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December 29, 1982

Mr. Darrell G. Eisenhut, Director
Division of Licensing
U.S. Nuclear Regulatory Commission
Washington, DC 20555

Subject: Dresden Station Units 2 and 3
Quad Cities Station Units 1 and 2
Information Concerning NUREG 0737
Item II.B.3, Post Accident Sampling System
NRC Docket Nos. 50-237/249 and 50-254/265

Reference (a): D. B. Vassallo letter to L. DelGeorge dated August 6, 1982
(b): E. D. Swartz letters to D. G. Eisenhut dated September 2, 1982
(c): D. M. Crutchfield letter to L. DelGeorge dated October 8, 1982

Dear Mr. Eisenhut:

In response to the Reference (a) request, Commonwealth Edison indicated in Reference (b) that certain information concerning the NUREG 0737 Item II.B.3 Post Accident Sampling Systems at Dresden and Quad Cities Stations would be provided by December 30, 1982. The requested information is provided in the enclosures to this letter.

To the best of my knowledge and belief the statements contained herein and in the enclosures are true and correct. In some respects these statements are not based on my personal knowledge but upon information furnished by other Commonwealth Edison employees or contractor employees. Such information has been reviewed in accordance with Company practice and I believe it to be reliable.

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Please address any questions you may have concerning this matter to this office.

One (1) signed original and forty (40) copies of this transmittal are provided for your use.

Very truly yours,

Thomas J. Rausch

Thomas J. Rausch
Nuclear Licensing Administrator

Enclosures

cc: J. G. Keppler
R III Insp-Dr
R III Insp-QC
R. Bevan
R. Gilbert

ENCLOSURE

COMMONWEALTH EDISON COMPANY

Dresden Station Units 2 and 3

NUREG-0737, Item II.B.3 Post-Accident Sampling System

Additional Information

DRESDEN STATION
HIGH RADIATION SAMPLING SYSTEM

The High Radiation Sampling System (HRSS) at Dresden Station is provided for obtaining and analyzing samples from process systems and from the containment atmosphere during normal and post-accident conditions. Two identical concrete shielded buildings have been built to separately house the HRSS components for Units 2 and 3, and have been located adjacent to the respective reactor buildings. The sampling panels, chemical analysis equipment, instrumentation and controls for the system are located in each HRSS building.

1.0 GENERAL DESCRIPTION

The HRSS functions, building and equipment layout, description of HRSS components, and system operation are described in the following sub-sections.

1.1 Functions

The HRSS has been designed to perform the following major functions during normal plant operations and post-accident conditions:

- During normal plant operations, obtain samples from systems such as reactor coolant system, reactor building equipment drain tank, and reactor building and drywell sumps.

- During normal operations, provide for continuous radiation monitoring of either drywell, suppression pool, or standby gas treatment atmospheres, and determine gaseous constituents in the drywell.

- Obtain post-accident reactor coolant grab sample in a shielded container suitable for transport to an on-site laboratory for analysis.

- Perform in-line chemical analysis of post-accident reactor coolant sample for chlorides, pH, conductivity, and dissolved oxygen. Degas the sample and perform in-line analysis for dissolved hydrogen and on-site analysis for radionuclides.

- Provide for storing, handling, and disposal of sample wastes.
- Obtain post-accident grab sample of drywell atmosphere in a sample separation device for on-site analysis.
- Provide backup capability for determination of hydrogen concentrations in drywell following an accident.

1.2 HRSS Building Arrangement

Each HRSS building is located south of the reactor building of the respective unit as shown in Figure 1. The building is a concrete structure with an external wall thickness of 3'-0" and roof thickness of 2'-0". The building is arranged into four separate areas as shown in Figure 2.

The building is entered through the vestibule area which contains a clothing change area and a portal radiation monitor for use by personnel before leaving the area. The vestibule is separated from the operating area by a wall with a door. A step-off pad is located at the door.

The operating area contains the control panels for liquid and containment air sampling, motor control center, and HVAC control panel located adjacent to the vestibule. The Liquid Sampling Panel (LSP), the Chemical Analysis Panel (CAP), the Containment Air Sample Panel (CASP), and the containment air gas chromatograph are located at the other end of the operating area. An aisle in front of these panels is provided for manual operations such as valve alignment at the panels, calibration, and shielded cask cart movement.

The maintenance aisle behind the sampling panels is separated from the operating area by a combination of concrete shield walls and a shield door. This area provides access to the back of the sampling panels for maintenance purposes.

The pit area houses the sample waste tank, the waste pumps, the sample coolers, the chilled water system, and the HRSS building sump. This area is adequately shielded in view of the very high radiation levels associated with post-accident sample wastes that are collected in the waste tank. A 5 feet wide, 3 feet deep concrete trench with

2 feet thick concrete removable covers connects the reactor building and the pit area. Piping carrying process samples, demineralized water, instrument air and other services, and electrical power and control cables are located in the trench.

The HVAC system for the building is designed to provide conditioned air to the operating areas to control airborne contamination by directing air flows from lesser to higher contaminated zones and to filter the exhaust air from the building when required through the plant vent. To enhance reliability, redundant exhaust fans are provided for the charcoal filter train. The HRSS building is maintained at a negative pressure to preclude air leakage out of the building.

Area radiation monitors are provided in the operating area and in the maintenance aisle with the readout in the vestibule.

1.3 HRSS Component Description

The major HRSS components are briefly described here. The equipment parameters and data for each component are listed in Table 1.

1.3.1 Liquid Sample Panel (LSP)

The extraction of liquid samples takes place in the LSP. The LSP also routes samples to the CAP for chemical analysis. The LSP is a free standing, self-supporting structure containing the necessary sample tubing, valves, and gages within a totally enclosed panel with steel and lead shielding on the front face. In order to avoid cross contamination between high purity and low purity sample fluids, the incoming sample lines are grouped into categories and are hydraulically separated within the panel. The front panel face has a graphic display showing the sample and support service flow paths, and has all necessary indicating instrumentation.

The LSP has the following capabilities:

a. For routine, non-accident sampling, a pressurized reactor coolant sample can be captured in a 75 ml sample bomb. The bomb is removable for transport to an on-site laboratory for hydrogen and isotopic analysis.

b. For routine, non-accident sampling, depressurized reactor coolant or sump sample can be captured as an open grab sample.

c. For post-accident sampling, pressurized reactor coolant can be isolated in a 30 ml flask, degassed into a 300 ml vessel where the stripped gases are diluted with argon. The stripped gases are routed to the gas chromatograph in the CAP for hydrogen determination. Alternately, a 0.02 ml "bite" of the stripped gases is captured in a shielded 15 ml serum bottle which can be removed, placed in a shielded carrying case, and transported to the on-site laboratory for isotopic analysis.

d. For post-accident sampling, undiluted depressurized reactor coolant or liquid from sumps can be captured in a 15 ml sealed bottle. The bottle is remotely lowered into a shielded cask resting on a special cart. The cart with cask is removed from the panel and transported to the counting facility.

e. For post-accident sampling, 24 ml of 1000 to 1 diluted depressurized sample can be captured in a sealed bottle and lowered into a shielded cask on a special cart. The cask is removed from the panel and transported to the on-site laboratory for chemical and isotopic analysis.

f. For post-accident sampling, a depressurized reactor coolant sample can be routed to the CAP panel to measure conductivity, pH, chloride, and dissolved oxygen.

The reactor coolant sample is drawn from the existing sample point on the recirculation loop. Sampling of reactor coolant under post-accident conditions does not require the startup of any isolated auxiliary system. The containment isolation valves on the sample line can be remotely opened from the control room to allow the reactor coolant sample to flow to the sampling system.

The sample lines are 1/2" OD stainless steel tubing of all welded construction up to the sample panels. Purge velocities are maintained at 1900 cc/min. The sample lines can be flushed with demineralized water, and the purge and flush volumes can be stored in the waste tank in the HRSS building before pumping the wastes to the drywell floor drain sump or to the reactor building equipment drain tank. The design minimizes the potential for leakage of samples. Should a rupture of the reactor coolant line occur within the HRSS building, the containment isolation valves can be remotely closed and the liquid contained in the HRSS building sump or waste tank.

1.3.2 Chemical Analysis Panel (CAP)

The in-line chemical analysis of reactor coolant samples and stripped gases takes place in the CAP which is located next to the LSP and is interconnected with the LSP. The CAP is a free standing, self-supporting structure containing the necessary valving, tubing, and analytical equipment within a totally enclosed panel with steel and lead shielding on the front face. A graphic display showing the sample and support services flow paths, flow and pressure indicators, calibration reagent tanks and other components are mounted on the front face of the panel.

The CAP provides for in-line analysis of the following sample parameters:

a. Chlorides

Chloride analysis is performed by an in-line Dionex Model 10 Ion Chromatograph. Prior to sample analysis, the instrument is calibrated with a chloride standard. After calibration, the reactor coolant is routed from the LSP to the CAP. The chloride analysis is recorded in the CAP control panel. The total time required to obtain a chloride analysis and flush components is approximately 45 minutes.

The system is capable of determining in undiluted samples chloride concentrations in the range of 0.1 to 20.0 ppm with an accuracy of approximately ± 15% for concentrations under 1 ppm and ± 20% for concentrations above 1 ppm. An undiluted sample can also be collected in a shielded cask at the LSP and retained for chloride analysis within 30 days.

b. pH

The pH analyses are performed in-line in the CAP using a Cole-Parmer combination pH probe mounted within a probe holder. Calibration of the probe is conducted in place using pH 7 and pH 4 or 10 buffer solutions. Accuracy of pH measurements is conservatively estimated as ± 0.5 pH units.

A Beckman Model 960B pH monitor mounted on the CAP Control Panel provides indication.

c. Conductivity

Conductivity measurements are made using a Beckman Model 412 conductivity probe and a Leeds and Northrup Model 7073-17 conductivity monitor. The range of the instrument is 0.1 to 500 micromhos per cm with an accuracy of ± 5% in the 1 to 20 range.

d. Dissolved Oxygen

Dissolved oxygen analyses for post-accident conditions are performed using an in-line dissolved oxygen probe and meter manufactured by Yellow Springs Instrument Company. The YSI analyzer was chosen for the post-accident conditions because the response time was relatively short and the probe holder volume was smaller, thus reducing radiation levels. Calibration is performed using air saturated water.

The instrumentation is capable of determining dissolved oxygen in the range of 0.1 ppm to 10 ppm with an accuracy of ± 10%.

A Rexnord in-line oxygen probe is installed in parallel with the YSI probe for dissolved oxygen analysis during normal operations, but could serve as a backup analysis system during post-accident conditions.

e. Dissolved Hydrogen

Dissolved hydrogen in the reactor coolant is measured by introducing the stripped gases from the reactor coolant into a Baseline Model 1030A gas chromatograph in the CAP. The instrument is calibrated using calibration gases containing various concentrations of hydrogen.

The gas chromatograph is capable of measuring dissolved hydrogen in the reactor coolant in the range of 3 to 2000 cc of hydrogen (at STP) per kilogram of reactor coolant with an accuracy of ± 15%.

f. Boron

Plans are being made for boron analysis of diluted reactor coolant samples.

To reduce radiation levels, the tubing within the panel is 1/4" OD and 1/8" OD stainless steel. Provisions are made for flushing the in-line probes with demineralized water.

The selected instrumentation and procedures have been tested to demonstrate their applicability in the post-accident water chemistry. The materials used in the instrumentation, tubing, and valves have been selected on the basis of their ability to withstand the radiation effects of the post-accident primary coolant.

The development and test program considered the following criteria in reviewing the analytical methods available to meet the post-accident requirement.

1. Chemical effect of the post-accident coolant matrix
2. Analyses time and radiological dose limitations
3. Radiation effect on method and/or equipment
4. Application to both normal and post-accident conditions
5. Compliance with sensitivity and range requirements
6. Applicability to in-line or grab sample analysis
7. Sample size requirements
8. Accuracy of the analysis methods

Most of the testing was performed in the laboratory during the development phase and some final verification tests were performed on the instrumentation as installed in the panel.

1.3.3 Containment Air Sampling Panel (CASP)

The containment (drywell), suppression pool, and standby gas treatment atmosphere samples are captured in sample separation devices in the CASP. The panel is an enclosed cabinet with a 3" steel plate in the front with provisions for locating and connecting containers for collecting samples. The panel encloses a network of valves, tubing (1/4" OD stainless steel), fittings, instruments, and quick connect couplings so arranged that all sampling operations can be performed by an automatic sequence programmer or by manual means.

The sample line is a 1/2" OD stainless steel tube tied into existing sample points downstream of the containment isolation valves. To minimize plateout, the sample tubing is run with large radius bends, flow velocities are maintained at 10 ft/sec and the tubing is heat traced to maintain it at 275°F. To minimize sample loss, the tubing is welded throughout up to the panel.

No isolated auxiliary system is required to be operational for sampling the containment air. The containment isolation valves on the sample lines can be opened from the control room for getting the sample to the panel.

The containment air may be analyzed for its various components using chromatography, and/or a grab sample can be automatically partitioned in the gas partitioner attached to the CASP at a grab sample location. The partitioner divides the sample into noble gases, iodines, and particulate species, and are housed in known calibrated geometries for analysis by the portable radionuclide analyzer located in the vestibule.

1.3.4 Control and Monitoring Panels

Three individual control panels for the operation of the LSP, CAP, and CASP are located in the operating area shielded from the sample panels by a 3 ft concrete wall. Under post-accident conditions, most of the operations for sampling and monitoring are performed from these panels to limit the radiation dose to the operator from the radioactive fluids in the sample panels.

a. LSP and Building Auxiliary Control Panel

The HRSS Control Panel consists of three sections. In the top section, annunciator windows indicating the various alarm conditions are located. The mid-section contains a graphical layout showing the liquid sample system flow paths, valves, pumps, and other equipment. All handswitches with indicating lights for operating valves, pumps, and HVAC equipment are located in the lower section of the control panel.

b. Chemical Monitor Panel

The Chemical Monitor Panel is an auxiliary recorder/monitor panel which contains the indicating and recording equipment for the cells and analyzers which are mounted in the CAP. The panel permits the operator to work with and observe the indicating and recording equipment from a remote location to reduce exposure under post-accident conditions.

c. CASP Control Panel

The CASP Control Panel contains selector switches, timers, pilot lights, annunciator system, pressure controller and gauge, and an electromechanical programmer. A mimic diagram of the CASP flow paths, valves, and equipment is also provided on the panel. The operator uses this control panel to select, initiate, and control sampling flask filling exercises. Also sample cycles for gross gamma readings of the air sample are programmed from this panel.

1.3.5 Containment Air Monitoring (CAM) Unit

The CAM unit is used only during normal plant operations to monitor the containment atmosphere for radionuclides. The unit is controlled by, and alarms at, a remote console located in the control room. The CAM unit is a wheeled skid on which the particulate filter assembly, the iodine charcoal canister, and the low range and medium range noble gas monitors are mounted. A separate high range gross gamma detector is located in the maintenance aisle which monitors the incoming containment air sample. The remote consoles located in the control room control the operation of the CAM unit and print, alarm and log the outputs from the CAM unit and the gross gamma detector.

1.3.6 Gas Chromatograph (GC)

The gas chromatograph is a Bendix Model 002 unit which is used during normal operation to analyze the containment atmosphere for carbon monoxide, carbon dioxide, hydrogen, oxygen, and nitrogen. The analysis initiation, frequency, and type of record is done from a programmer and keyboard/printer located in the CAS Control Panel.

The GC can be used with proper administrative controls as a backup containment atmosphere hydrogen monitor during post-accident conditions.

1.3.7 Motor Control Center (MCC)

The MCC is located in the operating area and provides 480V power supply to the HRSS and HVAC equipment and 208/120V power supply for control, lighting, and heat tracing the sample tubing.

This MCC is powered from 480 volt Bus #26 (for Unit 2) and Bux #36 (for Unit 3). In the event of off-site power failure, standby diesel power is available for the HRSS and the MCC can be energized to meet the time limits for sampling and analysis under post-accident conditions.

2.0 HRSS OPERATION

The HRSS can be designed to provide the capability to promptly obtain and analyze reactor coolant samples and containment atmosphere samples within 3 hours after a decision is made to take such samples. The HRSS and the permanent facilities are located at ground level, and therefore, sample transport in shielded containers is not a problem. Power from standby station diesels can be manually switched on to energize the HRSS MCC in the event of off-site power failure during post-accident conditions.

The HRSS can be used for sampling and analysis both during normal and post-accident conditions. Regularly scheduled surveillances are performed to assure equipment operability. Full graphic presentations are provided on the LSP and on the control panels to assist in the operation of the HRSS. These graphic presentations enable the operator to assess and control the sampling process. The post-accident sampling operations are only briefly described here.

The post-accident sampling operation is designed to be performed by one operator. However, a second operator located in the vestibule should be available to monitor and/or direct the operation, and to assist in the maneuvering the shielded cart out of the area.

Upon entry into the HRSS building, the operator will enter the vestibule and don protective clothing as required. The operator will then proceed to the sampling area and verify that the bottled gases such as nitrogen and argon are adequate to carry out the sampling exercise. A walk-through inspection of the pit area and maintenance aisle will ascertain the status of the sample cooling chilled water system and provide for verification that the backs of the sampling panels are closed. Having completed these verifications, the shield doors to the pit and the maintenance aisle will be closed. The next step would involve moving the sample cart from its storage area and positioning the cart with the sample bottles under the hypodermic needles in the LSP. The final step in this presampling sequence is the calibration of the analyzers on the CAP.

Having completed these verifications, the operator will proceed to establish system conditions necessary for drawing the liquid samples. The waste tank level will be checked to determine if adequate freeboard exists for the anticipated sampling at the control panel. The tank's contents will be drained entirely prior to the sampling operation. The waste tank pump control is switched from the automatic mode of operation to the manual mode. A nitrogen blanket on the waste tank is introduced by manually purging the tank through the vent line to the ventilation system. The nitrogen blanket is provided to dilute the large amounts of hydrogen that could be dissolved in the coolant. During the sampling operation, the nitrogen blanket will be maintained by the nitrogen feed system. After the nitrogen blanket is established, the tank is isolated from the ventilation system. The HRSS building ventilation flow through the charcoal filter is established using the redundant exhaust fans.

With these preliminary operations completed, the containment isolation valves in the sample lines will be reopened from the control room and the manual valves on the LSP are aligned using the reach rods to introduce the sample into the HRSS building. The sample panel is aligned to purge the sample lines to obtain a representative sample. For reactor coolant sample, the appropriate purge flow is determined by the indicator on the face of the LSP. During the purge, the operator will leave the vicinity of the LSP and proceed to the HRSS control panel area where he can monitor the process. The area of the HRSS control panel also provides a greater amount of shielding than that directly in front of the LSP, thereby, reducing the exposure of the operator during the purge recirculation operation. At the end of the purge mode, the operator will return to the LSP, secure the purge, and begin the sampling operation.

For the reactor coolant, any of the following sampling operations as required can be performed.

a. Capture 30 ml of pressurized coolant. Degas the sample and collect the offgas in an expansion vessel.

b. Transfer the offgas to the adjacent CAP to measure the hydrogen content of the offgas.

c. Capture 0.2 ml of offgas and dilute to 15,000 to 1.

d. Capture 0.024 ml of reactor coolant and dilute to 1,000 to 1.

e. Route undiluted sample to CAP panel for in-line analysis of chloride, dissolved oxygen, and pH.

Once the chemical in-line analysis has begun, the operator will proceed to the control panel area and monitor the output of the in-line analyzers through their remote indications on the control panels. After the in-line analysis has been completed, sample flow to the panel is secured and the containment isolation valves reclosed. The operator can then lower the sample bottle into the shielded cask/cart and remove it from the LSP and out of the HRSS building for isotopic analysis in the on-site laboratory.

To reduce the background radiation levels, the system is then flushed from the sample coolers forward through the LSP and CAP and into the waste tank using demineralized water. The tank is designed to hold one week's waste. The operator will check the tank level and, if necessary, pump the tank contents to the drywell sump.

Although the LSP provides the capability to collect undiluted backup grab samples, the necessity for their collection and development of separate analysis capability is not warranted for the following reasons.

a. If the dissolved hydrogen concentration is verified to exceed 10 cc/kg, the dissolved oxygen, chloride, and pH measurements need only be performed within the first 30 days. There is sufficient time to flush all panel lines, and remove and replace any probes or components to permit analyses in-line. Redundant oxygen probes are provided.

b. If the dissolved hydrogen is verified not to exceed 10 cc/kg, the dissolved oxygen measurement time requirement is dependent on the chloride analysis. Chloride measurement is required within 96 hours under the above hydrogen condition. The 96-hour time frame is sufficient to flush all panel and ion chromatograph lines, repair and/or replace components, and recalibrate the system. Calibration of the system can be accomplished in-line or by performing manual injections through a port in the rear of the I.C.

Similar procedures such as verification of system readiness, opening of containment isolation valves, purging and collection of samples, monitoring gross gamma readings, and system flushing will be used for the containment air samples. Using the portable radionuclide analyzer located in the vestibule, the operator can determine the noble gas, iodine and particulate components of the containment air sample. The grab sample can be transported for additional on-site analysis.

Commonwealth Edison Company is investigating the available sources for the development of procedures for estimating the extent of core damage based on post-accident sample analysis and plant physical parameters.

3.0 RADIATION SHIELDING

The HRSS is designed to provide an operator with the capability to extract, monitor, analyze, and dispose of samples of reactor coolant, containment atmosphere, and containment sump liquid during post-accident conditions with radiation exposures well below the criteria of GDC 19 (10CFR Part 50, Appendix A).

3.1 Design Criteria

The following criteria was used in the design of the HRSS building, the sample panels, and sampling methods:

a. The design objective is to limit operator whole body exposure to 100 mrem per sampling exercise in the HRSS building.

b. Building shielding is designed such that the dose rate is 15 mrem/hr in general occupancy areas and 100 mrem/hr in areas infrequently occupied except directly in front of the sample panels.

c. Reactor coolant source term is based on the release to the coolant of 100% of the noble gas radionuclides, 50% of the halogen radionuclides, and 1% of the particulate radionuclides in an equilibrium reactor core operating at 2561 MWt.

d. Containment atmosphere source term is based on the release to the containment of 100% of the noble gas radionuclides and 25% of the halogen radionuclides in an equilibrium core operating at 2561 MWt.

3.2 Building and Equipment Shielding

The HRSS building is provided with 3' thick external walls and a 2' thick roof to limit the radiation dose inside the building due to the post-accident radiation sources within the reactor building. Within the HRSS building, concrete shield walls protect the operator in the operating area from radiation sources due to sample flow in tubing, panels, and waste collection tank.

The LSP is provided with a front panel shield consisting of 7" of lead shot sandwiched between two 1/2" steel plates. Shield glass viewing ports are provided for observing the sample bottle needle area and the gages. The integral steel base consists of 5" of lead shot sandwiched between two 1/2" steel plates.

The CAP is provided with front panel and base shield similar in size and configuration as the LSP.

The CASP has a front panel fo 3" thick steel plate which provides adequate shielding from the volume of post-accident containment atmosphere present in the CASP hardware.

The sample tubing raceway in the maintenance aisle is provided with a 4" thick steel cover to reduce the dose contribution from this source.

To prevent streaming from the gaps around the LSP, CAP, or CASP, these gaps are packed with lead wool.

Laboratory procedures and localized shielding will be utilized to maintain doses to laboratory workers well below the allowable levels in GDC 19.

3.3 Operator Dose

Table 2 shows the total dose to an operator for typical sampling operations such as obtaining post-accident samples of reactor coolant and containment atmosphere. The total dose to an operator in the HRSS building is estimated to be less than 100 mrem for performing either the pH/conductivity/dissolved oxygen analyses or the chloride analysis in the CAP.

TABLE 1
HRSS EQUIPMENT PARAMETERS

1. Liquid Sample Panel

Quantity	1 per reactor unit
Manufacturer	Sentry Equipment Corporation
Sample Inputs	
Reactor Coolant Module	5
Demineralizer Module	3
Radwaste Module	5
Design Pressure/Temperature	
Reactor Coolant Module	2300 psig/120°F
Demineralizer Module	1250 psig/120°F
Radwaste Module	150 psig/120°F
Materials	
Tubing	1/4" Type 304 SS
Shielding	
Panel	7" of 0.09" dia lead shot
Base	5" of 0.09" dia lead shot
Panel Walls	1/2" steel plates (2)
Dimensions	
Height	7 feet
Depth	4 feet
Width	8 feet
Ventilation	360 cfm through panel

2. Chemical Analysis Panel

Quantity	1 per reactor unit
Suppliers	Sentry Equipment Corporation

Instrument	Manufacturer	Range
Hydrogen Gas Chromatograph	Baseline Model 1030A	10-2000 cc/kg
Chloride Ion Chromatograph	Dionex Model 10	0.1 to 20 ppm
Dissolved Oxygen Low Level	Rexnord	0-20 ppm
Dissolved Oxygen High Level	Yellow Springs Instrument	0.1 to 20 ppm
pH Probe	Cole-Parmer	pH 1 to 13
Conductivity Probe	Beckman	0.1-500 mho/cm

Materials	
Tubing	1/4" or 1/8" Type 304 SS
Shielding	
Panel	7" of 0.09" dia lead shot
Base	5 " of 0.09 dia lead shot
Panel Walls	1/2" steel plates (2)
Dimensions	
Height	7 feet
Depth	3 feet
Width	4 feet
Ventilation	100 cfm through panel

TABLE 1 (Continued)

3. Containment Air Sample Panel

Quantity	1 per reactor unit
Manufacturer	Sentry Equipment Corporation
Materials	
Tubing	1/4" Type 304 SS
Shielding	
Front Panel	3" thick steel plate
Dimensions	
Height	7 feet
Depth	2 feet
Width	3 feet
Ventilation	300 cfm through panel

TABLE 2
ESTIMATED INTEGRATED DOSE PER SAMPLE

Reactor Coolant Sample

Activity	Time Min	Dose Rate mrem/hr	Dose mrem
1. Assemble in vestibule	10	2.5	0.42
2. Perform valve lineup at control panel	10	2.5	0.42
3. Perform manipulations on the LSP	35	100-400	100.0
4. Withdraw shielded cart to vestibule for transport to hot lab	5	100	8.3
Total	60		109.1

It is estimated that the operator will receive a maximum dose of 500 mrem during the 30 minute time period spent outside the HRSS building in getting to and from the plant for obtaining a grab sample in the shielded cart.

Containment Air Sample

Activity	Time Min	Dose Rate mrem/hr	Dose mrem
1. Assemble in vestibule	10	2.5	0.42
2. Perform valve lineup, initiate auto sequencer	10	2.5	0.42
3. Capture sample	8	2.5	0.33
4. Wait for sequencer to complete panel purge	7	2.5	0.29
5. Withdraw sample cartridges*	1	1000	16.67
6. Prepare Partitioner for purge	0.5	1000	8.33
7. Purge Partitioner	7	2.5	0.29
8. Transport sample in shielded cart to vestibule	1	15	0.25
	44.5		27.0

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* During this activity, the dose to operator's hands is estimated at 1.22 Rem

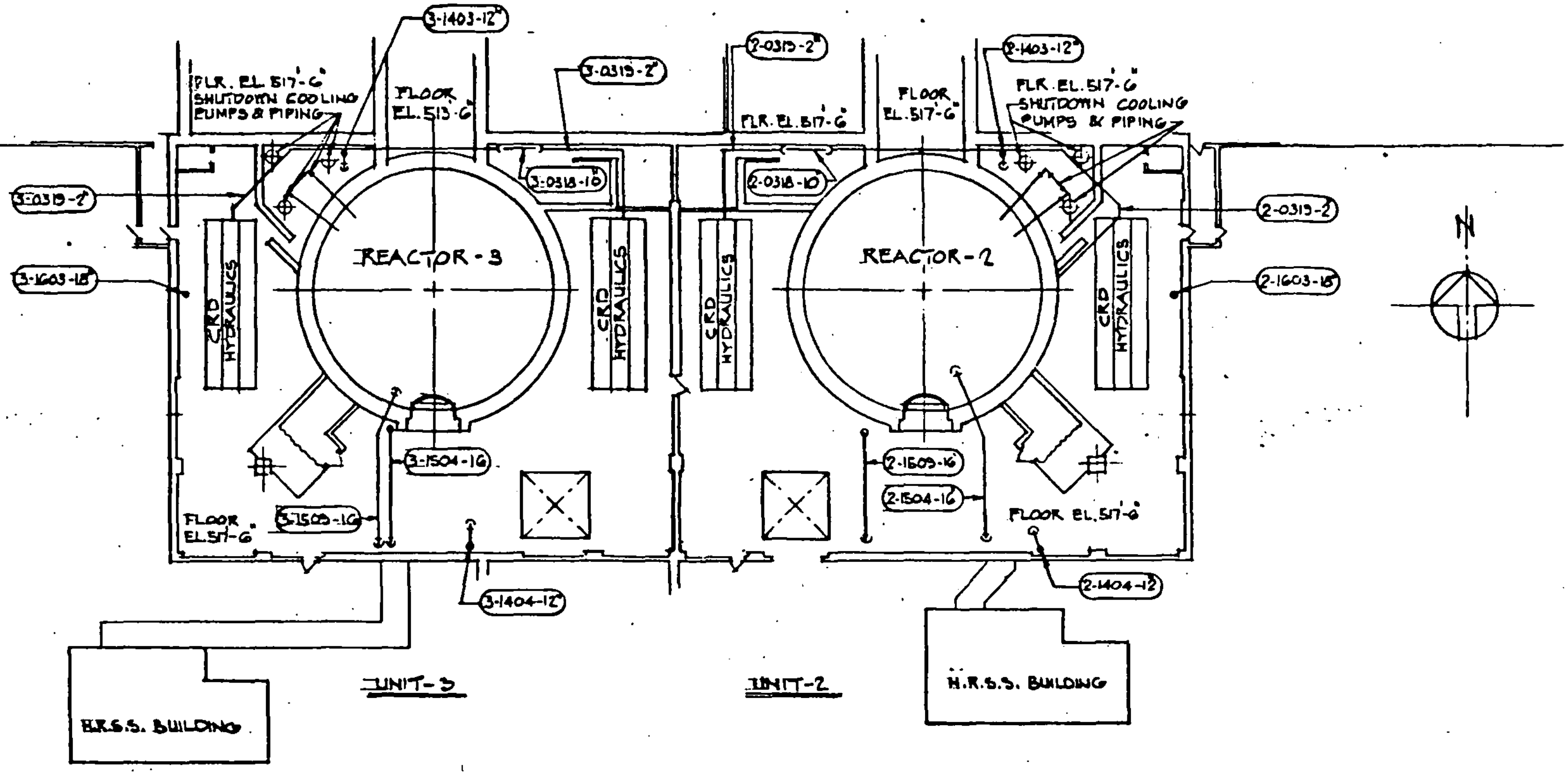
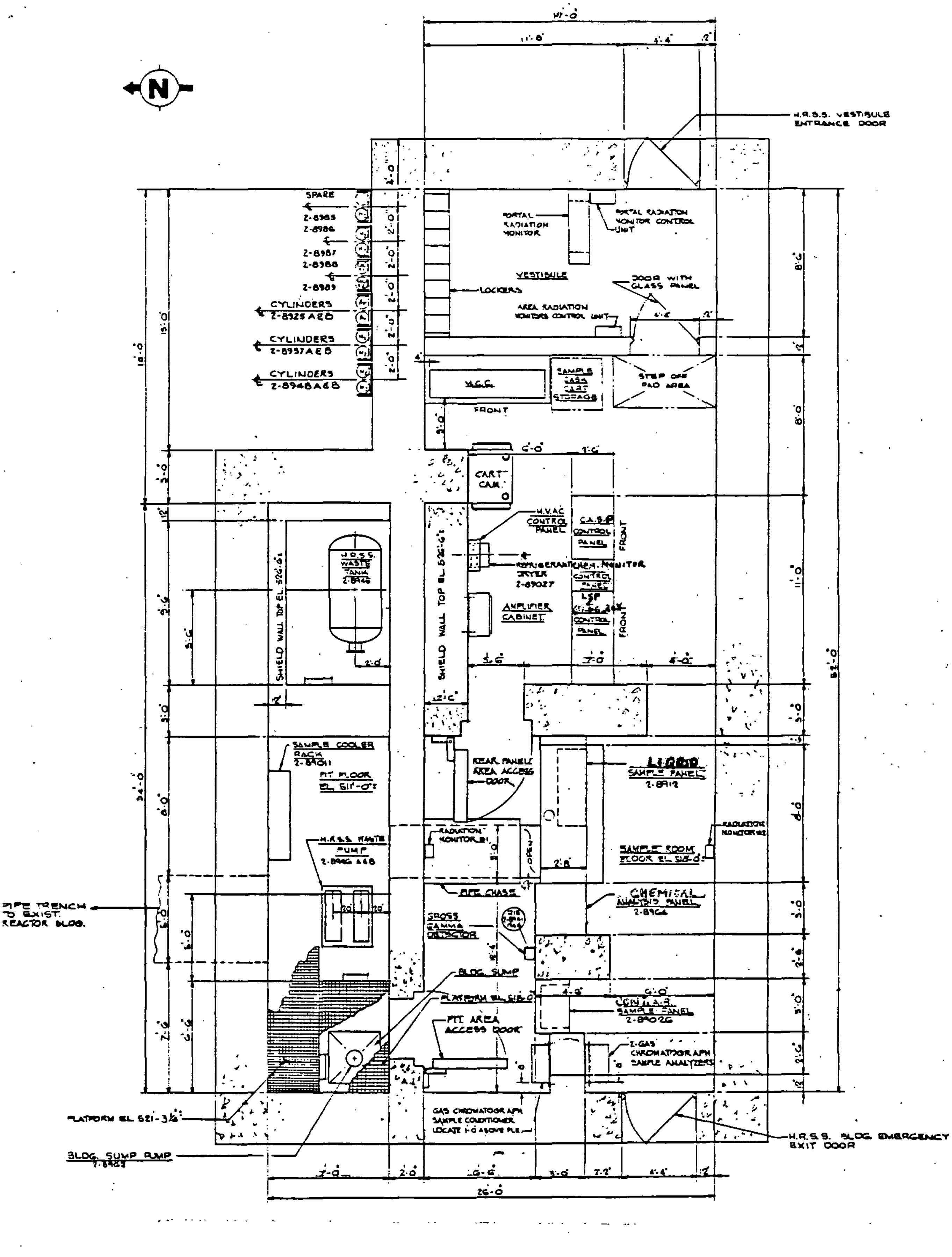


FIGURE 1
LOCATION OF HRSS BUILDING
DRESDEN 2,3



FLOOR PLAN @ EL. 518'-0"

Figure 2: Dresden Unit No. 2 HRSS Building