will be processed that could produce drums with exposure rates in excess of 100 mR/hr. The waste streams to be processed during this period are expected to result in drums of solidified waste having contact exposure rates of a few mR/hr (e.g., the contact exposure rate of solidified uranyl nitrate solution is estimated to be 2 mR/hr). Temporary shielding will be used if needed.

G.8.3.3 VENTILATION

The 01-14 Building HV System (described in Section G.7.4) provides fresh air to the operating aisles and cell areas. The air flowing through the operating aisles passes through a roughing and HEPA filter to remove radioactive particulates. Air flowing through the cells is from regions with a low potential airborne radioactivity to areas of elevated radioactivity (i.e., Process Room to Waste Dispensing Cell). A separate airflow is channeled through the Off-Gas Cell and combined and channeled through two HEPA filters in series to remove airborne radioactive particulates.

Filter changeout is via an air lock provided for entry into the Process Filter Room and the 01-14 Building Exhaust Filter Room on the third floor. A monorail hoist trolley is available for the transfer of filters from the filter housing area to a location at the southwest corner of this floor for packaging and disposal.

G.8.3.4 AREA RADIATION AND AIRBORNE RADIOACTIVITY MONITORING INSTRUMENTATION

The CSS will be equipped with three radiation monitors to warn operators of elevated radiation levels. The first radiation sampler will monitor the utility water line to sense contamination. This monitor's efficiency is rated at 65 cpm per µCi of Cs-137 per m, sensitivity of 9.7E-04 Ci/m with a maximum detectable range to 150 µCi/m at 1E+06 cpm. Two continuous air samplers monitoring airborne contamination (one in the Control Room and one in the Clean Drum Storage Area) will sound if elevated levels of airborne contamination occur in these areas. These beta/gamma systems are designed for readout of 10 to 100,000 cpm. Calibration of these instruments will be conducted on established schedules in accordance with Project QA procedures.

G.8.4 ESTIMATED ON-SITE DOSE ASSESSMENTS

Operation of the CSS will require personnel to work in areas where radiation levels are higher than background radiation and thus incur radiation doses. The annual occupational dose associated with operation of the CSS is estimated to be 10 person-rem based on the following assumptions:

- Operation of the CSS will require eight operators (four per shift, two shifts per day);
- Six maintenance activities will be performed annually; and
- Each operator will receive an annual dose of 500 mrem, and each maintenance activity will result in an annual dose of 1 person-rem.

Actual operation of the CSS will probably result in a somewhat lower occupational dose commitment since this estimate is based on Project design objective dose commitments.

Occupational doses associated with removal and transport of cemented drums from the CSS drum loadout to the RTS drum cell are discussed in the Class B/C Disposal Operations SAR.

G.8.5 HEALTH PHYSICS PROGRAM FOR CSS

The CSS will be operated in compliance with the requirements given in the Radiological Controls Manual, WVDP-010. The health physics program for the CSS will be the same as for other Project activities. The health physics program for the Project is discussed in Section A.8.5 in Volume I.

G.8.6 ESTIMATED OFF-SITE DOSE ASSESSMENT

G.8.6.1 EFFLUENT MONITORING PROGRAMS

Effluents from the CSS will be monitored along with effluents from other WVDP facilities. These programs are discussed in Section A.8.6.1 in Volume I.

The only new effluent release point associated with operation of the CSS will be from the new stack on top of the 01-14 Building. Monitoring equipment for this stack will be housed in a small equipment building adjacent to the stack. A multiport probe will be used to withdraw sample gas which will pass through a sampler, an alpha particulate monitor, and a beta particulate monitor simultaneously. These continuous air particulate monitors will provide alarm and chart indication in the Main Process Building Control Room of the radioactive particulate levels in the exhaust air. The sampler media will be screened weekly for gross radioactivity and quarterly composites of the glass fiber filters and charcoal media will be analyzed for specific isotopes, including gamma-emitting radionuclides, I-[illegible], and Sr-90. Flow and count-rate sensors will actuate a backup vacuum pump and various alarms if equipment failures occur. This system will be provided with emergency backup power.

G.8.6.3 ESTIMATED EXPOSURES

The CSS will process a variety of waste streams. For this analysis, it is conservatively assumed that the CSS produces 3,900 drums of solidified waste having an average contact exposure rate of 1.2 R/hr in a year of operation. The radionuclide distribution of these wastes is assumed to be similar to that in Tank 8D-2.

The amount of Cs-137 in a drum of solidified waste can be determined from (1) the average exposure rate of 1.2 R/hr and (2) the exposure rate associated with 1 curie of Cs-137 in a drum of solidified waste. The exposure rate from 1 curie of Cs-137 in a 269-L drum of solidified waste was determined to be 1,180 R/hr using the computer code QADMOD (Radiation Research Associates, 1979). Thus, each drum of solidified waste will contain one curie of Cs-137.

Since 3,900 drums of waste will be produced, about 3,900 Ci of Cs-137 will be processed by the CSS. Using the Tank 8D-2 radionuclide distribution as representative of the liquid wastes to be processed in the CSS, the quantity and distribution of radionuclides to be processed is given in Table G.8.6-1. As Table G.8.6-1 shows, about 15,000 curies of activity are estimated to be processed in the CSS in a year.

Airborne emissions resulting from operation of the CSS will come primarily from two sources: (1) the Vessel Off-Gas System and (2) the 01-14 Building HV System. One vessel is vented to the CSS Vessel Off-Gas System; the Waste Dispensing Vessel. The off-gas is heated and then directed into the 01-14 Building HV System.

The 01-14 Building HV System maintains the Process Room under a slight negative pressure to ensure that all air leakage is into, rather than out of, the Process Room. The 01-14 Building HV System air is passed through two HEPA filters in series before being discharged from a stack. The overall DF of the 01-14 Building HV System is taken to be 100,000, that is, the DF for the first HEPA filter is taken to be 1,000 and the DF for the second HEPA filter is taken to be 100 (American National Standards Institute, 1981).

Assuming that 0.01 percent of the activity processed in the CSS is released to the 01-14 Building HV System, about 59 curies of activity will be released from the stack in one year from operation of the CSS assuming a DF of 100,000 for the 01-14 Building HV System. The released radionuclides will be dispersed from a stack on top of the 01-14 Building into the surrounding environment.

The dose to the maximally exposed off-site individual is estimated to be 3.0E-04 mrem. The significant radionuclides giving rise to this dose and their resulting contributions are given in Table G.8.6-2.

G.8.6.4 LIQUID RELEASES

For this analysis it is assumed that the liquid decontamination solutions remove 0.01 percent of the activity processed in the CSS to the LWTS. Given this assumption, about 1.5 curies of activity are added to LWTS from operation of the CSS. The incremental increase of atmospheric emissions arising from treating these solutions in an evaporator in the LWTS will be analyzed in the LWTS SAR module.

The dose to the maximally exposed off-site individual is estimated to be 0.58 mrem. The significant radionuclides giving rise to this dose and their resulting contributions are given in Table G.8.6-3.

REFERENCES FOR SECTION G.8.0

American National Standards Institute, 1981, "Guidance for Defining Safety Related Features of Nuclear Fuel Cycle Facilities," ANSI N46.1 - 1980.

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Saha, A. K., Memo to Distribution, dated April 17, 1985, "RTS Waste Stream Data Sheets," Memo HF:85:0011.

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TABLE G.8.2-1 (1 of 2)
EXPOSURE RATES AND PROJECTED NUMBER OF WASTE DRUMS TO BE PRODUCED IN THE CEMENT SOLIDIFICATION SYSTEM [a]

Description Waste Stream	Stream Number	Number of 71 gal. Drums	Cs-137 Inventory (Ci/Drum)	Exposure Rate (mR/hr) Contact	Exposure Rate (mR/hr) 1 Metre
Decontaminated supernatant [b]	1	11,078	0.6	710	100
Wash solutions from sludge washing	2A, 2B, 2C	945	0.63	750	110
Internal decontamination solution	3	0	N/A	N/A	N/A
Effluents from primary and secondary NO_x scrubber	5[c]	0	N/A	N/A	N/A
Condensate from SBS condenser and melter feed concentrator overheads (combined)	6[c]	0	N/A	N/A	N/A
Spent organic from RTS	7A	87	0.26	300	44
Spent zeolite slurry from RTS	7B	21	0.26	300	44
Filter backwash slurries	9	1450	0.15	180	26

TABLE G.8.2-1 (2 of 2)

EXPOSURE RATES AND PROJECTED NUMBER OF WASTE DRUMS TO BE PRODUCED IN THE CEMENT SOLIDIFICATION SYSTEM [a]

Description Waste Stream	Stream Number	Number of 71 gal. Drums	Cs-137 Inventory (Ci/Drum)	Exposure Rate (mR/hr)	
				Contact	1 Metre
Uranyl nitrate	N/A	138[d]	N/A	2	BKG
Decon solutions	N/A	350	0.74	870	125

Note [a] - Modified from Saha (1986). All values have been rounded to two significant figures.

[b] - This projection is based on decontaminated supernatant activity level of 10 Ci/cm^3.

[c] - These streams will be returned to the Vitrification Facility.

[d] - Number of 55-gallon drums.

TABLE G.8.2-2 (1 OF 2)

RADIONUCLIDE INVENTORY IN HIGH-LEVEL WASTE TANK 8D-2 (1987)

Isotope	Normalized[a] Activity (Curies)	Total[b] Activity (Curies)
H-3	1.3E-03	9.5E+01
C-14	1.9E-03	1.4E+02
Fe-55	1.4E-04	1.0E+03
Ni-59	1.1E-05	8.2E+01
Co-60	6.4E-07	4.7
Ni-63	8.9E-04	6.5E+03
Se-79	5.1E-06	3.7E+01
Sr-90	1.0	7.4E+06
Y-90	1.0	7.4E+06
Zr-93	3.2E-05	2.3E+02
Nb-93m	3.2E-05	2.3E+02
Tc-99	2.2E-04	1.6E+03
Ru-106	1.8E-05	1.3E+02
Rh-106	1.8E-05	1.3E+02
Pd-107	1.6E-07	1.2
Sb-125	6.2E-04	4.5E+03
Te-125m	1.4E-04	1.0E+03
Sn-126	5.5E-06	4.0E+01
Sb-126m	5.5E-06	4.0E+01
Sb-126	7.7E-06	5.6E+01
I-129	2.9E-08	2.1E-01
Cs-134	1.9E-03	1.4E+04
Cs-135	2.2E-05	1.6E+02
Cs-137	1.0	7.3E+06
Ba-137m	9.3E-01	6.8E+06
Ce-144	1.9E-06	1.4E+01
Pr-144	1.9E-06	1.4E+01
Pm-147	4.2E-02	3.1E+05
Sm-151	2.9E-02	2.1E+05
Eu-152	5.8E-05	4.2E+02

TABLE G.8.2-2 (2 OF 2)

RADIONUCLIDE INVENTORY IN HIGH-LEVEL WASTE TANK 8D-2 (1987)

Isotope	Normalized[a] Activity (Curies)	Total[b] Activity (Curies)
Eu-154	1.8E-02	1.3E+05
Eu-155	3.2E-03	2.3E+04
U-233	1.0E-06	7.4
U-234	5.9E-07	4.3
U-235	1.3E-08	9.5E-02
U-236	4.0E-08	2.9E-01
U-238	1.2E-07	8.5E-01
Np-237	1.5E-06	1.1E+01
Np-239	3.3E-04	2.4E+03
Pu-238	9.0E-04	6.6E+03
Pu-239	2.3E-04	1.7E+03
Pu-240	1.8E-04	1.3E+03
Pu-241	1.2E-02	8.7E+04
Pu-242	2.3E-07	1.7
Am-241	9.9E-03	7.2E+04
Am-242	2.9E-06	2.1E+01
Am-242m	2.9E-06	2.1E+01
Am-243	3.3E-04	2.4E+03
Cm-242	3.0E-07	2.2
Cm-243	2.3E-05	1.7E+02
Cm-244	3.0E-03	2.2E+04
Cm-245	1.4E-06	1.0E+01
Cm-246	5.9E-07	4.3
		2.9E+07

Note [a] - Normalized to 1 Curie of Cs-137
[b] - Total activity in sludge plus supernatant

TABLE G.8.2-3

RADIONUCLIDE INVENTORY IN THE URANYL NITRATE SOLUTION[a]

Radionuclide	Concentration (Ci/ml)
Tl-208	3.7E-04
Pb-212	2.3E-03
Bi-212	4.8E-03
Bi-214	7.6E-03
Pa-234	4.2E-03
U-238	1.0E-01[b]
Pu-238	1.5E-02
Pu-239/240	7.8E-02
Pu-241	1.7E-01[c]
Am-241	1.0E-02

Note [a] - Obtained from measurements performed in 1984 (Tank A1 results were used since the radionuclide concentration was larger in this tank than in Tank A2).

[b] - Obtained from total uranium measurement of 310 g/L.

[c] - Obtained from gross beta measurement of 1.7E-01 μCi/mL.

TABLE G.8.6-1 (1 of 2)

RADIONUCLIDE INVENTORY OF THE LIQUID WASTES ASSUMED TO BE PROCESSED IN THE CSS IN ONE YEAR

Isotope	Normalized[a] Activity (Curies)	Total Activity (Curies)
H-3	1.3E-05	5.1E-02
C-14	1.9E-05	7.4E-02
Fe-55	1.4E-04	5.5E-01
Ni-59	1.1E-05	4.3E-02
Co-60	6.4E-07	2.5E-03
Ni-63	8.8E-04	3.4
Se-79	5.1E-06	2.0E-02
Sr-90	9.5E-01	3.7E+03
Y-90	9.5E-01	3.7E+03
Zr-93	3.2E-05	1.2E-01
Nb-93m	3.2E-05	1.2E-01
Tc-99	2.2E-04	8.6E-01
Ru-106	1.8E-05	7.0E-02
Rh-106	1.8E-05	7.0E-02
Pd-107	1.6E-07	6.2E-04
Sb-125	6.2E-04	2.4
Te-125m	1.4E-04	5.5E-01
Sn-126	5.5E-06	2.1E-02
Sb-126m	5.5E-06	2.1E-02
Sb-126	7.7E-06	3.0E-02
I-129	2.9E-08	1.1E-04
Cs-134	1.9E-03	7.4
Cs-135	2.2E-05	8.6E-02
Cs-137	1.0	3.9E+03
Ba-137m	9.3E-01	3.6E+03
Ce-144	1.9E-06	7.4E-03
Pr-144	1.9E-06	7.4E-03
Pm-147	4.2E-02	1.6E+02
Sm-151	2.9E-02	1.1E+02
Eu-152	5.8E-05	2.3E-01
Eu-154	1.8E-02	7.0E+01
Eu-155	3.2E-03	1.2E+01
U-233	1.0E-06	3.9E-03
U-234	5.9E-07	2.3E-03
U-235	1.3E-08	5.1E-05
U-236	4.0E-08	1.6E-04

TABLE G.8.6-1 (2 of 2)

RADIONUCLIDE INVENTORY OF THE LIQUID WASTES ASSUMED TO BE PROCESSED IN THE CSS IN ONE YEAR

Isotope	Normalized[a] Activity (Curies)	Total Activity (Curies)
U-238	1.2E-07	4.7E-04
Np-237	1.5E-06	5.9E-03
Np-239	3.3E-04	1.3
Pu-238	9.0E-04	3.5
Pu-239	2.3E-04	9.0E-01
Pu-240	1.8E-04	7.0E-01
Pu-241	1.2E-02	4.7E+01
Pu-242	2.3E-07	9.0E-04
Am-241	9.9E-03	3.9E+01
Am-242	2.9E-06	1.1E-02
Am-242m	2.9E-06	1.1E-02
Am-243	3.3E-04	1.3
Cm-242	3.0E-07	1.2E-03
Cm-243	2.3E-05	9.0E-02
Cm-244	3.0E-03	1.2E+01
Cm-245	1.4E-06	5.5E-03
Cm-246	5.9E-07	2.3E-03
		1.5E+04

Note [a]. - Normalized to 1 Curie of Cs-137
[b] - Total activity in sludge plus supernatant

TABLE G.8.6-2

ANNUAL DOSE TO THE MAXIMALLY EXPOSED OFF-SITE INDIVIDUAL FOR THE SIGNIFICANT RADIONUCLIDES DURING NORMAL OPERATIONS (AIRBORNE RELEASES)[a]

Isotope	Released Activity	Dose to Maximally Exposed Off-Site Individual (mrem)
Sr-90	1.4E-05	1.0E-04
Cs-137	1.5E-05	1.5E-04
Eu-154	2.7E-07	2.7E-06
Pu-238	1.4E-08	2.4E-06
Pu-239	3.5E-09	6.7E-07
Pu-240	2.7E-09	5.1E-07
Pu-241	1.8E-07	7.0E-07
Am-241	1.5E-07	3.2E-05
Am-243	5.0E-09	1.1E-06
Cm-244	4.5E-08	5.0E-06
		3.0E-04

Note [a]- The significant radionuclides are identified by the product of released activity (Ci) and dose conversion factor (rem per curie released). Those radionuclides contributing more than 0.1 percent of the total dose are included.

TABLE G.8.6-3

ANNUAL DOSE TO THE MAXIMALLY EXPOSED OFF-SITE INDIVIDUAL FOR THE SIGNIFICANT RADIONUCLIDES DURING NORMAL OPERATIONS (WATERBORNE RELEASES) [a]

Isotope	Activity Released from Low-Level[b] Liquid Waste Treatment System	Dose to Maximally Exposed Off-Site Individual (mrem)
Sr-90	7.0E-03	1.8E-03
Cs-134	1.6E-04	1.4E-03
Cs-137	8.3E-02	5.1E-01
Am-241	1.5E-02	5.4E-02
Am-243	5.0E-04	1.8E-03
Cm-244	4.5E-03	8.1E-03
		5.8E-01

Note [a] - The significant radionuclides are identified by the product of released activity (Ci) and dose conversion factor (rem per curie released). Those radionuclides contributing more than 0.1 percent of the total dose are included.

[b] - Decontamination factors are assumed to be of 200 for strontium and 18 for cesium.

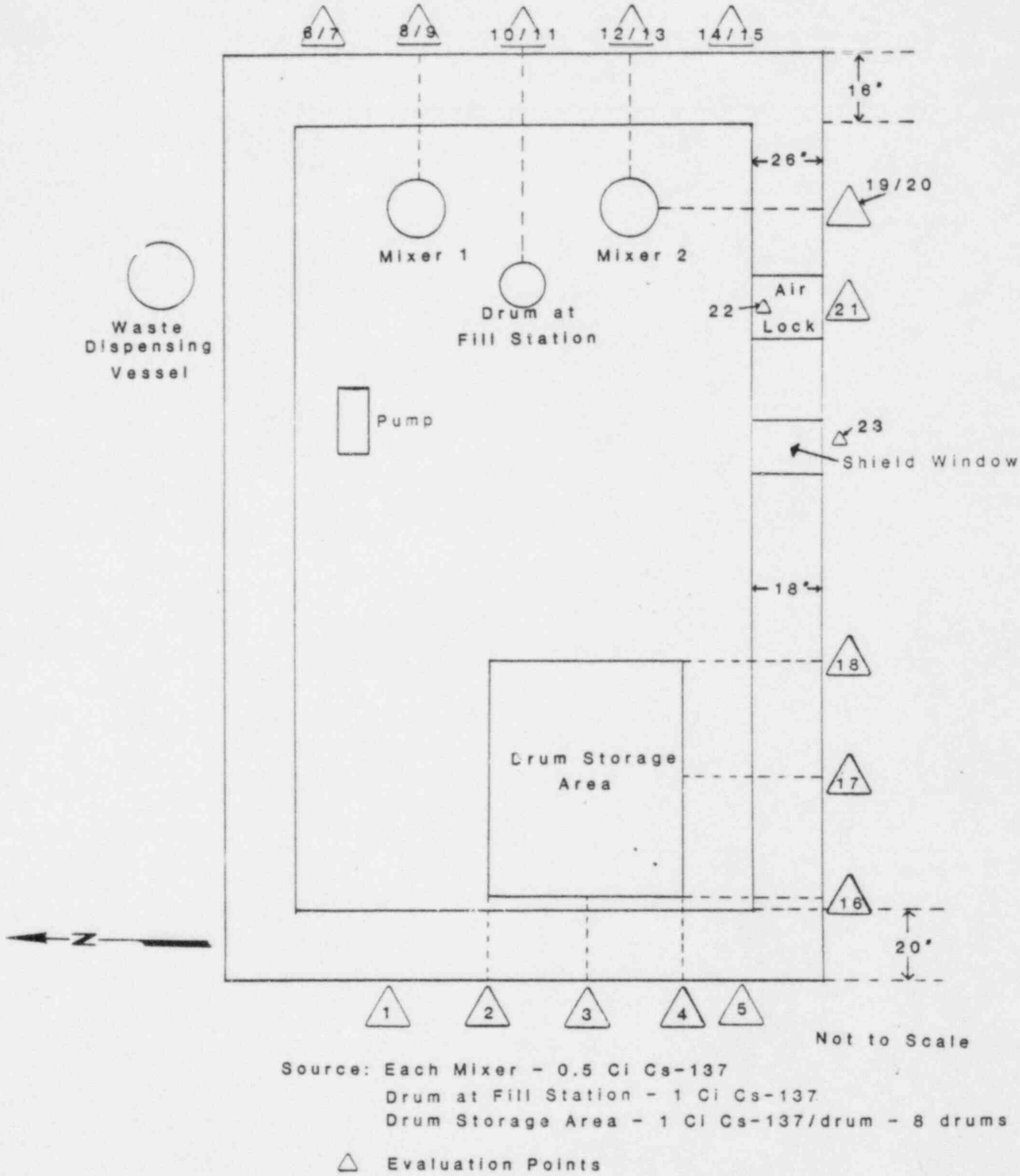
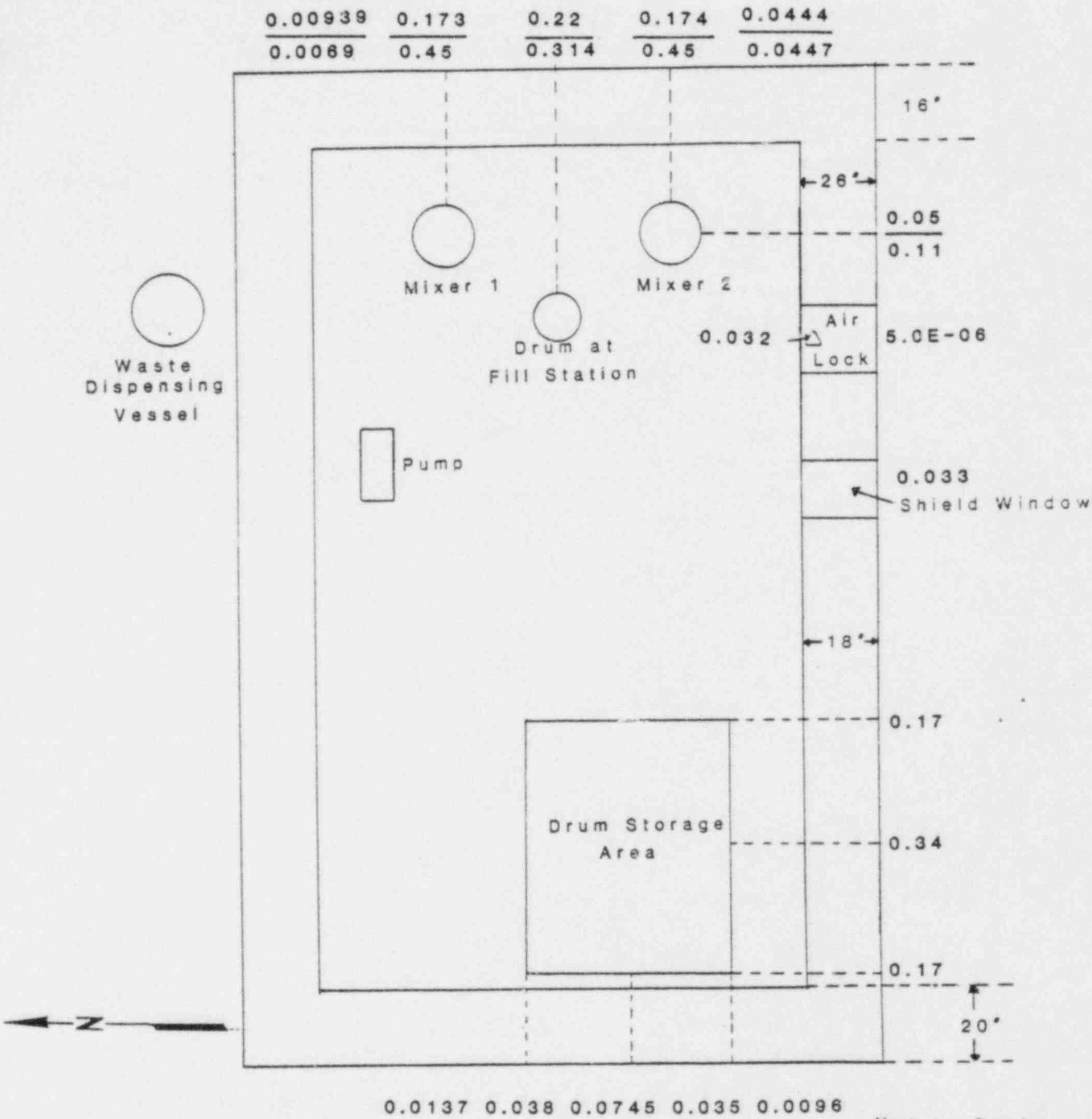


FIGURE G.8.3-1 SCHEMATIC OF MAJOR RADIATION SOURCES AND POINTS OF EXPOSURE EVALUATION FOR THE CSS



Source: Each Mixer - 0.5 Ci Cs-137
Drum at Fill Station - 1 Ci Cs-137
Drum Storage Area - 1 Ci Cs-137/drum - 8 drums
XX Exposure Rate mR/hr

(1) Top value is 2.7 m above the floor
Lower value is 1 m above the floor

FIGURE G.8.3-2 SCHEMATIC OF MAJOR RADIATION SOURCES AND ESTIMATED EXPOSURE RATES

G.9.0 ACCIDENT SAFETY ANALYSIS

G.9.1 ABNORMAL OPERATIONS

Abnormal operations are events which could occur from malfunctions of systems, operating conditions, or operator error. Abnormal events are only of consequence for those systems in the CSS which process, control, or confine radioactivity or other hazardous substances. These include the 01-14 Building HV System, Waste Encapsulation System, and Material Handling System (Clare, 1984). Table G.9.1-1 presents a list of the systems and potential abnormal events.

Other possible abnormal events are of little consequence either because they do not pose a radiological or industrial hazard or because the impacts are less than the abnormal events described further in this section.

G.9.1.1 ABNORMAL EVENTS - WASTE ENCAPSULATION SYSTEM

G.9.1.1.1 Waste Dispensing Vessel Failure

The largest volume of waste liquid that could spill on the floor of the Waste Dispensing Cell due to a rupture of the Waste Dispensing Vessel (WDV) or associated valves and piping is 1,900 L (see Section G.9.2.1 for a discussion of this accident). This is the maximum usable volume of the WDV during normal operation.

A larger spill from the WDV cannot occur from within the CSS. The inlet valves to the WDV from the site waste holdup tanks are controlled by the level indicators in the WDV. In addition, the flow from the waste holdup tanks is metered from the control station associated with the holdup tanks. Even if the inlet valves fail to close, more than 1,900 L of waste could enter the WDV only if the control station metering failed.

G.9.1.1.2 Failure of Valves Between WDV and Mixer

Failure to close the three-way ball valve (V-2) controlling the waste discharge to the mixers could result in spilling 1,730 L of liquid waste from the WDV onto the floor of the Process Room. This volume is the difference between the 1,900 L of waste in the WDV and the 170-L volume of a single mixer which would overflow if the valve fails.

The sequence of events required for this failure mode are:

A. the timer in the control panel fails while the valve (V-2) is open;

B. the level indicator in the mixer fails to indicate a high level;

or

A. a ball valve sticks in the open position;

B. the limit switches on the ball valve provide a false signal to the control panel;

C. the level indicator in the mixer fails to indicate a high level.

It should be stressed that these sequences of events are considered to be extremely unlikely.

G.9.1.2 ABNORMAL EVENTS - MATERIAL HANDLING SYSTEM

G.9.1.2.1 Failure to Place the Waste Package in Position

Failure to place an empty 269-L drum into position under a mixer could result in the dumping of 269 L of contaminated wet cement on the floor of the Process Room. The cement would include liquid waste.

If the Drum Position Indicator sent an invalid signal to the control panel indicating the placement of an empty drum when a drum was not there, and the lid lifter vacuum switch fails to detect that there is no drum lid to be picked up, the cement/waste mixture would spill on the floor. The signal indicating placement of an empty drum is supplied by the Material Handling System and is the result of extensive logic processing in that system. Failure to receive the proper drum position or lid signal are considered missing extremely unlikely events. In addition, the system is monitored by the operator with a Closed Circuit Television (CCTV) System.

G.9.1.2.2 Minor Failures

Four additional minor events leading to low-volume spills can occur within the material handling system (Associated Technologies Inc., 1984). These events are summarized as follows.

- O Overfilling of a drum would require the fill station load cell to indicate a low weight when the weight is actually high. Inattention on the part of the operator would also be required because he normally monitors the fill time while visually monitoring the drum through the CCTV System.

- O High acceleration of a full drum from the fill position would occur if the electronic acceleration control fails. This would result in a spill of a minimal amount of the contents of a drum due to the amount of freeboard.

- O Dripping of material from the fill assembly is another minimum spill event. It would occur if a faulty permissive indicates that the cement/waste flow is stopped and the drip tray is in place under the fill nozzle when it actually is not. This could result from a failure in the Waste Encapsulation System or in the Programmable Logic Controller of the Material Handling System.

G.9.1.3 ABNORMAL EVENTS - VENTILATION SYSTEM

Above normal release of radioactive particulates could occur due to failures of the roughing or HEPA filters. A pressure gradient across the filter resulting in filter tearing and subsequent disintegration or a fire would cause the failure. In either case, protection against uncontrolled release is afforded by a second filter in the filter train that limits the release. The loss of a filter would trigger an alarm, and operator response would include shutdown of the system. The loss of a filter train is considered in Section G.9.2.

G.9.1.4 ABNORMAL EVENTS - LIQUID SUMPS AND DRAINS

Liquids draining to the sumps and drains will be directed to the LWTS. A rupture of the pipe transporting the liquids from the 01-14 Building to Tank 7D-13 would not result in a significant release of radioactivity from the site.

G.9.2 ACCIDENTS

G.9.2.1 ACCIDENTS ANALYZED

Four accidents are analyzed in this section: a spill of 1,900 L of waste liquid from the Waste Dispensing Vessel (WDV), airborne release due to the addition of caustic to the uranyl nitrate solution, the failure of a HEPA filter train, and a HEPA filter fire.

G.9.2.1.1 Source Terms

The source terms for the accident analysis depend on the waste stream undergoing processing. Table G.8.2-1 presents the expected concentration of Cs-137 in each drum of solidified waste for the various waste streams. The condensate from SBS condenser and melter feed concentrator overheads (combined) waste stream represents the maximum curie content for the various waste streams that will be processed in the CSS. This waste stream, along with the uranyl nitrate waste stream, is used to analyze the consequences of the waste spill accident. The condensate from SBS condenser and melter feed concentrate overheads (combined) waste stream is also used to analyze the consequences of failure of the HEPA filter train accident. The uranyl nitrate waste stream is used for the analysis of the neutralization accident. The fourth accident, a HEPA filter fire, is waste stream independent; the distribution of radionuclides on the HEPA filter is assumed to be represented by that in Tank 8D-2.

G.9.2.1.2 Radiation Doses

All four of these accidents result in the off-site release of radioactivity. The released material would primarily be in the form of an aerosol from the evaporation of waste solutions or particulates for the HEPA filter failure and fire. For the liquid spill accident, airborne effluents are estimated by assuming a pool release partition coefficient of 100 for the volatile radionuclides and 1,000 for the nonvolatile radionuclides (American National Standards Institute, 1981)[1]. During a two-hour period, about 10 L of solution is estimated to evaporate. The airborne radionuclides will be released from a stack on top of 01-14 Building via the 01-14 Building HV System (DF of 100,000).

The uranyl nitrate solution is highly acidic (pH of 0.20). For this analysis, it is assumed that 100 L of this solution is mixed with caustic in a mixer in a manner which causes the solution to react vigorously. Such an accident is estimated to result in the evaporation of about 1.4 L of liquid based upon the heat of reaction associated with neutralizing this volume of uranyl nitrate solution with sodium hydroxide. For this accident a transient release decontamination factor of 100 is assumed for both the volatile and nonvolatile radionuclides (American National Standards Institute, 1981).[2] The airborne radionuclides will be released via the 01-14 Building HV System (DF of 100,000).

For the third accident, it is assumed that a bank of HEPA filters fail and the failure remains undetected for a period of two hours. This accident is assumed to occur during processing of the waste stream containing the largest concentration of radioactivity [i.e., condensate from SBS condenser and melter

[1]The pool release partition coefficienct is the ratio of the activity concentration in the liquid to that in the air above the liquid pool.
[2]The transient release decontaminated factor is the ratio of the quantity of radioactivity in the liquid to that in the vapor.

feed concentrator overheads (combined)]. Using a solidification rate of six drums per hour and the Tank 8D-2 radionuclide distribution, about 620 curies of activity will be processed in this two-hour time period. Assuming that 0.01 percent of this activity becomes airborne, about 62 mCi of activity will be released from the stack on top of the 01-14 Building.

The last accident considered the impacts resulting from a HEPA filter fire. It is assumed that the HEPA filters will be changed out when the radioactive loading results in a dose of 100 mR/hr at approximately 0.3 m from the filter face. Analysis shows that 1 curie of Cs-137 uniformly distributed on a HEPA filter will result in an exposure of 1.34 R/hr at 0.3 m from the filter face (Peterson, 1985). Thus each filter is assumed to conservatively contain 0.075 curies of Cs-137 before changeout. Activity of other radionuclides on the filter is assumed to be distributed according to the Tank 8D-2 radionuclide distribution. It is assumed for the analysis that both the primary and secondary filters in the process room HV System (12 filters total) are fully loaded when the fire occurs. A release of one percent of the radionuclides on the loaded filters, or a total of 0.036 curies, is assumed to occur as a result of this fire (American National Standards Institute, 1981).

The estimated doses to the maximally exposed off-site individual for the accidents considered are presented in Tables G.9.2-1 through G.9.2-5. Table G.9.2-1 and G.9.2-2 summarize the dose from the significant radionuclides resulting from the 1,900 L spill accident for the two waste streams analyzed. Table G.9.2-3 summarizes the dose from the uranyl nitrate neutralization accident. In each of these cases, the dose is much less than one mrem. The doses from the significant radionuclides for the HEPA filter accidents are presented in Tables G.9.2-4 and G.9.2-5. The dose from the HEPA filter failure accident estimated to be 40 mrem while the dose from the HEPA filter fire accident is estimated to be 22 mrem.

In the first three accidents the doses are low because the airborne effluent is assumed to be discharged from a stack on top of the 01-14 Building via the 01-14 Building HV System. The 01-14 Building HV System is assumed to have a DF of 100,000. The doses are much larger for the two HEPA filter accidents in which the radioactivity is released directly into the environment from this stack.

G.9.2.2 Potential Nuclear Criticality

The CSS will process waste streams containing fissile radionuclides, principally U-235 and Pu-239. The subcritical limits for fissile material concentrations in the CSS were calculated (O'Ahoofe, 1985) and are shown in Table G.11.4-1. From Table G.11.4-1, it is seen that the most limiting situation occurs when the fissile uranium concentration is 0.05 g/L.

In this case, the fissile plutonium concentration is 1.63 g/L resulting in a total fissile radionuclide concentration of 1.68 g/L. All other combinations of fissile uranium and plutonium radionuclides have subcritical concentration limits greater than this value.

The waste streams containing the greatest concentration of fissile materials will most likely be decontaminated supernatant, decontamination solutions and uranyl nitrate. The concentration of fissile radionuclides in the decontaminated supernatant is not expected to exceed 0.6 mg/L (O'Ahoofe, 1985). The concentration of fissile radionuclides in the interim decontamination solutions was estimated by using (1) the estimated contact exposure rate of 870 mR/hr on a drum of waste (Table G.8.2-1), (2) the exposure rate of 1,200 mR/hr from a 269-L drum of solidified waste per curie of Cs-137, (3) the spent fuel radionuclide distribution given in Table G.9.2-6, and (4) and liquid waste volume of 170 L per drum. Using these assumptions, the concentration of fissile radionuclides in the liquid waste being fed to the CSS is estimated to be about 9 mg/L. These values are several orders of magnitude below the previousl- cited subcritical limit.

The uranyl nitrate solution consists largely of depleted uranium. The concentration of fissile radionuclides in this solution is estimated to be about 0.8 g/L (principally U-235 at an isotopic enrichment of about 0.25 percent) based upon a sample analyzed in early 1984 (Feuz, 1984). There are no processes associated with operation of the CSS which will result in isotopic enrichment of U-235. Since the minimum critical isotopic enrichment of U-235 in aqueous solutions is about 1 percent, depleted uranium is inherently a noncritical substance. A nuclear criticality is therefore not considered to be a credible event. However, all batches of liquid wastes will be sampled and analyzed for fissile material concentration prior to processing in the CSS (see Section G.11.4.3).

REFERENCES FOR SECTION G.9.0

American National Standards Institute, 1981, "Guidance for Defining Safety Related Features of Nuclear Fuel Cycle Facilities," ANSI N46.1-1980.

Associated Technologies, Inc., 1984. "Review of Potential Radiation Releases by the Materials Handling System," ATI Document No. 172-Doc-002, Rev. 0.

Clare, G. H., 1984, memo to J. C. Cwynar, dated August 30, 1984, "West Valley Cement Solidification System Failure Analysis," SE:GC:84:166.

Feuz, A. C., 1984, Analysis of Sample 5D-15A, dated January 4, 1984, Log Number 84-28.

O'Ahoofe, K. A., 1985, memo to J. C. Cwynar, dated March 26, 1985, "CSS Criticality Safety Evaluation," FB:85:0072.

Peterson, J. M., 1985, memo to C. P. Bliss, dated February 5, 1985, "Correlation of Exposure Rate with Radionuclide Inventory on a Loaded HEPA Filter," HE:85:0016.

TABLE G.9.1-1

CEMENT SOLIDIFICATION SYSTEM ABNORMAL EVENTS

System Subsystem	Natural Phenomena	Event: Spill	Event: Rupture	Event: Fire	Chemical Reaction/ Explosion
I. Waste Encapsulation System					
Waste Storage and Dispensing		X	X		
Chemical Additive					X
Cement Metering					
High Shear Mixing					
II. Material Handling System					
Empty Drum Feed and Position		X			
Full Drum Processing		X			
Drum Storage and Loadout		X	X		
III. Cement Transfer and Storage System					
IV. Ventilation System					
Operating Aisles			X	X	
Cell Ventilation			X	X	
V. Liquid Sumps and Drains		X			
VI. Structures					
01-14 Building	X				
Content Silo	X				

TABLE G.9.2-1

DOSE TO THE MAXIMALLY EXPOSED OFF-SITE INDIVIDUAL FOR THE SIGNIFICANT RADIONUCLIDES FOR THE EVAPORATION OF 230 L OF SOLUTION ASSOCIATED WITH THE 1,900-L SPILL ACCIDENT[a] (CONDENSATE FROM SBS SCRUBBER AND MELTER FEED CONCENTRATOR OVERHEADS, COMBINED)

Isotope	Activity in Liquid Evaporated (Ci)	Partition[b] Coefficient	Activity Released From Cell (Ci)	Dose to the Maximally Exposed Off-Site Individual (mrem)[c]
Sr-90	2.3E01	1000	2.3E-02	1.3E-04
Cs-137	2.3E01	1000	2.3E-02	1.7E-06
Pu-238	2.1E-02	1000	2.1E-05	2.7E-05
Pu-239	5.3E-03	1000	5.3E-06	7.4E-06
Pu-240	4.1E-03	1000	4.1E-06	5.7E-06
Pu-241	2.8E-01	1000	2.8E-04	8.4E-06
Am-241	2.3E-01	1000	2.3E-04	3.5E-04
Am-243	7.6E-03	1000	7.6E-06	1.1E-05
Cm-244	6.9E-02	1000	6.9E-05	5.5E-05
				5.9E-04

Note [a] - The significant radionuclides are identified by the product of released activity (Ci) and dose conversion factor (rem per curie released). Those radionuclides contributing more than 0.1 percent of the total dose are included.

[b] - The partition coefficient is the ratio of the activity concentration in the liquid to that in the air above the liquid pool.

[c] - A decontamination factor of 100,000 is taken for the 01-14 building HV system.

TABLE G.9.2-2

DOSE TO THE MAXIMALLY EXPOSED OFF-SITE INDIVIDUAL FOR THE SIGNIFICANT RADIONUCLIDES FOR THE EVAPORATION OF 230 L OF URANYL NITRATE SOLUTION ASSOCIATED WITH THE 1,900-L SPILL ACCIDENT[a]

Isotope	Activity in Liquid Evaporated (Ci)	Partition[b] Coefficient	Activity Released From Cell (Ci)	Dose to the Maximally Exposed Off-Site Individual (mrem)[c]
U-238	2.3E-02	1000	2.3E-05	1.2E-05
Pu-238	3.5E-03	1000	3.5E-06	4.6E-06
Pu-239/240	1.8E-02	1000	1.8E-05	2.5E-05
Pu-241	3.9E-02	1000	3.9E-05	1.2E-06
Am-241	2.3E-03	1000	2.3E-06	3.5E-06
				4.6E-05

Note [a] - The significant radionuclides are identified by the product of released activity (Ci) and dose conversion factor (rem per curie released). Those radionuclides contributing more than 0.1 percent of the total dose are included.

[b] - The partition coefficient is the ratio of the activity concentration in the liquid to that in the air above the liquid pool.

[c] - A decontamination factor of 100,000 is taken for the 01-14 building HV system.

TABLE G.9.2-3

DOSE TO THE MAXIMALLY EXPOSED OFF-SITE INDIVIDUAL FOR THE SIGNIFICANT RADIONUCLIDES FOR THE EVAPORATION OF 1.4 L OF URANYL NITRATE SOLUTION ASSOCIATED WITH THE NEUTRALIZATION ACCIDENT[a]

Isotope	Activity in Liquid Evaporated (Ci)	Decontamination Factor[b]	Activity Released From Cell (Ci)	Dose to the Maximally Exposed Off-Site Individual (mrem)[c]
U-238	1.4E-04	100	1.4E-06	7.0E-07
Pu-238	2.1E-05	100	2.1E-07	2.7E-07
Pu-239/240	1.1E-04	100	1.1E-06	1.5E-06
Pu-241	2.4E-04	100	2.4E-06	7.2E-08
Am-241	1.4E-05	100	1.4E-07	2.1E-07
				2.8E-06

Note [a] - The significant radionuclides are identified by the product of released activity (Ci) and dose conversion factor (rem per curie released). Those radionuclides contributing more than 0.1 percent of the total dose are included.

[b] - The transient release decontamination factor is the ratio of the quantity of radioactivity in the liquid to that in the vapor.

[c] - A decontamination factor of 100,000 is taken for the vessel off-gas system directed to the 01-14 building HV system.

TABLE G.9.2-4

DOSE TO THE MAXIMALLY EXPOSED OFF-SITE INDIVIDUAL FOR THE SIGNIFICANT RADIONUCLIDES FOR THE HEPA FILTER FAILURE ACCIDENT[a]

Isotope	Activity Released from the 01-14 Building	Dose to the Maximally Exposed Off-Site Individual (mrem)
Sr-90	1.5E-02	8.4
Cs-137	1.6E-02	1.2E-01
Pu-238	1.4E-05	1.8
Pu-239	3.5E-06	5.2E-01
Pu-240	2.8E-06	4.1E-01
Pu-241	1.9E-04	5.7E-01
Am-241	1.5E-04	24
Am-243	5.1E-06	8.0E-01
Cm-244	4.7E-05	3.8
		40

Note [a] - The significant radionuclides are identified by the product of released activity (Ci) and dose conversion factor (rem per curie released). Those radionuclides contributing more than 0.1 percent of the total dose are included.

TABLE G.9.2-5

DOSE TO THE MAXIMALLY EXPOSED OFF-SITE INDIVIDUAL FOR THE SIGNIFICANT RADIONUCLIDES FOR A HEPA FILTER FIRE ACCIDENT[a]

Isotope	Activity Released from the 01-14 Building	Dose to the Maximally Exposed Off-Site Individual (mrem)
Sr-90	8.6E-03	4.8
Cs-137	9.0E-03	6.7E-02
Pu-238	8.1E-06	1.1
Pu-239	2.1E-06	2.9E-01
Pu-240	1.6E-06	2.2E-01
Pu-241	1.1E-04	3.3E-01
Am-241	8.9E-05	13
Am-243	2.9E-06	4.4E-01
Cm-244	2.7E-05	2.1
		22

Note [a] - The significant radionuclides are identified by the product of released activity (Ci) and dose conversion factor (rem per curie released). Those radionuclides contributing more than 0.1 percent of the total dose are included.

TABLE G.9.2-6 (1 OF 2)

RADIONUCLIDE INVENTORY IN REPROCESSED SPENT FUEL (1987)

Isotope	Normalized[a] Activity (Curies)	Total[b] Activity (Curies)
C-14	1.9E-05	1.4E+02
Fe-55	1.4E-04	1.0E+03
Ni-59	1.1E-05	8.2E+01
Co-60	6.4E-07	4.7
Ni-63	8.8E-04	6.4E+03
Se-79	5.1E-06	3.7E+01
Sr-90	9.5E-01	6.9E+06
Y-90	9.5E-01	6.9E+06
Zr-93	3.2E-05	2.3E+02
Nb-93m	3.2E-05	2.3E+02
Tc-99	2.2E-04	1.6E+03
Ru-106	1.8E-05	1.3E+02
Rh-106	1.8E-05	1.3E+02
Pd-107	1.6E-07	1.2
Sb-125	6.2E-04	4.5E+03
Te-125m	1.4E-04	1.0E+03
Sn-126	5.5E-06	4.0E+01
Sb-126m	5.5E-06	4.0E+01
Sb-126	7.7E-06	5.6E+01
Cs-134	1.9E-03	1.4E+04
Cs-135	2.2E-05	1.6E+02
Cs-137	1.0	7.3E+06
Ba-137m	9.3E-01	6.8E+06
Ce-144	1.9E-06	1.4E+01
Pr-144	1.9E-06	1.4E+01
Pm-147	4.2E-02	3.1E+05
Sm-151	2.9E-02	2.1E+05
Eu-152	5.8E-05	4.2E+02

TABLE G.9.2-6 (2 OF 2)

RADIONUCLIDE INVENTORY IN REPROCESSED SPENT FUEL (1987)

Isotope	Normalized[a] Activity (Curies)	Total[b] Activity (Curies)
Eu-154	1.8E-02	1.3E+05
Eu-155	3.2E-03	2.3E+04
U-233	2.4E-04	1.7E+03
U-234	1.4E-04	1.0E+03
U-235	3.1E-06	2.2E+01
U-236	9.5E-06	6.9E+01
U-238	2.8E-05	2.1E+02
Np-237	1.5E-06	1.1E+01
Np-239	3.3E-04	2.4E+03
Pu-238	4.9E-02	3.6E+05
Pu-239	1.3E-02	9.2E+04
Pu-240	9.9E-03	7.2E+04
Pu-241	6.6E-01	4.8E+06
Pu-242	1.3E-05	9.2E+01
Am-241	3.7E-02	2.7E+05
Am-242	2.9E-06	2.1E+01
Am-242m	2.9E-06	2.1E+01
Am-243	3.3E-04	2.4E+03
Cm-242	3.0E-07	2.2
Cm-243	2.3E-05	1.7E+02
Cm-244	3.0E-03	2.2E+04
Cm-245	1.4E-06	1.0E+01
Cm-246	5.9E-07	4.3
		3.4E+07

Note [a] - Normalized to 1 curie of Cs-137
[b] - Total activity in the fuel reprocessed by NFS from 1966 to 1972, decay corrected to 1987.

G.10.0 CONDUCT OF CSS OPERATIONS

G.10.2 PREOPERATIONAL TESTING AND OPERATION

G.10.2.1 ADMINISTRATIVE PROCEDURES FOR CONDUCTING THE TEST PROGRAM

All procedures and instructions for conducting the test program and documenting and evaluating the test results will be prepared, reviewed, and approved per the requirements of WVNS Policy and Procedures Manual, Engineering Procedures Manual, and SOP-002. Data will be collected and maintained on data sheets contained in test procedures.

Preoperational checkout of the CSS will be performed by Engineering personnel involved with the design of the CSS and its various components, and by Operations personnel who have undergone training per the operator qualification plan for the CSS.

G.10.2.2 TEST PROGRAM DESCRIPTION

The test program for the CSS will verify that system modifications were accomplished in accordance with the plans and specifications prepared for that purpose and that the system operates as designed to produce a waste form consistent with the criteria of US DOE Order 5820.2 and the intent of US NRC's 10 CFR Part 61 Sections 61.55 and 61.56. The preoperational checkout will culminate in a formal Operational Readiness Review which will be approved by DOE prior to the 400 drum campaign.

Section G.10.2.2.1 of this plan should be completed before Section G.10.2.2.2 but it is not absolutely necessary. It is possible to provide signals to the Programmable Logic Controllers (PLC) to simulate field equipment using an IBM PC. This will allow preliminary checkout of program PLC modifications before completing installation of all components to be checked out in Section G.10.2.2.1.

Within Section G.10.2.2.1 the hydro tests and motor tests should be conducted at the time of installation. The first test following installation should be the valve checkout since proper operation of these valves is required to perform many of the other checkouts.

The remaining tests in this section can be conducted in any order, as soon as a component and control for that component are installed. However, the checkout of level switches, flow switches, and the waste metering system involve pumping water from the WDV to the mixer, and should be postponed, if possible until the mixer temperature controllers are checked out with clean utility water. Figure G.10.2-1 is a recommended sequence for installation and checkout of the CSS.

G.10.2.2.1 Physical Facilities

All modifications to mechanical and electrical components including piping and wiring will be tested during installation or checkout to ensure proper installation and operation.

Piping - Prefabricated spool pieces will be hydrotested at 1.5 times maximum design pressure for 10 minutes in the vendors shop per the requirements of B31.3 prior to acceptance by WVNS. Following installation, the new piping systems will be hydrotested to the same criteria.

Motor - All motors will be tested for rotational speed, and correct rotation.

Valves - All solenoid valves, automatic valves and actuators will be tested to ensure proper automatic valve operation.

Field Instrumentation - Test pressure, flow, and level switches for proper response to an initiating event. Test and calibrate, flow meters, continuous level sensors, thermocouples, and load cells.

Drum Fill Nozzle - Test Drum Fill Head for operation and adjust limits and position indicator.

Drip Tray - Test Drip Tray for proper operation. Adjust actuators to ensure correct positioning of the tray in the fill nozzle.

Lid Lifter - Test Lid Lifter for proper operation. Adjust actuators to ensure correct positioning to remove and reinstall the caps.

Drum Capper - Test drum capper for proper operation. Adjust to ensure correct positioning over drum and to ensure an adequate seal on the drum.

Interface Signals - Test system to ensure that all required interface signals between the waste encapsulation, drum handling, and drum loadout systems are operational.

Waste Metering System - Check operation of waste dispensing pump, WD vessel, and feed valves. Calibrate magnetic flow meter, and pump delivery rate.

Data Acquisition System - Test Data Acquisition System for proper operation, including response to abnormal process conditions.

G.10.2.2.2 Process Operations

The CSS will be fully tested using cement and synthetic waste to ensure operation of the system as designed and to ensure production of waste forms meeting the required criteria.

Preliminary Testing - The components of the Westinghouse High-Shear Cement Subsystem including instrumentation and controls will be operated manually and automatically from the Westinghouse control panel using Plant water to ensure proper operation of all components (except the Cement Feeder) before introducing cement. This testing will include all modifications made to this subsystem, all changes made to the program logic and the data acquisition system. When the results of the water tests are satisfactory, they will be repeated with cement and water.

Drum Conveyor System for the Drum Loadout Facility - Test the drum conveyor mechanical components and instrumentation for proper operation. The system vendor will provide test program/procedures for this testing. The vendor will shop test this system prior to delivery and provide a test supervisor for site testing.

Integrated Testing - The final test will be a continuous, integrated test of the entire system including cement transfer and drum handling. The full system will be run automatically at rated capacity to demonstrate its ability to meet system design requirements. The product will be randomly sampled to verify the adequacy of Process Control.

Sump Pump System - The sump pumps in the waste dispensing cell and the associated instrumentation will be checked out to verify proper operation.

G.10.2.3 TEST DISCUSSION

Piping Test

Purpose - Confirm that piping systems as installed are leak-tight.
Response and Acceptance Criterion - Piping will be hydrotested at 1.5 times the design pressure; the acceptance criteria is no visible leaks after at least 10 minutes. The test procedure shall be as submitted by the fabrication vendor and approved by WVNS for shop testing, and as detailed in the installation work order for field testing.

Motor Tests

Purpose - Confirm that motors are wired and running properly.
Response and Acceptance Criterion - Each motor in the system will be started and operated for a short period of time. The acceptance criterion will be rotation in the correct direction.

Valve Tests

Purpose - Confirm correct operation of each valve.
Response and Acceptance Criterion - Each valve will be operated from a manual switch and valves will be visually inspected to verify proper operation. Panel mounted lights will be observed to verify the correct indications. The acceptance criterion will be a valve response in the correct direction (open/close, recirc/discharge, etc.), and a simultaneous indication on the control panel. The valve position on loss of air (failed position) will also be verified.

Field Instrumentation Test

Purpose - Confirm that field instrumentation responds to the physical stimulus in a proper manner.
Response and Acceptance Criterion - The acceptance criterion for switches is a correct response at the desired set point (i.e., open/close contact, sound alarm, activate light, etc.). The acceptance criterion for continuous sensors is a current or voltage change proportional to a change in the measured parameter. In addition, instruments will be calibrated to produce a chart or table of instrument reading vs. actual condition of measured variable for continuous reading instruments, where appropriate. Instruments delivered with factory certified calibrations, will not be calibrated in the field.

Drum Fill Nozzle Test

Purpose - Confirm correct positioning of Drum Fill Nozzle and a correct response to control signals.
Response and Acceptance Criterion - Acceptance criterion is a correct response to the command signal (i.e., raise/lower), with positioning at the correct elevations, and a simultaneous indication on the control panel.

Drip Tray Tests

Purpose - Confirm correct positioning of Drip Tray and a correct response to control signals.
Response and Acceptance Criterion - Acceptance criterion is a correct response to the command signal (retract/extend) and a simultaneous indication on the control panel.

Lid Lifter Test

Purpose - Confirm correct positioning of the cap removal lid lifter crane, and proper operation of the cap vacuum lifter.
Response and Acceptance Criteria - Acceptance criteria are as follows:

1) Correct response to control signals (Lid Lifter in/out; Lid lifter - up/down; Lid vacuum on/off).

2) Proper position indication on the control panel.

3) Ability to repeatedly remove cap from drum and hold for drum fill cycle (minimum of 10 consecutive operation).

4) Ability to repeatedly replace cap and correctly position for capping operation (minimum of 10 consecutive operations)

Drum Capper Test

Purpose - Confirm proper operation of capping mechanism.
Response and Acceptance Criteria - Acceptance criteria are as follows:

1) Correct response of capping mechanism to control signals (up/down; crimp/release).

2) Proper position indication on the control panel.

3) Ability to repeatedly produce a smooth tight crimp (minimum of 10 consecutive operations).

Interface Signal Tests

Purpose - Confirm that interface signals and system interlocks inhibit operation if unsafe or abnormal conditions exist (i.e., no drum in fill position). This will include alarm conditions determined by the Data acquisition system.
Response and Acceptance Criterion - Acceptance criteria will be an alarm, with interruption or inhibition of the processing sequence when an unsafe condition exists and no alarm with no interruption when safe conditions exist.

Waste Metering System

Purpose - Confirm accurate metering of waste. Characterize metering rate of waste dispensing valve.
Response and Acceptance Criterion - The data obtained during this phase will be used to establish the capability of the waste dispensing system to consistently meter an accurate volume of waste to the mixers. This information will be used to establish tolerance bands for the Process Control Program. There are no acceptance criteria for this test, it is required to obtain data.

Date Acquisition System Tests

Purpose - Confirm accuracy of recorded data vs primary instrument readings, correct recording sequence, and proper response to abnormal process conditions.
Response and Acceptance Criteria - The acceptance criteria is as follows:

1) Agreement between reading on primary instrument and recorded reading within ±2 percent.

2) The correct data point recorded at each step in the sequence where data recording is required.

3) The data acquisition system provides a signal to alarm and interrupt the auto-sequence whenever a parameter monitored by the system is abnormal (i.e., mixer weight compared to expected weight).

Preliminary Tests

Purpose - Confirm the proper operation of the High-Shear Cement Solidification Subsystem with cement and water, both in manual and automatic mode.
Response and Acceptance Criterion - Acceptance criterion will be production of ten drums of hardened cement automatically with no system failures.

Drum Conveyor System for the Drum Loadout Facility Tests

Purpose - Confirm proper operation of Drum Conveyor System components.
Response and Acceptance Criterion - Acceptance criterion will be as called out in equipment specification WVNS-EQ-250. System vendor will provide test program/procedures and acceptance criteria for this portion of test, and will perform shop testing. Vendor will also provide a test supervisor for site tests. WVNS Personnel will approve the procedures and acceptance criteria and will retain the right to witness all testing.

Integrated Testing

Purpose - Confirm automatic integrated operation of all subsystems of the CSS, and verify the adequacy of Process Control.
Response and Acceptance Criterion - Acceptance criterion will be continuous operation of the integrated CSS for a period of 4 hours at a rate of four (4) square drums/hr. Several drums will be randomly selected, and sampled for free water, and homogeneity of the mix. Acceptance criteria will be no free liquid present.

Sump Pump Tests

Purpose - To confirm proper operation of the three CSS sump pumps, and the adequacy of the instrumentation and control system.
Response and Acceptance Criterion - Pumps will be adjusted and operated to provide a pump out rate of approximately 30 gpm. The sumps will be flooded with water to verify response of level indicators, automatic alarm and pump start-up at high-level set point and automatic pump shutoff at low level set point.

G.10.3 TRAINING PROGRAMS

G.10.3.1 INTRODUCTION

G.10.3.1.1 Scope

The primary purpose of the Cement Soldification System is to encapsulate radioactive waste solutions and slurries in cement drums, which will be stored in a temporary on-site storage area for future shipment to a permanent disposal site.

The system consists of three major subsystems, the Waste Encapsulation Subsystem, the Cement Storage, and Transfer Subsystem, and the Materials Handling Subsystem. The entire system is located within and adjacent to the 01-14 Building at the WVNS Site.

G.10.3.1.2 Program Objective

The overall objective of the qualified program is to provide qualified personnel to safely operate the CSS in the areas as listed in the Qualification Program Contents Section (1.3), in accordance with DOE ORDER 5480.1A, Chapter V, "Safety of Nuclear Facilities". Qualified personnel will be provided by training and testing operator candidates who meet certain pre-requisites for the qualification program.

G.10.3.1.3 Qualification Program Curriculum Overview

The course curriculum for the CSS Operator Qualification Program is designed to include in detail, the following:

- o System and Subsystem Description, H & V Systems included.

- o Modifications

- o System and Subsystem Components, H & V Systems included:
  Instrumentation and Controls
  Alarms and Response Procedures

- Emergency Operating Situations
- 01-14 Building Emergency Procedures and Fire Safety
- Operational Safety Requirements
- Data Aquisition System
- System and Subsystem Interfaces:
  LWTS, CTS, Utilities, Warehouse
- Radiological and Environmental Monitoring
- Ancilliary Systems, Sumps, Cranes, Closed Circuit TV, Electrical Motor Control Center, etc.

G.10.3.2 PERSONNEL SELECTION

G.10.3.2.1 Entry Requirements

The personnel selected for Plant Systems Operations shall have a high school education or equivalent with courses in algebra, chemistry and/or physics.

G.10.3.2.2 Prerequisites

Furthermore, personnel who are selected and assigned to the CSS Operations group will possess, as a minimum, a Plant Systems "B" Operator Qualification. Such personnel will have completed training in the following pre-requisites:

- Radiation Worker Training
- Respiratory Protection Training
- Procedural Compliance Training
- Quality Assurance Training

- o Radioactive Materials Handling Training
- o Lifting and Handling Training
- o Nuclear Criticality Safety Training
- o General Plant and Chemical Safety
- o General Plant Emergency Plan & Procedures

Plant System "B" Operators possess the knowledge and are qualified to operate many areas of the main plant which utilize processes and instrument & controls similar to those used in The CSS:

- o Plant Ventilation
- o Waste Tank Farm Equipment
- o Water Treatment (FRS)
- o Low-Level Waste Treatment Facility

G.10.3.2.3 Training Resources

The WVNS Training Department will have the responsibility for overall coordination and documentation of the qualification program. The department will employ the expertise of the CSS Design Group to provide classroom instruction on the basic theory, process concepts, subsystem, components and procedures which compose the CSS process. This training will be supplemented by the use of vendor prepared materials related to basic functions of valves, pumps, instruments process controllers and/or other vendor material specific to the CSS. Further training reference material and information on procedures, Temporary Operating Procedures, Standard Operating Procedures, Unusual Occurrence Report and Operational Safety Requirements will be kept in the Training Department personnel will also provide instruction, tutorial activities, operator qualification guidance and training material preparation including training aids and lecture videotaping.

G.10.3.3 OPERATOR QUALIFICATION PROGRAM CONTENT

G.10.3.3.1 PROGRAM GOALS

The CSS Qualification Program will fulfill the specific needs determined for personnel to operate the facility and process in a safe and efficient manner.

The Operator at the completion of the training/qualification program shall be able to:

- o Understand the theory and function of the system process, equipment and controls for generation of an acceptable product.

- o Demonstrate the knowledge and perform the normal modes of operation for the CSS using established Temporary Operation Procedures, Standard Operation Procedures, R & ID's, and Operational Safety Requirements (OSR)

- o Detect and respond to abnormal or emergency conditions using the instrumentation on available and via visual monitoring of the components.

- o Mitigate emergency situations using appropriate procedures and bring the system to a safe shut down mode, if needed.

- o Operate the facility safely in accordance with DOE Order 5480.1A, Chapter V.

- o Maintain and update their knowledge and skills as required to remain qualified.

G.10.3.3.2 Training Content Outline

The content and depth of coverage for the CSS Operator Qualification Program will satisfy the specific needs for knowledge in all CSS Process areas. The curriculum is divided into three blocks to enable a more through and organized method for The operator to learn the process and equipment operation.

The following is an outline of the three blocks of the CSS Operator Qualification Program with a detailed course listing.

Block I

Technical training and System familiarization - includes trainee self-study and classroom lectures by CSS Design Engineer and/or Supervisory personnel. The Training Department will assist in training material preparation where needed, i.e. - training aids, videotapes, etc.

Fundamentals (week NO. 1)

a. CSS introduction and overview with tour.
b. Techniques and practices for equipment operators.
c. Process concepts and controls.
   o Introduction
   o Instrumentation diagrams and symbols. (ISA)
   o Instrumentation diagrams and symbols. (CSS)
d. Plant mathematics and chemistry fundamentals.
e. Programmable controllers.

REVIEW AND QUIZ ON WEEK NO. 1.

Fundamentals (week NO. 2)

a. Pumps - centrifugal and positive displacement.
b. Eductors, air lifts.
c. valve operations
d. CSS Valves - types, theory, operation
e. CSS Pumps - types theory, operation with field demonstration, - Diaphragm, Centrifugal, Submerged.

REVIEW AND QUIZ ON WEEK NO.2

CSS Equipment and Operation (week NO. 3)

a. Detailed CSS and 01-14 Building equipment overview with lecture tour, including modifications
b. Math and chemistry - specific to CSS. Problem solving, recipe calculations, calibrations, molarity and PH adjustments.
c. Bulk Cement Storage and Transfer, cement truck unloading, bulk cement transfer to day bin.
d. Cement Feed Subsystem.

e. HSCSS System (Westinghouse) - waste dispensing system with Isolok Sampler, chemical additive system, mixer operations and flushing, drum filling, control panel, waste transfer, CSS Manual Solidification with PLC operational.

REVIEW AND QUIZ ON WEEK NO. 3

CSS Equipment and Operation (week NO. 4)

a. Heating and ventilation system for 01-14 Building - H & V Filter changes for building and filter room filter change.
b. Data Aquisition System - includes keyboard practical training - Hardware, operations, etc.
c. Empty drum storage and transfer - empty drum delivery, conveyor loading, feeding empty drums into system. ATI alarm responses - manual drum operations.

d. Full drum handling and loadout - hardware; controls and operation.
   - o Conveyors
   - o Material Flow Diagram
   - o Drum Sealer
   - o Contact Dose Rate Meter
   - o Smear Survey Robot Reader (future)
   - o Drum overpack station
   - o Full drum loadout
   - o Product loadout station
   - o Transport vehicle

REVIEW AND QUIZ FOR WEEK NO. 4

CSS Interfaces and Ancillary Systems (week NO.5)

a. CSS interfaces with:
   - o Warehouse - (empty drums), (cold chemicals)
   - o LWTS - Waste Feed, 7D-13
   - o RTS - Drum Cell
   - o Analtycal Labs

b. Ancillary Systems

- o Cell sumps
- o Cranes
- o Closed circuit TV system
- o Utilities - (air, water, steam, electrical motor control center)
- o MSM operations
- o Hydraulic system

Emergency, Radiological and Safety Considerations

a. CSS emergency response for power failures

b. Emergency response procedures

c. Operational safety requirements

d. Radiological monitors - process, building and personnel

e. Radiological monitors - environmental (includes stack monitor system)

f. Fire safety systems: equipment to include:

- o Monitoring
- o Fire fighting and extinguishing

g. System test plan, process control plan, which includes:

- o Waste form requirements
- o Recipe developement and testing
- o QA plan
- o Run plan

REVIEW AND QUIZ ON WEEK NO. 5

Comprehensive Study and Review

Comprehensive written exam on weeks 1 through 5.

BLOCK II

Hands on training, cold operations and checkouts to include The following, documented by a checklist sheet for each CSS Operator.

System Operations - Manual and Automatic,

Where Applicable.

- o Waste Receiving in WDV - sampling
- o Waste Dispensing Sub-System
- o Cement Storage and Transfer Sub-System
- o Mixing , Flushing, Sub-System
- o Empty Drum Handling
- o Full Drum Handling, includes surveys, overpack system and loadout.
- o H & V systems - startup, shutdown, emergency situations, filter changeouts.
- o Control panel operation for HSCSS, AT1, SMOOT

BLOCK III

Review and Testing

Prior to becoming qualified as a CSS Operator, achievement of a passing grade on The following exams is required:

a. Written exam on Block I, sub headings 3.2.1.1 through 3.2.1.6 (passing grade minimum of 80%).

b. Operational walk-through exam by CSS Engineering or Supervisory personnel. (passing grade minimum 80%).

G.10.3.3.3 Documentation

- o The qualification program shall be documented in sufficient detail to permit independent evaluation of The scope of The training program. Procedures specific to training are found in WV-537, WV-538, WV-220 and The Training Policies & Procedures.

- o Documentation for each block of The training program will include an account of The time spent in The various training activities.

- A written training signature list (e.g. qualification standard) will be kept for each trainee, which covers all significant steps of training. The OJT qualification sign-off checklist will be more detailed to assure proper instruction and practice (under close supervision) on every aspect of CSS operations.

G.10.3.3.4 Requalification

DOE Order 5480.1 states that retraining and re-examination shall be required at least annually on all procedures for handling abnormal nuclear facility conditions and emergency situations relative to The employe's assigned responsibilities. And at least every 2 years on all other subjects in which The fissionable material handler, operator, or supervisor is expected to be proficient. Requalification on abnormal or emergency situations will be performed annually.

The requalification program will be designed to review changes to procedures and equipment and subject matter not reinforced by direct use (e.g. fundamentals and operation of seldom used equipment and procedures.) The requalification training program will provide for maintaining current knowledge and skills of The applicable operators. The requalification program will include, but not limited to:

- Equipment and Plant Modifications
- SARs and OSRs
- Changes in Operating Procedures
- Unusual Occurrences, accidents, or near misses which occur locally or elsewhere if appropriate.
- Changing sources of radioactivity, criticality potentials or other potential environmental hazards.
- New outlooks or methods regarding The ALARA concept.
- Safety (fire, personnel injury, etc.).

G.10.4 NORMAL CSS OPERATIONS

G.10.4.1 CSS PROCEDURES

The CSS will be operated using procedures prepared, reviewed, and approved per the requirements of the WVDP Policy and Procedures Manual. Procedures will be written to cover all aspects of CSS operation including but not limited to:

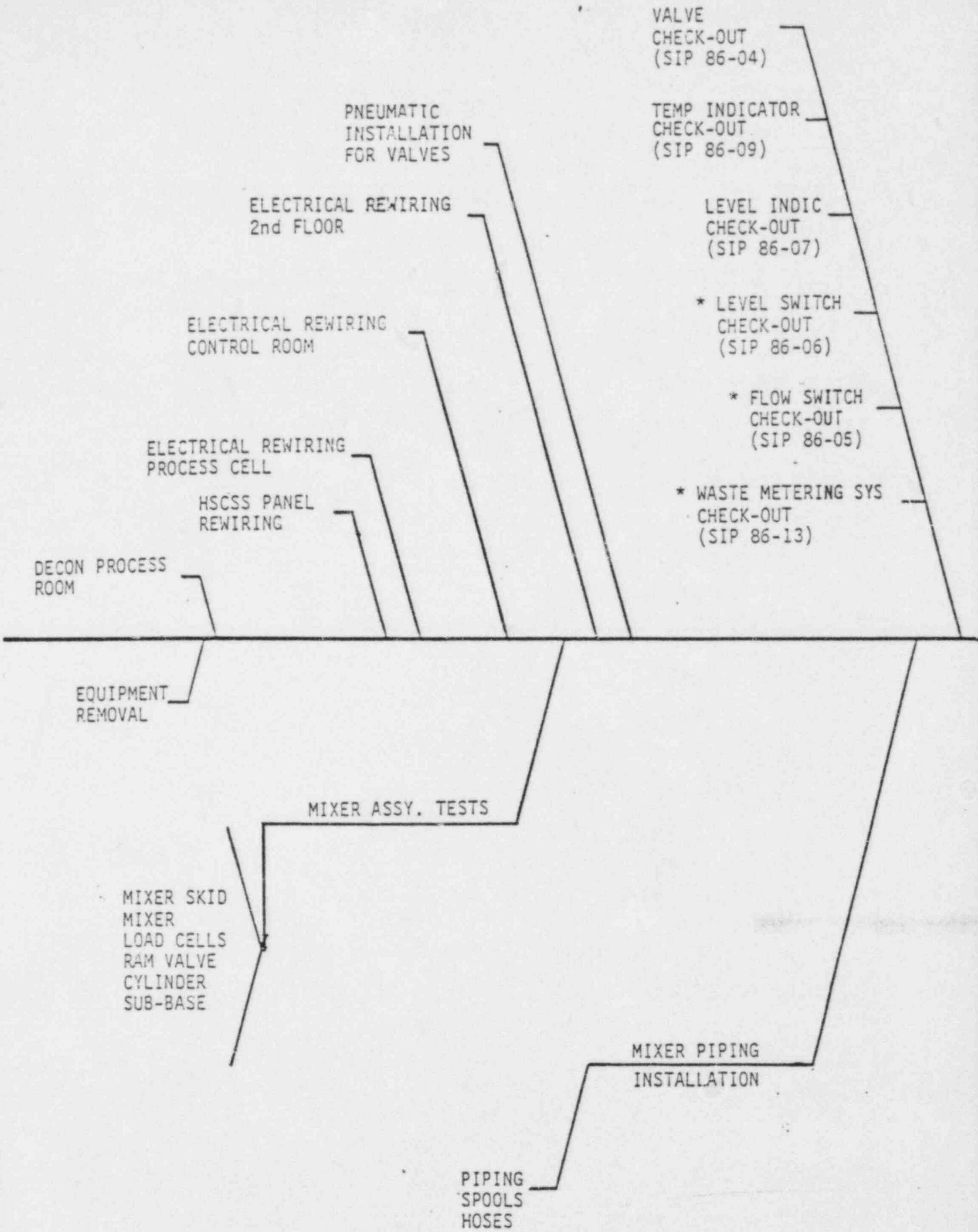
Waste transfer to the CSS,
Waste sampling,
Waste metering to the High-Shear Mixers,
Bulk cement receiving, storage, and transfer to the Acrison Day Bin,
Bulk cement metering to High-Shear Mixers,
High-Shear Mixer operations,
Clean drum loading and transfer,
Drum fill operations,
Drum capping,
Drum weighing, smearing, and labeling,
Drum overpacking,
Remote crane operation,
CCTV operation,
Full-drum storage operations,
Full-drum load-out,
Conveyor operation procedures,
Analytical Laboratory interface,
Mixer System flush procedures,
Mixer flush solution processing,
Calibration procedures,
Preventative maintenance, and
Programmable Logic Controller program loading.
Data Acquisition System Operation

REFERENCES FOR SECTION G.10.0

U.S. Department of Energy, 1985, Guidelines for Evaluating DOE Non-Reactor Nuclear Facility Training Programs.

U.S. Department of Energy, 1981, Order 5480.1, Radiation Standards for Protection of the Public In the Vicinity of DOE Facilities, Chapter V, Paragraph 8.

WVNS Training Policy and Procedures: WV-537, WV-538 and WV-220.



* INVOLVES PUMPING WATER FROM WDV TO MIXERS

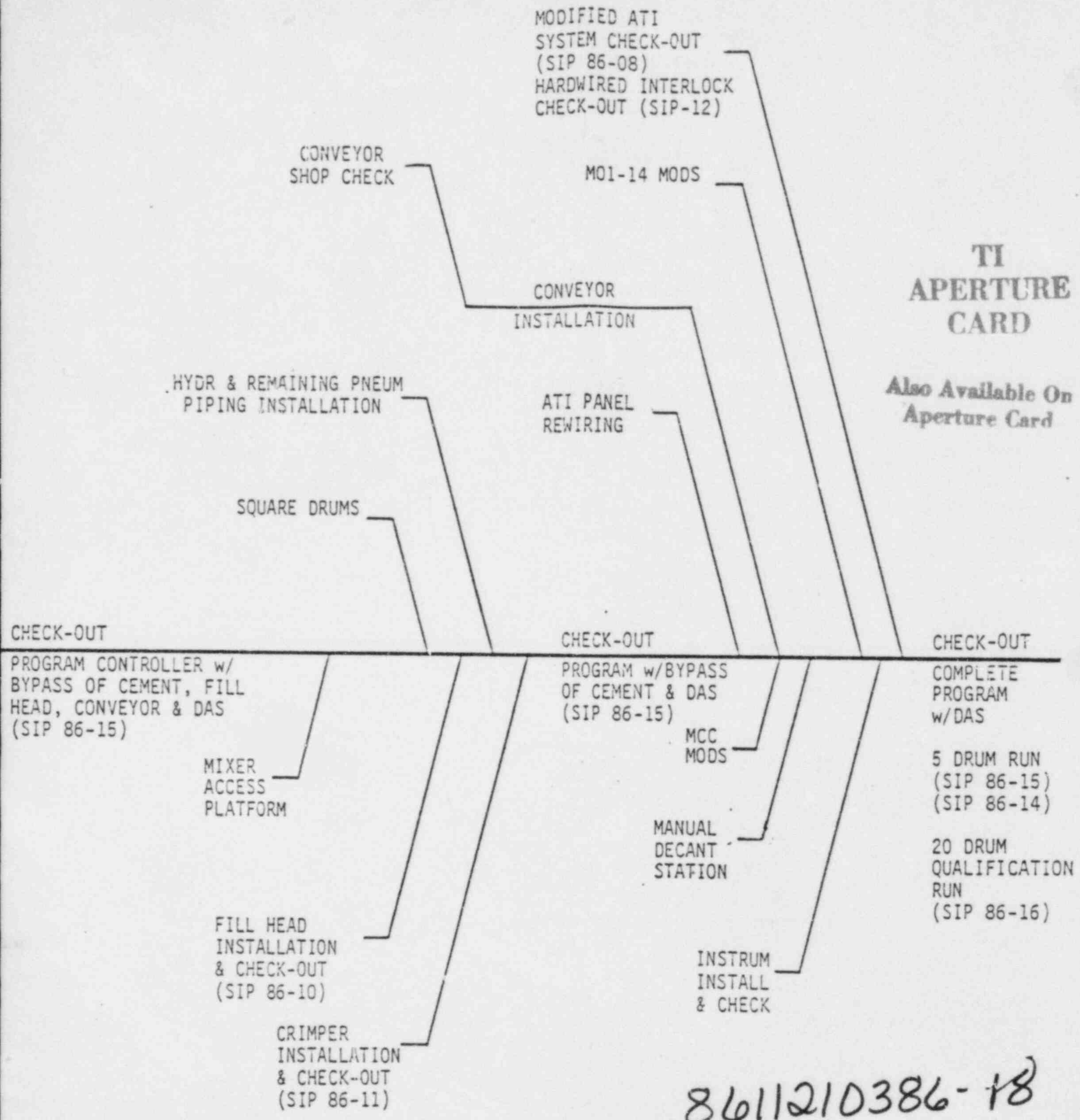


FIGURE 6.10.2-1

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SEQUENCE FOR INSTALLATION/QUALIFICATION OF CSS.

G.11.0 OPERATIONAL SAFETY REQUIREMENTS

G.11.4 OPERATIONAL SAFETY REQUIREMENTS (OSRs)

G.11.4.1 01-14 BUILDING VENTILATION

Applicability - This specification applies to the operability requirements of the 01-14 Building Heating and Ventilation (HV) System.

Objective - To assure that ventilation equipment necessary for containment and control of airborne contamination is operable and provided with appropriate backup.

Specifications -

Limiting Conditions for Operation

1. Processing of liquid waste in the CSS shall not be done without adequate ventilation of the process area. At a minimum, the electric powered blower and a diesel powered backup blower shall be available at the start of a campaign. If during a campaign the primary blower is lost, the backup blower shall be used to provide ventilation while the CSS is brought into a safe shutdown status and shall continue to provide area ventilation until the primary blower is again operational. Waste processing shall not be restarted until adequate backup ventilation is restored.

Surveillance Requirements

1. Operability of the backup blower and the automatic switching relay shall be tested every two weeks. This check shall test the automatic switch over, startup and operation of the backup blower. The backup blower shall be run for 30 minutes during each test.

Basis - The 01-14 Building HV System provides the appropriate air flow to assure control of airborne contamination. Operation of this system is important to maintenance of negative pressure differentials between operating aisles and process areas thereby assuring that airborne activity is contained within the cells. Failure of this system would eliminate this pressure differential and would allow contamination to spread into operating aisles.

G.11.4.2 HEPA FILTERS

Applicability - This specification applies to the High-Efficiency Particulate Air (HEPA) filters installed in the 01-14 Building HV System.

Objective - To assure that particulate airborne contamination is properly filtered from air being discharged from the 01-14 Building HV System so that it is below the release limits given in DOE Order 5480.1A, Chapter XI.

Specifications -

Limiting Conditions for Operation

1. One complete filter train in the Operating Aisle Filter System and five of the six filter banks in the Process Room Ventilation System shall be operational at all times during processing.

2. Pressure differential instrumentation shall be operational across each filter bank at all times. This may be accomplished by pressure differential alarms low <u>and</u> high or a pressure differential recorder for each bank.

3. The 01-14 Building HV Stack Monitor shall be operational at all times. Alarm instrumentation on this Monitoring System shall provide a continuous readout in the Main Plant Control Room and shall signal an alarm in both the CSS Control Room and Main Plant Control Room, if stack discharges exceed 75 percent of discharge limits. This Monitor shall be provided with suitable redundancy and backup power to assure uninterrupted operation.

Surveillance Requirements

1. HEPA filters shall be checked with a standard DOP test prior to initial use and after each changeout to assure that they will operate at an efficiency of at least 99.95 percent.

2. Ventilation filters shall be changed when the pressure differential across the filter is 15 cm w.c. or the dose rate on the filter exceeds 100 mR/hr.

Basis - Filters are provided in both parallel and series in the 01-14 Building HV System. The cell ventilation air passes through two banks of filters, each bank containing six HEPA filters. Individual filters may be valved out to allow replacement, hence the requirement of five filters can be met even during filter changing operations.

The operating aisle ventilation is filtered through a roughing filter and HEPA filter prior to discharge. A redundant filter train, in parallel to the first, is provided to allow for continuous filtration even during filter changeout.

Pressure differential monitoring instrumentation is provided in several forms. Pressure differential alarms (low) are installed across each filter, whereas pressure differential alarms (high) are installed across each bank of filters. These instruments are backed up by pressure differential recorders.

The filters shall also be monitored for radiation exposure rate to assure compliance with the 100 mR/hr limit. This may be accomplished by either fixed area radiation detection instrumentation or by portable survey instrumentation.

The Stack Monitor will provide an isokinetic sample of ventilation discharge from the 01-14 Building stack and will monitor to assure that this discharge is within DOE limits. The alarm point is set sufficiently low to assure that the system can be shut down until the cause of elevated activity can be identified without violating the discharge limit.

G.11.4.3 CSS WASTE LIMITS

Applicability - This specification applies to the concentration of Cs-137 and/or fissile material in the waste being processed.

Objective - To assure that waste feeds to the CSS are of sufficiently low activity to maintain exposure rates in routinely occupied areas below 0.25 mrem/hr and to assure that the system remains subcritical.

Specifications -

Limiting Conditions for Operation

1. The Cs-137 concentration of wastes entering the CSS shall be less then 6 µCi per mL of waste solution. Solutions above this concentration shall not be processed without written approval of the Radiation and Safety Manager.

2. The following fissile material limits shall be applied to each batch of waste processed in CSS:

   O For unrestricted batch processing, the allowable and/or limiting fissile material solution concentration for each process step for each CSS batch operation shall not exceed the values given in Table G.11.4-1.

   O If the solution sample analysis results of a CSS batch show fissile material concentrations exceeding the limits given in Table G.11.4-1, the CSS processing operation shall not proceed. Written concurrence and authorization of the Radiation and Safety Manager will be required before the operation can proceed.

Basis - The Cs-137 concentration limit was derived from the design waste loading of 1 Ci of Cs-137 per drum of solidified waste. This value was used for shielding design of the Drum Loadout Facility. Processing of waste containing Cs-137 concentrations above this concentration may result in higher exposures in the operating aisles.

The fissile material limits were derived from a criticality safety evaluation for allowable fissile material solution concentrations for liquid transfers (FB:85:0037). The concentrations presented in Table G.11.4-1 represent the safe subcritical concentrations for fissile material.

G.11.4.4 EMERGENCY POWER REQUIREMENTS

Applicability - This specification applies to the emergency power requirements for vital components in the CSS.

Objective - To provide sufficient emergency power to the CSS for bringing the system to a safe shutdown status and maintain vital services throughout the power outage.

Specifications -

Limiting Conditions for Operation

1. Ventilation

   o Sufficient diesel fuel shall be stored on-site to allow continuous operation of the backup blower for eight hours.

   o Electrically operated controls and relays utilized to switch blowers or filter trains shall be provided emergency electrical service from the Utility Room or shall be equipped with battery backup.

   o The Stack Monitoring System shall be provided emergency electrical power from the Utility Room or shall be equipped with battery backup capable of sustaining the Monitoring System for eight hours.

2. Process

- The High-Shear Mixers and Cement Removal Pump shall be provided with sufficient backup electricity from the Utility Room to dispense a full mixer volume of cement and to flush the mixer with water.

- Lighting in the 01-14 Building shall be included in the site emergency power distribution system.

3. Instrumentation

- Ventilation filter instrumentation shall be provided emergency electrical power or shall be equipped with battery power capable of maintaining instrumentation continuously for eight hours.

Basis - Emergency power is required to safely shut down the CSS process while maintaining the containment provided by the 01-14 Building HV System. To shut down the CSS requires that the cement mixers be emptied and flushed. The above specification provides for this.

Once the CSS is shut down, ventilation will still be required to assure the containment of airborne activity. Backup ventilation is provided by a diesel driven blower. This specification assures an adequate fuel supply is on hand for this blower. The eight-hour fuel supply provides sufficient time to restore power or obtain more fuel.

Instrumentation and lighting will be required to monitor the system during its shutdown status. Backup power for these services is assured by this specification.

TABLE G.11.4-1

MAXIMUM ALLOWABLE FISSILE MATERIAL SOLUTION CONCENTRATIONS FOR CSS OPERATION (ALL VESSELS)[1]

Column 1: Concentration of Uranium (U-233 + U-235), grams/litre — Greater than	But less than	Column 2: Corresponding Maximum Plutonium Concentration (Pu-239 + Pu-241), grams/litre
0	0.049	1.35
0.05	0.499	1.63
0.5	0.99	1.39
1.0	1.99	0.92
2.0	2.49	0.68
2.25	2.99	0.44
3.0	3.49	0.20
Greater than	3.5	Not authorized for processing: Special written authorization required

(1) Each CSS solution batch shall be sampled for fissile radionuclides prior to processing. For a sample containing a combined U-235 plus U-233 concentration in the range shown in Column 1, the corresponding value in Column 2 is the safe limiting and allowable combined Pu-239 plus Pu-241 concentration for processing.

G.12.0 QUALITY ASSURANCE

G.12.2 QUALITY ASSURANCE PROGRAM

G.12.2.1 QUALITY LEVELS

Table G.12.2-1 presents Quality Levels and Service Classes for the structures, systems, and components associated with the CSS. The criteria and procedures used to determine Quality Level and Service Class designation are presented in Section A.4.4 of Volume I.

The exposure rate within the CSS Process Room could exceed 100 mR/hr should an accident occur resulting in either a spillage of liquid waste or cement setting up within one of the Mixers. If such a situation were to occur, it would be necessary for workers to enter the cell to repair or replace various pieces of equipment. These workers could receive a dose in excess of 100 mrem should they be required to work within the Process Room for several hours. For this reason, certain components within the Process Room have been assigned a Service Class of III. Components exterior to the Process Room, which are all standard industrial components which have a proven history of industrial reliability, are assigned a Service Class of IV. The exception to this is the WDV and associated transport components. The Quality Level designations given in Table G.12.2-1 are based on the Safety Classification of structures, systems, and components given in Table G.4.4-1.

Section A.12.0 of Volume I discusses the implementation of the Quality Assurance Program based on DOE Order 5700.6A, DOE-ID Order 5700.6B and the eighteen criteria of ANSI/ASME NQA-1, 1983.

QUALITY LEVEL CLASSIFICATION AND SERVICE CLASS OF IMPORTANT STRUCTURES, SYSTEMS AND COMPONENTS ASSOCIATED WITH THE CEMENT SOLIDIFICATION SYSTEM

COMPONENT OR SYSTEM	SERVICE CLASS	QUALITY LEVEL
STRUCTURES		
01-14 Building (Modified)	III	C
Shield Walls	III	C
Shield Doors and partitions	III	C
Shielded Viewing Window	III	C
Access Doors	IV	N
Air Lock Doors	IV	N
Stainless Steel Liner	IV	N
Sumps and Associated Drainage Lines	IV	N
Floor Drains and Associated Drainage Lines	IV	N
Pipe Supports	IV	N
Conduit Supports	IV	N
HV Supports	IV	N
WASTE PROCESSING		
Cement/Additives Preparation and Delivery	IV	
Cement Fill Station	IV	N
Cement Silo	IV	N
Pneumatic Cement Transport System	IV	N
Additive Tanks (2)	IV	N
Cement Bin	IV	N
Cement/Additives Transport Lines	IV	N
Cement/Additives Transport Pumps	IV	N
Cement/Additives Transport Valves	IV	N
Loss-in-Weight Feeder	IV	N
Liquid Radioactive Waste Preparation and Delivery		
Waste Dispensing Vessel	III	C
Waste Transport Lines (Note 1)	III	C
Waste Transport Pumps (Note 1)	III	C
Waste Transport Valves (Note 1)	III	C
Mixer Flush System		
Flushwater decant pumps	III	N
Sump Pumps	III	N
Cement Solidification		
High-Shear Mixers (2)	III	N
Cement Transport Lines	IV	N

Note 1: This classification applies only to the Waste Transport Lines, Pumps, and Valves within 01-14 Building.

TABLE G.12.2-1 (2 of 3)

QUALITY LEVEL CLASSIFICATION AND SERVICE CLASS OF IMPORTANT STRUCTURES, SYSTEMS AND COMPONENTS ASSOCIATED WITH THE CEMENT SOLIDIFICATION SYSTEM

COMPONENT OR SYSTEM	SERVICE CLASS	QUALITY LEVEL
Cement Solidification (Continued)		
Fill Nozzle	IV	N
Drums	IV	N
Lid Crimper	IV	N
LOADOUT HANDLING EQUIPMENT		
Air Lock Door Engaging System	III	C
Drum Feed Conveyors	III	C
Manipulator	III	C
Transfer Drawer	III	C
In-Cell Crane	III	C
Drum Lift Table	IV	N
Drum Overpack Conveyor	III	N
Smear Station		
Automated Swipe/Label Robot	III	C
Swipe Tool(s)	III	C
Overpack Station		
Drum Transporter		
Shielded Cask	III	C
Truck	IV	N
MONITORING SYSTEMS, CONTROLS AND INSTRUMENTATION		
Area Radiation Monitors	III	C
Airborne Particulate Monitors	III	C
Ventilation Monitoring System and Alarms	III	C
Liquid Radioactive Waste Sampling System	IV	N
In-Cell TV Camera	IV	N

QUALITY LEVEL CLASSIFICATION AND SERVICE CLASS OF IMPORTANT STRUCTURES, SYSTEMSAND COMPONENTS ASSOCIATED WITH THE CEMENT SOLIDIFICATION SYSTEM

COMPONENT OR SYSTEM	SERVICE CLASS	QUALITY LEVEL
MONITORING SYSTEMS, CONTROLS AND INSTRUMENTATION(Continued)		
In-Cell Radiation Monitors	III	C
Communications Equipment	IV	N
Electronic Instruments and Controls	III	C
In-Cell Alpha/Beta Counter	III	N
Pneumatic, Hydraulic Instrumentation & Controls	III	C
UTILITIES AND SUPPORTING SYSTEMS		
Electrical Power Systems		
01-14 Building Supply	IV	C
Panels, Transformers and Motor Control Center	IV	C
Conduits	IV	C
Engine Drive	IV	C
Steam	IV	N
Utility Air	IV	N
Instrument Air	IV	N
Demineralized Water	IV	N
Utility Water	IV	N
Fire Detection and Protection	IV	C
VESSEL OFF-GAS SYSTEM		
Ducting	III	C
Blowers	III	C
Exhaust Filtration	III	C
HEATING AND VENTILATION (HV) SYSTEM		
01-14 Building HV System		
Ducting	III	C
Blowers	III	C
Exhaust Filtration	III	C
SYSTEM CHECKOUT AND TESTING	N/A*	C

*N/A Not Applicable