ATTACHMENT 1

FINAL REPORT

Environmental Assessment of the Operation of On-Site Low-Level Radioactive Waste Holding Facility (Interim Storage) at Susquehanna Steam Electric Station

July 1981

Prepared for
Pennsylvania Power and Light Company
Allentown, PA 18101
under Contract 23112 04789

Battelle
Pacific Northwest Laboratories

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ENVIRONMENTAL ASSESSMENT OF THE OPERATION OF ON-SITE LOW-LEVEL RADIOACTIVE WASTE HOLDING FACILITY (INTERIM STORAGE) AT SUSQUEHANNA STEAM ELECTRIC STATION

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GLOSSARY AND ABBREVIATIONS

ALARA - as low as reasonably achievable

BWR - boiling water reactor

CFR - Code of Federal Regulations

cfs - cubic feet per second

CST - condensate storage tank

DAW - dry active waste

DER - Department of Environmental Resources (Pennsylvania)

DOLI - Department of Labor and Industry

ha - hectare

HEPA - high efficiency particulate air (filters)

Hz - hertz (cycles per second)

Liner - a steel inner container that is designed to fit in an NRC certified shipping cask

LLRW - low-level radioactive waste

LLRWHF - Low-Level Radioactive Waste Holding Facility

MW - megawatt (10^6 watts)

mrem - millirem (10^{-3} rem)

msl - mean sea level

NRC - Nuclear Regulatory Commission

NUREG - Nuclear Regulatory Commission Publication

Applicant - Pennsylvania Power and Light Company and Allegheny Electric Cooperative, Inc.

pH - measure of alkalinity-acidity

R - roentgen

rem - special unit of dose equivalent

R/h - roentgen per hour

SES - Steam Electric Station

1.0 EXECUTIVE SUMMARY

This is an environmental assessment report on the proposed action to store waste in an on-site low-level radioactive waste holding facility (LLRWHF) at Susquehanna Steam Electric Station (SES) Units 1 and 2. This facility is intended to be used for contingency storage in the event that off-site disposal facilities are not available. The analyses and conclusions in this report are based on data provided by the Pennsylvania Power and Light Company and Allegheny Electric Cooperative, Inc. (Applicant). Units 1 and 2 are each designed to generate 1050 MW of electricity; the first unit is anticipated to be in operation within the next two years. The proposed action, described in detail in Chapter 3.0 of this report, involves the operation of a facility sized to temporarily store about 1700 m^3/yr (60,000 ft^3/yr) of low-level radioactive waste (LLRW) generated from both units. This waste will be packaged in steel liners or in 55 gallon steel drums, and stored for up to four years per unit or until the waste can be shipped to off-site disposal sites. The holding facility was not planned at the commencement of construction of Units 1 and 2 because at that time off-site disposal sites were available. In recent months however, waste quantities that will be accepted at off-site disposal sites have been restricted. Developing circumstances suggest that adequate off-site disposal may not be available when required for Susquehanna SES.

The LLRWHF will measure about 88 m x 73 m (290 ft x 240 ft) and occupy a land area of about one hectare (ha) (2.5 acres). The Applicant shall comply with all applicable existing laws, regulations and permit requirements for the operation of the facility to protect public and occupational health and safety. The estimated cost of the facility will be $23 million with an annual estimated cost of $350,000 for operation and maintenance. If off-site storage were not available and in the absence of this facility, the operation of Susquehanna SES Units 1 and 2 might have to be suspended until adequate storage became available. The estimated economic impacts from suspending operations would include: 1) cost of replacement power at $600 million per year for both units, and 2) loss of revenue needed for payment of the fixed annual cost of $475 million for carrying the investment. Other impacts would include temporary loss of regional employment and possible interruption of power supply with consequent impacts on the regional socioeconomics.

Impacts from facility operation to the general public would be substantially less than applicable limits and insignificant in comparison to the natural background radiation dose. The estimated radiation dose to a hypothetical individual continuously residing at the site boundary would be less than 5 mrem/yr. However, based on professional judgement, it is reasonable to expect that essentially no radioactivity would reach the site boundary from a potential accident such as a waste container rupture. The occupational radiation doses will be maintained as low as reasonably achievable (ALARA) within applicable limits (10CFR20).

It is concluded from this assessment that the potential environmental impacts of operating the LLRWHF would be insignificant.

2.0 PURPOSF AND NEED

The Susquehanna SES is located about 8 km (5.0 mi) northeast of Berwick, Pennsylvania, and consists of two 1050-MW boiling water reactors (BWR). The need for the power that will be generated at this facility has already been addressed in a Final Environmental Impact Statement (NRC 1981 NUREG 0564) relating to issuance of an operating licensing by the Nuclear Regulatory Commission (NRC) for operation of the Susquehanna SES.

Routine operation and maintenance of the plant would result in the generation of LLRW. It consists of a variety of radioactively contaminated material such as paper, rags, protective clothing, etc., which are collectively described as dry active waste (DAW). Low-level waste also includes process wastes such as filter treatment sludges, spent filter cartridges, and spent ion-exchange resins. Based on the experience at other BWR operating plants, the Susquehanna SES is expected to produce about 1700 m^3 (60,000 ft^3) of LLRW per operating year for two units (assuming no allowance for volume reduction other than trash compaction).

At the time the Susquehanna SES was planned LLRW from operating power reactors in the eastern U.S. was packaged and shipped to a low-level waste disposal facility operated by Chem-Nuclear Systems, Inc. at Barnwell, South Carolina. However, in recent months, significant restrictions have been placed on the amount of packaged LLRW that will be accepted at the Barnwell site. The long-term availability of alternative disposal sites in Beatty, Nevada and Hanford, Washington has also become less certain. Although deliberations are being held across the country for establishing state and regional disposal sites, operation of additional LLRW sites is uncertain.

In view of these uncertainties, the Applicant proposes to establish an on-site LLRWHF with the capacity to temporarily store LLRW generated for up to four reactor-years per unit of operation. The use of this facility would only be necessary if off-site disposal were not available. Permanent retention of these wastes in the proposed facility is not planned. The only wastes to be temporarily stored are those low-level solid wastes that are incidental to the production of power by the Susquhanna SES; acceptance of any off-site generated wastes for storage in this facility is not contemplated.

3.0 PROPOSED ACTION

This chapter describes the proposed action for interim storage of LLRW generated by Units 1 and 2 of the Susquehanna SES. Appendix A contains more detailed information.

3.1 GENERAL DESCRIPTION AND LOCATION OF THE FACILITY

The proposed action is defined to include the following:

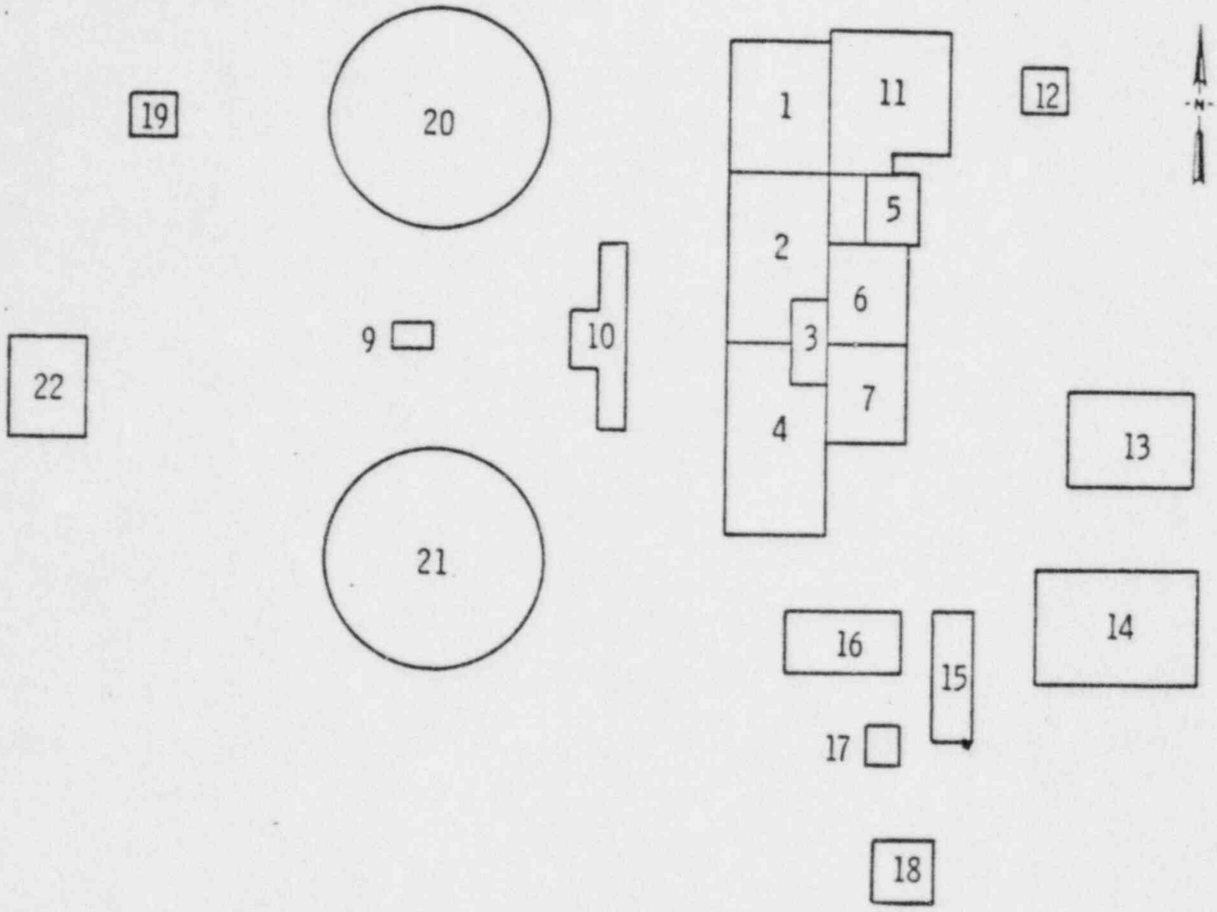
- interim storage of LLRW generated by four reactor-years of operation per unit
- interim storage period not to exceed four years per unit
- operation of the facility as necessary to hold the LLRW when licensed off-site disposal facilities are unavailable

The facility is designed to house the low-level wastes inside an uninsulated, sheet metal building with the solidified wastes placed within shielded concrete vaults and DAW stored outside the vaults in drums and metal boxes.

The primary function of this metal building will be to provide weather protection for the stored wastes and to provide all-weather loading and off-loading capability. The primary function of the concrete vaults will be to provide radiation shielding around the solidified wastes.

The LLRWHF will be located approximately 300 m (1000 ft) due west of the cooling towers for Units 1 and 2 (see Figure 1). The grade elevation of the LLRWHF is approximately 215 m (700 ft) msl. This elevation exceeds both the probable maximum flood elevation of 167 m (548 ft) msl and the maximum historical flood elevation of 158 m (517 ft) msl (NRC 1980).

The overall dimensions of the facility will be 73 m (240 ft) by 88 m (288 ft) with a centerline elevation of 13 m (42 ft). In addition, a control and equipment room 6 m x 9 m (20 ft x 30 ft) will be located adjacent to the north wall of the facility approximately 5 m (16 ft) from the northeast corner of the structure (see Figure 2).



Key

1 - Rad Waste Building
2 - Unit 1 Turbine Building
3 - Control Structure
4 - Unit 2 Turbine Building
5 - Diesel Generator Building
6 - Unit 1 Reactor Building
7 - Unit 2 Reactor Building
8 - Engineered Safeguards and Service Water Pump House
9 - Acid Storage Building
10 - Pump House
11 - Service and Administration Building
12 - North Gate House
13 - Combination Shop
14 - Warehouse
15 - Change House
16 - Project Office
17 - Welding Shop
18 - South Gate House
19 - Security Control Center
20 - Unit 1 Cooling Tower
21 - Unit 2 Cooling Tower
22 - LLRWHF

FIGURE 1. Plan View of Susquehanna SES

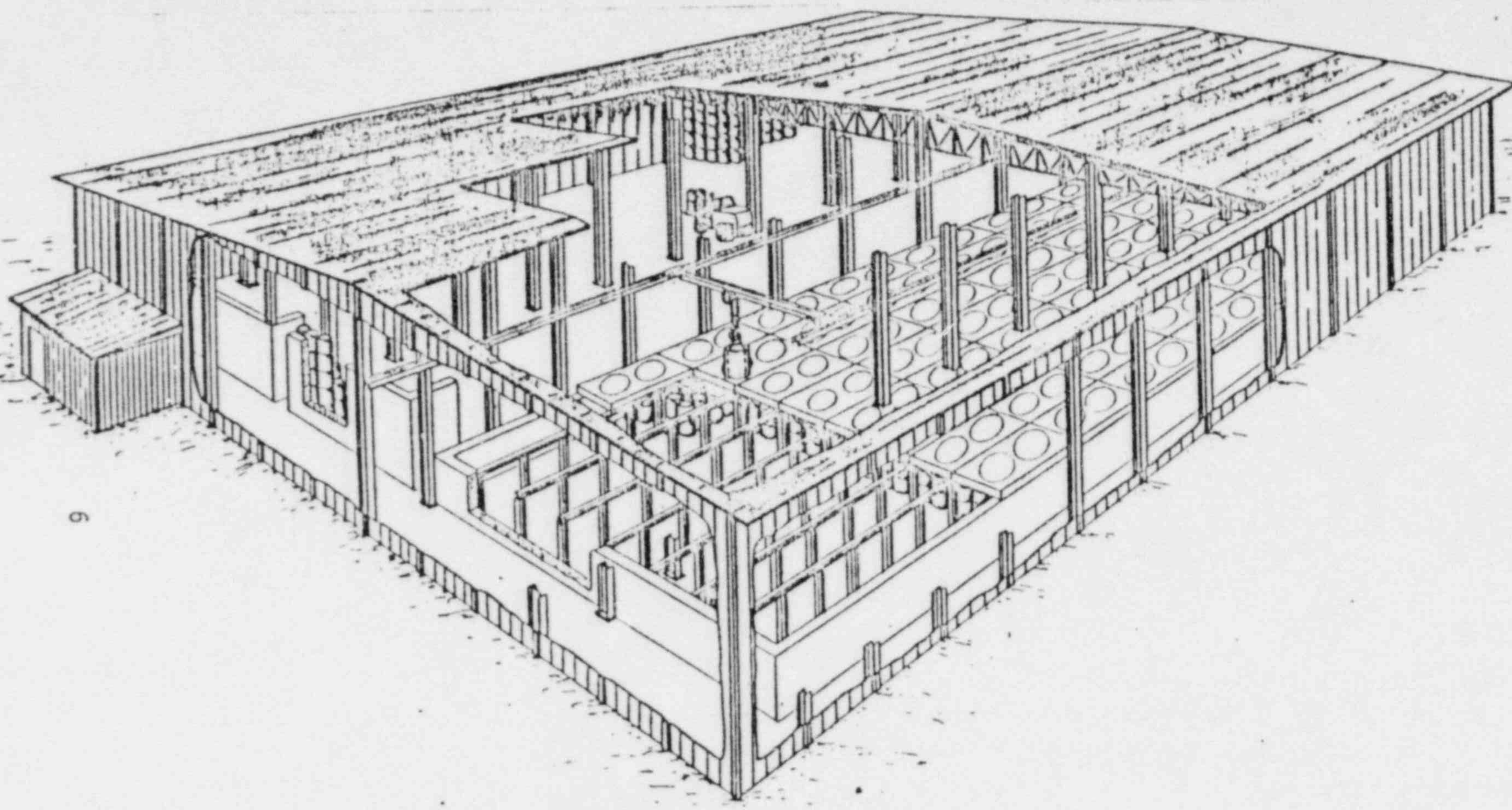


FIGURE 2. Artists Rendering of Low-Level Radioactive Waste Holding Facility

3.2 WASTE DESCRIPTION

The LLRWHF is designed to store dry, solid LLRW and dewatered solidified (cement) LLRW generated by the Susquehanna SES. The facility may also be used to temporarily store large pieces of contaminated plant equipment. The LLRWHF will not be used to store gaseous wastes nor wastes containing free-standing liquids.

Low-level radioactive waste is defined as contaminated material containing sources of radioactivity dispersed in small concentrations throughout large volumes of inert substances, and has no free-standing water. It generally consists of paper, high efficiency particulate air (HEPA) and cartridge filters, rags, clothing, small equipment, and other dry materials.

Solidified waste is defined as wet, dewatered waste in the form of evaporator bottoms, resins, and sludges that have been immobilized in cement and contain less than 0.5 percent free-standing water by waste container volume or 3.8 liters (1.0 gal) of liquid in the waste container.

Estimates of the annual waste generation rates for the two units range from 1100 to 1800 m^3 (40,000 to 63,000 ft^3) based on operation of both units. For this report a nominal figure of 1700 m^3 (60,000 ft^3) was chosen; Table 1 gives a breakdown of the low-level waste volume by source and waste type. After four years of operation the two Susquehanna SES units will have generated approximately 6800 m^3 (240,000 ft^3) of LLRW that will have required storage; the capacity of the LLRWHF will be about 6800 m^3 (240,000 ft^3).

TABLE 1. Estimated Annual Low-Level Waste Generation Rate for Operation of Both Units

Source Waste Type	m^3/yr	ft^3/yr
DAW--compacted	500	17,800
DAW--noncompactible	150	5,000
Evaporator bottoms (25 wt%)	510	18,000
Resins	90	3,200
Waste sludges	450	16,000
TOTAL	1,700	60,000

3.3 DESIGN FEATURES

General Design Considerations

The LLRWHF will be sized to store wastes generated by four years each of the Susquehanna SES Units 1 and 2. The design life of this facility will be 40 years.

The LLRWHF will be a Non-Seismic Category I structure (i.e., one whose failure would not release significant amounts of radioactivity and would not require reactor shut down). The facility is not designed for the effects of a flood since the elevation exceeds the maximum probable flood level. However, it is designed for a maximum rainfall intensity of 4.2×10^{-5} m/s (6 in/hr) and consequent surface run-off.

Architecture

The LLRWHF will consist of a storage vault within the confines of an uninsulated steel-framed, metal-sided structure. The walls of the vault will be reinforced concrete. The vault will be covered with removable, reinforced-concrete shield panels to permit the loading and off-loading of the waste containers.

A curb around the perimeter of the building will contain any liquid such as rainwater or fire sprinkler water that may be introduced into the building. The curb will be designed to retain the volume of fire protection water that would be released if all the sprinklers were actuated for one-half hour. A system of floor drains and sumps will ensure drainage of additional flow. This system will route such water to a sump in the off-loading area so that it can be sampled and collected for disposal. Ramps will be provided for vehicular traffic over the curb. The floor, curbing, sumps, and shield walls of the facility will be coated with a decontaminable material to a height equal to the height of the curbing.

Health and Safety Requirements

The LLRWHF is designed to maintain off-site (beyond the site boundary) doses within the guidelines of 10CFR50 and on-site radiation exposure within the guidelines of 10CFR20. In both instances, the facility will be designed to maintain dose rates ALARA as outlined in Regulatory Guides 8.8 (NRC 1979) and 8.10 (NRC 1977). Exposure of on-site workers will be minimized by the use of concrete shielding around the stored material, shielded loading equipment, and controlled access to the facility. Since no radioactive materials would be released off-site, dose rates would be minimized through the use of shielding, distance, and the self-shielding properties of the storage containers.

Provisions for the removal of equipment exhaust fumes are included in the facility design. The building ventilation system will be structured so that the flow of air draws exhaust fumes away from operators working on the floor of the facility.

Containers

The containers to be stored in the LLRWHF will be designed to preclude or reduce uncontrolled releases of radioactive materials during handling, transportation, or storage. Container material will conform to the requirements established in NUREG-75/087, Section 11 (NRC 1975). The waste container materials will not support combustion. All material stored in the facility will be packaged in a form that allows for eventual off-site shipment and permanent disposal. All containers will be decontaminated for shipping to the standards of 49CFR 173.397 and/or other applicable burial site criteria before leaving the Rad Waste building and transported to the LLRWHF.

Three types of containers may be used: 1) liners for the cemented waste, ranging from 0.2 to 5.7 m^3 (7.5 to 200 ft^3) which will be stored inside the vault area, 2) 55-gallon drums (0.2 m^3 or 7.5 ft^3) for the DAW that will be stored in the open trash area, and 3) steel boxes 2.7 m^3 (96 ft^3) for the DAW that will also be stored in the open trash area (see Figure 3).

Loading and Off-Loading Systems

The loading system (i.e., forklifts for DAW, a remote controlled crane for cemented waste), will be capable of handling the cemented waste and DAW, and transporting within the facility, placing, retrieving, and reloading. This system will also have the capacity to lift, transport, and replace all movable and temporary shielding devices.

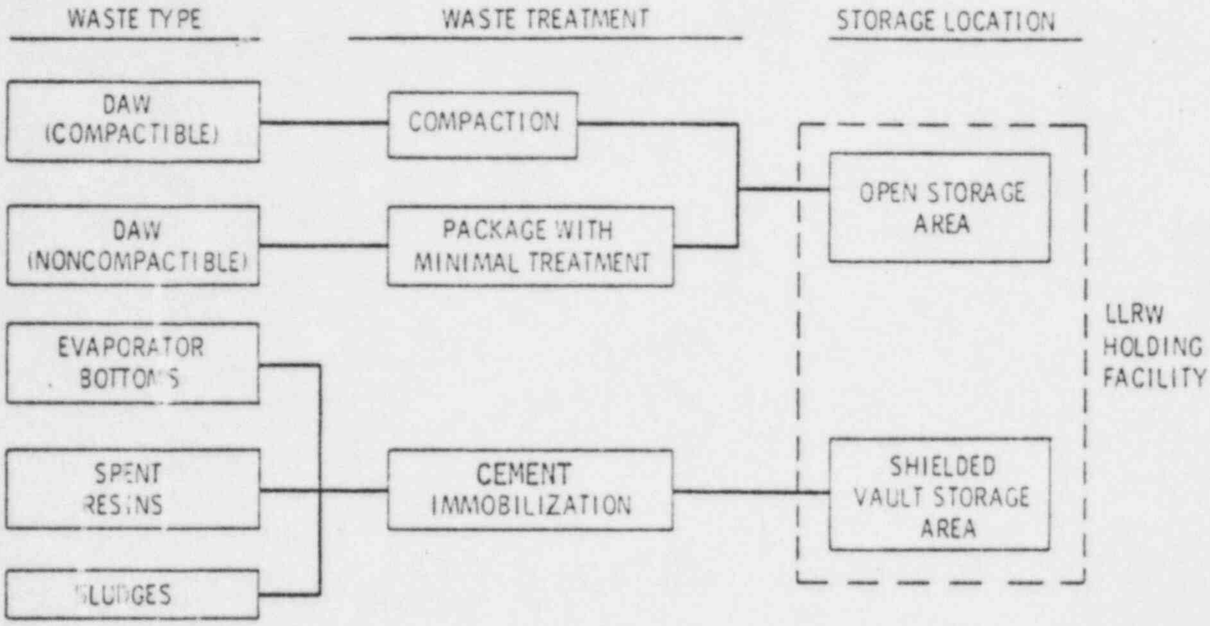


FIGURE 3. Proposed Action for Storing Low-Level Radioactive Waste at Susquehanna SES

The loading system for cemented wastes will allow the transfer of these wastes from one area of the building to another as the vaults are filled. This capability will also include the trash storage area in the event the vault storage is expanded into this area at a later time. The loading system will also be capable of retrieving dropped and damaged waste containers for repackaging or other disposition.

Trash Restraining System

A trash restraining system will be designed to prevent any trash containers from being blown out of the confines of the facility during a tornado with up to a 134 m/s (300 mph) velocity. This will be accomplished through the use of a nylon netting or other suitable material, enclosing the trash storage area and secured to anchors in the foundation and/or floor slab. All tornado wind loading is transmitted directly into the anchors. The system is designed such that failure of the building structures will not tend to cause failures of the restraining system.

Floor Drains System

Under normal conditions there there will be no free-standing liquids inside the building. Therefore, any free-standing liquids entering the facility would come from such sources as fire protection water, minute amounts of liquid from a breached cement container, rainwater or snow melt from roof leakage, cooling system or fuel leakage from equipment inside the facility, snow brought in on vehicles, and liquids used for decontamination of containers before shipment, should that ever become necessary. All such liquids will be considered contaminated until verified otherwise.

The floor drain and curb system will collect any liquids spilled on the floor of the facility. The system will route all drains to one or more collection sumps located along the periphery of the building. Each sump will be equipped with liquid-detection devices that signal the main plant and facility control rooms whenever any liquid enters the sumps.

Sampling of the liquids in the sumps may be performed from either inside or outside the building. These liquids may be pumped to portable tanks from either inside or outside the building. However, no permanent pumping equipment or piping is connected to the main plant.

Ventilation System

Two basic functions of the ventatilation system will be: 1) to remove noxious or irritating exhaust fumes when internal combustion engine-powered machinery operates inside the facility, and 2) to prevent excessive heat buildup from the roof in the summer. The system will move air generally in an upward direction away from operators. Air inlets will be designed to evenly distribute air entering the facility even when it is closed. Inlets will be placed to prevent accumulation of snow and other substances from restricting the flow of air and to prevent these substances from being drawn into the facility. The system will exhaust through a damper that opens when the fans are in operation and closes when the fans are shut down.

Electrical System

A power system will supply AC power to all the electrical loads in the facility at the appropriate voltage. These loads will include the lighting system, the ventilation system, the overhead crane, the power operated door, the fire detection system, and the fire protection system. The AC power system equipment will be located in an enclosed space outside the facility storage area. Convenience outlets for 125-eV, 60-Hz service and 480-v power and welding receptacles will be installed in the control room, the electrical equipment room, and the loading area. All electrical equipment including cable contained within the storage area will function normally under all environmental conditions existing inside and outside the LLRWHF. As a result, provisions for a back-up electrical system to be used in the case of failure of the main system are not planned.

The grounding system will establish a building ground grid to connect electrical and mechanical equipment and structures, raceways, duct banks, and other required grounds to the existing exterior station grounding system.

Lighting

The facility lighting will be in service only during loading or off-loading. The lighting will be adequate for safe, efficient handling of the waste containers in the off-loading area, the dry trash storage area, and for safe and efficient handling of the shielded vault cover blocks. There will be no permanent lighting installed inside the shielded vault area. Lighting for this area will either be provided on the container handling equipment or will be portable lighting.

3.4 FACILITY OPERATION

The facility's operating function will be to temporarily store LLRW on-site until it can be shipped to an off-site location. The facility will be occupied only during periods of loading and off-loading activities. Storage of the low-level wastes will be segregated, the cemented wastes being placed in shielded vaults and the trash being stored in the open storage area. Further segregation will also occur to the extent practicable within both the vault and open storage areas to take advantage of the self-shielding properties of the contained material. Wastes in the shielded vaults will be arranged with containers having a contact dose rate $\leq$3 R/h stored next to the vault walls and on the top layer. Containers with a contact dose rate $\geq$3 R/h will be stored inside this perimeter. Waste stored in the open storage area will be arranged with containers having contact readings $\leq$ 1 mrem/h stored around the outer perimeter of the storage area, containers with $\leq$10 mrem/h stored on top, and containers reading $\geq$ 10 mrem/h stored within this perimeter.

Loading the LLRWHF with solidified waste will generally proceed as follows. A loaded truck will leave the Rad Waste Building (see Figure 1) with the waste containers and will travel approximately 460 m (1500 ft) to the LLRWHF. These containers will have been examined for surface contamination prior to transport and will be in a condition that would allow for their shipment to a permanent disposal site. Depending on the level of radioactivity, the LLRW may be shielded during transport.

The loaded truck will enter the LLRWHF in the off-loading area. If the truck is transporting cemented wastes, it will stop in the overhead crane pickup area. All personnel must then either move a safe distance from the container or get behind shielding. The container is lifted off the truck and moved to the approximate storage location. Then the auxiliary hook removes the appropriate shield panel. The container is then moved into proper position and lowered into the storage vault. The removed cover is then replaced, whereupon the operation is complete

Waste trash loading will take place in a similar fashion. The truck with the 0.2-m^3 (55-gal) drums or the 2.7-m^3 (96-ft^3) steel boxes on pallets will enter the facility. The truck will stop with the drums adjacent to the trash storage area. They will be unloaded with a forklift. Depending on the dose rate from the containers, the forklift may be equipped with shielding for the driver. Removal of the LLRW from the facility will occur generally in the reverse order of these steps.

In the event of a fire in which water or other fire fighting materials are introduced into the facility, these items will be considered contaminated until proven otherwise.

Prior to off-site shipment of the containers, all containers will be inspected for damage and surveyed for residual surface contamination. In the unlikely event that radioactive contamination is discovered, the container would be transported back to the main plant for decontamination.

3.5 SAFETY AND SECURITY

The discussion of safety and security will be addressed in the context of five separate topics:

- security system
- radiation monitoring system
- shielding
- fire detection/protection system
- communications system.

Security System

The entire LLRWHF will be 43 m (140ft) from the security fence that encloses this and other plant buildings. The facility will be designed with security provisions as an extension of the existing plant system. Personnel access doors will be provided for operational requirements, and to satisfy safety standards; they will be equipped with magnetic card readers. All accesses to the facility will be monitored to provide an alarm in the event an unauthorized entrance into the facility should occur.

Radiation Monitoring System

The radiation monitoring system will be designed to monitor the general area radiation levels at various locations in the trash storage area, the off-loading area, and the LLRW control room. The readout will be located in the LLRW control room.

Shielding

The LLRWHF will contain two types of shielding:

1. fixed shielding for the in-place stored material,
2. transient shielding to protect the operator while the waste is moved from the vehicle in the off-loading/on-loading area to the storage location.

The fixed shielding will consist of concrete vaults for the cemented waste, concrete walls in the storage area for the trash, and concrete wall shielding for the control room. The storage vaults will consist of reinforced concrete walls and reinforced concrete cover panels. The trash storage area walls will consist of reinforced concrete along the north and south walls. The control room will have reinforced concrete along the south and west walls.

The transient shielding for the cemented wastes will consist of a portable shielding device attached to the loading crane. This device will protect the operator while the containers are being moved from the truck in the off-loading area to the place of storage. The transient shielding for the DAW will consist of either a shielded forklift or other shielded vehicle to be provided as necessary.

Fire Detection/Protection System

The fire protection design will be based on a combustible loading of 1790 kg/m^2 (1200 lbs/ft^2). The facility will be equipped with a fire detection system. The entire structure will be equipped with a dry pipe sprinkler designed to deliver 1.0×10^{-2} m^3 of water per m^2 of floor surface (0.25 gal per sq. ft). The sprinkler heads will be rated at 141 °C (286°F) which is in accordance with standard practices.

Water will be supplied from the existing fire protection system by a 0.25-m (10-in.) mortar-lined, ductile-iron fire protection line. The water supply will be capable of supplying a minimum of 0.1 m^3/s (1500 gpm) at 6.8 atm (100 psi). Fire hydrants will be provided and equally spaced at 91 m (300 ft) intervals around the building perimeter.

In addition, the ventilation system will be equipped with instrumentation for the monitoring of smoke, and smoke detectors will also be placed at other locations in the facility. If smoke is detected, the ventilation system will automatically shut down and an annunciator will be actuated in the control rooms of the main plant and the LLRWHF.

Communications Systems

The communications system will allow two-way conversation and paging between the main plant and the facility. It will have at least one station for paging and conversation in the off-loading area. It will have enough speakers inside the storage area to insure that paging or alarms can be heard when the facility is at full capacity. It will also have one station for paging and conversation in the facility control room. One telephone with a plant extension will also be provided in the control room. All communications cables will be in rigid steel conduit.

3.6 EXPOSURE TO OPERATING PERSONNEL

The LLRWHF is designed and will be operated to minimize the exposure to operating personnel while providing sufficient facility access. This will be accomplished by providing the necessary radiation shielding (see previous section), by using current design technology and by using appropriate administrative controls to ensure that radiation levels are at or below applicable limits (10CFR20) for all phases of operation. Exposure of on-site workers and operating personnel will be minimized through the use of shielded waste storage areas, shielded on-site transport vehicles, and shielded remote loading and unloading equipment where required. The technical design and operating procedures are designed to maintain occupational doses ALARA, as discussed in Regulatory Guides 8.8 (NRC 1979) and 8.10 (NRC 1977).

The loading and unloading procedures will be designed to take advantage of the fixed and transient radiation shielding and remote facility operations to help reduce occupational exposures. The number of operating personnel will be minimized to further eliminate unnecessary radiation exposures. Other administrative procedures will be designed and used to control loitering in the area immediately outside of the facility to prevent unnecessary inadvertent radiation exposures.

The dose equivalent rates at any accessible point outside of the storage facility will not exceed an average of 0.5 mrem/hr as required by 10CFR20.

4.0 ALTERNATIVES TO THE PROPOSED ACTION

This chapter discusses three alternatives to the proposed action.

4.1 THE NO ACTION ALTERNATIVE (OFF-SITE DISPOSAL)

The no action alternative is defined as the use of the Susquehanna SES design-basis, one-month, on-site storage capacity for interim storage of LLRW. (NRC 1981, NUREG 0776). Under this alternative no other alternatives, including the proposed action, would be considered. The success of this alternative would depend on the continued availability of off-site commercial LLRW disposal sites. The Susquehanna SES plant design provided very limited storage capacity based on this assumption. Any interruption in shipment of LLRW could potentially shut the plant down.

The positive aspects of the no action alternative would include a savings of approximately $23 million in LLRWHF construction costs and $350,000 annual operating and maintenance costs. An additional benefit may include minimizing SES occupational exposures through prompt off-site shipment of LLRW.

In recent years, LLRW disposal has been hampered by the unavailability of shipping casks, transportation problems, and restrictive disposal quotas (McArthur 1979). Space for waste disposal is expected to become increasingly scarce in the next few years as restrictions either have been placed or are placed on the amount and type of LLRW the three disposal sites (Barnwell, South Carolina; Beatty, Nevada; Hanford, Washington) are willing to accept. Finally, development of new disposal facilities is not expected to begin until 1986 (NWPA 1980). As a consequence, interruptions in off-site shipments of radioactive wastes are possible, and operation of the station could be severely limited. Even if the plant were shut down it would continue to generate some amount of radioactive waste requiring storage and ultimate disposal. Therefore, the no action alternative would limit the electric power generating capability of Susquehanna SES and would not resolve the problem of LLRW storage.

4.2 OFF-SITE OPERATION OF A LOW-LEVEL RADIOACTIVE WASTE HOLDING FACILITY

Off-site storage facilities would consist of the same facilities and would require the purchase of property for a site and also require obtaining additional permits. The land-use impact from such a site would have to be evaluated and problems resolved prior to construction. Radiological and other monitoring programs independent of the Susquehanna SES would have to be established. The increased waste handling and transportation requirements for off-site storage of the waste would add extra costs (in terms of both dollars and radiation exposure) above those for on-site storage. Off-site interim storage of the LLRW is concluded to be a less desirable alternative to the proposed action because all effects of the proposed actions would result plus those that would be specific to a new construction site and waste handling and transportation.

4.3 ON-SITE INTERIM STORAGE IN EXISTING FACILITIES

The use of existing structures on-site for interim storage of the LLRW is a third alternative to the proposed action. This option would potentially save the estimated $23 million dollars required for construction of an on-site LLRWHF. Several areas were considered as potential sites for interim storage of the waste.

Most areas identified as prospective storage locations would already be in use as equipment laydown, washdown, access, or storage areas. In addition, extensive handling of the LLRW containers and special lifting devices would be required so that some locations could be used. Other prospective sites demand removal of hatches, and evacuation of transfer areas. Some locations, in particular the refueling floor, would require outside transfer of containers. In the event of a forced outage, storage of LLRW on the refueling floor would hamper work by requiring additional shielding or removal of waste to permit worker access. These requirements could extend the duration of the outage. Multiple storage locations would make accountability of the LLRW inventory difficult.

Storage of the LLRW in-station would increase the radiation exposure of plant personnel. The overall background radiation levels in the plant would increase. Multiple storage locations dictate expanded radiation surveillance which means greater human contact and increased dose. Nonradiation zones could be changed to radiation zones to accommodate the waste. The overall impact of interim in-station storage of LLRW would be to increase the radiation dose to employees. This would not be consistent with the policy of maintaining doses ALARA.

5.0 DESCRIPTION OF AFFECTED ENVIRONMENT

The Susquehanna SES site is located (NRC 1981 NUREG 0564) on a 435-ha (1075 acre) tract of land on the west bank of the Susquehanna River in Salem Township, Luzerne County, Pennsylvania (Figure 4). It is about 8 km (5 mi) northeast of Berwick and 32 km (20 mi) southwest of the city of Wilkes-Barre. The topography near the site is characterized by moderate-to-steep slopes directed toward the river on both banks. Elevations range from 151 m (496 ft) above msl at the river to 213 m (700 ft) msl at the proposed LLRWHF to over 275 m (900 ft) msl in the northern section of the site. The waste holding facility site will be approximately 61 m (200 ft) msl above the river level. The area typically has hot humid summers and cold winters with considerable amounts of snow. The average annual air temperature is 9°C (48°F) with average temperatures ranging from -3°C to 22°C (0° to 72°F). Annual average precipitation is about 88 cm (35 in.) distributed fairly evenly throughout the year. Prevailing winds are from the W and SW, but during some years this may be reversed (Dames & Moore 1980). Wind direction is influenced by the generally NE-SW oriented valley near the site. The average wind speed is about 7.3 km/h (4.5 mph). The calculated tornado frequency at the site is 4.6×10^{-4}/yr. Between 1953 and 1974, 35 tornados were reported in the 160-km^2 (62-sq. mi) area containing the Susquehanna SES; between 1871 and 1977 ten hurricanes passed within 30 km (50 mi) of the site (NRC 1979).

The Susquehanna River the principal source of station cooling water is located about 1220 m (4000 ft) east of the LLRWHF. The river flows 68 km (42 mi) through Luzerne County with an average gradient of 0.18 m per km (0.95 ft per mi). Average annual flow is 387 m^3/s (13,650 cfs). Maximum flows of 9880 m^3/s (349,000 cfs have been measured at the site and minimum flows of less than 15.6 m^3/s (550 cfs) have been observed at Wilkes-Barre. River elevations during historic floods at the Susquehanna SES range from 155 to 157 m (510 to 517 ft) above msl. This is below the 213 m (700 ft) elevation of the LLRWHF.

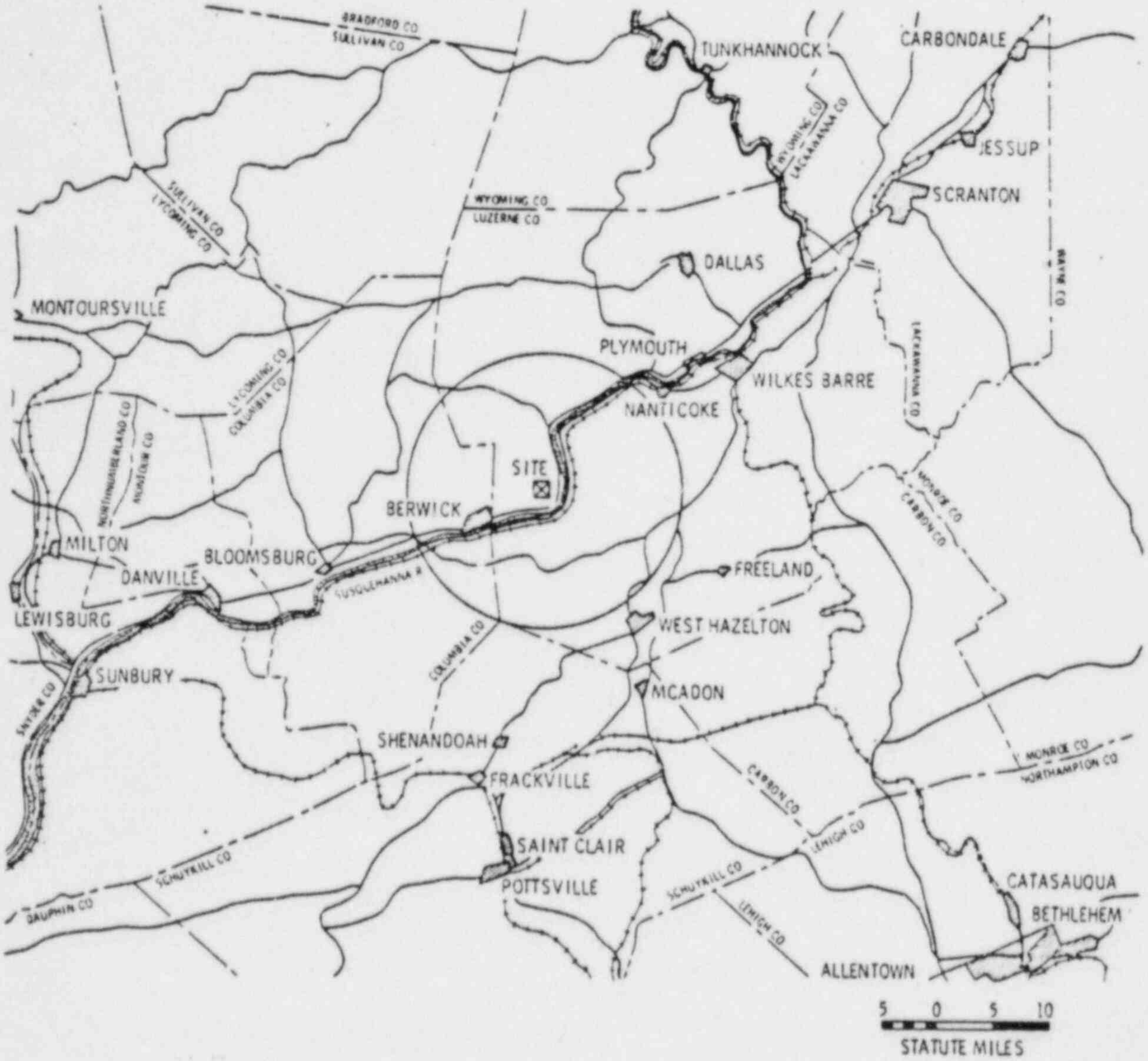


FIGURE 4. Susquehanna Site and Its Immediate Surroundings

Susquehanna River water quality near the Susquehanna SES site is generally acceptable. Acid mine drainage, much of which reaches the Susquehanna by way of the Lackawanna River, tends to produce high concentrations of iron and at times low pH. Iron concentrations in the river near the site at times exceed state water quality standards (1.5 mg/l). The generally high acid mine runoff tends to impair the river ecosystem. The high iron levels are not acutely toxic to most river organisms but they increase turbidity and the precipitation of iron compounds which in turn reduces light penetration and alters the bottom substrate. These changes generally reduce the production of aquatic plants and bottom dwelling animals. The pH of the Susquehanna River varies from 6.0 to 8.5. Annual river temperatures range from 0°C (32°F) to 29.4°C (85°F) and dissolved oxygen concentration ranges from 5.6 to 15 mg/l.

Little use is made of surface water, except for that used by the power station, within 3.2 km (2 mi) of the site. The first municipal water user downstream from the station is located approximately 45 km (28 mi) away at Danville, Pennsylvania.

Fish in the Susquehanna River do not seem to be directly affected by the high iron concentrations. The most abundant species are the white sucker, spotfin shiner, bluegill, white crappie and pottail shiner. None of the fish are on the U.S. Fish and Wildlife Service's Rare and Endangered list, but two ciscos, a species classified as rare by the Pennsylvania Fish Commission have been caught during recent sampling in the river. These fish probably entered the river near Nanticoke by way of Harvey's Creek, the outlet of Harvey's Lake. The Pennsylvania Fish Commission introduced the cisco into Harvey's Lake from 1969 to 1972. Because cisco prefer deeper lake waters, there is little likelihood that a population of cisco has been or will be established in the river as a result of movement from Harvey's Lake.

Ground water is generally of acceptable quality at the site but may be rather hard (up to 545 mg/l total dissolved solids) in some areas near the station. Estimated ground water travel time to the Susquehanna River is 8.8 years. Depth to the water table is 2.1 to 7.9 m (7 to 26 ft) at the Susquehanna SES and there are 185 wells with 3.2 km (2 mi) of the site. Estimated withdrawal of ground water is 212 m^3 (7485 ft^3) per day within 3.2 km (2 mi) of the station.

Twenty-three species of amphibians and reptiles are found in the region. No threatened or endangered species are found near the site.

One-hundred and twenty-eight species of birds have been recorded near the Susquehanna SES. Most of these are songbirds. The major migratory birds flyway is located to the east, nearer the Atlantic Ocean.

Twenty-six species of mammals live near the site and none are considered threatened or endangered. Rodents are the most abundant group. Larger game and fur-bearers include opossum, cottontail, woodchuck, raccoon, muskrat, and gray squirrel. Muskrats are trapped extensively in the area. Whitetail deer are the most important large game species in the area.

The region is relatively free from earthquake activity and seismic hazard. No capable faults exist within 8 km (5 mi) of the station. The maximum expected earthquake intensity would be VI to VII on the Modified Mercali Scale. The site is within Zone 1 seismic risk.

Soils in the vicinity of the Susquehanna SES are mainly of glacial origin and are used more for grazing and timber production than for farming. The dominant vegetation on the land near the site is made up of maple, birch, cherry and oaks with an understory of spicebrush, blackberries, viburnum, witch hazel, laurel, dogwood and rhodedendron. None of the plant species in the area are classified as threatened or endangered.

Land use near the site is varied. About 228,000 hectares (570,000 acres) or 11 percent of the land in Luzerne County is used for agriculture on about 500 farms. Farming occupied about 0.8 percent of the county's workforce in 1975. Approximately 40 hectares (100 acres) of Susquehanna SES floodplain land is farmed by a tenant farmer. Much of the surrounding area that is not cultivated is covered with woodlands and scrub brush.

A number of small industries are located within 8 km (5 mi) of the site. These include textile and clothing manufacturing, meat and animal products, concrete products, manufacturing, and lumber production. The nearest industry is about 2.4 km (1.5 mi) NNE of the site and employs approximately 490 persons.

Outdoor recreation facilities at the Susquehanna SES includes a small lake for fishing and boating, native trails and a picnicing area. Also a number of recreational facilities are near the site. The Applicant maintains the

Riverland's Park near the Susquehanna SES. Within a 16 km (10 mi) radius there is one county park, two Girl Scout camps and three privately owned camps. Recreational fishing is popular in the Susquehanna River along the east bank of the river near the site. The nearest boat launching facility is about 3.2 km (2 mi) south of the site. No commercial fishing exists within 80 km (50 mi) of the Susquehanna SES. In Luzerne County, hunting harvest for both small game mammals (squirrels and rabbits) and deer make up about eight percent of the state total. Waterfowl are not abundant near the site and are of minor value to local hunting.

The Susquehanna River has no commercial navigation; transportation routes are mainly by highway, railroad and air. Three Salem Township roads and U.S. Route 11 pass within 790 m (2600 ft) of the center of the Susquehanna SES exclusion area. The Delaware and Hudson Railroad line passes approximately 2 km (1.25 mi) east of the station and the Conrail line is located about 0.8 km (1/2 mi) east of the center of the site. The nearest operating airports are the Hazleton Municipal Airport and the Wilkes-Barre Scranton Airport located 19 and 45 km (12 and 28 mi), respectively, from the station.

The population in the vicinity of Susquehanna SES is low. The steep sloping terrain and the present land use for agriculture limits human habitation. In 1976 about 2420 persons were living within the low population zone (within three miles). This is projected to increase to 4670 by the year 2020, the expected end of operation of Units 1 and 2 of the Susquehanna SES. In 1970 the population within 80 km (50 mi) of the SES was about 1,420,000. The year 2020 population estimate in this area is 1,582,000. Berwick is the largest borough (1970 population of 12,274) within 16 km (10 mi) of the site. Hazleton, about 24 km (15 mi) from the Susquehanna SES had a 1970 population of about 30,000. No schools, hospitals, and state or municipal parks are located within the low population zone.

6.0 ENVIRONMENTAL CONSEQUENCES

Environmental consequences of the operation of the Susquehanna SES LLRWHF are presented and contrasted with the consequences from several alternatives to the proposed action.

6.1 ENVIRONMENTAL CONSEQUENCES OF OPERATION OF THE LOW-LEVEL RADIOACTIVE WASTE HOLDING FACILITY (PROPOSED ACTION)

During routine operation, no significant environmental consequences should occur related to the facility. No gases or liquids will be stored in the facility. Therefore, no releases of radioactive gaseous or liquid effluents will occur during routine operation.

The only expected radiation exposure pathway for a hypothetical member of the general public is exposure from penetrating radiation originating within the facility either as direct radiation or as sky shine. The facility has been designed to limit the whole-body dose equivalent rate to less than 5.0 mrem/yr to a hypothetical individual residing continuously at the site boundary. On that basis, the annual off-site dose equivalent to the public from operation of the LLRWHF would be less than that from operation of the Susquehanna SES. The dose equivalent from naturally occurring sources in this geographical area is about 100 mrem/yr to which the operation of the facility would make no significant contribution.

In the event of a waste container rupture, small amounts of radioactive material may be released into the building. By the nature of the packaged waste, and the facility design, the contamination would be essentially retained within the facility.

No known endangered or threatened species as listed by the Department of Interior's list of endangered, threatened wildlife and plants (U.S. Federal Register 1979) are on the LLRWHF site. The plant has no interaction with the wet lands aspect of the Susquehanna River flood plain.

6.1.1 Irreversible or Irretrievable Commitment of Resources for Operation of the Facility

The only irreversible or irretrievable commitment of resources for operation of this facility would be fuel, electricity, and manpower. These would constitute an insignificant addition to those already committed for the operation of the station proper.

6.2 ENVIRONMENTAL CONSEQUENCES OF ALTERNATIVES TO THE PROPOSED ACTION

Although none of the previously discussed alternatives to the proposed action are believed to be viable, a brief comparative discussion is provided.

6.2.1 The No Action Alternative

While the no action alternative would eliminate the minor operational impacts and further reduce the already trivial doses to the hypothetical resident at the site boundary from the LLRWHF, the dose to in-plant workers would be increased because of the need to store in-plant until space was fully occupied. If off-site disposal facilities were available, occupational doses resulting from placement of wastes in an on-site LLRW facility would be eliminated for the Applicants (however, similar doses would be incurred by the disposing contractor staff). Assuming that the LLRW will eventually be sent to a waste disposal site, direct off-site shipment would result in less handling and also reduce its attendent potential for accidents. This alternative is, however, not viable since the plant could not operate more than one month without some additional storage capability in the event that off-site storage were not available and adequate off-site disposal facilities are not expected to be available when needed for LLRW from the Susquehanna SES.

6.2.2 Operation of an Off-Site LLRWHF

The environmental consequences of an Applicant owned and operated LLRWHF off-site would be the same as those for the on-site facility plus the following:

- Additional public exposure (however trivial) would be incurred as a result of shipment of wastes to the off-site location; the additional exposure would be proportional to the distance traveled.

- Because of the time needed to obtain the required permits, an off-site facility would probably not be ready in time to receive wastes as generated, thus increasing in-plant worker exposure because of the need to store waste in-plant.

6.2.3 On-Site Storage in Existing In-Plant Facilities

The alternative of on-site storage in existing in-plant facilities would merely postpone construction of the LLRWHF given the present uncertainty in off-site disposal. The alternative would result in reduction of the already small doses from the proposed action to the public. This dose reduction, however, would be more than offset by an increase in dose to the station workforce. Because in-plant storage, if feasible, would not permit station operation beyond a few months, a more detailed discussion of environmental consequences is believed unwarranted.

7.0 COST-BENEFIT DISCUSSION

No anticipated significant environmental impacts and costs are associated with the operation of a LLRWHF; also, there are no significant direct environmental benefits deriving from its operation.

The estimated capital cost of the LLRWHF at the Susquehanna SES site is approximately $23 million (1982 dollars). The annual levelized facility cost (e.g., interest, taxes, and depreciation) at an assumed 15.85% annual rate, is estimated to be $3.6 million, and operating and maintenance costs are estimated at approximately $350,000. Total annual cost is thus estimated to approximate $4.0 million.

If an off-site disposal facility were available at which all waste could be disposed (currently, no candidate sites have been identified), the estimated annual cost to dispose of the low-level wastes would be about $3.0 million (1982 dollars). Since LLRW storage defers but does not eliminate this cost, direct disposal would be the preferred alternative, if it were available.

The principal benefit of providing a LLRWHF at Susquehanna SES is to insure against a possible forced shut down of the station. Without off-site disposal, in the absence of the LLRWHF, shut down would result after approximately one month of continuous operation of Units 1 and 2 unless on-site space in existing facilities could be converted to waste storage.

This benefit (i.e., avoided cost) can be quantified in dollar terms. The cost to replace the station power with power generated with higher cost fuel (ultimately borne by the Applicant's customers) would be about $50 million per month. The fixed cost to the Applicant of carrying a non-productive Susquehanna SES investment is estimated to approximate $50 million per month.

Also, the non-productive wages of $1.5 - 2.0 million per month (1982 dollars) are an added cost in the event of a shut down. Another benefit to the regional society would be the uninterruption of local, state, and federal taxes estimated to exceed $95 million annually.

The environmental impacts, detailed in Chapter 5, are insignificant in keeping with the passive character of the LLRWHF. A 73 m x 88 m (240 ft x 288 ft) tract of land (already dedicated to activities associated with the generation of electricity) will be required for the storage building.

No significant ecological impacts or costs have been identified. Radiation dose to the limited number of LLRW workers (estimated as 2 full-time worker equivalents) will be will below the applicable limits (10CFR20). Radiation dose to the general population from LLRW activities will also be far below guidelines for normal operations (10CFR50).

8.0 COMPLIANCE WITH APPLICABLE LAWS AND REGULATIONS

The proposed action, operation of a LLRWHF would be implemented to ensure compliance with all applicable Federal, State and local licenses, standards, and permits. The facility design and operation will conform to all applicable codes (see Appendix A for details of applicable codes).

At present the only permit or license required for the operation of the LLRWHF is an occupancy permit from the Pennsylvania Department of Labor and Industry.

REFERENCES

Dames & Moore. 1980. Susquehanna Steam Electric Station 1979 Meteorological Summary. Prepared for Pennsylvania Power and Light Company by Dames & Moore. Washington, D.C.

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State Planning Council on Radioactive Waste Management. 1980. Nuclear Waste Policy Act.

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U.S. Nuclear Regulatory Commission. 1981. Final Environmental Statement Related to Operation of Susquehanna Steam Electric Station, Units 1 and 2 Pennsylvania Power and Light Company Allegheny Electric Cooperative, Inc., NUREG-0564. Washington, D.C.

U.S. Nuclear Regulatory Commission. 1979. Information Relevant to Ensuring that Occupational Exposures at Nuclear Power Stations Will be As Low As Is Reasonably Achievable, Regulatory Guide 8.8, Revision 4. Washington, D.C.

U.S. Nuclear Regulatory Commission. 1977. Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As Is Reasonably Achievable, Regulatory Guide 8.10, Revision 1-R. Washington, D.C.

U.S. Nuclear Regulatory Commission. 1975. Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants--LWR Edition, NUREG-75/087. Washington, D.C.

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APPENDIX A

SUSQUEHANNA STEAM ELECTRIC STATION
LOW LEVEL RADWASTE HOLDING FACILITY
TECHNICAL CONCEPT

JULY 1981

The following information was transmitted from PP&L to Battelle to be used as baseline data in the development of the Environmental Assessment Report.

SUSQUEHANNA STEAM ELECTRIC STATION
LOW LEVEL RADWASTE HOLDING FACILITY
TECHNICAL CONCEPT

-- Table of Contents --

1.0 Facility Function

The function of the Low Level Radwaste (LLRW) Holding Facility is to provide interim, on-site storage for low level radioactive waste produced at the Susquehanna Steam Electric Station (SSES) until it can be shipped off-site to permanent disposal facilities. This storage capability is required whenever shipment off-site is temporarily restricted by unavailability of disposal quota, unavailability of shipping casks, transportation problems or other such problems that have hampered LLRW disposal in recent years.

The original plant design provided very limited storage capacity based on the assumption that the waste would be continuously shipped off-site for disposal. Therefore, any interruption in shipment would have the potential to shut down the plant. This facility allows temporary shipping interruptions to occur without impacting plant operations.

This facility also aids in reducing the total man-rem exposure associated with the disposal process by providing the means to allow significant decay before the shipping and burial activities occur.

2.0 General Description

The LLRW Holding Facility shall be designed to hold all of the dry solid (trash) and dewatered solidified (cement) low level radioactive wastes that are generated by both units. It shall be designed to house all such wastes inside an uninsulated, sheet metal building with the cement stored in a shielded vault inside this building and the trash stored outside the shielded vault.

The primary purpose of the metal building will be to provide weather protection for all stored wastes and to provide all-weather loading and off loading capability.

The primary purpose of the shielded vault will be to provide radiation shielding around the cemented wastes such that on-site worker doses are as low as reasonably achievable and the total site boundary dose rate is less than the plant operating license allowable.

This facility shall be a Non-Seismic Category I facility per the definitions in Section 3.7a of the FSAR. The Safety Classification shall be "other" as defined in Section 3.2.3.4 of the FSAR. Its Quality Group Classification shall be N/A.

3.0 General Design Requirements

3.1 Codes and Standards. The design of the Low Level Radwaste Holding Facility (LLRW) shall conform to codes, standards, and specifications listed below, except where specifically stated otherwise. In the case of conflict between the various codes and standards, the more stringent requirements shall apply and such conflicts shall be called to the attention of PP&L. When a determination is required as to which code or standard is more stringent, direction and clarification shall be requested from PP&L.

a. 10CFR20, Standards for Protection Against Radiation.

b. 10CFR30, Rules of General Applicability to Domestic Licensing of By Product Material.

c. Occupational Safety and Health Standards, Department of Labor, Volume 36, No. 105 of Federal Register.

d. Draft NRC Licensing Position, "Safety Considerations for Temporary On-Site Storage of Low Level Radioactive Waste".

e. Reg. Guide 8.8, Information Relevant to Insuring that Occupational Radiation Exposure at Nuclear Power Plant Stations will be as Low as is Reasonably Achievable.

f. Reg. Guide 8.10, Operating Philosophy for Maintaining Occupational Radiation Exposure as Low as is Reasonably Achievable.

g. Uniform Building Code (UBC) 1976 and later revisions where applicable.*

h. American Institute of Steel Construction (AISC). "Specification for the Design, Fabrication and Erection of Structural Steel for Buildings"---1969 and later revisions where applicable*.

i. American Institute of Steel Construction (AISC). "Manual of Steel Construction"---1970.

j. American Iron and Steel Institute (AISI). "Specification for the Design of Cold-Formed Steel Structural Members" ---1968.

k. American Concrete Institute (ACI). "Building Code Requirements for Reinforced Concrete"---(ACI 318-77 and later revisions where applicable*) and Recommended Practice for Concrete Formwork---(ACI 347-68).

l. American Welding Society (AWS). "Structural Welding Code"---AWS D1.1-72 and later revisions where applicable."

m. Regulations of the Commonwealth of Pennsylvania as follows:

    1) Standard specifications of the Department of Transportation (PennDOT) for 1970 and later editions where applicable*, with respect to roads and bridges.

* Latest edition and supplements, if any, current at the time of design shall be listed.

2) Regulations of the Department of Environmental Resources with respect to water supply, sewage, and erosion control.

3) Department of Labor and Industry regulations. Current issue for:

Construction and Repairs.
Plant Railways.
Excavation for Construction.
Railings, Toeboards, Opensided Floors, Platforms, and Runways.
Ladders.
Protection from Fire and Panic.
Miscellaneous Hazards and Conditions of Employment.
Cranes, Booms, and Hoists.

4) Pennsylvania State Police Department, Bureau of Fire Protection, regulations for storage, handling, and use of flammable and combustible materials.

n. Safety and Health Regulations for Construction. Department of Labor, Volume 36, No. 75 of Federal Register.

o. American Concrete Institute (ACI), Concrete Masonry Structures Design and Construction, ACI 531-70*.

p. American Society for Testing Materials (ASTM), Structural Steel, ASTM A 36-74*.

q. American Society for Testing Materials (ASTM), High Strength Bolts for Structural Steel Joints Including Suitable Nuts And Plain Hardened Washers, ASTM A 325-74*.

r. Metal Building Manufacturers Association (MBMA), Recommended Design Practices Manual, dated 1974*.

s. 49 CFR 170, Transportation.

t. NUREG 75/087---Section 11.4.

u. PP&L Procedure SP-12---Quality Requirements for Fire Protection and Bechtel Systems.

v. Branch Technical Position 9.5.1 Appendix A---Guidelines for Fire Protection for Nuclear Power Plants.

w. NFPA Standards---Latest Revision.

* Latest edition and supplements, if any, current at the time of design shall be listed.

aa. ANSI C33.98 Electrical Metallic Tubing Safety Standard.

ab. ANSI C80.1 Rigid Steel Conduit, Zinc Coated.

ac. ANSI C80.4 Fittings for Rigid Metal Conduit and Electrical Metallic Tubing.

ad. ASTM A525-73 Steel, Zinc Coated (Galvanized) by the Hot Dip Process.

ae. NEMA TC-2 Electrical Plastic Tubing (EPT) and Conduit EPC-40 and EPC-80.

af. NEMA TC-6 Plastic Utilities Duct for Underground Installation.

ag. UL-1 Flexible Metal Conduit.

ah. UL-6 Rigid Metal Electrical Conduit.

ai. UL-514 Electrical Outlet Boxes and Fittings.

aj. UL-797 Electrical Metallic Tubing.

ak. 40CFR-190, Environmental Radiation Protection Standards for Nuclear Power Operations.

al. PP&L DWG.E-183152-1. Susquehanna SES LLRW Holding Facility Conceptual Layout.

am. PP&L DWG. D-184172, Rev. 0; LLRW Holding Facility, Test Bore Holes, Location and Description.

an. Factory Mutual Standards.

3.2 References. The following references shall be considered in the design of the LLRW Holding Facility. None of these are specific requirements for the facility. However, much that is contained in these references is pertinent to the design and may be applied if engineering judgment indicates that is is prudent and practicable. Some references are listed simply to provide background information for the engineer.

a. Reg. Guide 1.69, Concrete Radiation Shields for Nuclear Power Plants.

b. Reg. Guide 7.1, Administration Guide for Packaging and Transporting Radioactive Material.

c. 10CFR71---Packaging of Radioactive Material for Transport.

d. ANSI/ANS 55.1-1979, Solid Radioactive Waste Processing Systems for Light Water Reactor Plants.

* Latest edition and supplements, if any, current at the time of design shall be listed.

e. 10CFR50 Appendix R---Fire Protection Program for Nuclear Power Facilities Operating Prior to January 1, 1979.

3.3 Health and Safety Requirements. The facility shall be designed such that on-site radiation exposure is maintained as low as reasonably achievable and the calculated off-site boundary dose contribution from this facility will not exceed 5 mrem per year. Exposure of on-site workers shall be minimized through the use of concrete shielding around the stored material, shielded loading equipment, and/or controlled access to the facility. Off-site dose rates shall be minimized through the use of concrete or other suitable shielding, distance, and, to the maximum extent practicable, the self shielding properties of the stored material.

Provisions shall be made in the facility design to minimize the detrimental effects of machinery exhaust fumes and excessive temperature. Such provisions shall include a building ventilation system which tends to draw the exhaust fumes away from persons working on the operating floor of the facility and prevents temperatures from becoming excessive in the working areas.

3.4 Material Being Stored. The LLRW Holding Facility shall be designed to store low level dewatered solidifed radioactive wastes, and the low level dry trash radioactive wastes. Should the need arise, it may also be used for the temporary storage of large pieces of contaminated or activated plant equipment. It will not be used for storage of gaseous wastes or wastes containing free liquids as described below.

Solidified waste is defined as wet dewatered waste (e.g., evaporator bottoms, resins, and sludge) which is solidified and contains less than 0.5% free water (by container volume) or 1.0 gallon of liquid (in the container), whichever is less. Low level dry trash is defined as contaminated material which contains sources of radioactive material that is dispersed in small concentrations throughout large volumes of inert material which contain no free water. Generally, this consists of dry material such as paper, trash, air filters, rags, clothing, small equipment, and other dry material. This material should not cause fires from spontaneous chemical reactions, retained heat, etc.

3.5 Containers. The radwaste containers which will be stored in LLRW Holding Facility are designed to preclude or reduce the occurrence of uncontrolled release of radioactive materials due to handling, transportation, or storage.

Container material will conform to the requirements established in NUREG-75/087 (Section 11). Where corrosive material is being stored, the container shall be designed to contain such material without loss of container integrity until final disposal. The waste container materials shall not support combustion.

In those special cases where large contaminated or activated plant equipment is to be stored in this facility, the requirements for the proper storage container or lack thereof shall be ascertained at the time the need arises. Also, provisions for transportation, storage, retrieval, shielding, etc., shall be made as required for these special cases.

All material which is stored in this facility will be packaged for eventual shipment and permanent disposal. All containers will be decontaminated for shipping to the standards of 49CFR 173.397 before being brought into this facility. All unpackaged plant equipment will be decontaminated to the extent that there is minimal surface contamination.

At the present time, and for the foreseeable future, there is a wide profusion in sizes and shapes of disposal containers in use in the nuclear industry. Each has its own advantages and applications. It is expected that during the life of the facility it will be required to accommodate several of these different types. The most likely containers which will be stored in the facility are listed below:

Manufacturer	Designation	Volume	Dimensions
United Nuclear	50 CFL	50 ft.^{3}	48"ϕ x 53-7/8" High
Hittman	HN-100	163 ft.^{3}	72-3/8"ϕ x 72-3/4" High
Hittman	HN-600	83 ft.^{3}	72-3/8"ϕ x 40" High
Hittman	HN-200	75 ft.^{3}	52-3/8"ϕ x 61-3/8" High
Chem. Nuclear	14-195	200 ft.^{3}	76"ϕ x 79" High
Chem. Nuclear	6-80	85 ft.^{3}	58"ϕ x 57-7/8" High
	55 gal. drum	7.35 ft.^{3}	1.95 ft.ϕ x 2.9' High
Container Products Corp.	B-25	96 ft.^{3}	50" High x 46" Deep x 72" Wide

The above listed containers essentially envelop the volumes and dimensions that will be stored in the facility. The facility shall be designed to accommodate all of these containers except the Container Products B-25 in the shielded vault area, and the B-25 and the 55 gallon drum in the storage area.

3.6 Storage Requirements. The LLRW Holding Facility shall be designed to store the quantity of solidified and dry low level radioactive wastes generated by the SSES for the equivalent of 8 reactor years based on normal operation with the radwaste equipment provided with the original design. This storage shall be segregated, with cemented wastes stored in the shielded vault area and compacted trash stored in the open storage area. Wastes stored in the open storage area shall be further segregated with containers having contact readings ≤ 1 mrem/hr stored on the east face and top layer of containers, ≤ 10 mr/hr stored on the north, south and west faces and containers reading >10 mrem/hr stored within this perimeter to the maximum extent practicable. Similarly, wastes stored within the shielded vaults will be arranged with containers with a contact dose rate ≤3 rem/hr stored next to the vault walls and on the top layer and containers >3 rem/hr inside this perimeter to the maximum extent practicable. These measures will take maximum advantage of the self shielding properties of the waste material.

3.7 <u>ALARA Requirements</u>. This facility shall be designed such that off-site boundary doses are held within the requirements of 40CFR190 and on-site worker dose rates meet the requirements of 10CFR 20. In addition, the design should be aimed at maintaining these dose rates as low as reasonably achievable per Reg. Guides 8.8 and 8.10. This can be accomplished through the use of controlled access to the facility and surrounding area, utilization of the waste material for shielding to the maximum extent practicable, providing shielding for loading equipment and use of remote operating stations.

3.8 <u>Design Life</u>. This facility shall be designed to temporarily store the wastes generated by SSES for the equivalent of 8 reactor years. The design life of the facility shall be 40 years. At the end of the design life the facility will be either 1) overhauled and maintained in service, 2) decommissioned and converted to other use, or 3) decommissioned and removed from use.

3.9 <u>Architecture</u>. The LLRW Holding Facility shall consist of a storage vault within the confines of an uninsulated steel-framed, metal sided structure. The purposes of the steel building are to provide weather protection; all-weather loading capability; unified building services such as security, radiation monitoring, and lighting; and an exterior architectural treatment which will economically meet the service life of the structure and also be aesthetically compatible with other similar site structures.

The storage vault shall consist of a rectangular cross-section as indicated on the conceptual drawing. The walls of the vault shall be of reinforced concrete or of concrete block construction. The vault shall be covered with removable, reinforced concrete shield panels to permit the loading and unloading of the waste containers. The sizing of these removable panels shall be compatible with the lifting capacity of the handling equipment. The thickness of the roof panels and walls shall be designed to limit the off-site boundary dose and the on-site worker dose to levels specified in Section 3.3. The vault shall be designed to minimize streaming and the off-site and worker dose rate when the roof panels are removed for loading and unloading.

The floor of the facility shall be designed to support all of the following:

a. Load from stacked waste containers
b. Load from vault walls and shielding panels
c. Load from handling equipment if carried by floor
d. Load from steel superstructure if carried by floor
e. Load from truck carrying waste and shielding

Before beginning the floor design, the designer shall evaluate the advantages of designing the floor for a maximum uniform load throughout.

A curb shall be placed around the perimeter of the facility to contain any liquid such as rainwater or fire sprinkler water which may be introduced into the building. The curb shall be of such height as to contain the volume of fire protection water released if all the sprinklers are actuated in the maximum credible fire event for a period of one half hour. Ramps shall be provided to facilitate vehicular traffic over the curb.

The floor, curbing, sumps, and shield walls of the facility shall be coated with a decontaminable material to a height equivalent to the height of the curbing.

The metal building shall provide a truck unloading area which will afford convenient inside unloading to either the vault area or the unshielded area. Access to the truck bay shall be provided by a rolling door.

A loading dock shall also be provided which will allow essentially level access from the trash storage area to an enclosed van or trailer for ease of loading such a vehicle with a drive-on forklift.

Personnel access doors are needed for operational requirements and also to satisfy fire safety standards. The actual number and location of the access doors shall be determined by the designer in accordance with all of the governing reference regulations. The personnel access doors shall be the hollow metal type.

The doors shall be equipped with cardreaders, an electric strike, and a door switch. All facility doors shall be integrated into the plant security system to provide an alarm in the event an unauthorized or abnormal opening into the facility should occur.

Louvers shall be provided to permit air intake into the facility for the HVAC system. The size, number, and location of the louvers shall be determined by the design requirements of the HVAC system. The louvers shall be located and/or protected in such a manner as to not become blocked with snow, ice, mud, or any other substance which may restrict the flow of air into the facility.

3.10 Security. The security of this facility will provide for personnel access control and shall be integrated with the existing plant security system.

4.0 System Design Requirements

4.1 Building and Storage Vaults. The storage vault shall store the higher level wastes, such as the solidified evaporator bottoms and demineralizer resins, while the open area shall provide storage space for the lower level wastes such as trash.

The designer shall design the metal building to include the following:

a. Primary and secondary structural framing members, base plates, anchor bolts, connection bolts, and other items which are applicable

b. Metal roof deck and exterior metal siding

c. Closures

d. Flashing

e. Fasteners

f. Sealants

g. Gutters and Downspouts

h. Louvers

i. Coatings (structural steel)

j. Hatches and roof openings

k. Crane rails and supports

The facility should be designed, to the maximum extent practicable, to facilitate independent and simultaneous construction of the exterior metal building structure and the internal storage structure.

The building shall be designed such that additional shield vault storage can be constructed in the entire trash storage area at a later time.

4.2 <u>Floor Drains System</u>. The facility will be designed such that under normal conditions there will be no free liquids inside the building. All waste will be either dewatered, solidified waste or compacted dry waste. Therefore, any free liquid that enters the facility will be from an other than normal source. Potential abnormal sources are fire protection water, minute amounts if a cement container were to be breached in loading or unloading, rainwater or snow melt from roof leakage, cooling system leakage from equipment inside the facility, snow brought in on vehicles or liquids used for decontamination of containers before shipment,should that ever become necessary. All such liquids must be considered contaminated until verified otherwise.

The floor drains system shall be designed to collect any liquids that are spilled on the floor of the facility. The system shall route all drains to one or more collection sumps located at the building periphery. Each sump shall be equipped with liquid detection devices which will provide annunciation in the main plant and facility control rooms whenever any liquid enters the sumps.

Provisions shall be made such that sampling of the sumps may be performed from either inside or outside the building. Provisions shall also be made such that the sumps may be pumped to portable tanks from either inside or outside the building. There shall be no permanent pumping equipment installed or piping connections to the main plant.

The sump(s) shall be provided with a metal container which will catch the initial quantities of water entering from the drains system. The container shall allow for removal from the sump by hand to provide a means for convenient disposal of small quantities of water which enter the sump.

The areas inside the vault shall also be provided with drains to route free liquids to the sumps.

4.3 Loading System. The loading system for this facility shall be capable of unloading, transporting within the facility, placement, retrieval, and reloading of cemented waste. It shall also have the capacity to lift, transport, and replace all movable and temporary shielding devices.

Features shall be incorporated to minimize operator radiation exposure in accordance with ALARA principles.

The system shall be designed with features which facilitate its transfer from one area of the building to another as the areas are filled. This capability shall also include the trash storage area in the event the vault storage is expanded into this area at a later time.

The loading system shall also be capable of retrieving dropped and damaged waste containers for repackaging or other disposition.

In selecting the loading systems, consideration should also be given to delivery schedule, cost, maintainability with regard to ALARA, parts availability, operational practicality, and the impact of the systems on the design of the balance of the facility.

Loading for the compacted trash shall be by a battery or L.P. gas powered forklift. Shielding for the forklift operator shall be provided on the vehicle as required to meet ALARA requirements. A battery recharging station for the forklift shall be provided in the facility at a location outside the storage areas.

4.4 Lighting. The facility shall be provided with lighting which will normally be in service only during loading or unloading operations. The lighting shall be adequate for safe, efficient handling of the waste containers in the offloading area, the dry trash storage area, and for safe, efficient handling of the shielded vault cover blocks. There will be no permanent lighting installed inside the shielded vaults. Lighting for this area will be provided on the container handling equipment with intensity as required by the CCTV manufacturer.

The lighting shall be designed to provide long lighting element life and to afford ease of changing the elements in order to minimize maintenance time and potential radiation exposure. The lighting shall be controlled from the facility control room. Yard lighting will also be provided as required for security purposes to maintain a minimum of 2.5 foot-candles via banks supplied from the security control center source.

The wiring shall be 600V, type THW color coded No. 12 AWG minimum solid copper wire; No. 8 AWG conductor and larger shall be stranded copper. All cables shall be installed in conduits not smaller than one inch diameter.

4.5 Heating, Ventilation & Air Conditioning Systems. The facility shall be provided with an active ventilation system for two basic functions: 1) removing noxious or irritating exhaust fumes whenever internal combustion engine powered machinery is operating inside the facility, and 2) preventing excessive heat build-up from the roof in the summer.

The system shall be designed such that it moves air generally in an upward direction, away from the equipment operators.

Air inlets shall be provided such that when the facility is closed, air entering the facility is evenly distributed and flows as described above. They shall be located and/or protected such that snow accumulation cannot significantly restrict the flow of air or be drawn into the facility.

The ventilation system shall not provide any heating or cooling for the facility. It will also not provide any humidity control.

The system shall be provided with thermostatic controls to automatically maintain the facility temperature below the maximum allowed for safe working occupancy. It shall also be provided with an automatic shutdown feature which is activated when smoke is detected by the fire detection system. The controls shall provide for manual starting and stopping of the system which shall override the automatic functions described above. The system controls shall be located in the facility control room.

The system shall exhaust through a damper which shall open when the fans are in operation and close when the fans are shut down.

The facility control room shall be provided with heating and air conditioning which shall normally be required when the facility is being loaded or unloaded.

4.6 AC Power Systems. The three phase, 480 volt power supply to the building will be provided by owner supplied 500 kVA pad-mounted transformer and associated fuse cabinet located approximately 20 feet from the control/equipment room. The power will be distributed at appropriate voltage levels from the facility motor control center equipped with relay ground fault protection. This will be the only source of electrical power for all facility loads except for the following: Security equipment will be supplied normally from the Security Control Center source which has diesel backup. Fire protection equipment will have battery backup to normal building AC supply specified as part of the panel.

In addition to permanent loads, power is required for convenience 120 VAC outlets and power/welding 480 VAC receptacles.

All electrical equipment including cable contained within the storage area shall be capable of performing its normal function under all environmental conditions which shall exist inside and outside the facility. Cable shall be of non-PVC insulation/jacketing and shall comply with IEEE Standard 383-1974 for construction and flammability.

4.7 Communications System. The communications system will allow two way conversation and paging between the main plant and the facility. It shall be designed to be compatible with and connected to the existing main plant communications system. It will have at least one station for paging and conversation in the offloading area. It will have sufficient speakers inside the storage area to insure that paging or alarm can be heard when the facility is at full capacity. It will also have one station for paging and conversation in the facility control room. One telephone with a plant extension shall also be provided in the LLRW control room. All communications cable shall be in rigid steel conduit.

4.8 Radiation Monitoring System. The radiation monitoring system shall be designed to monitor the general area radiation levels at various locations in the trash storage area, above the shielded vault area, the offloading area, and the facility control room. Readout shall be in the facility control room.

4.9 Fire Detection/Protection System. The fire protection design shall be based on a combustible loading of 1200 lbs/ft^2. The facility shall be provided with a fire detection system to provide an early warning system. Location and placement of detectors shall consider access to each detector for annual testing.

The entire building shall be provided with a dry pipe sprinkler system designed to deliver .25 gpm per square foot over the hydraulically most remote 3000 square foot area. The system shall utilize sprinkler heads rated at 286°F.

Water will be supplied from the existing fire protection system by a 10" mortar lined ductile iron fire protection line. The water supply is capable of supplying a minimum of 1500 gpm at 100 psi. Fire hydrants shall be provided and equally spaced at 300 foot intervals around the building perimeter. Hydrants and hose houses shall be identical to existing plant equipment.

All fire protection equipment shall be Underwriters Laboratories listed and approved by Factory Manual. All fire protection and fire detection drawings are subject to PP&L and insurance approvals.

4.10 Security System. This facility shall be designed with security provisions that are an extension of the existing plant security system. All accesses to the facility shall be monitored by the system. Normal accesses shall be equipped with entry control devices such as magnetic card readers. All others such as the fire exit doors shall initiate an alarm in the plant security system if they are opened.

4.11 Annunciator System. The following occurrences in the facility will activate an annunciator in the main plant control room and at the facility:

a. Detection of fire

b. Detection of liquid presence in any of the facility sumps.

c. Loss of electrical power to the facility.

The main control room will have one common annunciator window which will be activated for any of the above listed alarms. An annunciator panel will be provided at the facility control room which will have separate windows for each alarm.

4.12 Grounding Systems. The grounding system shall establish a building ground grid to connect electrical and mechanical equipment and structures, raceways, duct banks, and other required grounds to the existing exterior station grounding system.

The grounding conductors shall be: larger than #8 AWG---Class B, bare, stranded, soft drawn copper wire; #8 AWG and smaller---bare, solid, soft drawn copper wire.

The building ground grid shall include a minimum of a 250 kcmil cable loop connected to every other steel column as a minimum with additional connections as required to establish a uniform potential in and about the structure.

Any steel columns not tied to the building frame by welding, riveting, or bolting must be tied to the 250 kcmil cable loop or jumpered to the building frame which does tie to the 250 kcmil loop.

The building ground grid shall be connected to the existing exterior station ground system by a minimum of two connections located on diagonally opposite sides of the building and attached to different sections of the exterior station grounding system.

All underground or embedded grounding connections shall be made by the exothermic process.

In each area containing electrical equipment, there shall be access to the grounding system from either structural steel or the ground grid.

All stairways, handrails, and grating shall be connected to the grounding system through the structural building steel back to the column grounds.

Each motor control center shall be connected to the building ground grid by two 250 kcmil equipment grounds.

All electrical apparatus supplied from low resistance or solidly grounded alternating current systems operating at greater than 240 volts shall be provided with:

a. One fault current return path grounding conductor unless rigid steel conduit is used for the raceway.

b. One equipment grounding conductor connected to the nearest point on the building ground grid.

The grounding conductor for both the fault current return path and equipment grounding shall be at least the same size as the largest source conductor in the raceway.

Duct banks under buildings containing circuits of 240 volts or more shall have one No. 4/0 AWG fault return conductor embedded as close to the top of the duct bank as possible. Such conductor shall be connected to the electrical equipment at either end of the duct bank.

If such duct banks extend beyond the building, a second No. 4/0 AWG conductor shall be bonded to the first, at a point approximately 3 feet from the wall of the building. Approximately 3 feet of each conductor shall be left, coiled and taped at the end of the duct bank if such duct bank will be completed by others.

4.13 <u>Raceway</u>. All raceway within the storage area shall be rigid steel conduit not less than 1-inch diameter and shall be UL approved. Percentage fill in conduit shall not exceed 40 percent. Raceway shall be marked with black letters on white background. All rigid steel conduit bends shall be cold bends. Conduit runs shall not have more than the equivalent of four 90-degree bends between pulling points.

Embedded conduit shall not be less than 1-inch diameter. A minimum clear space of 1-1/2 times the size of the coarse aggregate or 2 inches, whichever is greater, shall be maintained between embedded conduit and the concrete surface except at the point of stubout and embedded conduit and reinforcing steel.

When two or more layers of conduit exist, the clear spacing between two adjacent conduits in the vertical plane of mats or slabs and in the plane perpendicular to the plane of the wall shall be at least 1-1/2 times the size of the coarse aggregate, or 2 inches, whichever is greater.

A 1/8 inch nylon pull rope with 8 inches turned back at each end shall be left in all conduit in which the cable is not pulled.

Conduit for telephone, PABX, public address, fire detection, and fire signalling systems shall be rigid steel. Such conduit shall not exceed 75 feet between pull or junction boxes for 3/4 inch size and 150 feet for 1 inch or larger sizes, and shall not contain more than the equivalent of three 90 degree bends.

The A/E shall provide a detailed schedule for controlling the installation of the raceway system. The schedule should include:

a. Raceway Index

   1) The latest revision number indicating when the raceway was added, last changed or deleted

   2) "From" and "To" destination

   3) Raceway code

   4) Raceway function (P-Power, K-Control, M-Instrument, C-Communication)

   5) Approximate length of raceway

   6) Layout drawing number on which the raceway appears

   7) Included cables

   8) Percent fill

b. Raceway Code Description

   1) Size

   2) Type

   3) Area of the raceway in square inches

   4) Estimated footage

4.14 Shielding. The shielding for this facility shall consist of two major areas: 1) the fixed shielding for the in-place stored material, and 2) the transient shielding which shields the waste while being moved from the vehicle in the off-loading area to the storage position.

The fixed shielding shall consist of the following:

a. The cemented waste storage vault

1) the walls---reinforced concrete

2) the cover--- reinforced concrete slabs

b. The trash storage area

1) the north and south walls--- reinforced concrete

c. The facility control room

1) the south and west walls--- reinforced concrete

The transient shielding shall consist of the following:

a. For the cemented wastes---a portable shielding device which is attached to the loading crane which shields the containers while being moved from the transporter in the off-loading area to the place of storage.

b. For the trash wastes---shielded forklift or other loading vehicles will be provided by the owner as required.

4.15 Trash Restraining System. The facility shall have a trash restraining system which shall be designed to prevent any trash containers from being blown out of the confines of the facility during a tornado having a 300 mile per hour wind velocity.

The primary element of the system shall be netting of nylon or other suitable material enclosing the trash storage area and secured to anchors in the foundation and/or floor slab. However, all tornado loading shall be transmitted directly into the anchors. The system shall be designed such that failure of the building structure will not tend to cause failure of the trash restraining system.

The system shall be designed such that it will allow ease of movement and placement of the trash to the maximum extent practicable.

4.16 Shipping Inspection Station. The facility shall be equipped with a shipping inspection station where inspections required by 49CFR170 can be performed on the solidified waste containers immediately prior to shipment. The inspections shall include the following:

1) Visual inspection of the container for deterioration, leakage, or other conditions which might preclude shipment, disposal, or require repackaging.

2) A contact radiation dose reading at the area of highest radiation on the container surface.

3) A radiation dose reading at three feet from the outer surface at the area of highest radiation.

4) An outer surface contamination smear.

The station shall provide shielding for the person performing the inspections and remote operating capability for these functions to minimize the radiation exposure per ALARA principles. The station shall be compatible with the loading system of the facility and shall be transferrable between overhead crane service areas.

The station shall be equipped with the appropriate lighting to allow these inspections. Provisions shall be made in the facility for electrical power for the station at the locations it will occupy.

5.0 Facility Operation

5.1 General. The purpose of the operation of this facility will be to temporarily store low level radioactive waste generated by the plant until it can be shipped off-site. It is normally an unoccupied facility with occupancy normally occurring only whenever loading and unloading operations are in progress.

Waste will be loaded into the facility in a controlled manner with the lower activity wastes being stored around the periphery and, where practicable, on the top layer of each of the storage areas. This will maximize utilization of the self shielding properties of the material and minimize personnel exposure.

5.2 Loading and Unloading. Loading of the facility will generally proceed as follows for solidified waste. A truck loaded with a container of the waste will enter the facility in the offloading area. The waste containers will be inside a shielding device if radiation levels so dictate. The truck will stop with the container located in the overhead crane pickup area. Before any other unloading steps are taken, all personnel must either move a safe distance from the container or get behind the protection of appropriate shielding. The container is lifted off the truck and moved to the approximate storage location. Then the auxiliary hook removes the appropriate shield panel. The container is then moved into proper position and lowered into the storage vault. The removed cover is then replaced, whereupon the operation is complete.

Loading the facility with trash waste will take place in similar fashion. The truck with the 55 gallon drums on pallets will enter the facility or the loading dock area. The truck will stop with the material adjacent to the trash storage area. It is then offloaded with a forklift or other appropriate machine. If required, depending on the dose rate from the containers, the forklift will be equipped with shielding for the driver.

Unloading the facility will generally occur in the reverse order of the loading steps. However, during the unloading process inspection for shipping may be required.

5.3 Fire. In the event of fire in the facility the fire detection system will annunciate an alarm in the main plant control room and automatically shut down the ventilation system. Should the fire continue to propagate, the fire protection system will be automatically actuated in the area of the fire.

Any water or other fire fighting materials introduced into the facility should be considered contaminated until proven otherwise. If contaminated, they should be disposed of accordingly.

6.0 Civil Design Criteria

6.1 Classification of Structure. The Low Level Radwaste Holding Facility shall be designated as a Non-Category I structure. A Non-Category I structure is one whose failure would not result in the release of significant amounts of radioactivity and is not required for reactor shutdown.

6.2 Design Loads. The following design loads shall apply to the LLRW Holding Facility. Situations not specifically covered by the following shall be evaluated on an individual basis, recorded, and approved by PP&L before implementation.

6.2.1 Dead Load (DL)---includes weight of framing, roof, floors, walls, platforms, and all permanent equipment.

Permanent equipment such as:

a. HVAC equipment
b. Electrical panels and equipment
c. Control panel for overhead crane
d. Fire protection equipment

A load allowance for piping, electrical trays, and ducts of 10 psf shall be taken as dead load in computing structural member stresses. This load allowance may include such items as:

a. HVAC ducts
b. Lighting
c. Sprinkler system
d. Fire detection system

6.2.2 Live Load (LL)---includes all vertical loads except DL. Following are minimum live loads to be used in design of the various areas:

a. Roof: The roof live load, including snow loads, shall be 30 psf on the projected horizontal area, or a concentrated load of 200 pounds acting on a 1 foot by 1 foot area at the center of the longest span, whichever is the more severe.

b. Ground Floor.

c. Waste Impact: The floor shall be designed to withstand the impact of a filled liner and shield bell dropped from the maximum lift of the loading crane without any degradation of the overall structural integrity of the facility.

d. Truck Bay: AASHO H20-S16 Special Load Transporter.

e. Forklift Access Areas:

   1) Equipment Room: 250 psf.
   2) Control Room: 250 psf.

f. Surcharge outside and adjacent to structures: 250 psf; Railroad surcharge per A.R.E.A. specification.

g. Concentrated load on beams and girders (in addition to all other loads): 5 kips to be applied at points of maximum moment and shear. This load is not cumulative and is not carried to columns. It is not applied in office or access control areas and at equipment access and walkway platforms.

h. Concentrated load on slabs (to be considered with dead load only): 5 kips acting over an area of 3 sq. ft. to be applied at points of maximum moment and shear. This load is not cumulative and is not carried to columns. It is not applied in office or access control areas.

6.2.3 Crane Loads. The designer shall include within the scope of his work the design of the crane rails and supports. Crane and equipment vendor drawings shall be followed for wheel loads, equipment loads, weights of moving parts, and crane rail deflection requirements.

Impact allowance for traveling crane supports and their connections shall be 25%. Lateral force on crane runways shall be 20% of the sum of the weight of the lifted load and the crane trolley applied at the top of rail, one-half on each side of the runway, and shall be considered as acting in either direction normal to the runway rail. The longitudinal force shall be taken as 10% of the maximum wheel loads of the crane applied at the top of rail.

6.2.4 Ground Water Pressure. The ground water level shall be determined by the designer based on site specific information.

6.2.5 Floods. The LLRW holding facility need not be designed for the effects of a flood since the proposed site location is well above the flood stage for the probable maximum flood (PMF).

The facility shall be designed for a maximum rainfall intensity of 6 in/hr.

6.2.6 Wind Loads. The structure shall be designed for the basic wind loads tabulated below in accordance with ASCE paper No. 3269. Values are in pounds per square foot unless noted otherwise.

Wind Load on Structures:

a. Height	0-50 ft.
b. Basic Velocity	80 mph
c. Dynamic Pressure with 1.1 Gust Factor q	20 psf
d. Wall Pressure 0.8q	16 psf
e. Wall Suction 0.5q	10 psf
f. Total Design Pressure 1.3q	26 psf
g. Roof Suction 0.6q	12 psf

6.2.7 Seismic Loads. The LLRW Holding Facility shall be designed in accordance with the Uniform Building Code (UBC) for structures in Seismic Zone I as defined therein.

6.2.8 Pressure Loads. The facility shall be designed to withstand the pressures generated by the HVAC system.

6.3 Materials and Design Methods.

6.3.1 Materials.

a. Concrete design strengths for the LLRW structure shall be based upon the following table:

1) Precast concrete panels	4000 psi
2) All other materials	4000 psi
3) Concrete infill for unit masonry walls	2500 psi
4) Mass concrete fill and mud mat	2000 psi

b. Reinforcing steel shall conform to ASTM-A615, Grade 60.

c. Structural Steel shall conform to ASTM-A36, or other ASTM designations listed in Section 1.4.1.1 of AISC Specification for the design, fabrication, and erection of structural steel for buildings.

d. Masonry Construction

1) Concrete masonry units shall conform to either ASTM C90, Type I, grade N for hollow masonry unit or ASTM C145, Type I, grade S for solid masonry units.

2) Masonry mortar shall conform to ASTM C-270, type M having a minimum compressive strength of 2500 psi at 28 days.

3) Masonry grout shall conform to ASTM #-4765, minimum compressive strength of 2500 psi, at 28 days.

6.3.2 Design Methods.

a. General. All steel structures shall be designed by the working stress method. All reinforced concrete structures shall be designed by the strength method. Any deviation from above is permitted only when approved by PP&L. All masonry blockwalls shall be designed by working stress design method and in accordance with requirements of Chapter 24 of UBC. The allowable stresses shall be as specified in UBC, table 24-H for special inspection, or as modified in this section.

For multi-wythe block walls, shear stresses shall be calculated at the interface of masonry block and infill material. Where the calculated shear stresses exceed the allowable limits specified in "masonry structures" subsection of this section, metal ties (DUR-O-WALL, bent plate, or No. 3 rebar) between the two wythes shall be designed to transfer the full shear value.

In determining the most critical loading condition to be used for design, the absence of a load or loads shall also be considered, when appropriate.

Formwork design shall be in accordance with ACE 347 and "Safety and Health Regulations for Construction," Department of Labor, Volume 36, No. 75. If any conflict occurs, the latter shall govern. Foundation design shall maintain minimum safety factors in accordance with the following criteria:

a.	Load Combination:	D+H+W	D+F
b.	Overturning	1.5	---
c.	Sliding	1.5	---
d.	Flotation	---	1.1

b. Notations.

U: Required strength to resist design loads, as defined in ACI 318.

D: Dead load of structure plus any other permanent loads contributing stress, such as hydrostatic loads.

L: Live loads expected to be present when the plant is operating, including movable equipment, piping, cables, and lateral earth pressures.

V: Seismic load on Non-Category I structures as specified in the Uniform Building Code for Seismic Zone 1.

W: Wind load.

f's: Allowable working stress in tension for reinforcing bars (as specified in ACI 318-77).

Fy: Yield strength of reinforcing steel.

Sm: Allowable stress for reinforced masonry per UBC, Table 24-H (special inspection) for global wall analysis; or allowable stress for unreinforced masonry per table 24-B for local wall analysis as a result of attachments.

H: Lateral earth pressure.

Fs: Allowable stress for structural steel (as specified in AISC, 1970 edition).

f: Calculated stress for structural steel.

Fy: Yield strength for steel (as specified in AISC, 1970 edition).

F: Buoyant force due to ground water pressure.

c. Design. Designated as a Non-Category I structure, the Low Level Radwaste Holding Facility shall be designed using the following load combinations:

1) Concrete Structures

a. U = 1.4 D + 1.7 L
b. U = .75 (1.4 D + 1.7 L + 1.7(1.1)V)
c. U = .75 (1.4 D + 1.7 L + 1.7 W)
d. U = .9D + 1.3(1.1)V (Note 1)
e. U = .9D + 1.3 W (Note 1)

2) Steel Structures

a. D + L .....stress limit of Fs
b. D + L + V .....stress limit of 1.33 Fs
c. D + L + W .....stress limit of 1.33 Fs

Note 1: Where overturning forces cause net tension in the absence of live load.

3) Concrete Masonry Structures
Normal Conditions:

a. D + L .....stress limits of f's, Sm*
b. D + L + V .....stress limits of 1.33 f's, 1.33 Sm*

*If the designer chooses to use double wythe walls designed as a composite section, the allowable shear or tension stresses between the masonry block and concrete or grout infill shall be equal to three percent of the compressive strength of the block.

6.4 <u>Site Information and Site Work</u>.

6.4.1 <u>Plant Datum and Orientation</u>.

a. Plant datum corresponds to U. S. Geological Survey Mean Sea Level (MSL) datum.

b. Plant north corresponds to true north.

6.4.2 <u>Design Depth for Frost Protection</u>.

a. Bottoms of all foundations shall be located at a minimum depth of 4 ft. below grade.

b. All water piping shall have a minimum cover of 4-1/2 ft.

6.4.3 <u>Earthwork Slopes</u>.

Maximum embankment slope: 1-1/2 horiz.: 1 vert.

6.4.4 <u>Rock Slopes</u>.

Recommended slopes: 1 horiz.: 4 vert.

ATTACHMENT 4

Resume of training and experience for the Radiation Protection Officer, (Michael R. Buring) is included as pages 2, 3 and 4 of this attachment.

The resume of training and experience for the Radiation Protection Officers alternates are as follows:

Mark W. Granus - included as pages 5 and 6 of this Attachment.

F. Peter Jaegar - Included as pages 7 through 10 of this Attachment.

ATTACHMENT 4

RADIATION PROTECTION OFFICER - TRAINING AND EXPERIENCE

Name: Michael R. Buring

Education and Training

1970 Ohio State University; B.S. - Zoology

Work Experience

1962-1967 U.S. Navy - Enlisted Nuclear Plant Operator, Engineering Lab Technician, Prototype Instructor

Duties: Mechanical Operator/Instructor at Naval Nuclear Power Plant Prototype, Health Physics and Water Chemistry Control, both Primary and Secondary.

1967-1970 Batelle Memorial Institute - Safety Technician

Duties: Inspection and Auditing of various research projects in progress, for compliance with es ablished procedures and regulatory requirements.

1970-1973 Virginia Electric and Power Company - Surrey Power Station Health Physicist

Duties: Assist station Health Physicist in routine and special projects, personnel dosimetry, radwaste, radiochemistry, procedure writing, radiological environmental monitoring.

1973-1979 Metropolitan Edison Company - Corporate Radiation Safety.

Duties: Technical Support of TMI station personnel in Health Physics, personnel dosimetry, radwaste, procedure writing and review, radiological environmental monitoring, etc. Supervised personnel dosimetry group during and after accident.

1979-1981 Pennsylvania Power & Light Company - Environmental Group Supervisor - Nuclear

Duties: Supervise the implementation of radiological and non-radiological environmental monitoring programs.

1981- Present - Pennsylvania Power & Light Company - Radiation Protection Officer

Duties: Management of Radiation Protection Program controlling all H.P. activities including whole body counting personnel dosimetry, radwaste, ALARA control, respiratory protection and supervisor of H.P. personnel.

Licenses and Certificates

None.

ATTACHMENT 4

Experience With Radiation - Michael R. Buring

Isotope	Amount	Location	Duration of Use	Type of Use
Mixed Fission, Activation, & Corrosion Products - Byproduct, Source and Special Nuclear Material	Trace - Kilocurie	U. S. Navy Surrey Nuclear Sta. Three Mile Island Nuclear Station	12 years	Power and Naval Reactor Health Physics Physics Program

ATTACHMENT 4

HEALTH PHYSICS SPECIALIST

Name: Mark W. Granus

Education and Training

1978 Purdue University
B.S. - Environmental Health & Health Physics

Work Experience

10/80 - Present - Health Physics Specialist, PP&L Nuclear Support Group

Duties: Assist the Staff Health Physicist in the following activities: ALARA training, review of health physics procedures, radwaste.

6/78-10/80 Health Physicist, Dresden Nuclear Power Station, Commonwealth Edison Co.

Duties: Health Physics related to Dresden Unit 3, station respiratory, bioassay and radwaste programs

9/77-5/78 Health Physics Technician, Radiological Services Dept., Purdue University

Duties: Assist Radiation Safety Officer in leak testing, receipt of radioactive material, laboratory survey and decontamination.

Licenses and Certificates

None.

ATTACHMENT 4

Experience With Radiation - Mark W. Granus

Isotope	Maximum Amount	Where Experienced Gained	Duration	Type of Use
MFP*	Trace to Kilo Curies	Dresden Nuclear Power Station	2.5 yrs.	Power Reactor Health Physics
CO-60	7500 Curies	Purdue University	3 mos.	Irradiation Facility
CS-137	30 Curies	Dresden Nuclear Power Station	2.5 yrs.	Calibration Facility
CS-137	3 Curies	Purdue University	9 mos.	Calibration Device
CO-60	1500 Curies	Purdue University	9 mos.	Irradiation Facility

* Mixed Fission, Activation & Corrosion Products-By Product, Source and Special Nuclear Material

ATTACHMENT 4

NAME: F. Peter Jaeger

WORK EXPERIENCE

NUCLEAR WORK:

POSITION: Health Physics Specialist
Pennsylvania Power & Light Co.
Susquehanna SES

DATES: November 1977 to Present

LOCATION: Susquehanna Steam Electric Station - Berwick, PA

DUTIES: Assisted in the development and writing of health physics procedures, based on FSAR and tech spec requirements, for a two unit BWR. (1050 MWE) Responsible for developing our health physics budget from pre-fuel load through Unit I outage. Procured the bulk of equipment and supplies required for normal operation and outage situations. Supervised 10 Health Physics Monitors for the past year and a half since they were brought into our section. Spent five days (Mar. 28-Apr. 2) at TMI providing health physics support to Met-Ed. This support was in the form of on-site/off-site radiological surveys, aerial surveys, job coverage for any entry to island, etc. Revamped our emergency materials budget as a result of the experience gained at TMI.

POSITION: Radiation Protection Man
Florida Power & Light Co.
Ft. Pierce, FLA

DATES: June 76' to June 77'

LOCATION: St. Lucie I

DUTIES: Radiation Protection Man - Joined the Health Physics Department at St. Lucie Nuclear Unit #1 (850 (MWE PWR) at start of fuel modification program. This program consisted of removing all the fuel from the reactor and changing faulty poison pins. Provided HP coverage for all phases of this job. This included radiation/contamination surveys, air and gas sampling, writing Radiation Work Permits and providing constant HP coverage for all hot work done in containment building. This project completed after five months and plant went back on line. Routine duties then consisted of conducting required (license) surveys, air samples, instrument calibrations, procedure review, etc. We also coordinated work with operations/maintenance and provided HP coverage where needed.

POSITION: Lead Shift Tech
Nuclear Fuel Services

DATES: 1967 to June 1976

LOCATION: West Valley, N.Y.

DUTIES: Supervisor Technician - Waste Burial Site - Receive and monitor all radioactive waste from outside sources and our own waste. Determine which area of burial grounds to bury waste, oversee operation of burial and supervise six to eight operators. Maintain radiation and contamination control burial gounds, keep burial records and coordinate shipments.

Health Physics Coordinator - Supervised two junior technicians and provided HP coverage during our clean up effort following an incident in our fuel pool storage area. This task consisted of having an average of 10-15 contract personnel per shift who were indoctrinated, suited up and provided health physics coverage while working in highly contaminated areas. Dose rates were routinely 10-50R/hr.

Lead Shift Technician Responsible for all aspects of health physics functions during off shifts and weekends at fuel reprocessing plant. Duties included conducting radiation surveys, air sampling, and personnally entering and inspecting work areas before entry by operations/maintenance/contract personnel. Contract personnel averaged 20-30 men per shift. Determine dose rates, working times, shielding if required, respiratory and clothing requirments for work in grossly contaminated areas. Personnaly monitor all work in these areas to insure there were no overexposures.

EDUCATION:
Hamburg High School, Hamburg, New York 1957 - 1961
U.S. Army Administration School; Fort Harrison, Indiana
"Personnel Administrative Specialist Course"
University of Maryland; extension courses in math and history.
Labor Relations; plant level at Nuclear Fuel Services
Red Cross; several advanced first aid courses.

SPECIAL TRAINING/COURSES:

Radiation Protection Technology - Rockwell International (1 week)
Basic Health Physics - Harvard University (1 week)
Respiratory Protection Course - Los Alamos Lab. (3 days)
BWR Systems Course - General Electric (3 weeks)
BWR Design Technology - General Electric (3 weeks)
Instructors Course - PP&L (1 week)
Instructors Course - American Red Cross (multi-media, CPR)

PROFESSIONAL SOCIETIES:

Delaware Valley Society for Radiation Safety

CERTIFICATIONS:

Registered (1978) with the National Registry of Radiation Protection
Technologist (NRRPT) as a Radiation Protection Technologist.

ATTACHMENT 4

Experience with Radiation - P. Jaeger

Isotope	Amount	Location	Duration	Type of Use
Mixed fission, activated and corrosion products. Byproduct and Special nuclear material.	Trace to kilocurie	Nuclear Fuel Svs. West Valley, NY	9 years	Fuel Reprocessing
		Florida Power & Light St. Lucie I	1 year	Reactor H.P. Program

ATTACHMENT 5

RADIATION SAFETY TRAINING PROGRAM

Individuals working with licensed material will, as a minimum, receive Level I and Level II Health Physics Training or equivalent. To be qualified in Level I Health Physics an individual must demonstrate proficiency in the following areas as evidenced by passing a written exam. All training shall be conducted by Pennsylvania Power & Light personnel with lesson plans and instruction material approved by the Health Physics Supervisor. Retraining shall be conducted at least once every two years.

- o Requirements of 10CFR19.12
- o Radiation/Contamination (examples and controls)
- o ALARA (Corporate commitments, meaning and individual responsibility)
- o Personal Monitoring and Self-Survey Requirements
- o Radiological Control Signs and Posting Requirements
- o Radiological Control Signs and Posting Requirements
- o Radiation Exposure Control and Limits
- o Radiation Emergency Plan and Applicable Procedures
- o Prenatal Radiation Exposure

To be qualified in Level II Health Physics an individual must demonstrate proficiency in the following areas as evidenced by passing a written exam.

- o All Level I Areas Listed Above
- o ALARA
- o Contamination Control and Self-Survey Requirements
- o Fundamentals of Radioactivity
- o Radiation Dose Units and Biological Effects
- o Radiation and High Radiation Area Survey Techniques
- o Principles of Radiation Safety (time, distance and shielding)
- o Radiation Work Permits (RWP)
- o Use of Protective Clothing/Devices

LOW LEVEL RADWASTE HOLDING FACILITY
TABLE OF QUALITY ASSURANCE APPLICABILITY

System, Equipment or Structures	Testing	Engineering	Installation or Construction	Manufacturing
The Building	No	Yes	No	N/A
Foundations	No	Yes	No	N/A
Building Framework	No	Yes	No	No
Building Shell	No	Yes	No	No
Floor Pad	No	Yes	No	No
Internal Shield Walls/Roof	No	Yes	No	No
Doors	No	Yes	No	No
The Overhead Crane	Yes	Yes	No	Yes
Ventilation System	Yes	Yes	Yes*	Yes
Lighting System	Yes	Yes	No	No
Floor Drains System	Yes	Yes	No	N/A
Fire Detection System	Yes	Yes	Yes	Yes
Fire Protection System	Yes	Yes	Yes	Yes
Trash Restraining System	N/A	Yes	Yes	No
AC Power System	Yes	Yes	No	No
Radiation Monitoring System	Yes	Yes	Yes	Yes
Security System	Yes	Yes	No	No
Annunciator System	Yes	Yes	No	No
Grounding System	Yes	Yes	No	No
Communications System	Yes	Yes	No	No

*Auto Shutdown Feature Only.

ATTACHMENT 7

OPERATIONAL ACTIVITIES CONTROLLED BY PROCEDURE

Operational procedures for facility loading, unloading and inventory shall be developed. Activities such as cask loading and vehicle inspection shall be performed in accordance with existing plant procedures.

Health Physics procedures for container survey and inspection and vehicle survey will be covered in existing plant procedures.

12.5 HEALTH PHYSICS PROGRAM

12.5.1 ORGANIZATION

12.5.1.1 Introduction

The Health Physics program at Susquehanna SES is developed and implemented to evaluate and document plant radiological conditions and assure that every reasonable effort is expended to maintain personnel exposure as low as reasonably achievable (ALARA). The Health Physics Organization is displayed on Figure 12.5-1.

12.5.1.2 Responsibilities

The Health Physics Supervisor is responsible to the Superintendent of Plant. The Health Physics Supervisor is charged with the responsibility of providing the Superintendent of Plant with the information necessary to establish compliance with regulations pertaining to radiation safety, uniform enforcement of Station Health Physics requirements, and that every reasonable effort to minimize personnel exposures has been made. In addition, the Health Physics Supervisor is responsible for assuring the staff who implement the Health Physics program is trained and retrained in operational Health Physics principles applicable to Susquehanna SES.

The Health Physics Engineer is removed from the line function of day to day Health Physics activities to provide the latitude and time to develop and implement a station ALARA program that is responsive to plant status. The Health Physics Engineer's major responsibility is to provide the Health Physics Supervisor the information necessary to establish that every reasonable effort has been made to minimize personnel exposures.

The Health Physics Specialists assure implementation of the Station Health Physics program by supervision of routine and special survey and evaluation programs required by applicable regulations and procedures. The Health Physics Specialists' major responsibility is to provide the Health Physics Supervisor the information necessary to establish that survey and record keeping requirements are properly met and that plant activities receive appropriate Health Physics attention.

The Health Physics Monitors implement the Health Physics Program by performing routine and special surveys and providing Health Physics surveillance in accordance with Station Health Physics Procedures.

12.5.1.3 Authority

The Superintendent of Plant, ultimately responsible for all station activities including radiation safety, receives direct reports from the Health Physics Supervisor concerning the status of the Health Physics program. To assure uniform enforcement of Health Physics requirements, the Superintendent of Plant delegates his authority with respect to radiation safety to the Health Physics Supervisor. The Health Physics Supervisor has the authority to cease any work activity when, in his professional judgment, worker safety is jeopardized, or unnecessary personnel exposures are occurring.

The Health Physics Engineer has the independence and authority to assure that jobs are accomplished with minimal exposures. Independence from routine Health Physics activities allows the objectivity necessary for selective review and recommendation of work planning packages such as Radiation Work Permits (RWP), work requests, and special maintenance procedures, in accordance with station procedures. The Health Physics Supervisor delegates authority to the Health Physics Engineer to cease any work activity which is not being performed in accordance with As Low As Reasonably Achievable (ALARA) procedures. The Health Physics Engineer has the authority to conduct informal training and/or discussions with workers and supervisors regarding observed practices and ALARA recommendations.

The Health Physics Specialist has the authority to assure that jobs are conducted in accordance with Health Physics procedures and RWP requirements. The Health Physics Supervisor delegates the authority to the Health Physics Specialist to cease any work activity which is not being performed in accordance with RWP requirements.

In the absence of Health Physics Supervision, the authorities of the above positions may be delegated in accordance with Station Health Physics procedures to shift supervisors or assistant shift supervisors who have successfully completed Level IV training as described in Subsection 12.5.3.7. A member of Health Physics Supervision, or an individual meeting the minimum experience and qualification requirements of one or more of these positions, will be available for consultation regarding Health Physics and ALARA concerns.

The Health Physics Monitors implement Health Physics and RWP requirements under the direction of qualified supervision.

12.5.1.4 Experience and Qualification

The Health Physics staff, responsible for the Health Physics program at Susquehanna, will meet minimum experience and qualification requirements.

The Health Physics Supervisor will be an experienced professional in applied radiation protection at nuclear power plants or nuclear facilities dealing with radiation protection problems similar to those at nuclear power stations; familiar with the design features of nuclear power stations that affect the potential for exposures of persons to radiation; in possession of technical competence to establish radiation protection programs and supervisory capability to direct the work of professionals, technicians and journeyman required to implement such programs.

The Health Physics Supervisor will have a minimum of nine years of experience in applied radiation protection which is to include five years of professional experience. Four years of the experience requirement may be fulfilled by a bachelor's degree in a science or engineering subject. Three years of the professional experience will be in a nuclear power plant or nuclear facility dealing with radiological problems similar to those encountered in nuclear power stations. One year of professional experience may be fulfilled by a master's degree and two years may be fulfilled by a doctor's degree where course work related to radiation protection is involved.

The Health Physics Engineer will have a minimum of five years of experience in applied radiation protection in a nuclear power plant or a nuclear facility dealing with radiological problems similar to those encountered in nuclear power stations. Up to four years of the experience requirement may be fulfilled by related technical training or academic training in a science or engineering subject.

The Health Physics Specialist will have a minimum of four years of experience in applied radiation protection to include two years of experience in a nuclear power plant or a nuclear facility dealing with radiological problems similar to those encountered in nuclear power stations. A maximum of two years of the experience requirement may be fulfilled by related technical training or academic training in a science or engineering subject.

To at all times assure adequate manpower for Health Physics supervisory functions, the experience and qualification requirements of the Health Physics Engineer and Health Physics Specialist positions may be reduced on a temporary basis. The Superintendent of Plant will approve or disapprove such action following review of the Health Physics Supervisor's recommendations and justification.

The Health Physics Monitor will meet the qualification requirements of Subsection 12.5.3.7.

12.5.2 FACILITIES, EQUIPMENT & INSTRUMENTATION

12.5.2.1 Control Structure Facilities

The facilities, shown in Figure 12.5-2, are located at the central access to the Controlled Zone, elevation 676', for efficiency of operation. Self-survey personnel monitoring equipment, such as hand and foot, portal, or Geiger-Mueller (G-M) type friskers, will be located at the exit from the central access control area. Self-survey requirements will be administratively imposed prior to exiting the Controlled Zone.

12.5.2.1.1 Health Physics Facilities

The Health Physics office and workroom are located along the Central Corridor. Job planning and Radiation Work Permit coordination may be conducted through the pass-thru window of the workroom. Portable radiation survey instrumentation as well as air monitoring and sampling equipment, self-reading dosimeters, and miscellaneous Health Physics supplies will be stored in the Health Physics Office and Workroom area. Health Physics equipment used for routine counting of smears and air samples such as end window G-M counters, alpha and beta scintillation detectors, and/or gas flow proportional counters will be located in the Health Physics Office to prevent cross contamination of chemistry samples and minimize counting room background variations. Health Physics samples requiring gamma isotopic analysis and/or low level counting may be analyzed in the Counting Room. Health Physics use of the Counting Room will be coordinated with the Chemistry Group. The Health Physics office will be equipped with filing cabinets and bench tops for survey record keeping and RWP preparation.

Decontamination facilities at the central access control area consist of a main personnel decontamination area and auxiliary decontamination area. Auxiliary toilets and locker room are also provided. The personnel decontamination areas contain showers, sinks, and decontamination agents. Decontamination area ventilation is filtered through prefilter, High Efficiency Particulate Air (H.E.P.A.), and charcoal filters prior to exhaust through the Turbine Building vent. Sinks and showers drain to the chemical drain tanks for processing through the Liquid Radioactive Waste System. G-M type friskers will be located at these areas for personnel contamination monitoring.

Portable radiation survey instruments and self-reading dosimeters will normally be calibrated in the instrument calibration room using a calibration apparatus or appropriate neutron, beta and gamma sources, traceable to the National Bureau of Standards (N.B.S.). Sources will be stored in locked source containers and storage areas will be locked when not in use. Portable sources used to calibrate the area, process, and effluent radiation monitoring system as well as small solid and liquid sources used to calibrate the counting room instruments may be stored here. The calibration apparatus will utilize sources of varying strength and energy and/or varying thicknesses of shielding to provide a radiation field of known strength for use in calibrating portable radiation survey instruments. Provisions will be available for calibrating instruments in reproducible geometries. An N.B.S. calibrated condenser R-meter will be used to accurately measure radiation levels to determine source to detector distances for desired instrument calibration radiation levels. Record of calibration and repair for portable radiation detection instruments will be maintained on file. Instrument calibration may be performed by a qualified vendor. Records of such calibrations will be maintained.

The laundry room will be equipped with a washer and exhausted dryer to launder contaminated protective clothing/equipment. Facilities include a transfer table and stainless steel sorting table with exhaust hood. Protective clothing, laundered on site, will be selectively monitored for contamination, sorted and stored in the Protective Clothing area or Laundry Storage Room. Laundry detergents for protective clothing laundering, and other appropriate supplies will be stored in this area. The laundry table and dryer exhaust is discharged to the Turbine Building vent. Liquid laundry effluent will be collected in the Laundry

Drain Tanks for sampling and analysis prior to processing through the Liquid Radioactive Waste System.

The first aid room will contain a medical service center and toilet. Adequate supplies will be maintained to administer first aid for injuries requiring immediate attention. An inventory of first aid supplies will be performed at a frequency specified in station procedures to assure an adequate stock is maintained. Individuals requiring first aid will be checked by Health Physics personnel for wound contamination prior to administering first aid, when applicable.

The locker room contains approximately 100 lockers. Controlled zone workers may change from street clothing into plant clothing in the locker room. Personnel scheduled to work on Radiation Work Permit jobs may also change into clean protective clothing in the locker room. Adjacent to the locker room is a toilet and washroom, shower room and drying room.

Frequently occupied contaminated areas will have local change facilities with appropriate protective clothing supplies to minimize the spread of contamination from work areas.

Storage facilities will be located in the Central Access Control Area for storage of anti-contamination equipment, respiratory protective equipment, and miscellaneous Health Physics supplies.

The Emergency Equipment and Laundr Storage Room will be used for storage of protective clothing and emergency equipment.

12.5.2.1.2 Radiochemistry Facilities

Radiochemistry facilities consist of a sample room, radiochemistry laboratory, and counting room.

The sample room is shielded with 1'6" concrete walls and contains cabinets with worktops, sink, wall mounted storage cabinets and a fume hood assembly exhausted through prefilter, H.E.P.A. and charcoal filters to the Turbine Building vent.

The radiochemistry laboratory will be utilized for sample preparation and contains filtered fume hoods with service air connection, refrigerator, utility tables, sinks, cabinets, and drawers. The concrete walls range in thickness from 1' to 3'2". Fume hoods are exhausted through prefilter, H.E.P.A., and charcoal filters to the Turbine Building vent and the sinks drain to the Chemical Drain Tanks for processing through the Liquid

Radioactive Waste System. An emergency shower is accessible from both the radiochemistry and chemistry laboratories.

The Counting Room is constructed with 1'6" concrete walls to provide a low background environment for analysis of radiochemistry samples of station effluents and process streams. Instrumentation, such as a gas flow proportional counter, liquid scintillation counter, alpha and beta scintillators or crystals, end window G-M, and Germanium, Lithium drifted, Ge(Li) and/or Sodium Iodide (NaI), systems will be utilized for counting and/or analysis of radiochemistry samples.

12.5.2.1.3 Chemistry Laboratory

The chemistry laboratory contains an exhaust hood assembly with service air connection, drawers, worktops, sinks and laboratory equipment necessary for performing chemical analyses on non-radioactive plant materials. Station chemistry procedures will provide administrative control to assure that, under normal conditions, only non-radioactive materials are analyzed in the Chemistry Laboratory.

The laboratory exhaust hood discharges to the Turbine Building vent and the sinks drain to the neutralization tank for processing through the Liquid Radioactive Waste System.

12.5.2.2 Radwaste Building Facilities

The Radwaste Building elevation 646', 676' and 691'6" facilities are located as shown on Figures 12.5-3, 12.5.-4, and 12.5-5, respectively. Ventilation is filtered through prefilter and H.E.P.A. filters prior to exhaust to the Turbine Building vent. Drains discharge to the Chemical Drain Tank and Laundry Drain Tank for processing through the Liquid Radioactive Waste System.

12.5.2.2.1 Radwaste Building Elevation 646'0"

The facilities consist of a solid waste packaging, decontamination, and monitoring area, personnel decontamination facility and personnel decontamination facility adjacent to the laundry drain sample tank.

The solid waste packaging area contains an apparatus for remote capping operations, water spray nozzles for container decontamination, and a remote smearing device for monitoring package surface contamination.

The two (2) personnel decontamination facilities contain showers, sinks and appropriate decontamination agents.

12.5.2.2.2 Radwaste Building Elevation 676'0"

The facilities consist of an instrument repair shop, sample room, repair area including a welding area, personnel decontamination room, controlled zone shop including a washdown area, monitoring and final decontamination area, and storage area.

The Instrument Repair Shop will be equipped with an assortment of tools and equipment necessary for work on contaminated instruments.

The sample room provides a central location for sampling various Radwaste Systems. Samples will be analyzed by the Chemistry group to determine the final disposition of the effluents being processed.

The Repair Area will be used for maintenance and welding of contaminated equipment. Appropriate tools and equipment, including welding equipment, will be stored in this area.

The personnel decontamination room will be equipped as those described at the central access control area. It is conveniently located to facilitate the rapid removal of contamination from personnel working in the instrument repair shops, sample room, repair area, or controlled zone shop.

The controlled zone shop will be equipped similar to the station machine shop. Repair of contaminated components will be performed in this area. The adjoining washdown area will be used for decontamination of components and equipment to be worked on in the controlled zone shop and is constructed with a 6" curbing.

The monitoring and final decontamination area will be used for surveying and decontamination, if necessary, of radwaste containers prior to storage.

A storage area is available on the 676'0" elevation for storage of anti-contamination equipment, respiratory protective equipment, and miscellaneous Health Physics supplies.

12.5.2.2.3 Radwaste Building Elevation 691'6"

The Health Physics facilities consist of a contaminated laundry and storage area, clean laundry and storage area, personnel decontamination area, Health Physics area, and janitor's closet.

The contaminated laundry area contains two (2) washers and two (2) exhausted dryers, an exhaust hood and sink, miscellaneous tables and carts, and a storage area for laundry detergents used in protective clothing laundering, disinfecting agents for cleaning of respiratory protective equipment, and other supplies. One washer will be labeled and administratively controlled by station procedure for use in cleaning of respiratory protective equipment only. Contamination limits will be specified by station procedure for the respiratory protective equipment washer. A separate area within the laundry facilities will be used for maintenance and repair of personnel respiratory protective equipment. Equipment will be cleaned in the designated washer, dried, inspected and disinfected, wrapped in plastic or paper bags, and stored in the Emergency Equipment and Laundry Storage Room, Radwaste Building Health Physics Area, or other designated area. The laundry effluent will be discharged to the laundry waste storage tanks for sampling prior to processing through the liquid radioactive waste system.

The clean laundry area contains two (2) washers and two (2) exhausted dryers, a sink, and miscellaneous tables and carts. The facility will normally be used for laundering of station clothing not used as anti-contamination clothing. Laundry drainage will be collected in the laundry drain tanks for sampling prior to processing through the Liquid Radioactive Waste System.

The personnel decontamination area will be equipped as those at the central access control area.

The Health Physics area will serve as an office for Health Physics personnel and storage area for Health Physics supplies and equipment in support of Radwaste activities. Equipment and instrumentation will include portable survey instruments, air samplers, counting equipment, respiratory protection equipment, contamination control supplies and other related Health Physics supplies.

12.5.2.3 Reactor Building Facilities

The Reactor Building elevation 719'1" facilities are located as shown in Figure 12.5-6.

Each unit has two (2) emergency personnel decontamination stations and a washdown area.

The two (2) emergency personnel decontamination stations contain showers and sinks, a monitoring station with frisker and protective clothing, and appropriate decontamination agents.

The washdown area will be used for equipment decontamination prior to maintenance and is constructed with a six (6) inch curb.

Ventilation from these areas is filtered through prefilter, H.E.P.A., and charcoal filters prior to exhaust through the Reactor Building vent. Drains discharge to the Reactor Building Sump, Chemical Drain Tank, and Laundry Drain Tank for processing through the Liquid Radioactive Waste System.

12.5.2.4 Turbine Building Facility

The 729' elevation of the Turbine Building contains a washdown area, with 6" curbing for turbine blading and component decontamination prior to maintenance. Ventilation from this area is filtered through prefilter, upstream H.E.P.A., charcoal, and downstream H.E.P.A. filters prior to exhaust to the Turbine Building vent. Drains discharge to the Turbine Building Chemical Radwaste Sump for processing through the Liquid Radioactive Waste System.

12.5.2.5 Guard House Building

The Guard House building serves primarily as the access control to the restricted area of the plant. Personnel dosimetry will normally be issued and stored at this area. A portal monitor and/or G-M type frisker will normally be maintained at this location as the final monitoring area prior to leaving SSES.

12.5.2.6 Health Physics Equipment

12.5.2.6.1 Protective Clothing

Protective clothing will be worn in contaminated areas to prevent personnel contamination and aid in controlling the spread of surface contamination. Protective clothing available at Susquehanna SES will include: reusable coveralls and lab coats, disposable coveralls and lab coats, plastic suits, surgeons caps, cloth hoods, plastic hoods, splash shields, cotton glove liners, cloth gloves, rubber gloves, disposable gloves, gauntlet gloves, rubber shoe covers, rubber boots, and disposable shoe covers.

Protective clothing will be stored at the Protective Clothing Area, Emergency Equipment and Laundry Storage Room (Figure 12.5-2), plant laundries (Figure 12.5-6), and selected local change areas. After use, protective clothing will be laundered and monitored, or surveyed, packaged and shipped to an off-site vendor for laundering, or discarded as radwaste.

12.5.2.6.2 Respiratory Protective Equipment

Respiratory protective equipment will be used to minimize the intake of radioactive material when engineering controls are not practicable. The Respiratory Protection Program is described in Subsection 12.5.3.5.

Respiratory Protective Equipment utilized at Susquehanna SES will consist of National Institute of Occupational Safety and Health/Mine Equipment Safety Administration, (N.I.O.S.H./M.E.S.A.) approved air purifying respirators, self-contained breathing apparatus (pressure demand), pressure demand air line respirators, constant flow air line respirators, and constant flow air line hoods, welding masks and plastic suits. A variety of respiratory devices will be available to assure proper fit of the differing facial contours of personnel requiring respiratory protection. Sufficient quantities of respiratory protective equipment will be available to allow for the use, decontamination, maintenance, and repair of equipment.

Respiratory Protective Equipment will be available at the Emergency Equipment and Laundry Storage Room (Figure 12.5-2), and Radwaste Building Health Physics Area (Figure 12.5-3, 12.5-4 and 12.5-5). Respiratory Protective Equipment will be available for emergency use at the Emergency Control Center and Control Room. N.I.O.S.H./M.E.S.A. approved emergency escape devices will be placed at locations where the potential exists for an unexpected increase in radioactive or chemical airborne concentrations (such as the water treatment building and radwaste system). Fifteen (15) escape devices will also be located in the control room. If applicable, respiratory protective face pieces will be wrapped in plastic bags and stored individually to prohibit plastic deformation.

12.5.2.6.3 Air Sampling Equipment

Air sampling equipment will be available at the Health Physics office (Central Access Control Area, Figure 12.5-2) and the Health Physics Station (Radwaste Building, Figure 12.5-3).

Airborne activity levels will be determined by the use of continuous airborne monitors (CAMS), high and low volume portable air samplers, and breathing zone air samplers. Five (5) CAMs, five (5) high volume air samplers, five (5) low volume air samplers, and two (2) impactor attachments will be available for use at Susquehanna SES.

The CAM(s) can be used to measure particulate and gaseous activity. The air samplers can be used to measure particulate and iodine activity using the appropriate filtering medium. Particulate activity and particle size distribution can be determined using an impactor attachment. Volumes necessary for representative samples will be specified in Station Health Physics procedures. Filter media such as H.E.P.A. filters and charcoal cartridges will be stored at the Health Physics office and Workroom Area.

12.5.2.6.3.1 Continuous Air Monitors

CAMS will normally be used to sample selected areas of potential airborne concentrations. CAM sampling rates will be checked against calibrated rotometers or wet test meters on a quarterly basis and after pump replacement or repair. If CAM's are equipped with strip chart recorders or local readout, a base line sampling program will be completed prior to Unit 1 fuel load to allow estimation of naturally occurring isotopes' contribution to airborne background. CAM detector response to an appropriate check source will be performed on a quarterly basis. Manufacturer's recommended calibration or voltage plateau procedures will be performed on a quarterly basis. If applicable, operation of local alarms will be verified on a quarterly basis.

12.5.2.6.3.2 Portable Air Samplers

When possible, each portable air sampler will be monitored for flow rate as above. Devices utilizing flow meters will be checked against calibrated rotometers or wet test meters when practicable. Manufacturers' certification of flow rate will be utilized when physical flow measurements are not possible due to equipment design.

12.5.2.6.3.3 Breathing Zone Samplers

Ten (10) battery powered breathing zone samplers will be available for use in evaluating air concentrations that radiation workers may encounter. Personnel breathing zone samplers will be checked for flow rates as above if practicable. If design prevents physical flow measurement, manufacturer's certification of rated flow or accuracy of flow meter will be utilized.

12.5.2.6.3.4 Sampling Media

Particulate air concentrations will be sampled with H.E.P.A. sampling media or impactor attachments. Manufacturer's certification of collection efficiency will be utilized in calculations of airborne concentrations.

Surveys for radioiodine concentrations will normally utilize charcoal in a reproducible geometry such as a cartridge. If studies to determine various forms of radioiodine are required, reproducible geometries of materials such as cadmium iodide, 4-iodophenol, and silver zeolite may be used with charcoal in various configurations. If charcoal impregnated filter paper is utilized in equipment such as breathing zone monitors, manufacturers recommended sampling rates and times will be followed whenever practicable.

12.5.2.6.3.5 Special Air Sampling

Water bubblers, dessicant columns, or cold traps will be available for tritium air sampling, and gas sample containers (such as Marinelli containers) will be available for special gaseous air sampling.

12.5.2.6.4 Personnel Dosimetry

The Personnel Dosimetry program is described in Subsection 12.5.3.6. Self-reading dosimeters of five different ranges for use at Susquehanna SES are as follows:

Range (mR)	Normal Use	Number Available
0-200	Low Dose Accumulating Work	400
0-500	Intermediate Dose Accumulating Work	75
0-1000	High Dose Accumulating Work	50
0-5,000	Radiation Emergency Plan Use	25
0-100,000	Radiation Emergency Plan Use	25

A total of five (5) dosimeter chargers will be available at the Central Access Control Area Health Physics Office and the Radwaste Building Health Physics Station. Self-Reading Dosimeters will also be available at these locations. Dosimeters will be tested for calibration response charging drift, and leakage prior to initial use, and on a six month frequenc thereafter.

If vendor service is not utilized, approximately 1500 thermoluminescent dosimeters (TLD) will be available for use as the dosimetry of record. TLD(s) will be used for neutron, beta, and gamma exposure and will normally be evaluated on site. Approximately one hundred (100) extremity TLD devices will be available for issue when authorized by Health Physics personnel.

If applicable, a TLD reader will be installed and calibrated in accordance with vendor's instructions. Operation will be conducted by qualified individuals in accordance with approved station procedures. A performance testing program will be implemented to assure the TLD reader is properly calibrated and exposure information is accurate.

Internally deposited radioactive material will be evaluated with a whole body counter sufficiently sensitive to detect in the thyroid, lungs, or whole body a fraction of the permissible body/organ burden for gamma emitting radionuclides of interest. The whole body counter will be calibrated on a quarterly basis using phantoms and standard solutions of various radionuclides such as Co-60, Ce-137, and Ba-133. The detectors will be used in conjunction with a multi-channel analyzer and associated readout to obtain a permanent record. A vendor whole body counting system on or off site may be used as an alternative or supplement to a PP&L whole body counter.

Ten (10) battery powered personnel alarm dosimeters will be available for use when an audio alarm at a preset accumulated exposure or exposure rate may be advantageous. Personnel alarm dosimeters will be checked for accuracy on a quarterly basis and following any repair affecting calibration.

12.5.2.6.5 Miscellaneous Equipment

The following miscellaneous Health Physics equipment will be stored at various locations in the plant:

Contamination control supplies such as glove bags, containment tents, absorbent wipers, absorbent paper, rags, step-off pads, rope, plastic sheets, plastic bags, tape, contamination area signs, and protective clothing. Appropriate supplies may be assembled into kits and located throughout the plant to aid in the control of a contaminated spill.

Temporary shielding, such as lead bricks, lead sheets, and lead wool blankets, will be available to reduce radiation levels.

A trash compactor located on the 676' elevation of the Radwaste Building as shown in Figure 12.5-4. This location will provide adequate storage and access for loading at the rear truck access door of the Radwaste Building. The compactor and room will be vented through prefilter, H.E.P.A., and charcoal filters prior to exhaust to the Turbine Building vent.

A fitting apparatus for quantitative test fitting of individual involved in the Respiratory Protection Program. The apparatus will be a sodium chloride (NaCl) aerosol generator with flame photometer, or equivalent system, to measure airborne concentrations. Irritant smoke and/or isoamyl acetate will also be available to qualitatively test respirator fit.

12.5.2.7 Health Physics Instrumentation

Instruments for detecting and measuring alpha, beta, gamma and neutron radiation will consist of counting room, and portable radiation survey/monitoring instruments. All instruments will be subjected to operational checks and calibration to assure the accuracy of measurements of radioactivity and radiation levels. Primary and reference standards (utilizing, or prepared from, standards of Sr-90, Am-241, Cs-137, Co-60, H-3, and others, traceable to the National Bureau of Standards) will be used to maintain required accuracies of measurement. Background and efficiency checks of routinely used Health Physics counting equipment will be performed daily and these instruments will be recalibrated whenever their operation appears statistically to be out of limits specified in Station procedures. Routine calibrations will be performed on counting room instrumentation and radiation survey/monitoring instruments on a quarterly basis and after repairs affecting calibration. Efficiency curves for multi-channel analyzer systems will be determined on a semiannual basis using N.B.S. traceable sources for various reproducible geometries. Sufficient quantities of instrumentation will be available to allow for use, calibration, maintenance, and repair.

The instrumentation described in these Subsections may be replaced by equipment providing similar or improved capabilities.

12.5.2.7.1 Counting Room Instrumentation

Counting Room instruments for radioactivity measurements will include the following:

A 4096 channel analyzer, using a 3" x 3", 7% resolution Na I crystal, and a 5 Kev resolution (at 1 Mev energy full width half maximum peak) GE(Li) detector, for identification and measurement of gamma emitting radionuclides in samples of reactor primary coolant, process streams, liquid and gaseous effluents, airborne and surface contaminants.

One computer which can be interfaced with a pulse height analyzer; equipped with a teletype machine for entering instructions and printing results, a tape deck for entering programs and storing data, and an X-Y plotter for making graphs.

A low background gas flow proportional counter used for gross alpha and gross beta measurements of prepared samples.

A liquid scintillation beta counter used for measurement of tritium in reactor primary coolant, liquid and gaseous wastes, and gross beta activity other than tritium.

A NaI well crystal with counter-scaler or pulse height analyzer used for gamma analysis of various radionuclides in samples of reactor primary coolant, liquid and gaseous wastes, or prepared samples.

One beta-gamma counter-scaler, thin end window (2 mg/sq.cm, 2-inch diameter G-M) used for gross beta-gamma measurements of reactor primary coolant or prepared samples.

One alpha scintillator or semiconductor crystal used for gross alpha measurements of reactor primary coolant and prepared samples.

One beta scintillation counter-scaler used for gross beta measurements of reactor primary coolant and prepared samples.

12.5.2.7.2 Health Physics Office and Workroom Instrumentation

Health Physics instrumentation normally located in the Health Physics Office and Workroom will include the following instruments, or equivalent:

One (1) automatic and one (1) manual beta-gamma counter-scaler, thin end window (2 mg/sq.cm), 2 inch diameter G-M, used for gross beta-gamma measurements of removable contamination, air samples and nasal swabs.

An alpha scintillation or semiconductor counter-scaler used for evaluation of removable contamination, air samples and nasal swabs.

A low background gas flow proportional counter used for gross alpha and/or beta measurements of removable contamination, air samples and nasal swabs.

Ten (10) G-M beta-gamma survey meters (most sensitive range 0-.2 mR/hr., maximum range 0-2 R/hr., with internal probe) used for detection of radioactive contamination on surfaces and for low level exposure rate measurements.

Ten (10) ionization chamber beta-gamma survey meters 0-5 rem/hr. (0-5 mrem/hr. most sensitive range) used to cover the general range of dose rate measurements necessary for radiation protection evaluations.

Five (5) wide range ionization chamber beta-gamma survey meters (0-5 mR/hr. most sensitive range, maximum range 0-50 R/hr.) used for exposure rate measurements.

Four (4) remote monitoring (telescoping probe) G-M tube beta, gamma survey meters, 0-1000 R/hr, 0-2 mR/hr most sensitive range used for exposure rate measurements.

One (1) cadmium loaded polyethylene sphere, BF_3 tube, neutron Rem Counters 0-5 rem/hr (0-5 mrem/hr most sensitive range). The instrument is used to measure the dose equivalent rate due to thermal, intermediate, and fast neutron fluxes.

Two (2) alpha scintillation survey meters, 0-2M cpm (0-2K cpm most sensitive range) 30% efficiency used for measurement of alpha surface contamination.

One (1) thermal and fast BF_3 tube, paraffin moderated, neutron detectors, ("Lin-Log" decades of 0-500, 500-5,000, 0-50,000 and 50,000-500,000 cpm which is equivalent to 0-10,000 n/sq.cm/sec. for 1 Mev neutrons). Designed to detect thermal neutrons with detector removed from moderator and fast neutrons with detector inserted in moderator. An indication on the meter can be correlated with a known neutron flux and a known energy to obtain cpm/n/sq.cm - sec (flux) which in turn can be converted to mrem/hr.

12.5.2.7.3 Health Physics Radwaste Building Instrumentation

Health Physics Instrumentation normally located at the Health Physics Station in the Radwaste Building will include the following:

One (1) thin window (2 mg/sq.cm) G-M detector with counter-scaler for gross beta-gamma measurements on smears and prepared samples.

Five (5) Ionization chamber beta-gamma survey meters 0-5 rem/hr., (0-5 mrem/hr. most sensitive range) used for general survey work.

Two (2) G-M beta-gamma survey meters (most sensitive range 0-.2 mR/hr., maximum range 0-2 R/hr., with internal probe) used for detection of radioactive contamination on surfaces and for low level exposure rate measurements.

One (1) remote monitoring (telescoping Probe) G-M tube Beta, Gamma survey meter 0-1000 R/hr., 0-2 mR/hr. most sensitive range used for exposure rate measurements.

12.5.2.7.4 Personnel Contamination Monitoring Instrumentation

Personnel monitoring instruments consisting of friskers, portal monitors and a hand and foot monitor described below, will be used at the locations specified in Subsection 12.5.2.1:

Twenty-five (25) beta-gamma geiger count rate meters, 2mg/sq.cm window, 0-50,000 cpm range, adjustable audio and/or visual alarms. Gamma sensitivity for Co-60 is 3,500 cpm/mR/hr. Beta sensitivity (1" diameter source, 2 pi):

Sr-90/Yr-90 (E max. 0.54-2.2 Mev) = 45%

C-14 (E max. 0.15 Mev) = 10%

Used to detect contamination on personnel, materials, protective clothing, and equipment.

Two (2) portal monitors consisting of eight audio and/or visual alarmed G-M detectors to provide head to foot beta-gamma detection capability. Count rate alarm adjustable from 160-7000 cpm; counting time adjustable from 1 to 10 seconds.

One (1) audio and/or visual alarmed hand and foot monitor with ports monitored by G-M detectors for the hands and feet and an external probe for frisking the body.

Personnel contamination monitoring instrumentation will be calibrated on a quarterly basis or following repair, in addition to monthly source checks, to determine proper response and alarm operability.

12.5.2.7.5 Miscellaneous Health Physics Instrumentation

One (1) Condensor R-meter used to accurately measure radiation levels consisting of one (1) low energy chamber (0.025R) and three (3) high energy chambers (0.25R, 2.5R and 25R), which have been N.B.S. calibrated.

Other equipment used for Health Physics related functions will be maintained and controlled in accordance with station procedures. Such ewuipment may include:

One (1) pulse generator for calibraing pulse counting instruments. One (1) wet test meter, one (1) calibrated flow meter, one (1) velometer, and one (1) magnehelic pressure differential gauge.

The location of the area, process, and effluent radiation monitoring systems are described in Sections 11.5 and 12.3.

12.5.3 PROCEDURES

The Health Physics Procedure Program, as described in this section, will be implemented by Susquehanna SES Health Physics Technical, Operating, and As Low As Reasonably Achievable (ALARA) procedures in accordance with Section 13.5.

12.5.3.1 Control of Access and Stay Time in Radiation Areas

Physical and administrative controls will be instituted to assure the philosophy of maintaining personnel exposures as low as reasonably achievable (ALARA), as specified in Section 12.1, is implemented.

12.5.3.1.1 Physical Controls

12.5.3.1.1.1 Security Check Point

The security check point at the fence line perimeter will be a continuously manned physical control. Assigned personnel dosimetry devices and identification badges will be stored at this location when not in use. The security force will assure that all personnel who enter the station are issued appropriate badges and dosimetry in accordance with station procedures. A restricted area access list will be maintained at the security entrance. Any individual not on the access list must be accompanied by a person who is authorized unescorted restricted area access. The training, retraining and testing requirements for unescorted access are described in the Susquehanna SES Security Plan.

12.5.3.1.1.2 Security Doors

Although not primarily intended to control access to radiation areas, the security interlocked door system will assure only specifically trained and authorized individuals are able to open security entrances to the reactor, turbine, radwaste and diesel generator buildings. Security entrances will be locked or provided with continual surveillance. Details of security access control are contained in the Susquehanna SES Security Plan.

12.5.3.1.1.3 Posting and Locking

A third physical control will be the posting and locking, as appropriate, of radiation and high radiation areas. Radiation areas, as defined in 10CFR20.202(b), will be posted in accordance with 10CFR20.203(b). Plant areas that are routinely accessible will be surveyed in accordance with station procedures to determine radiation levels. In addition to recording the results of these surveys in accordance with 10CFR20.401(b), the radiation area signs will be updated by surveyors to reflect current conditions. Every reasonable effort will be expended to erect rope or other physical barriers to minimize inadvertent entry in radiation areas.

High radiation areas, as defined in 10CFR20.202(b), will be posted in accordance with 10CFR20.203(c). These signs will be routinely updated to reflect current conditions. Surveys of high radiation areas will be performed and results recorded as above. Each entrance to a high radiation area will be equipped with audible and/or visible alarms in accordance with 10CFR20.203(c)(2)(ii) or controlled in accordance with 10CFR20.203(c)(2)(i) or (iii).

In lieu of the above controls, high radiation areas in which the intensity of radiation is greater than 100 mrem/hr. but less than 1000 mrem/hr. may be barricaded and conspicuously posted as high radiation areas and entries controlled by issuance of a Radiation Work Permit. In addition, areas in which the intensity of radiation is greater than 1000 mrem/hr. will be provided with locked doors under the administrative control of the Shift Supervisor. Controls utilized at entrances will at all times permit egress from high radiation areas. Any individual or group of individuals permitted to enter such areas shall be provided with or accompanied by one or more of the following:

A radiation monitoring device which continuously indicates the radiation dose rate in the area.

A radiation monitoring device which continuously integrates the radiation dose rate in the area and alarms when a present integrated dose is received. Entry into such areas with this monitoring device may be made after the dose rate levels in the area have been established and personnel have been made knowledgeable of them.

An individual qualified in radiation protection procedures who is equipped with a radiation dose rate monitoring device. This individual shall be responsible for providing positive control over the activities within the area and shall perform periodic radiological surveillance at the frequency specified by Health Physics Supervision on the Radiation work permit.

Entrances to radiation areas and high radiation areas will be posted to reflect the requirement of a Radiation Work Permit (RWP) in accordance with limits specified in station procedures.

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12.5.3.1.1.4 Surveillance

When appropriate, surveillance of work activities will be provided to assure a positive control of access and stay time in radiation areas. Surveillance will be utilized when it is necessary to assure accurate record of working time as an assistance to the work group. In addition, it may be utilized for tasks involving large numbers of workers to assure control at the staging or entry point. Surveillance may also be provided for tasks in areas where conditions are unstable to assure that timely instructions to workers are issued.

12.5.3.1.2 Administrative Controls

12.5.3.1.2.1 Training

As specified in Subsection 12.5.3.7 personnel allowed unescorted restricted area access will receive Health Physics and related training in accordance with 10CFR19.12. During this training, the individual responsibility of utilizing proper Health Physics procedures in radiation areas will be emphasized. The methods utilized at Susquehanna SES to control access physically and administratively will be reviewed. Supervisory or other personnel responsible for the direction of workers may receive additional Health Physics training that will include guidance on work planning, controlling access, utilizing shielding and distance, and minimizing stay time in radiation areas.

12.5.3.1.2.2 Radiation Work Permit

The Radiation Work Permit (RWP) system described in Subsection 12.5.3.2 will be implemented to administratively control access and stay time in radiation areas. Work in radiation contamination or airborne levels greater than limits specified by station procedure will require the completion and approval of a RWP. For personnel or groups who must routinely enter specific areas as a necessary part of work duties, a Standing Radiation Work Permit (SRWP) may be issued in accordance with station procedures. Application for the SRWP will specify the need for routine entry, and expected occupancy per day, week or month. The SRWP application will receive a survey, review and approval process similar to that described in Subsection 12.5.3.2. Approved SRWP's will specify access and record keeping requirements as well as special instructions and maximum stay time. An approved SRWP will be considered in effect until conditions warrant a change and will be subject to immediate cancellation by the Health Physics Supervisor or designated alternate. Each SRWP will be reviewed on a monthly basis by a Health Physics representative.

12.5.3.1.2.3 Reporting Requirement

The individual responsibility to report, through proper chain of command, any violation of Federal Regulations or Station procedures will be emphasized during training sessions. Violation involving potential exposure of personnel to radiation or radioactive material will be reported through appropriate channels to the Superintendent of Plant or designated alternate. Appropriate action will be taken to prevent recurrence. Any individual who violates station procedures will be subject to disciplinary action.

12.5.3.1.2.4 Independent Review

A member of Health Physics Supervision will periodically observe activities in RWP areas to review the effectiveness of specified precautions. In addition, a member of Health Physics supervision may perform independent measurements of radiation levels to assure that areas are properly posted to indicate accurate readings. During these surveys, the reviewer will assure that every reasonable effort has been expended to minimize inadvertent entry in radiation areas.

12.5.3.1.2.5 Procedure Review

Health Physics procedures related to control of access and stay time in radiation areas will at all times be subject to review to assure every reasonable administrative effort has been expended to minimize personnel exposure. Recommended changes will be evaluated and, if necessary, a proposed change will be forwarded through appropriate review and approval channels. Approved changes requiring retraining will be forwarded to the Training Supervisor for scheduling and implementation. Health Physics procedures will be reviewed annually.

12.5.3.2 Assuring that Occupational Radiation Exposure (ORE) Will Be As Low As Reasonably Achievable (ALARA)

To effectively implement the corporate ALARA commitment as stated in Section 12.1, a station ALARA program will be utilized to assure that activities are performed with the lowest practicable personnel exposure. PP&L considers it necessary to apply the basic concepts of ALARA to internal and external exposure to assure proper emphasis on both modes of potential exposure. Procedures employed to implement the program described in this section will be subject to review and revision to assure the ALARA program is responsive to plant conditions.

12.5.3.2.1 ALARA Procedures Common to External and Internal Exposure

12.5.3.2.1.1 Training

Individuals allowed unescorted restricted area access will receive Health Physics training as described in Subsection 12.5.3.7. The individual responsibility of assuring that unnecessary exposure is to be avoided will be emphasized during Health Physics Training sessions.

As appropriate, individuals involved in potentially high dose accumulating jobs will receive pre-job training in exposure reduction techniques and controls applicable to the specific job.

12.5.3.2.1.2 Radiation Work Permit

Where radiation dose rates, anticipated accumulated exposures, airborne concentrations, or contamination levels exceed limits specified by station procedures, a Radiation Work Permit (RWP) will be initiated, completed and approved prior to commencement of scheduled work. As a minimum, station procedures will specify that scheduled work in Zone IV or higher (greater than 15 mRem/hr.) will require completion of a RWP.

Health Physics will evaluate the radiological conditions associated with the work to be performed. Based upon evaluation of proposed work and surveys, Health Physics will specify the appropriate protective clothing/devices, respiratory protective equipment, dosimetry, special samples, surveys, procedures, precautions to be taken, and expiration date

The RWP will be evaluated to assure the work will be performed from an ALARA approach. As appropriate, the evaluation will include review of proposed special tools, remote handling devices, access and communications needs, minimum manpower requirements, and work which may be performed outside of the RWP area to increase job efficiency and reduce personnel exposures. Potential incidents such as fires, spills, and equipment failure will be evaluated and proper response action discussed with radiation workers, when applicable. For high dose accumulating work, job preplanning will include Man-Rem estimates, comparison with similar jobs, establishing exposure goals, and simulated dry run, as appropriate, to increase job efficiency.

Radiological engineering controls will be used, when applicable, to minimize personnel exposures and prevent the spread of contamination and/or inhalation/injestion of radioactive material. Controls such as flushing of tanks and lines, use of temporary shielding, use of proper ventilation and purging, and properly filtered temporary exhaust will be considered. In addition, other effective methods of reducing man-rem exposures and potential intake of radioactive material will be considered. When airborne concentrations cannot be reduced below station limits, the use of respiratory protective devices will be considered.

The RWP will be approved and signed by the Health Physics Supervisor or designated alternate prior to commencement of work. RWP implementing process will be detailed in Station procedures.

A member of Health Physics supervision will selectively review completed and returned RWP's. Selection, on a variety of bases, of those RWP's which should receive a post operation evaluation will be made. Arrangements will be made, when necessary, to hold a de-briefing session with the responsible supervisor and/or workers. De-briefing and RWP review will be conducted when unexpected airborne concentrations, high man-rem exposures or high individual exposures are encountered. De-briefing will emphasize and analyze problems or difficulties encountered during performance of work. Alternative work methods will be discussed and if improvements are practicable, the responsible supervisor will initiate the review, approval and implementation process.

12.5.3.2.1.3 Work Scheduling

Use of the Radiation Work Permit system described in the previous section will establish a data base from which supervisory staff will be able to efficiently schedule workers. Health Physics will provide reports to supervisors that will indicate current individual exposure status to assist in work scheduling and assure individual exposures are minimized.

12.5.3.2.1.4 Reporting Requirements

Activities performed under an approved Radiation Work Permit must be carried out in accordance with the provisions of the RWP. Violation of RWP requirements will be reported to Health Physics and appropriate supervision. RWP violations that cause or threaten to cause unnecessary personnel exposure may result in disciplinary measures.

12.5.3.2.1.5 Internal Program Reviews

In an effort to provide more efficient methods of control, evaluation, and reporting, a member of Health Physics supervision will conduct reviews of the RWP program and procedures utilized to minimize personnel exposure. Results of internal reviews will be reported to appropriate levels of station management and the ALARA Review Committee. In addition, the Health Physics group will perform special reviews or studies requested by corporate committees to assist management in assuring that all aspects of the ALARA program are implemented.

12.5.3.2.1.6 Exposure Goals

On major dose accumulating job functions, total man-rem and/or man-MPC-hours (man-hours x ratio of measured airborne concentration to Maximum Permissible Concentration), exposure goals may be established prior to commencement of scheduled work. A general goal will be based on the lowest dose commitment recorded on jobs of similar nature. A general goal of equaling or bettering the lowest total worktime expended on jobs of similar nature may be utilized when airborne concentrations or dose rates are unpredictable or subject to variations. These general goals may be modified if work tasks are not identical or estimated if there is no available historical data. Significant deviations above established goals will be investigated by Health Physics and/or the responsible supervisor. Methods to improve performance on future jobs will be investigated and implemented, if appropriate.

12.5.3.2.1.7 Job Pre-planning

When applicable, tasks to be performed under the provisions of a Radiation Work Permit will be pre-planned. The responsible supervisor will assure that individuals selected to perform the task are familiar with the appropriate procedures to be employed. Supervision will also assure that, when applicable, a tool list to include special tools that will reduce exposures is completed and reviewed. When practicable, the responsible supervisor will observe dry-run procedure performance. This training may be observed by a Health Physics representative to make time study records as an aid in estimation of exposure or worktime goals. Special emphasis will be placed on job pre-planning for work in high radiation areas to maximize the use of temporary shielding and distance and minimize the work time.

12.5.3.2.1.8 Worker's Recommendations

An informal mechanism of soliciting worker's recommendations for improvement of job efficiency will be utilized to evaluate alternative work methods. Supervisors will encourage workers to present alternatives that will reduce work time in radiation areas and airborne concentrations. Responsible supervisors may consult with Health Physics during or following evaluation of a recommended change to assure that individual and group exposures will not be adversely affected. Changes in methods or equipment that are anticipated to improve efficiency and reduce exposure will be reviewed, approved and implemented in accordance with station procedures.

12.5.3.2.2 External ALARA

12.5.3.2.2.1 Dosimeter Evaluations

Each RWP issued to permit work or entry in a radiation field will require each worker to wear at least one pocket dosimeter. Time and exposure record log sheets will be posted with the Radiation Work Permit near the general work location. The dosimeter log sheets will be reviewed and running totals will be updated. The responsible individual will assure required data is properly recorded and will forward the final dosimeter log sheets and the completed RWP to Health Physics following work completion.

12.5.3.2.2.2 Categorization of Exposures

Exposures incurred on RWP tasks will be categorized by type of worker(s), work group, and job function. To facilitate collation of data, scheduled work functions will be coded and entered on the Radiation Work Permit, when applicable. In addition, plant system codes will be developed for RWP use. Whenever applicable, the equipment component number will also be recorded on the RWP. This system will allow an exposure history data base to be collected by equipment, system, and work function, and thus permit supervisors and Health Physics personnel access to definitive records when planning RWP tasks.

12.5.3.2.2.3 Work Time Evaluation

Recording entry and exit times will allow total man hours spent on particular tasks to be tabulated. Under favorable conditions, a comparison of exposure rate multiplied by man hours expended and measured dosimeter individual or group totals may be made to assure proper data entry and verify that no significant exposure rate changes occurred. The man hours expended will also be used as a data base to assist supervisory staff in planning work of similar nature.

12.5.3.2.2.4 Special Alarms and Instruments

The use of special alarms and instruments will be evaluated. Alarmed timers may be used to warn workers they are approaching the maximum allowable work time. Remote radiation monitors may be installed in the general work area to allow readouts in lower radiation areas. Portable survey instruments may be placed in the work area to allow workers to monitor changes in exposure rate. Radiation rate meters and integrating devices with audible pre-set alarms may be used to warn workers of unexpected radiation levels or dose accumulation.

12.5.3.2.2.5 Temporary Shielding

During the planning phase of RWP work, supervision will evaluate the use of temporary shielding. Care will be taken to assure that installation and removal of shielding will not cause larger man-rem total exposures than expected without its use. Every reasonable effort will be made to utilize temporary shielding, such as lead blankets, that can be quickly installed on initial entry and easily removed upon exit.

12.5.3.2.2.6 Special Tools and Apparatus

Every reasonable effort will be expended to assure special or modified tools are available for specific tasks. Available tools that will significantly reduce stay time in radiation areas and maximize distance from radioactive sources will be included on job procedure tool lists. Appropriate supervisors will review tasks to identify procedures that may be improved by modifications or replacement of tools and/or apparatus.

12.5.3.2.2.7 Non-RWP Work Review

Health Physics personnel will review radiation surveys to identify areas not normally meeting RWP criteria. These areas will be studied to locate those of the highest occupancy frequency and/or duration of stay time. Health Physics may make recommendations pertaining to shielding or occupancy limits. These recommendations will be implemented whenever practicable to assure that the exposures incurred in low dose rate areas are as low as reasonably achievable.

12.5.3.2.2.8 Administrative Limits

Administrative limits will be implemented by station procedures to maintain personnel exposures ALARA with respect to Federal Limits. Station exposure limits may be exceeded only after approval of the Health Physics Supervisor, or designated alternate. Unapproved exposure exceeding station limits will be investigated by Health Physics to identify causes and establish methods to prevent recurrence.

12.5.3.2.3 Internal ALARA

12.5.3.2.3.1 Engineering Controls

Minimizing airborne concentrations by utilizing practicable engineering or physical controls will assure that occupational exposures are as low as reasonably achievable. Airborne concentrations will be minimized by appropriate use of containment techniques, temporary exhaust mechanisms, and review of air flow patterns and velocities. Control and evaluation of airborne radioactivity is described in Subsection 12.5.3.5.

12.5.3.2.3.2 Respiratory Protection

When engineering controls are not practicable, the use of respiratory protection will be evaluated. Respiratory protection may be utilized to minimize the intake of radioactive material. The respiratory protection fitting and training program is described in Subsection 12.5.3.5.

12.5.3.2.3.3 Pre Work Air Surveys

When RWP requests indicate that work is required in airborne radioactive material concentrations, appropriate air samples will be taken. These samples will normally be of short-term, high volume nature in order to obtain representative data in the shortest period of time. Any area that is posted as an Airborne Radioactivity Area will be sampled and analyzed prior to commencement of scheduled work. Whenever practicable, surveyors will utilize respiratory protection and/or remote air samplers to minimize their exposures. When existing airborne radioactive materials are not specifically identified, the MPC (Maximum Permissible Concentration) for unidentified alpha and/or beta-gamma materials will be used for scheduling, criteria for respiratory protection, and calculations of anticipated MPC-hours of exposure.

12.5.3.2.3.4 Special Air Sampling

When applicable, air samples will be taken with portable breathing zone (BZ) air samplers equipped with appropriate filter media during work in actual or potential airborn radioactivity areas. The data from analyses of these air samples will be used to assist in future job planning and demonstrate that exposures to airborne material are as low as reasonably achievable. When portable BZ samplers are not practicable, temporary air samplers located close to the breathing zone of workers may be utilized.

12.5.3.2.3.5 Routine Air Sampling

Continuous air monitors will be placed in representative areas to sample those locations where airborne concentrations may be generated. These samplers will be periodically checked to verify proper function and assure that unexpected airborne concentrations are detected at the earliest possible time. The air sampling program is described in Subsection 12.5.3.5.

12.5.3.2.3.6 Control of Absorption and Ingestion

When work is scheduled on equipment or systems that contained or may contain radioactive liquids, every reasonable effort to prevent skin contact with radioactive solutions will be expended. Items such as plastic suits, rubber gloves and/or gauntlets, high rubber boots, face shields and hoods may be utilized as appropriate to the task to be completed.

Ingestion of radioactive materials will be minimized by assuring that adequate protective equipment is properly worn, removed, stored, laundered and surveyed. These physical controls in conjunction with administrative requirements and training in the areas of self-survey, prohibition of eating and smoking in contaminated areas and, decontamination techniques will assure that potential ingestion of radioactive material is minimized.

12.5.3.2.3.7 Control of Area and Equipment Contamination Levels

Contaminated areas and equipment will be decontaminated to as low a level, as practicable. Special emphasis will be placed on items that may be inadvertently touched by personnel and areas sufficiently contaminated so as to pose the potential for an airborne concentration. Supervisory staff will be responsible for assuring that work areas are maintained in a neat and orderly manner. The housekeeping practices employed will facilitate clean-up and decontamination efforts and thus minimize personnel stay time in radiation/contamination areas.

12.5.3.2.3.8 Airborne Exposure Evaluation

Exposures to airborne radioactive material will be tabulated to aid in work planning and demonstrate the effectiveness of the internal ALARA program. Air sample results in terms of a fraction or multiple of the maximum permissible concentration (MPC) for identified or unidentified isotopes multiplied by the work times will permit a running tabulation of individual and group MPC-hour exposures. When respiratory protection is employed, appropriate reductions of intake will be based on recommended protection factors. Subsection 12.5.3.5 describes the respiratory protection program.

12.5.3.2.3.9 Administrative Limits

To minimize potential intake of radioactive material in excess of Federal limits, station limits will be established. Airborne exposure or intake in excess of these limits may require work restriction, use of respiratory protection, or special in-vivo or bioassay studies.

12.5.3.3 Radiation Surveys

The Health Physics program will utilize a comprehensive system of radiation surveys to document plant radiological conditions and identify sources of radiation that contribute to occupational radiation exposure. The radiation survey program will be subject to evaluation by Health Physics supervision to assure that necessary data is collected while exposures to surveyors are as low as reasonably achievable.

12.5.3.3.1 Radiation Survey Program Controls

12.5.3.3.1.1 Record Review

A member of Health Physics supervision will review radiation survey records to assure that adequate readings are taken and properly recorded. If a need for additional data is noted, supervision will assure that such readings or supplemental surveys are taken and recorded. In addition, supervision will review data to assure that unwarranted readings that contribute to time spent in radiation areas are not taken. If appropriate, h Physics supervision will assure that proper corrective .es are taken.

12.5.3.3.1.2 Independent Reviews

To assure proper performance of job duties by surveyors, a member of Health Physics supervision will perform independent reviews which may include physical measurement of radiation levels in areas previously surveyed. Review data will be compared with survey records and posting of warning signs. The reviewer may accompany surveyors to observe and verify proper survey techniques. Deviations from approved Health Physics procedures or discrepancies in radiation measurements will be investigated and results reported to the Health Physics Supervisor or designated alternate. Appropriate corrective measures will be taken to prevent recurrence.

12.5.3.3.1.3 Surveyor Dose Evaluation

Every reasonable effort will be expended to assure that occupational radiation exposure to surveyors is maintained as low as reasonably achievable consistent with providing sufficient survey data required for minimizing total plant exposures. Surveyors' radiation exposure will be tabulated in accordance with the ALARA program described in Subsection 12.5.3.2. Health Physics personnel will be issued appropriate dosimetry to be worn during radiation survey work. Beginning and ending dosimeter readings will be recorded. Individual exposures incurred during the survey may be reviewed and compared with previous surveyor exposures. This dosimeter data will be updated to reflect group man-rem exposures incurred during radiation survey work. Analyses of exposures incurred during survey work will allow investigation and implementation of methods to control and minimize radiation exposure of surveyor personnel.

12.5.3.3.1.4 Surveyor Work Rotation

Every reasonable effort will be made to assure that surveyor exposure is evenly distributed by work assignment scheduling and rotation of Health Physics personnel. This rotation will allow comparison of surveyor performance, minimize individual exposures, and assure maintenance of familiarity with all areas of the plant.

12.5.3.3.1.5 Training

Training of radiation workers will aid in the reduction of man-hours expended in radiation fields. All station personnel requiring Level II Health Physics training as described in Subsection 12.5.3.7 will receive training in the types of radiation and methods of detection, self-survey and radiation rate survey. This training will include high radiation area survey techniques, data evaluation and special instrument operation. Retraining of station personnel requiring Level II Health Physics training will include the areas of radiation survey techniques and procedures.

Health Physics personnel will receive formal and on-the-job training in survey techniques prior to fuel load at Susquehanna SES. Special emphasis will be directed toward assuring that efficient high radiation area survey techniques are exercised by Health Physics personnel. Impromptu training sessions will be held as needed to assure state-of-the-art understanding or improved performance in areas where reviews have indicated the need for additional training.

Training sessions will emphasize the importance of collecting necessary data while exercising the factors of time, distance and shielding to minimize occupational exposures.

12.5.3.3.2 Radiation Survey Program

12.5.3.3.2.1 Instrument Selection

Health Physics procedures will describe the instrument type(s) to be utilized during radiation survey work. The surveyor will be required to enter instrument description(s) and identification number(s) on survey forms. Prior to performing a radiation survey, the surveyor will check the calibration status of the portable instrument(s) selected for use to assure not more than three months have elapsed since the last calibration. The instrument selected will be checked for battery strength, if applicable, and, in a reproducible geometry, at least one scale's response to known check source(s) will be verified. Instruments overdue for calibration will not be used for radiation survey work. Personnel will be instructed to report instrumentation suspected to be malfunctioning. A properly checked replacement or equivalent survey instrument will be utilized.

12.5.3.3.2.2 Routine Radiation Area Surveys

Each area on site found to produce a radiation dose rate such that an individual could receive 5 mrem in any one hour or 100 mrem in any five consecutive days will be conspicuously posted as a Radiation Area in accordance with 10CFR20.203. Every reasonable effort will be made to minimize inadvertent entries in such areas. The "Caution Radiation Area" signs posted at the boundaries will be updated to reflect the date of the latest survey. Whenever practicable, the signs will also reflect the general and maximum radiation levels within the area and any special conditions required for entry. Routine surveys of radiation areas will normally be taken to assure that each area is surveyed once per week. Areas subject to variations in radiation levels or increased time of occupancy may be surveyed on a more frequent basis, as appropriate. When reactor conditions are operationally stable, survey frequency in radiation areas may be reduced to spot checks at the boundaries to minimize Health Physics personnel exposures.

12.5.3.3.2.3 High Radiation Area Surveys

Each area on site found to produce a radiation dose rate equal to or greater than 100 mrem/hr. will be posted as a High Radiation Area and access will be controlled in accordance with Subsection 12.5.3.1. Routine surveys within such areas will not normally be performed with conventional portable survey instruments. Every reasonable effort will be made to utilize readings from the Area Radiation Monitoring (ARM) System to identify changes of radiation levels. Analyses of maximum and general radiation levels within high radiation areas will normally be performed with remote probe survey instruments, long reach survey instruments, retrievable TLD's or dosimeters. When practicable, findings from these surveys will be correlated to the appropriate ARM readings and reactor operating conditions. Correlation readings and/or perimeter readings will be taken to assure each high radiation area is surveyed once per week. In addition, radiation surveys will be taken at the entrances to high radiation areas on a frequency dependent upon occupancy in the vicinity and variation in radiation levels. Signs will be updated to reflect the latest readings. If surveys at entrances or ARM readings show significant change, additional surveys may be performed to update the readings within the area. In order to minimize occupational exposure of surveyors, high radiation area survey frequency may be reduced when operating conditions are stable.

12.5.3.3.2.4 Non-Radiation Area Surveys

Areas in and around the Controlled Zone not considered potential radiation areas will be selectively surveyed to establish that every reasonable effort has been made to keep measurable radiation levels as low as reasonably achievable. Portable instrument surveys will be performed so as to assure a representative number of non-radiation areas are surveyed once per month. Areas subject to significant change or variation will be surveyed on a more frequent basis as appropriate. Any area, not previously noted, that is found to be a radiation area will be promptly posted with a "Caution Radiation Area" sign and reported to Health Physics supervision. If the radiation dose rate cannot be eliminated, every reasonable effort will be made to minimize the dose rate and inadvertent entry. The area will be placed on the radiation area survey routine.

Areas within Susquehanna SES security fence not covered by portable instrument survey programs will be selectively monitored by area TLD's to document integrated exposures. Area TLD's will normally be changed and evaluated on a monthly basis.

12.5.3.3.2.5 Radiation Work Permit Surveys

RWP surveyors will wear self-reading dosimeters. The surveyor will enter the exposure incurred on the RWP request to assure this exposure category is included in the RWP job function as well as the system and/or equipment exposure totals.

A member of Health Physics supervision will screen incoming RWP requests to assure inclusion of special measurements or considerations. Special instructions may be developed or impromptu training performed to assure that necessary data is collected in the minimum of time.

12.5.3.3.2.6 Special Radiation Surveys

Special radiation surveys will be performed as requested by operating groups, regulatory agencies, or corporate committees. These survey requests will be coordinated by Health Physics supervision to assure the need for the survey justifies occupational exposure of surveyors. A member of Health Physics supervision may draft special instructions for performance of the survey and/or perform impromptu training sessions with surveyors. Emphasis will be placed on assuring that necessary data is collected in the minimum of time. Individual and man-rem exposure incurred during special surveys will be logged by job function, equipment and/or system.

12.5.3.3.2.7 Unit 2 Construction Surveys

During the start-up/operation phase of Unit 1 and the construction phase of Unit 2, routinely occupied areas in the proximity of Unit 1 will be surveyed on a weekly basis with portable instrumentation. Any area found to contain a dose rate such that if an individual were continuously present he would receive a dose in excess of 100 mrem in any seven consecutive days due to the operation of Unit 1 will be reported to Health Physics supervision. Special shielding, barricading or access control may be employed to eliminate or minimize the potential for personnel exposure. If such areas are identified, portable instrument survey frequency may be increased depending on potential for occupancy and degree of access control exercised.

In addition to portable instrument surveys a program of area TLD monitors will be used to supplement and verify instrument findings. These TLD's will be placed in representative locations of routinely occupied areas near Unit 1 and will normally be changed on a weekly basis. An investigation will be performed if, after natural background subtraction, administrative limits have been exceeded. Health Physics supervision will assure that areas monitored are representative of construction activities in progress.

12.5.3.3.2.8 Radiation Survey Records

Radiation surveys performed at Susquehanna SES will be documented in accordance with approved station procedures. A member of Health Physics supervision will review the record(s) completed by surveyors to assure proper data entry. The reviewer will initial and date the record and forward it for permanent filing.

12.5.3.4 Contamination Survey Procedures

A system of contamination evaluation will be utilized to minimize the spread of radioactive material. Evaluation of personnel, equipment and surface contamination will also be made to demonstrate the efficiency of engineering and procedural controls. In addition, the contamination survey programs will be evaluated to assure that surveyor exposures are as low as reasonably achievable.

12.5.3.4.1 Personnel Contamination Surveys

Evaluation of exposures due to personnel contamination will be conducted in accordance with Subsection 12.5.3.6.

12.5.3.4.1.1 Frisker Survey

G-M personnel friskers will be placed in strategic locations within the controlled zone. Every effort will be made to locate these instruments in as low a radiation background area as possible in order to maximize sensitivity. Personnel will be trained in the use of the instrument(s) and interpretation of the readings.

In the event of frisker malfunction, personnel will be required to notify Health Physics. Audible or visible alarms will be preset at a suitable point above background to minimize spurious alarms and maximize sensitivity. Limits will be conspicuously posted for instruments without automatic alarms.

Personnel contamination causing frisker alarm will require notification of Health Physics. Health Physics will take appropriate actions to minimize further spread of contamination, and direct appropriate decontamination of affected areas and personnel.

When personnel contamination is noted, a Health Physics investigation appropriate to the incident will be performed. A contamination incident found to have caused an intake of radioactive material will be promptly reported to appropriate supervision. When applicable, recommended methods to prevent recurrence will be forwarded to the Superintendent of Plant for concurrence and implementation by his directive.

12.5.3.4.1.2 Nasal Swab

Nasal swabbing procedures will be implemented as requested by Health Physics or when contamination exceeding station limits is detected on facial areas to qualitatively determine if inhalation of radioactive material occurred. Health Physics personnel will evaluate the swab as soon as practicable. Findings in excess of station limits will require nasal clearance, shower and scrubdown, a whole body count and/or bioassay, and a documented investigation and evaluation.

12.5.3.4.1.3 Ingestion Procedures

If contamination is detected in or on the mouth, a shower and scrubdown and a whole body count will be performed. Fecal and/or urine collection may be initiated to more accurately determine ingested amounts. All cases of ingestion will be investigated, evaluated, documented and reported to appropriate supervision and the Superintendent of Plant, and appropriate corrective measures will be taken.

12.5.3.4.1.4 Wound, Cut, Abrasion Surveys

To control inadvertent entry of radioactive material in wounds, cuts or abrasions, individuals will be responsible for bringing such matters to the attention of supervisors and/or Health Physics prior to work commencement. Supervisory personnel will assure that reported skin breaks are brought to the attention of the Health Physics group during job planning or RWP request. Health Physics will be responsible for assuring that skin breaks are properly protected prior to work commencement. Open wounds that cannot be adequately sealed will be sufficient grounds to restrict the worker from contamination work.

Any injury that may have caused contamination of a wound will require the worker to immediately exit the work area and report the incident to Health Physics and appropriate supervision. The wound will be flushed and surveyed with portable instrumentation. If contamination is detected in the wound, the Shift Supervisor may initiate the Susquehanna SES Emergency Plan in accordance with written Emergency Plan Implementing Procedures. If injury is sufficient to prevent the worker from moving or exiting the area, the Shift Supervisor will be immediately notified and the Emergency Plan will be initiated, if appropriate. Appropriate whole body counts and/or bioassays will be taken following any needed medical treatment.

12.5.3.4.2 Equipment Contamination Surveys

12.5.3.4.2.1 Contamination Zone Equipment Surveys

Movement of equipment from a contamination zone will require notification of Health Physics personnel. Fixed and removable contamination levels will be evaluated as appropriate and a clearance for removal will be issued in accordance with station procedures.

Routinely used tools may be permanently marked to indicate they are contaminated and will normally be stored inside well marked contamination areas. Repair or use outside contamination zones will require Health Physics approval. Permanently marked tools will be surveyed by Health Physics personnel as necessary and at the request of the appropriate supervisor. Contaminated items that cannot practicably be decontaminated will be covered with plastic or other material and appropriately posted.

12.5.3.4.2.2 Personal Item Surveys

Change-out procedures will require that individuals leaving a contamination zone perform surveys of personal items that may have become contaminated during work. Items such as dosimeters, TLD or badge holders, pens and pencils, will be scanned with a G-M frisker. Contamination noted on such items will be reported to Health Physics personnel. Additional surveys will be performed and the items decontaminated or discarded as radioactive waste as appropriate.

12.5.3.4.2.3 Protective Clothing Surveys

Reusable protective clothing and shoe covers used in contamination zones will be collected in recepticles at step-off areas and sent for laundering/decontamination. If clothing is cleaned at Station laundry facilities it will be removed from containers, sorted in an exhausted area of the laundry and scanned with a G-M detector to locate highly contaminated items that may require separate decontamination or disposal. Following washing and dryin , clothing will be re-surveyed to assure that items are within station limits. Records of the range of survey results before and after laundering will be maintained. Every reasonable effort will be expended to assure that clothing is maintained at as low a contamination level as practicable.

Protective clothing that is shipped off site for laundering will be prepared for shipment and labeled in accordance with applicable U.S. Department of Transportation (USDOT) regulations. Items returned from vendors will be spot checked with survey instruments to assure that residual contamination levels are less than applicable station limits. Records of survey results will be maintained for each shipment.

12.5.3.4.2.4 Respiratory Protection Device Surveys

Respiratory protective masks will be checked for contamination prior to cleaning and disinfection. Following decontamination and cleaning, masks will be checked for removable and fixed contamination levels prior to disinfection, storage and/or reissue. Survey results will be recorded.

Exterior surfaces of other protective devices, such as supplied air hoods and suits, self contained breathing apparatus and hoses, will be checked for contamination levels following job completion. Items other than face pieces that will routinely be reused in contamination zones may be bagged and labeled to reflect the latest survey findings.

12.5.3.4.2.5 Fixed Equipment Surveys

Routinely accessible plant equipment that may become inadvertently contaminated will be spot checked to assure items are less than appropriate station limits. Fixed equipment of this category found to exceed removable contamination limits will be wiped down and resurveyed. If decontamination efforts are not successful or if the item is prone to recurrent contamination it will be posted as "Contaminated". An equipment contamination list will be tabulated to assure items in this category are resurveyed. If an item is found not to be a recurrent contamination problem it will be removed from the survey list.

A representative number of smears will be taken on items such as door knobs and stair railings, to assure that other controls exercised are minimizing the spread of contamination.

12.5.3.4.2.6 Surveys Involving Receipt/Shipment of Radioactive Material

The security staff will be instructed to notify the Health Physics Supervisor or designated alternate upon arrival of shipments in excess of "Type A" quantities at the site. Shipping containers will be monitored for radiation and/or contamination in accordance with 10CFR20.205. Whenever practicable, the container will be monitored prior to removal from the vehicle. If removable contamination or radiation levels are found to exceed the limits of 10CFR20.205, the Superintendent of Plant or designated alternate will notify the final delivering carrier and the Nuclear Regulatory Commission (NRC) Inspection and Enforcement Regional Office.

When applicable, Health Physics Supervision will assure that, prior to leaving the site, exclusive use transport vehicle surface contamination and radiation levels are within limits specified in 49CFR173.

Station procedures will specify special procedures and precautions to be taken when opening packages containing licensed material, including instructions pertaining to specific types of shipments normally received at Susquehanna SES.

Radioactive material will be shipped in accordance with USDOT and NRC regulations. Station procedures will implement the applicable regulations with regard to proper packaging and labeling requirements. Appropriate removable contamination and dose rate surveys will be taken, records completed, and shipments labeled accordingly.

12.5.3.4.3 Surface Contamination Surveys

12.5.3.4.3.1 Controlled Access Areas

A smear survey program will be developed and implemented to assure that a representative number of routinely accessible surface areas within the controlled zone are checked for removable contamination. Special emphasis will be placed on survey of the clean side of established contamination zone step-off areas. Smears will be analyzed on appropriate counting equipment and records of results will be maintained in disintegrations per minute (dpm) per 100 sq.cm. If results indicate removable contamination exceeds station limits, the area will be posted as a contamination zone. The area will be decontaminated and resurveyed as soon as practicable. Area signs and barriers will be removed when surveys indicate that removable contamination is below station limits.

In representative areas where gamma background permits, surveys will be performed with portable detectors to establish the level of fixed contamination on normally occupied controlled zone surfaces. A fixed contamination survey will be performed prior to any sanding, chipping, welding, grinding and sawing, of potentially contaminated Controlled Zone surfaces.

12.5.3.4.3.2 Non-Controlled Zone Areas

Occupied plant areas outside the controlled zone will be surveyed to assure that a representative number of floor surfaces are checked for removable contamination. The exit areas from the controlled zone will receive special emphasis to minimize the spread of contamination. Smear survey, analyses and record keeping techniques will be as described above. Non-controlled zone areas found to have removable contamination levels exceeding station limits will be decontaminated and resurveyed.

12.5.3.4.3.3 Special Area Surveys

Lunch room facilities and vending machine areas frequented by controlled zone workers will be checked for removable contamination. Stoves, benches, table tops, and floor surfaces will be representatively smeared to assure minimal contamination in eating areas. Removable contamination in excess of non-controlled zone limits will be reported to Health Physics or

Shift Supervision and the area will be restricted from further use until decontaminated. Special emphasis will be placed on eating or cooking surfaces to assure that these items are as far below non-controlled zone limits as reasonably achievable.

Other specific areas will be checked for removable contamination to demonstrate the effectiveness of the contamination controls exercised within controlled zone areas. These areas include:

(1) Entrances to the control room and the Control Structure.

(2) The Guard House at the site perimeter.

(3) General floor areas of shower and locker room facilities.

Floor surfaces in areas that offer a repeated potential for contamination may be maintained as contamination zones to assure positive contamination control. In addition to the routine check outside step-off areas, a general survey of contamination levels inside the areas will be performed whenever practicable. Dose rates within the areas, frequency of occupancy, past survey results, and actual need for such surveys will be evaluated by Health Physics supervision when selecting established contamination zones to be surveyed. When area dose rates permit, every reasonable effort will be expended to minimize contamination levels.

12.5.3.4.3.4 Implementation, Review, and Reporting Practices

Contamination limits, general survey locations and survey frequencies will be specified in station Health Physics Procedures. Procedures will be subject to review by Health Physics Supervision to assure contamination survey implementation is responsive to plant status.

A member of Health Physics supervision will review records of contamination survey results to assure proper completion and adequate survey. In the event of contamination in excess of station limits, a member of Health Physics Supervision will be responsible for assuring that corrective measures are implemented and that further reports through appropriate channels are initiated if required.

12.5.3.5 Airborne Radioactive Material

Every reasonable effort will be expended to assure that material released as airborne concentrations within the plant is minimized. A sampling and analysis program will be utilized to determine airborne concentrations in representative numbers of routinely occupied areas. These routine measurements as well as special surveys, respiratory protection procedures and administrative procedures will be implemented to minimize airborne contamination and the potential intake of radioactive material.

12.5.3.5.1 Physical Controls

12.5.3.5.1.1 Air Flow Patterns

A survey program for determining air flow patterns within the controlled zone will be implemented prior to Unit 1 fuel load. After Unit 1 fuel load these surveys will be periodically performed to demonstrate that air flow patterns are toward areas of higher actual, or expected, airborne concentrations. Affected areas will be re-surveyed following ventilation modifications to assure proper air movement. Appropriate measures will be taken if flow patterns are found to be unacceptable.

12.5.3.5.1.2 Contamination Confinement

Contaminated items will be properly confined to prevent inadvertent airborne contamination. Such items will be sealed in appropriate material or stored in ventilated areas whenever practicable. When necessary, alternatives such as temporary tents or enclosures, storage in rooms or areas where air movement is away from occupied areas, or wetting of the item may be utilized to minimize airborne concentrations. Contaminated trash will be sealed in plastic prior to disposal wherever practicable. Every reasonable effort will be made to assure that contaminated trash recepticals are closed when not in use.

12.5.3.5.1.3 Air Exhaust

Exhaust of areas or items where airborne concentrations may be generated will be employed whenever practicable. Contaminated laundry sorting areas, trash compactors, fume hoods, and sampling stations are typical locations where air exhaust will be utilized. Exhaust flow rates or face velocities on such equipment will be verified periodically and after ventilation modifications to assure proper function. Items that may contain highly contaminated materials such as trash compactors or high level fume hoods will be equipped with a visual indicator or alarm to warn individuals upon loss of exhaust flow. Portable exhaust fans will be directly discharged to building exhaust whenever practicable. When discharge to building exhaust is not practicable the portable exhaust fan will be filtered to minimize airborne concentrations.

12.5.3.5.1.4 Posting and Locking

Accessible areas containing airborne concentrations exceeding the limits specified in 10CFR20.203 will be posted with a "Caution - Airborne Radioactivity Area" sign. Whenever practicable, access points to such areas will be locked or barricaded to reduce the risk of inadvertent entry.

12.5.3.5.2 Administrative Controls

12.5.3.5.2.1 Health Physics Review

All posted airborne radioactivity areas will be reviewed by a member Health Physics supervision on a quarterly basis. Methods to reduce existing airborne concentrations will be forwarded through appropriate channels for review, approval, and implementation. During the review, Health Physics Supervision will assure that every reasonable effort has been expended to reduce the risk of inadvertent entry in airborne radioactivity areas.

12.5.3.5.2.2 Health Physics Investigation

When an occurrence produces unusually high airborne concentrations in occupied areas, Health Physics Supervision will assure that an investigation appropriate to the incident is completed. The first priority will be evaluation and follow-up of personnel intake of radioactive material if applicable. The second portion of investigation will emphasize determination of the events leading to the release. Recommendations to prevent recurrence will be forwarded through appropriate channels for implementation.

12.5.3.5.2.3 RWP Procedures

Radiation Work Permit procedures, as described in Subsection 12.5.3.2, will be a primary administrative control of exposure to airborne radioactive material. Health Physics review prior to approval will assure that every reasonable effort is expended to minimize the production of, or reduce existing, airborne concentrations before work commencement.

12.5.3.5.3 Air Sampling Equipment

A description of the use, calibration methods and frequencies of specific air sampling equipment utilized at Susquehanna SES is contained in Subsection 12.5.2.

12.5.3.5.4 Airborne Concentration Sampling

12.5.3.5.4.1 Routine Sampling

Routine sampling in selected areas of potential airborne concentrations will be accomplished with continuous air monitors (CAM) or portable air monitors. CAM sampling media and detector will be selected as appropriate to the intended use of the device. CAM's will be routinely checked for proper operation. Abnormal readings or equipment malfunction will be reported through appropriate channels for investigation and/or repair. Alarms, if applicable, will be checked for operability during source check and calibration procedures. Fixed filter devices will be changed on a frequency specified by Health Physics procedures to assure optimum sampling time, meaningful results, and proper equipment operation.

12.5.3.5.4.2 Special Air Sampling

Records will be maintained to reflect the reason for the special surveys, device(s) and sampling media used and final results. The majority of special air samples will be taken as result of Radiation Work Permit requests and pertinent results will be recorded thereon.

12.5.3.5.5 Air Sample Evaluation

12.5.3.5.5.1 Particulate Initial Evaluation

A data sheet will be completed to reflect sample location, date, starting flow rate, starting time, sampler and collection media used, and collection efficiency. At completion of sampling, the date, time, and ending flow rate will be recorded. Air sample filters will be counted as soon as practicable following collection. Results will be recorded on an analysis form to reflect counter used, efficiency, counting time, background count rate, gross sample count rate, net sample count rate, and sample disintegrations per minute beta, and/or beta-gamma, and/or alpha. Sample disintegrations per minute divided by collection efficiency of the media, the number of disintegrations per minute per microcurie and the total volume of air sampled will yield the initial estimate of airborne concentration.

Prior to Unit 1 fuel load an air sampling program will be implemented to obtain a base line of information concerning naturally occurring radioactive concentrations. This data will enable development of an average beta to alpha ratio of naturally occurring airborne emitters. This "First Count Factor" may be utilized as an initial evaluation technique for low level particulate air samples.

12.5.3.5.5.2 Subsequent Particulate Evaluations

Every effort will be made to initially evaluate air samples as soon as practicable following collection. In instances where time delay before analysis in conjunction with suspected short lived isotopes is significant, repeated counts may be performed to obtain a decay curve. Extrapolation and subtraction techniques may be used to determine initial amounts and half lives of component isotopes.

When statistically possible, fixed filter samples may be gamma scanned with a NaI or Ge(Li) detector to identify gamma emitting isotopes. When this or other specific analyses are not practicable, the MPC for unidentified beta-gamma emitters will be used for exposure evaluation and procedural controls.

Other evaluations that may be utilized are beta absorption counting, radiochemical separations and analysis, and liquid scintillation counting.

12.5.3.5.5.3 Gaseous Evaluations

Airborne radioiodine samples will normally be collected on charcoal canister or cartridges, and analyzed on a NaI or Ge(Li) detector. Appropriate standard sources in reproducible geometries will be used to obtain efficiency curves for analysis equipment. Photopeak areas, counting efficiency and branching ratios for the identified isotope will be utilized to calculate the amount of deposit. Collection efficiency and total volume of sampled air will be incorporated to calculate airborne concentrations.

Airborne tritium samples will normally be collected in water bubblers or dessicant columns. Collection and counting efficiencies and total air volume will be verified and used to calculate airborne concentrations.

If analyses of restricted area air for noble gases are required, sample chambers may be analyzed with NaI or Ge(Li) detectors to identify isotopes.

12.5.3.5.6 Respiratory Protection

The respiratory protection program will assure that personnel intake of radioactive material is minimized. The respiratory protection program will not be used in place of practicable engineering controls and prudent radiation safety practices. Every reasonable effort will be expended to prevent potential, and minimize existing, airborne concentrations. When controls are not practicable, or conditions unpredictable, respiratory protective devices may be utilized to minimize potential intake of airborne radioactive material.

The Susquehanna SES Respiratory Protection Program will ensure that the following minimum criteria are met: written standard operating procedures; proper selection of equipment, based on the hazard; proper training and instruction of users; proper fitting, use, cleaning, storage, inspection, quality assurance, and maintenance of equipment; appropriate surveillance of work area conditions, consideration of the degree of employee exposure to stress; regular inspection and evaluation to determine the continued program effectiveness; program responsibility vested in one qualified individual and an adequate medical surveillance program for respirator users.

12.5.3.5.6.1 Training and Fitting

The training and fitting program is described in Subsection 12.5.3.7.

12.5.3.5.6.2 Written Procedures

The Respiratory Protection Program and program responsibility will be implemented by Health Physics procedures. Applicable Health Physics Procedures will include as a minimum: description of equipment; information regarding issuance, maintenance, selection, use, and return of equipment; and training techniques. Information regarding air sampling and bioassay programs will be referenced.

12.5.3.5.6.3 Selection of Equipment

The need for respiratory protection will be determined by Health Physics personnel after evaluation of appropriate engineering controls. Airborne concentrations will be determined by air sampling methods described in this section. The hazard will be evaluated and applicable respiratory protection prescribed in accordance with the RWP evaluation, review, approval and implementation process as described in Subsection 12.5.3.2.

12.5.3.5.6.4 Issue and Use

For normal work situations, respirators will be issued after approval of a Radiation Work Permit. Individuals' I.D. cards or qualification list will be utilized to assure only the specific models approved for the worker are issued. After issuance, the worker will be responsible for proper use and storage of the device. Approved Health Physics procedures for use, storage and return of respirators will be reviewed during qualification training sessions.

12.5.3.5.6.5 Contamination Surveys

Whenever practicable, respirators will be scanned with a G-M detector during final change-out procedures upon completion of assigned work. Detectable radiation levels on inside surfaces of the device will require notification of Health Physics. The inside surfaces will then be monitored for removable contamination and/or a nasal swab will be taken. Based upon findings and suspected isotopes, further evaluations may be required in accordance with Subsection 12.5.3.6.

12.5.3.5.6.6 Cleaning, Decontamination, Inspection, Maintenance, Disinfection and Storage

Station procedures will specify cleaning, decontamination, survey, inspection, maintenance, disinfection and storage requirements. Respirators will normally be used no more than one day (shift) prior to return for cleaning survey, inspection, maintenance if needed, and disinfection. In no case will a respirator be issued to another individual prior to cleaning survey, inspection and disinfection. Respiratory face pieces will be washed, dried, surveyed for removable and fixed contamination levels, inspected, disinfected and stored in accordance with approved Health Physics procedures. Inspection of masks will emphasize defects at critical points, proper function of attached fittings and valves, and proper shape of face-piece. Simple maintenance and repair will be performed as necessary. Maintenance and repair of regulators will be performed only by specially trained and qualified individuals. Masks ready for reissue will be stored in plastic or paper bags in cabinets or containers. Every effort will be made to assure proper storage of masks to prevent deformation of face piece parts.

12.5.3.5.6.7 Quality Controls

Inspection and testing of new equipment will be implemented by written station procedures to detect instances of human error or defective materials in the manufacture and assembly of the devices. Procedures will specify the components of each device to be inspected and the acceptance criteria when applicable.

Respiratory protection devices will be routinely inspected and tested after cleaning and maintenance. The inspection will be performed to detect any damage or defects caused by cleaning or wear. Testing will normally consist of a positive or negative pressure leak detection test or exposure to a challenge atmosphere.

In accordance with station procedures periodic checks of items in storage will be performed to ensure that the facepiece rubber is not taking a set, rubber parts are not hardening or deteriorating, sorbent canisters have not exceeded their shelf life, and breathing air or oxygen cylinders contain sufficient pressure.

12.5.3.5.6.8 Surveillance of Work Area Conditions

For work conditions involving respiratory protection, air sampling surveillance will provide an estimate of the potential intake of airborne radioactive materials and resulting exposure of the individual worker, indicate the continuing effectiveness of existing controls, and warn of the deterioration of control equipment or operating procedures.

The periods of time respirators are worn continuously and the overall durations of use will be kept to a minimum by procedural controls and work surveillance. Workers will be instructed of provisions to leave areas where respirator use is required for relief in case of equipment malfunction, undue physical or psychological distress, procedural or communication failure, significant deterioration of operational conditions, or any other condition that might require such relief.

12.5.3.5.6.9 Evaluation of Program Effectiveness

Respirator failures, evidence of respirator leakage, and equipment problems encountered will be investigated by Health Physics. Problems will be solicited from respirator users during activities such as plant safety meetings and training sessions. Proposed changes to prevent recurrence or improve efficiency of the program will be forwarded through appropriate channels for review, approval and implementation.

Respiratory protection will be evaluated by bioassay results correlated with air sampling results as described in Subsection 12.5.3.6. Evidence of a rise in exposure levels attributable to inhalation will be investigated.

12.5.3.5.6.10 Medical Surveillance

Prior to participation in the Susquehanna SES Respiratory Protection Program, individuals will be evaluated by competent medical personnel to ensure they are physically and mentally able to wear respirators under anticipated working conditions.

Individuals involved in the respiratory protection program will also be re-evaluated as part of their routine company physical with respect to physiological and psychological factors affecting respirator use.

Details of the medical surveillance program will be specified in Station Health Physics Procedures.

12.5.3.5.7 Handling of Radioactive Material

12.5.3.5.7.1 Unsealed Material

Radioactive material in liquid form will be stored in sealed or vented/ exhausted containers whenever practicable. When containers are opened to atmosphere and generation of airborne concentrations is possible, they will be opened in fume hoods, exhausted areas, or in locations where air movement is away from workers' breathing zones. Whenever practicable, liquid radioactive material will be transported in unbreakable containers or in a secondary container to collect material in case of breakage.

Gaseous radioactive material will be similarly stored and opened. Transport of gaseous samples will be done in sealed, gas tight containers.

Solid articles that are sufficiently contaminated with particulate and/or volatile material so as to pose a potential airborne hazard will be handled and stored as described in Subsection 12.5.3.5.1.2.

Protective clothing, respiratory protection, and special precautions will be specified by Health Physics procedures and/or Radiation Work Permit for handling unsealed material.

12.5.3.5.7.2 Sealed Materials

Sources will be stored in appropriate shielded containers when not in use. Containers and storage locations will be posted to reflect contents and radiation levels. Sources will be locked inside containers or containers will be locked in a storage location when not in use. When sources produce a whole body or contact radiation dose rate greater than limits established by station procedure, a Radiation Work Permit will be completed and approved prior to use. Remote devices such as forceps, tongs or manipulators will be used whenever practicable or required by Radiation Work Permit.

| Licensed sealed sources will be monitored for leakage to assure that storage or use is not causing the spread of contamination or airborne radioactive material. When monitoring of the source capsule is not practicable, removable contamination surveys will be performed at places on the container or source holder where contamination might be expected to accumulate if the source were leaking. Samples will be analyzed on counting equipment appropriate to the source material and records of results maintained. Frequency, materials to be tested and record keeping requirements of NRC license or Technical Specifications will be implemented by Station Health Physics Procedures. Sealed sources found to be leaking will be sealed from atmosphere whenever practicable and/or stored in ventilated areas until disposal or repair.

12.5.3.6 Personnel Monitoring

12.5.3.6.1 External Personnel Monitoring

Personnel monitoring devices will be used at Susquehanna SES to evaluate external occupational exposure to radiation sources. Exposure information will be used for work function exposure evaluation, job planning, reporting requirements, incident analysis, and an indication of the effectiveness of ALARA practices.

12.5.3.6.1.1 Personnel Dosimetry Evaluation

Routinely used personnel dosimetry will include self-reading dosimeters, thermoluminescent dosimeters (TLD), and/or film badges. Individuals requiring personnel dosimetry will be instructed in the purpose and use of the devices, station administrative exposure limits, and interpretation of self-reading dosimeter readings. Appropriate dosimetry devices will be issued in accordance with station procedures implementing 10CFR20.202.

Dosimetry will normally be worn on the front of the body between the neck and the waist in a clearly visible location. When appropriate, dosimetry will be issued and worn on the extremities. Dosimetry may be wrapped in plastic to prevent the contamination of personnel monitoring devices when entering contaminated areas.

As described in Subsection 12.5.3.2, self-reading dosimeter results will be used for specific ALARA job exposure evaluation as well as to indicate current individual exposure status. Dosimeters of appropriate ranges will be available for use during work in radiation and high radiation areas. Radiation workers will be responsible for checking their dosimeter readings when working in RWP areas. The frequency of dosimeter checking will depend upon the nature of the job and whole body dose rates, and will be discussed with the radiation workers during RWP pre-job planning. Off-scale or malfunctioning dosimeters will be reported to Health Physics. Health Physics personnel will evaluate the occurrence, issue a replacement dosimeter and test the suspect dosimeter for response and leakage. Dosimeters will be removed from service if the calibration response, 24 hour leakage, or changing drift test results exceed acceptance criteria specified in the Station Health Physics procedures.

Self-reading dosimeters will normally be used to monitor gamma exposure only. They may be used to determine neutron dose equivalent in a mixed radiation field provided the neutron dose equivalent rate and gamma exposure rate at the point of personnel exposure are known from separately made determinations; the neutron-to-gamma ratio is essentially constant during the period of personnel exposure; and the degree of response of the dosimeter to the neutron flux density is known. Methods of evaluation of dosimeter readings to determine neutron dose equivalent will be specified in Station Health Physics procedures. When neutron dose equivalent is determined from self-reading dosimeters, it will be added to the whole body gamma dose equivalent.

TLD devices will normally be used as the dosimetry of record. Personnel TLD(s) will normally be evaluated on a monthly basis or more frequently as determined by Health Physics Supervision. The data obtained from TLD's will be evaluated to determine dose equivalents. Gamma TLD chip readings indicate the dose equivalent to be attributed to whole body. Appropriate correction and quality factors will be applied to neutron chip readings to determine the neutron dose equivalent. Neutron and gamma doses will normally be added together to yield the whole body dose equivalent. Appropriate correction factors will be applied to the Beta TLD chip readings to determine the beta dose. The beta dose will normally be added to the whole body dose equivalent to determine the skin dose equivalent. When appropriate, the skin of whole body dose equivalent will be added to the gamma dose equivalent, determined by issued extremity monitoring devices, to determine total extremities' dose equivalent. For individuals who do not utilize extremities devices during a calendar quarter, the skin of whole body dose equivalent will be assigned as extremities' dose equivalent.

If film badges are used as the dosimetry of record, the service will be purchased from an outside vendor and evaluated by the vendor on a monthly basis or as specified by Health Physics Supervision. A program will be implemented to verify film badge accuracy. Film badge results will be evaluated and categorized according to whole body, skin of the whole body, and extremity dose equivalent. Film badges may be used to determine neutron dose equivalent when the effects of image fading, low sensitivity, and masking in high gamma fields are not critical.

Personnel exposures will be accumulated and evaluated against applicable station and federal limits by Health Physics personnel.

12.5.3.6.1.2 Administrative Exposure Control

| Administrative exposure limits will be established and implemented by Health Physics procedures to assure the limits of 10CFR20.101 are not exceeded and personnel occupational exposures are maintained ALARA.

12.5.3.6.1.3 Methods of Recording and Reporting

Designated supervisors will receive reports of their employees' accumulated exposures for use in RWP job planning and scheduling. Updates of exposure totals will be compiled from self-reading dosimeter readings. Unapproved exposures exceeding station limits will be reported to the Superintendent of Plant and appropriate supervision, and investigated by Health Physics to identify causes and establish methods to prevent recurrence.

Occupational radiation exposure received during previous employment will be used in preparation of individuals' Forms NRC-4, or equivalent. When an individual's occupational exposure history cannot be obtained, the values specified in 10CFR20.102(c)(1) will be used. Records used in preparing Form NRC-4, or equivalent, will be retained and preserved until the NRC authorizes disposition.

Records of the radiation exposure of all individuals issued personnel dosimetry in accordance with 10CFR20.202 will be maintained on Form NRC-5, or equivalent. Exposures will be tabulated for periods not exceeding one calendar quarter. A separate record will be completed when it is necessary to enter information for exposure to the extremities or skin of the whole body. Records of radiation exposure received during employment at Susquehanna SES will be maintained indefinitely or until NRC authorizes disposal.

Reports of exposure to radiation or radioactive materials will be made to individuals as specified in 10CFR19.13. When reports of individual exposure to radiation or radioactive material are made to the NRC, the individual(s) concerned will also be notified. This notice will be forwarded to the individual(s) at a time no later than the transmittal to the Commission and will comply with 10CFR19.13.

A report of the individual's exposure to radiation or radioactive material incurred while employed or working at Susquehanna SES will be furnished to the NRC in accordance with 10CFR20.408 and to the individual upon termination of employment or work assignment at Susquehanna SES.

A personnel monitoring information report will be submitted, in accordance with 10CFR20.407, within the first quarter of each calendar year. As part of a routine annual operating report, personnel exposure information will be submitted within the first quarter of each calendar year. It will include a tabulation of the number of station, utility, and other personnel (including contractors) receiving exposures greater than 100 mrem/yr. and associated man-rem exposure according to work and job functions. It will also include for each outage or forced reduction in power of over 20 percent of design power level, where the reduction extends for greater than four hours, a report of radiation exposure associated with the outage which accounts for more than 10 percent of the allowable annual values.

In the event of an exposure in excess of 10CFR20.101 limits, Health Physics Supervision will investigate the event and document the description of the occurrence; conditions under which the exposure occurred; names of personnel involved and amount of exposure received; action taken at time of occurrence; recommendations for corrective measures and means of implementation to prevent a similar occurrence.

In the event of an unauthorized exposure in excess of station administrative limits, Health Physics Supervision will investigate the event to determine the cause(s). Recommendations for corrective measures will be forwarded for review, approval, and implementation in accordance with station procedures.

Reports of overexposures at Susquehanna SES will be submitted to the NRC and the individual(s) involved in accordance with 10CFR19.13 and 10CFR20.405. Reports will also be forwarded to appropriate committees for review and recommendation for follow-up action.

12.5.3.6.2 Internal Radiation Exposure Assessment

When engineering controls are impracticable and airborne concentrations exceed station limits, trained individuals will be equipped with properly fitted respirators. Internal exposure evaluation will be utilized to determine the effectiveness of the Respiratory Protection Program and evaluate suspected intake of radioactive material. The Respiratory Protection Program is described in Subsection 12.5.3.5. Whole body counting and/or bioassay techniques will be used to compare the quantity of radioactive material present in the body to that quantity which would result from inhalation for 40 hours per week for 13 weeks at uniform airborne concentrations specified in Appendix B, Table 1, Column 1, 10CFR20.

12.5.3.6.2.1 Bioassay Methods

Whole body counting will be used to qualitatively and quantitatively identify radionuclides deposited in the body which emit penetrating radiations. Depending upon the physical construction and geometry of the whole body counter, sensitivity of the detector(s), and biological factors, concentrations of radionuclides may be detected in the whole body, thyroid, lung, or wounds. The whole body counter will be set up and calibrated and/or utilized in accordance with Subsection 12.5.2.

Urine analysis may be conducted to identify the presence of pure alpha or beta emitters in extracellular body fluids. Under favorable circumstances, with a full 24-hour sample and further analyses, the amount of radionuclides may be qualitatively and quantitatively determined. Results may be utilized to substantiate in vivo analyses findings.

Fecal analysis will normally be used to evaluate intake of non-transportable (i.e. insoluble) material and provide evidence of the clearance of such material from the lungs. When it is suspected that a nontransportable radionuclide has been inhaled, the total amount excreted in feces during the succeeding few days may be used to estimate the amount initially deposited in the lungs. Standard lung models recommended by International Commission on Radiological Protection (ICRP) may then be used to evaluate the amount inhaled.

Dose commitment for internal deposits may be estimated by calculating the amount of airborne radioactive material inhaled, based on airborne radioactive material measurements, exposure times, standard lung models and breathing rates.

12.5.3.6.2.2 Administrative Controls

Records, approved station procedures, program reviews, and investigation will assure proper administrative control over the internal personnel monitoring program. Reviews of the internal personnel monitoring program and investigations of individual cases of suspected or known intakes will be performed and documented by Health Physics Supervision and reported to appropriate committees.

12.5.3.6.2.3 Criteria for Participation or Selection

Selection of personnel and frequency of routine whole body counting and bioassay analyses will be implemented by Health Physics Procedures.

The following is a guideline for participation in special whole body counting and/or bioassay analyses:

(1) Personnel evaluated by means of a nasal swab as having contamination in the nasal passages in excess of limits specified in Health Physics Procedures.

(2) Personnel suspected to have ingested a detectable level of radioactive material, or absorbed a detectable level of radioactive material through a wound or break in the skin.

(3) Personnel physically present without respiratory protection, or those experiencing respirator failure, in a concentration resulting in greater than 40 MPC-Hours exposure in any seven consecutive days may be counted. An evaluation will be performed in accordance with 10CFR20.103 and whole body, lung, or thyroid counting will be performed if calculations show potential deposit of greater than the Minimum Detectable Activity (M.D.A.) of the counter for long lived isotopes.

The following is a guideline for selection of personnel for special, non-routine urine analysis:

(1) When there is suspicion of an intake of a beta or alpha emitter only.

(2) In conjunction with non-routine fecal analysis.

In addition to the above criteria, personnel may be required to submit urine samples to evaluate clearance rates of radioactive material identified by special or routine whole body counts, or as directed by Health Physics Supervision.

Fecal sampling and analysis will normally be done on a non-routine basis as designated by Health Physics Supervision. Fecal analysis may be done as a follow up on whole body or lung counts.

12.5.3.6.2.4 Evaluation and Reporting

Identifiable deposits will be evaluated against the criteria of 10CFR20.103 assuming conservative conditions and time frames with respect to the time of intake. Reports will be generated when internal deposits indicate greater than 40 MPC-hours exposure in any seven consecutive days. The reports will be reviewed by appropriate supervision and maintained on file subject to NRC inspection. Reports of overexposure will be completed and submitted to the NRC when it is determined a quantity greater than specified in 10CFR20.103 has been inhaled.

Whole body dose commitment resulting from internal deposits exceeding station limits will be calculated and included on the individual's Form NRC-5 or equivalent.

Specific organ counting may be performed if appropriate. Organ content may be assigned using whole body measurements and ICRP-2 recommended fractions and clearance times, when organ counting is not possible. Dose commitment to blood forming organs, gonads,

IMAGE EVALUATION
TEST TARGET (MT-3)

150mm

6"

whole body or eyes resulting from deposits in other organs may be calculated using Medical Internal Radiation Dose Committee (MIRD) equations. Whole body dose commitment resulting from internal deposits exceeding station limits will be calculated and included on the individual's Form NRC-5.

12.5.3.7 Health Physics Training Programs

Health Physics Training Programs will assure that personnel, who have unescorted access to the restricted area, possess an adequate understanding of radiation protection to maintain occupational radiation exposures as low as reasonably achievable. Special training/retraining will be administered upon recommendation of the Superintendent of Plant or Health Physics Supervisor. Record keeping and training scheduling will be performed by the Training Supervisor or designated alternate.

12.5.3.7.1 Program Controls

12.5.3.7.1.1 Management Review

Management will formally review Health Physics Training Programs once every three (3) years. Consideration will be given to workers' suggestions and instructors' comments. Management will evaluate the program's influence on maintaining radiation exposures as low as reasonably achievable. The review will be documented and comments/changes will be recorded and incorporated into the training program when applicable.

12.5.3.7.1.2 Health Physics Training Program Review

Health Physics Training Programs will be reviewed by Health Physics Supervision and pertinent committees to assure implementation of ALARA philosophy. Recommendations for improvements to training programs will be forwarded through appropriate channels for review, approval, and implementation.

12.5.3.7.1.3 Access Control

An access control list will be compiled and maintained. The list will specify personnel qualified for unescorted access to the

Restricted Area by having met the requirements of Level I Health Physics Training and appropriate plans and procedures. A listing specifying individuals' retraining dates will be maintained. A copy of the access list will be maintained at the security guard house.

During appropriate training sessions, individuals whose job duties do not require entry in radiation, contamination, or RWP areas will be informed of the reasons they are denied access to such areas.

12.5.3.7.1.4 Retraining/Replacement Training

To assure individual proficiency in Radiation Protection practices, retesting will be performed on a yearly basis. Retraining will be performed every two (2) years or as recommended by the Superintendent of Plant. Scheduling, records, and test results will be maintained by the Training Supervisor or designated alternate. Individuals changing job classification will receive training of the level required by their new job classification.

Training/retraining will be administered, under the direction of the Training Supervisor or designated alternate, to candidates for Nuclear Regulatory Commission (NRC) operating licenses and those holding NRC licenses. The Training Supervisor or designated alternate may request the Health Physics Supervisor to provide instruction on selected Health Physics topics.

12.5.3.7.2 Training Programs

12.5.3.7.2.1 Level I Training

All persons allowed unescorted access to the restricted area will, as a minimum, receive Level I Health Physics training. To be qualified in Level I Health Physics an individual will demonstrate proficiency in the following areas as evidenced by passing a written examination:

Requirements of 10CFR 19.12

Radiation/Contamination (examples and control)

ALARA (Corporate commitments, meaning and individual responsibility)

Personnel Monitoring and Self-Survey Requirements

Radiological Control Signs and Posting Requirements

Radiation Exposure Control and Limits

Radiation Emergency Plan and Applicable Procedures

Prenatal Radiation Exposure

12.5.3.7.2.2 Level II Training

Level II Health Physics Training will normally be administered to individuals who have successfully completed Level I and require access to Radiation Work Permit Areas. The need for such training will be evaluated and scheduled by the Training Supervisor, or designated alternate. Level II training will be administered to provide radiation workers with an adequate knowledge to effectively cope with job situations while maintaining radiation exposures as low as reasonably achievable. The individual will demonstrate proficiency in the following areas as evidenced by passing a written examination:

ALARA (applicable procedures)

Contamination Control and Self-Survey Requirements

Fundamentals of Radioactivity

Radiation Dose Units and Biological Effects

Radiation and High Radiation Area Survey Techniques

Principles of Radiation Safety (Time, Distance and Shielding)

Radiation Work Permits (RWP)

Use of protective clothing/devices

12.5.3.7.2.3 Level III Training

Level III training will emphasize special applications of ALARA practices and will normally be directed at supervisors of radiation workers. ALARA training in the planning of radiation work permit jobs will include man-rem reviewing techniques, methods for reducing personnel exposures, and other areas recommended by the ALARA Review Committee and Health Physics supervision. In addition, effective methods of improving work efficiency, such as mock-up situations, dry-runs, and maintenance oriented photographs for job planning will be discussed.

12.5.3.7.2.4 Level IV Training

Level IV training will emphasize ALARA and Health Physics aspects of the RWP review process discussed in Subsection 12.5.3.2. The training will be directed at qualifying members of Shift Supervision for RWP review and approval authority in the absence of Health Physics Supervision.

12.5.3.7.2.5 Respiratory Protection Training Program

Individuals and their supervisors requiring access to areas where respiratory protection will be utilized will complete the Respiratory Protection Training Program. The instructor will be a qualified individual with a thorough knowledge and considerable experience regarding the application and use of respiratory protective equipment and the hazards associated with radioactive airborne contaminants.

Training will include lectures, demonstrations, discussions of pertinent station procedures, and actual wearing of respirators to become familiar with the various devices utilized at Susquehanna SES. The program will include as a minimum: discussion of the airborne contaminants against which the wearer is to be protected, including their physical properties, MPC's, physiological action, toxicity, and means of detection; discussion of the construction, operating principles, and limitations of the respirator and the reasons the respirator is the proper type for the particular purpose; discussion of the reasons for using the respirators and an explanation of why more positive control is not immediately feasible, including recognition that every reasonable effort is being made to reduce or eliminate the need for respirators; instruction in procedures for ensuring that the respirator is in proper working condition; instruction in fitting the respirator properly and checking adequacy of fit; instruction in the proper use and maintenance of the respirator; discussion of the application of various cartridges and canisters available for air-purifying respirators; instruction in emergency action to be taken in the event of malfunction of the respiratory protective devices; review of radiation and contamination hazards, including the use of other protective equipment that may be used with respirators; classroom and field training to recognize and cope with emergency situations; and other special training as needed for special use.

Individuals will be required to don the device(s) that may be used, perform appropriate pressure tests for leak detection, and be exposed to a challenge atmosphere. If a quantitative test device is available, it will be utilized to quantitatively measure and record leakage. If leakage exceeds the devices rated protection factor and retests confirm this, the individual will not be approved to use the device. If quantitative testing is not practicable or unavailable, qualitative tests such as irritant smoke or isoamyl acetate may be used as a challenge atmosphere. Detection of odor will be considered a fitting failure. After successful completion of training and fitting programs, appropriate records will be maintained to assure individuals are issued only the approved type and model of protective device(s). These records will reflect expiration dates. Individuals will receive retraining and reconfirmation of respirator fit on an annual basis. Related records will be maintained by the Training Supervisor or designated alternate.

12.5.3.7.2.6 Health Physics Monitor Initial Training Program

A Health Physics Training Program will be administered to applicants for the position of Health Physics Monitor under the direction of the Health Physics Supervisor or designated alternate. The content of instruction will depend upon the experience and qualifications of the applicant with course content outlined in approved station procedures. Applicants with Health Physics experience may be waived from participation in part or all of the initial monitor training program. All applicants must demonstrate their proficiency by successfully completing the Monitor Qualification Examination.

The initial training program will cover a period of approximately one (1) year for the applicant lacking Health Physics experience. The formal training may include instruction by outside consultants, and participation at operating reactor facilities in addition to on the job training, in-house instruction and examinations. The following is an outline of the Initial Monitor Training Program:

Introduction to Health Physics, (General topics: Mathematical computations, Basic Atomic and Nuclear Physics, Radiation and Radioactive Decay, Isotope production and disposal, Reactor Fundamentals).

Health Physics Course (General topics: Radiation and Contamination Surveys and Control, Posting Requirements, ALARA Applications, Respiratory Protection, Protective Clothing, Health Physics Procedures, Decontamination of Personnel and Equipment, Air Monitor Operation and Results Interpretation, Health Physics Record Keeping, Appropriate Station Plans and Procedures, Applicable Regulations and Limits, Radiological Emergency Monitoring Program, Radiation Work Permits (RWP), Health Physics Job Coverage, Personnel Monitoring)

BWR Health Physics (General Topics: BWR Systems, BWR Outage/Refueling, BWR Operational Health Physics)

Review and Monitor Qualifying Examination

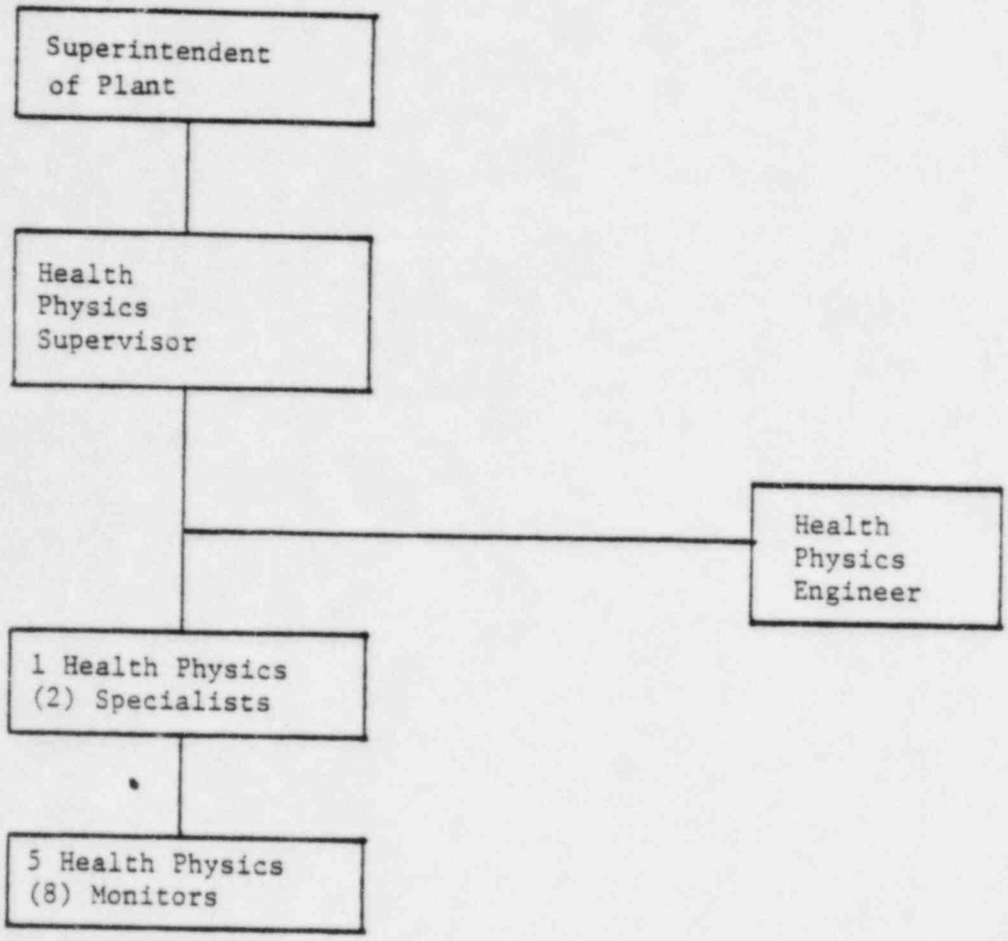
Health Physics Supervision will review the applicant's proficiency as displayed during the training programs, examinations and the monitor qualification examination. The successful candidate will be assigned the responsibilities of Health Physics Monitor.

12.5.3.7.3.7 Health Physics Monitor Retraining Program

All Health Physics Monitors will receive a retraining review on an annual basis. The purpose of the review will be to strengthen the monitor's understanding of Health Physics applications and state of the art Health Physics technology. Review will consist of formal and/or informal training sessions that will include topics similar to those described in the Health Physics course above. One method of evaluating the monitor's competence in several areas may be the presentation of a hypothetical work situation problem requiring demonstration of Health Physics knowledge in a logical progression.

Areas not covered by the problem solving process will be evaluated by means of written and/or oral examinations. Records of training sessions and examinations will be forwarded to the Training Supervisor. An evaluation will be performed to identify areas where supplementary retraining may be necessary. Informal sessions will be held with the monitor by a member of Health Physics Supervision to discuss areas of individual concern and additional retraining needs.

Health Physics Monitors will be subject to all or any portion of the retraining process when deemed necessary by the Health Physics Supervisor or designated alternate based on job performance. Monitors may also request additional training in areas of individual interest. A member of Health Physics Supervision will evaluate such requests and, if appropriate, administer specialized informal training to suit individual needs. In this case, the monitor's performance will not be subject to formal, documented evaluation.



Note: Numbers in parenthesis are the combined Unit 1 and Unit 2 staffing.

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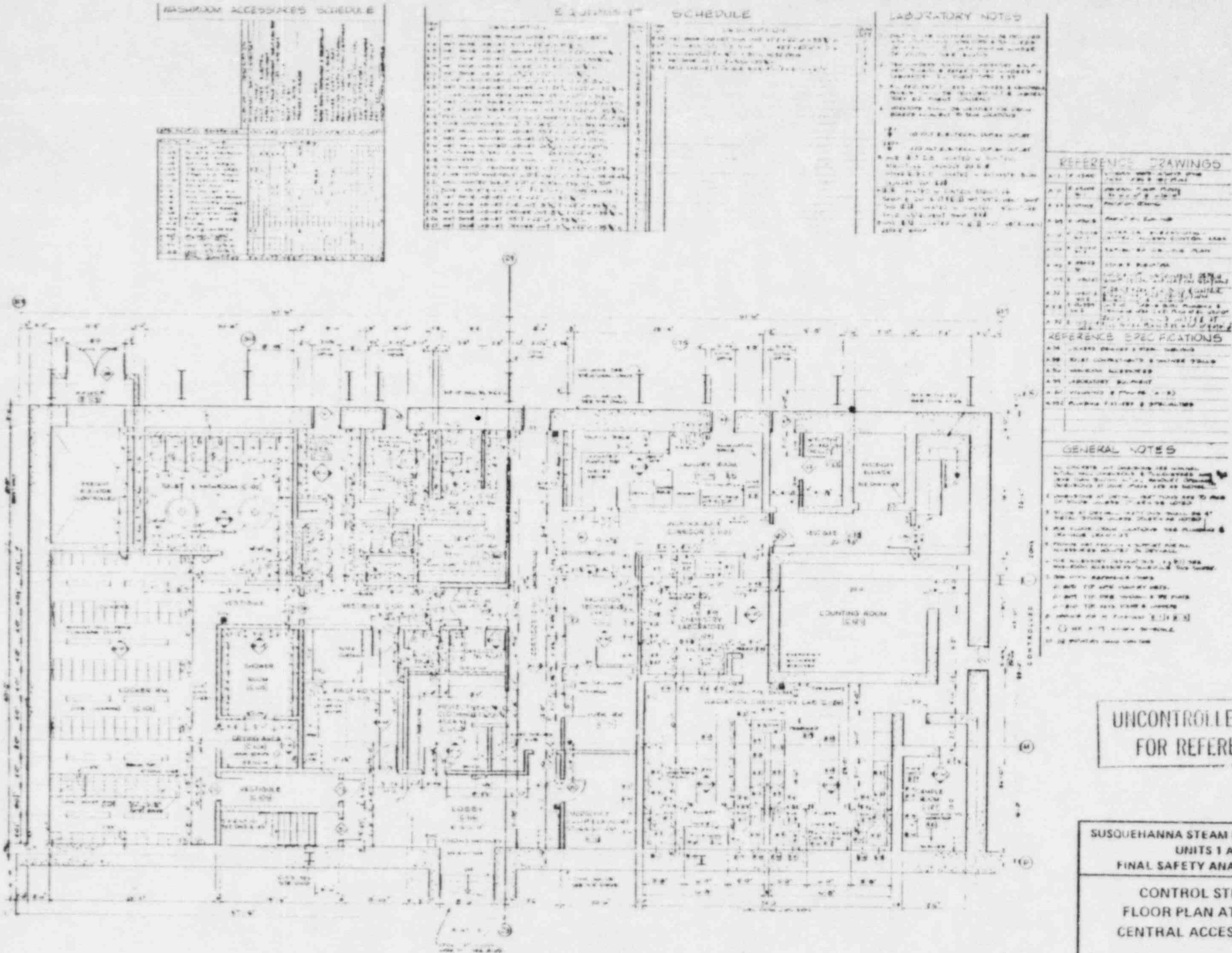
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 AND 2
FINAL SAFETY ANALYSIS REPORT

HEALTH PHYSICS ORGANIZATION

FIGURE 12.5-1



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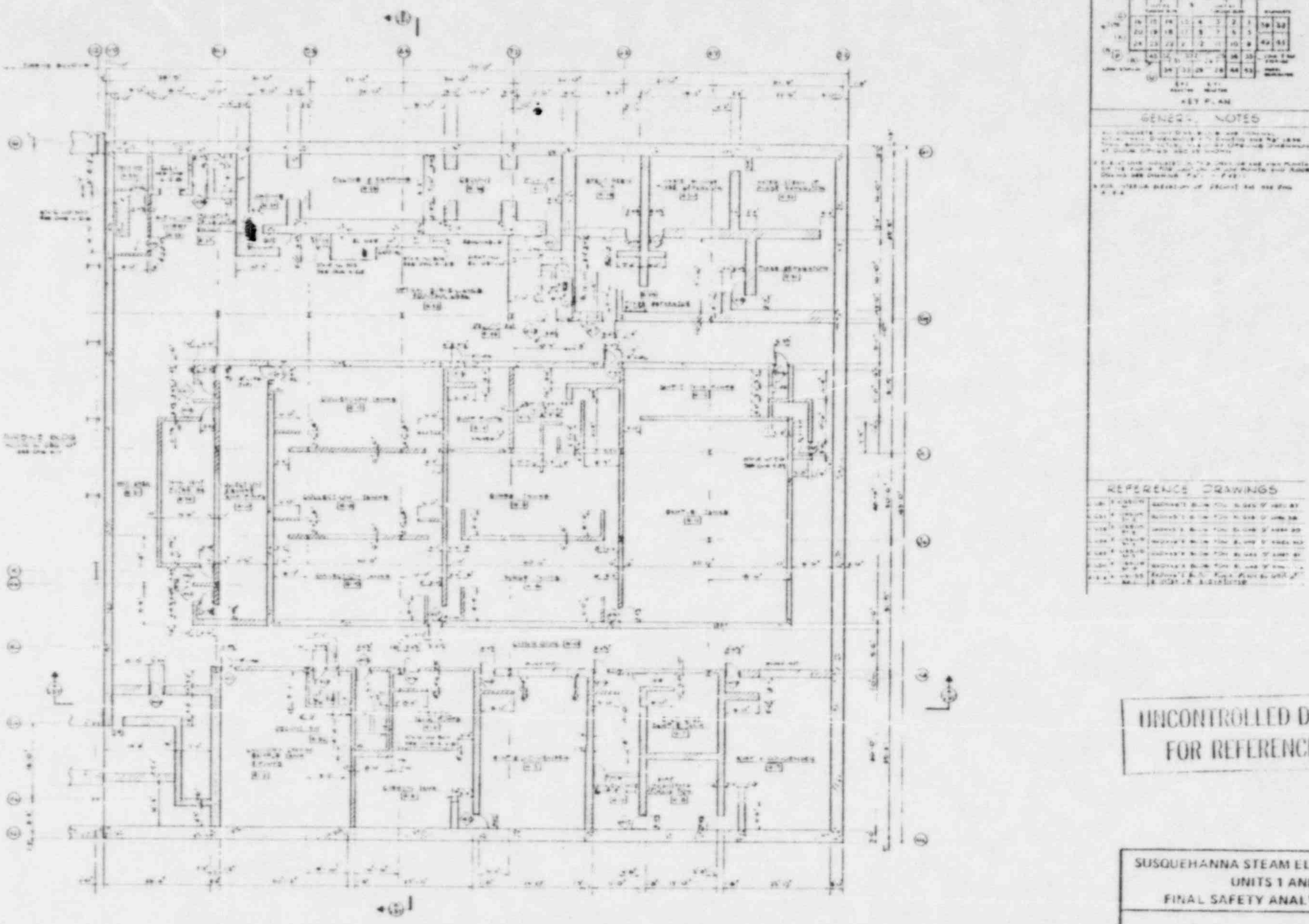
FOR REFERENCE ONLY

A-101

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 AND 2
FINAL SAFETY ANALYSIS REPORT

CONTROL STRUCTURE
FLOOR PLAN AT EL. 676'-0"
CENTRAL ACCESS CONTROL

FIGURE 12.5-2



RADWASTE BUILDING FLOOR PLAN - EL 646'-0"

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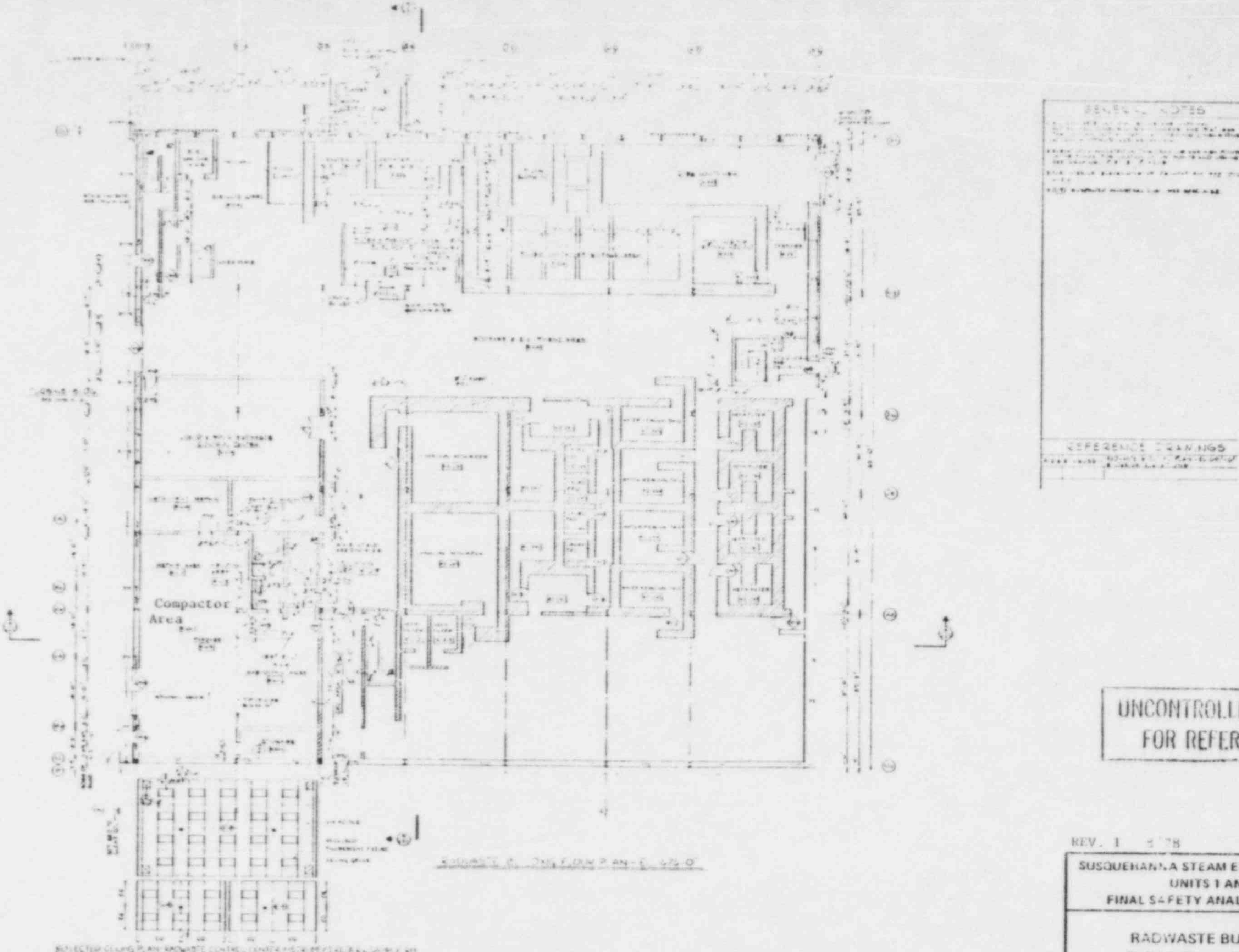
A-211

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 AND 2
FINAL SAFETY ANALYSIS REPORT

RADWASTE BUILDING
FLOOR PLAN EL. 646'-0"

FIGURE 12.5-3



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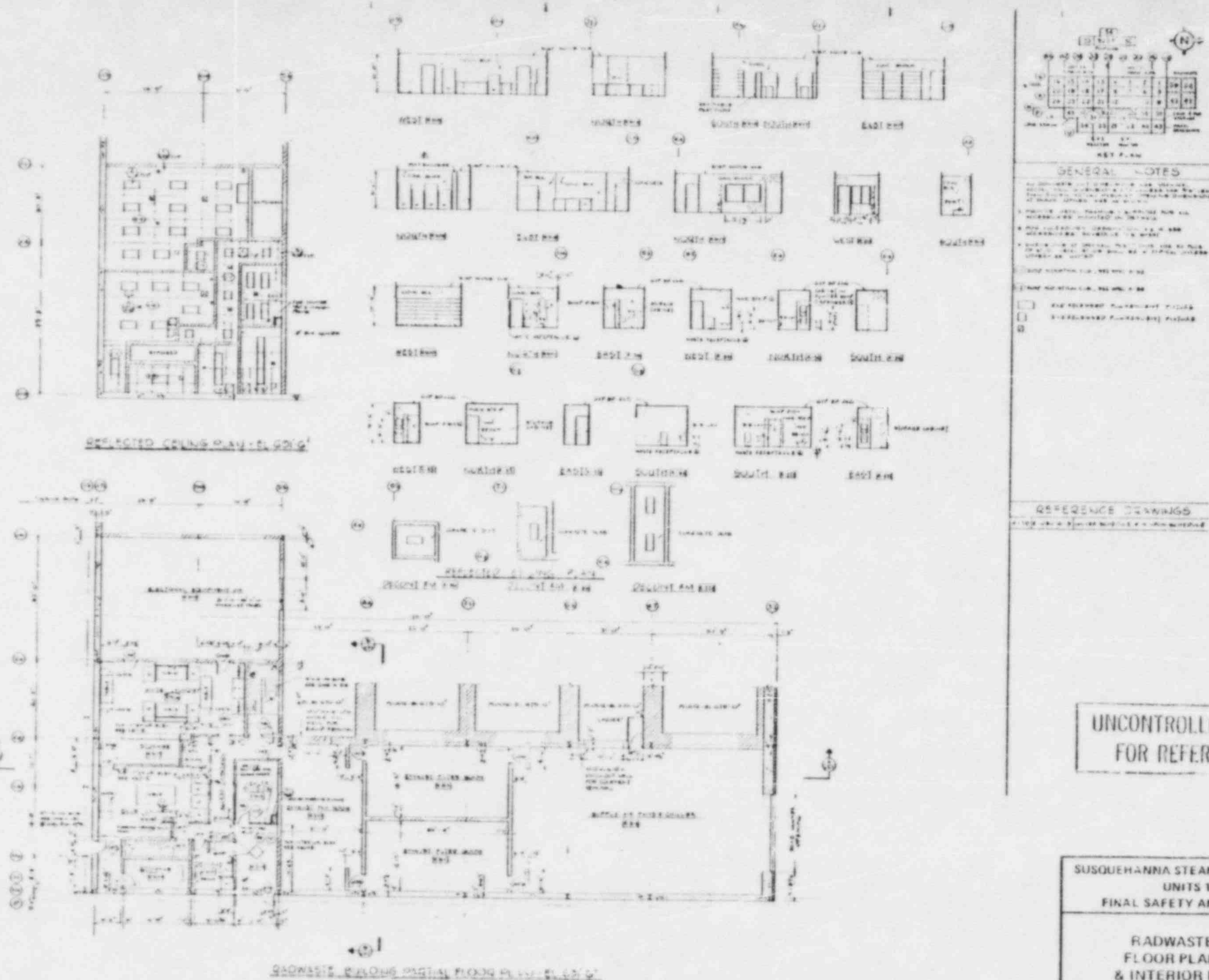
A-213

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 AND 2
FINAL SAFETY ANALYSIS REPORT

RADWASTE BUILDING
FLOOR PLAN EL. 676'-0"

FIGURE 12.5-4



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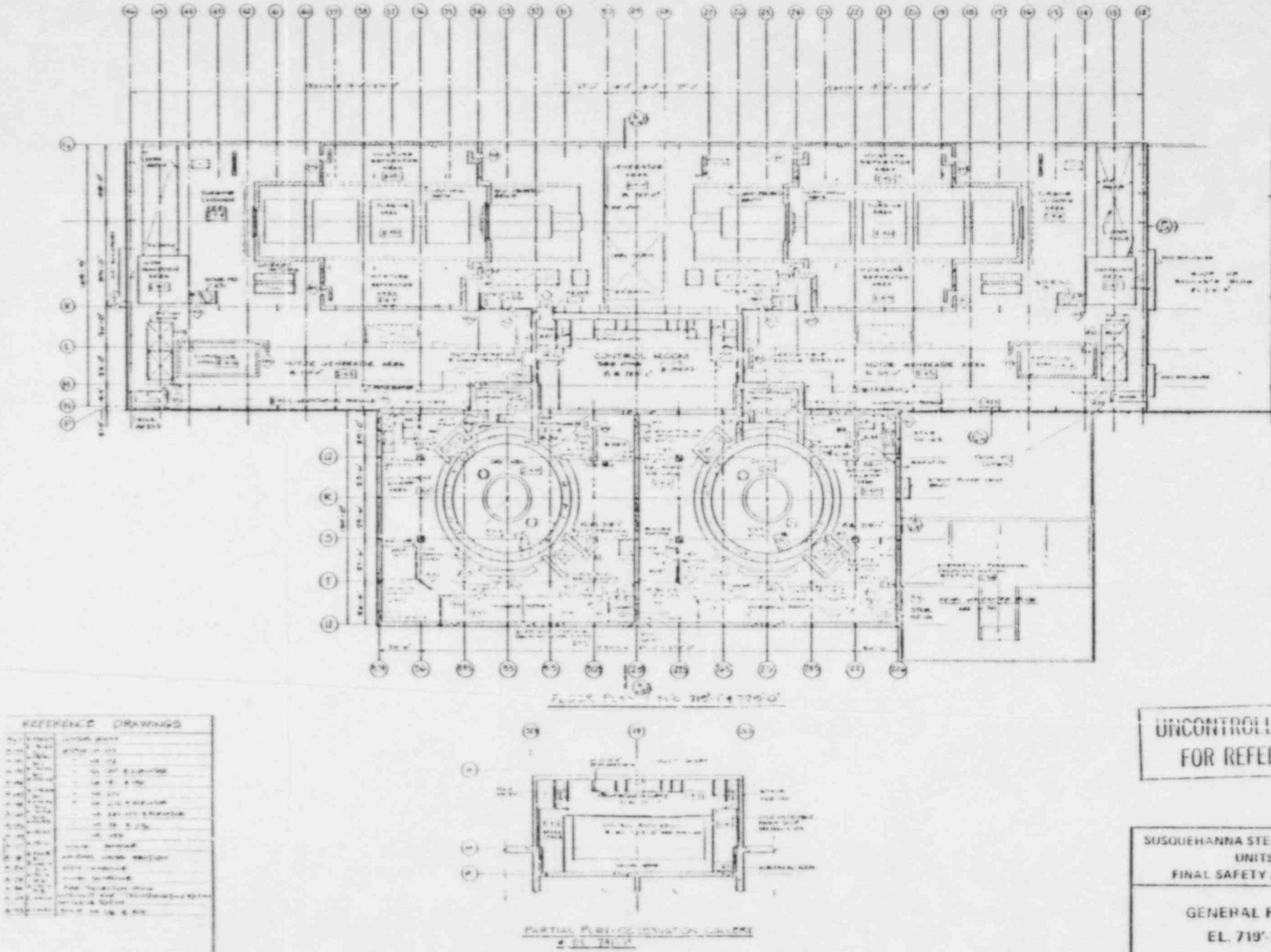
A-214

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 AND 2
FINAL SAFETY ANALYSIS REPORT

RADWASTE BUILDING
FLOOR PLAN EL. 691'-6"
& INTERIOR ELEVATIONS

FIGURE 12.5-5



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A-14

SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 AND 2
FINAL SAFETY ANALYSIS REPORT

GENERAL FLOOR PLANS
EL. 719'-1" & 729'-0"

FIGURE 12.5-6