ATTACHMENT 3

SAFETY ANALYSIS REPORT FOR THE OPERATION OF THE ON-SITE LOW-LEVEL RADIOACTIVE WASTE HOLDING FACILITY (INTERIM STORAGE) AT THE SUSQUEHANNA STEAM ELECTRIC STATION

SEPTEMBER, 1982
REVISION 1

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1.0 INTRODUCTION

This is the safety analysis report to support the application of the Pennsylvania Power and Light Company and the Allegheny Electric Cooperative, Inc. to store waste in a Low-Level Radioactive Waste Holding Facility (LLRWHF) at the Susquehanna Steam Electric Station (SSES). The LLRWHF is designed to safely store about 60,000 cubic feet of low-level radioactive waste per year from both units for up to a four year period. This facility is to be used for contingency storage in the event that offsite disposal facilities are not available.

The purpose of this report is to determine the effects of possible process disturbances or postulated component failures and to ensure the facility's design adequacy to control or mitigate the consequences of these events and failures.

2.0 FACILITY DESIGN

The LLRWHF, shown in Figures 1 & 2, is designed to store all the dry activated (trash) and solidified (cement) low-level radioactive wastes generated by SSES for the equivalent of 8 reactor-years. These wastes would be stored in the facility for up to four years or until they can be shipped to permanent disposal facilities offsite.

The overall facility dimensions will be 73 meters (240 feet) x 88 meters (290 feet) with a centerline elevation of 13 meters (42 feet). In addition, a control and equipment room 6 meters (20 feet) x 9 meters (30 feet) will be located adjacent to the facility's north wall approximately 5 meters (16 feet) from the northeast corner.

Additional information is available in the Susquehanna SES LLRWHF Technical Facility Description.

2.1 Architecture

The LLRWHF is a structural steel frame building with uninsulated metal siding and roofing to provide weather protection. The building encloses a system of three concrete waste storage vaults. A trash storage vault consisting of reinforced concrete walls and a poured-in-place concrete roof is provided for the storage of dry active waste (DAW). A labyrinth allows access by a forklift truck to store and retrieve the DAW containers. Two waste storage vaults are provided for storing solidified waste containers. The walls of these vaults are reinforced concrete. These vaults are covered with precast concrete panels supported by a structural steel framing system. The precast panels have removable plugs, which permit loading and retrieval of solidified waste containers by means of a remote controlled crane. Inspection stations are provided in each of the solidified waste storage vaults.

A shielded truck bay area is provided on the north side of the building. The facility control room is located at the north east corner of the building. A battery charging station and parking area for a forklift truck is located adjacent to and to the west of the control room.

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.

2.2 Waste Description

The LLRWHF is designed to store low level dry active waste (DAW) and solidified (cement) waste 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.

Dry active waste (DAW) 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. 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). A breakdown of the low-level waste volume by source and waste type is as follows:

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

Source Waste Type	m^3/yr	ft^3/yr
DAW—compacted	500	18,000
DAW—noncompactible	150	5,300
Evaporator bottoms (25 wt%)	510	18,000
Resins	90	3,200
Waste sludges	450	16,000
TOTAL	1,700	60,000

2.3 Containers

The containers to be stored in the LLRWHF will be designed to preclude or reduce uncontrolled releases of radioactive materials during handling, transporation, or storage. 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.

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 steel liners for the cemented wastes and 55 gallon drums and steel boxes for the trash.

2.4 Loading and Off-Loading Systems

The loading system (i.e., forklifts for DAW, a remote controlled crane for cemented waste), will be capable of placing, retrieving and reloading the cemented waste and DAW within the facility. This system will also have the capacity to lift, transport, and replace all movable shield bells and individual cell or vault covers.

The loading system for cemented waste will allow the transfer of the crane from one vault bay to the other as the vaults are filled.

2.5 Floor Drains Systems

Under normal conditions 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, and snow brought in on vehicles. 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.

2.6 Ventilation System

Two basic functions of the ventilation 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 restricting the flow of air and from being drawn into the facility. The system will exhuast through a damper that opens when the fans are in operation and closes when the fans are shut down.

2.7 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 120-VAC, 60-Hz service and 380-VAC 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 be designed to function normally under expected environmental conditions existing inside and outside the LLRWHF.

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.

2.8 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, and for safe and efficient handling of the shielded vault cover blocks. There will be no permanent lighting installed inside the solidified waste storage vaults. Lighting will be provided for remote operation of the crane.

2.9 Safety and Security

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

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

2.9.1 Security

The entire LLRWHF will be within the restricted area security fence that encloses this and other plant buildings and is under routine surveillance by plant security patrols. Access to the LLRWHF will be administratively controlled by the use of a locked door.

2.9.2 Radiation Montoring System

The radiation monitoring system will be designed to monitor the general area radiation levels at various locations inside the trash vault, the off-loading area, and the LLRWHF control room. The radiation monitor to be used is a gamma measuring device that has a sensor, an indicator, and power supply. The monitors sensors will be strategically located on the walls of the trash storage area, control room, and truck bay. There will be two area radiation monitors in the truck bay (one near the inspection station and one near the catch basin), and one in the control room. During the interim when the solidifed shielded vault is used to store trash, an area radiation monitor will be near the north entrance and another near the emergency stairs at the south end. Thus five radiation monitors will be in use initially. When the future dry trash storage area is in use, four additional area radiation monitors will be installed. One area radiation monitor will be near each of the four entrances. When all the trash is removed from vault No. 1, the two monitors may be removed.

Radiation levels detected by the sensors will be sent to indicators located in the facility control panel. Nine radiation monitors may be necessary when both trash vaults are in use, but channels for twelve monitors will be provided.

2.9.3 Shielding

The LLRWHF will contain two types of shielding:

1. fixed shielding for the in-place stored material

2. transient shielding for the waste containers for transport to the facility and for loading and unloading in the waste storage areas.

The fixed shielding consists of concrete storage vaults for the cemented waste and DAW, concrete walls in the truck bay area and concrete walls for the control room. The storage vault walls are reinforced concrete. The trash storage vault has a poured-in-place concrete roof and the solidified waste storage vault pre-case concrete convers with removable plugs. Reinforced concrete wall are provided for shielding on the north and west sides of the truck bay area. 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 (shield bell). The transient shielding for the DAW consists of a shielded forklift.

2.9.4 Fire Detection/Protection System

The fire protection design will be based on a combustible loading of 1790 kb/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 0.25m (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.

Smoke detectors will be placed at various 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.

2.9.5 Communication 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 communication cables will be in rigid steel conduit.

2.10 Health and Safety Requirements

The LLRWHF is designed to limit offsite doses from the onsite storage of LLRW to a small fraction of the 40CFR190 limit for the Susquehanna SES Site, 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.

3.0 FACILITY OPERATION

The purpose of operating the facility is to temporarily store low-level radioactive waste generated by the plant until it can be shipped off-site. It is normally not occupied by plant personnel except during loading and unloading operations.

3.1 Loading and Unloading

Loading of the facility will generally proceed as follows for solidified waste. A truck loaded with a container of waste will enter the facility in the unloading area. The waste container will be inside shielding device called a shield bell. The truck will stop in the overhead crane pickup area and the overhead crane is connected to the bell. Before any other unloading steps are taken, all personnel must move out of the storage area to a safe distance from the container or get behind shielding protection. The overhead crane then lifts the shield bell and container from the truck and moves it adjacent to its designated storage cell where the auxiliary crane hook removes the cell cover. The container and shield bell are then moved over the opened cell and the container is lowered into the cell. The shield bell is removed and the cover is 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 back onto the loading ramp adjacent to the trash storage vault. It is then unloaded with a forklift. The forklift will be equipped with radiation shielding.

Unloading the LLRWHF will generally occur in the reverse order of the loading sequence.

3.2 Storage Patterns

Storage of the low-level DAW and cemented waste will be segregated. DAW is stored in the trash storage vault and cemented waste in the solidified waste storage vaults. Further segregation of the waste containers within the vaults will also be used to take maximum advantage of the self shielding properties of the waste material and to minimize exposure. To the maximum extent practicable, waste stored in the trash storage vault will be arranged with containers having contact dose rates of less than or equal to 30 mrads/hr on the top layer of the storage area and containers with higher contact dose rates stored underneath. Similarly, to the maximum extent practicable, cemented waste stored within the solidified waste storage vaults will be arranged with containers having contact dose rates of less than or equal to 3 rads/hr stored next to the vault walls and on the top layer. Containers with a contact dose rate greater than 3 rads/hr will be stored inside this perimeter.

4.0 SAFETY ANALYSIS

Due to the facility design, the possibility of an equipment failure or serious malfunction is remote. Because strict administrative controls will be exercised during waste transfer operations the possibility of an accident caused by human error is also minimized. However, an accident analysis has been performed to demonstrate the facility's capability to control or mitigate the consequences of postulated failures or accidents. These accidents are divided into two categories: 1) handling and storage accidents and 2) other accidents.

Radiological consequences for postulated accidents are evaluated at the site boundary and at the western perimeter of the site security fence. The minimum distance from the LLRWHF to the site boundary is 1308 ft. to the west. The western perimeter fence is located 75 ft. west of the facility.

4.1 Handling and Storage Accidents

Handling and storage accidents include drops, collisions, and system failures.

The potential for drop accidents is minimal due to the operating and design features which are incorporated in the crane design. Lifting cables and lugs are designed with a minimum safety factor of 2. In addition, container lifting devices are designed to remain engaged until an operator initiates an electrical or mechanical force to release them. The control switches which activate and deactivate the lifting devices are totally segregated from those that position the trolley and crane, thus reducing the possibility for operator error.

The lifting devices are also designed to remain engaged until the downward force is completely removed by resting the load on a floor surface. In addition, lifting heights, travel times and distances will be minimized to further reduce the possibility of a drop accident.

Overhead crane and transport vehicle collisions are not anticipated to occur due to their slow travel speed and the facility design. In the LLRWHF, the transport vehicle moves no faster than 10 miles per hour and the overhead crane no faster than 50 feet per minute. A collision with a storage vault or truck bay wall is possible, but due to vehicle speed and building design, has no impact on the structural integrity or the shielding capabilities of the facility.

System failures, though not anticipated, would not impair the overall integrity of this facility. Failure of normally operating systems, such as lighting, ventilation, or electrical would not affect the facilities' safe storage function.

Should a shield panel or cell cover become damaged for any reason, spare panels and covers will be available onsite.

4.1.1 Container Drop from a Transport Vehicle

LLRW storage containers are transferred from the solidification facility to the LLRWHF on a truck. A container drop from the transport vehicle is assumed to occur during transport as the result of a postulated vehicle collision or vehicle upset and the radiological consequences offsite evaluated. Since waste materials inside the containers are in the form of dry activated trash and solidified wastes, a waste container damaged in a fall to the ground during transport would not creat an airborne radiation hazard. However, direct radiation doses could result.

Solidified waste containers will have the highest container radiation levels and are shielded with a portable shield bell while being transferred to the LLRWHF. A container drop accident could cause damage to or loss of the portable shielding resulting in direct radiation doses from the container. It is assumed for this accident that a solidified waste container with a design radiation level of 60 rads/hr is dropped with total loss of container shielding. The worst case drop location for the LLRWHF is immediately outside the shielded truck bay area and is also assumed. The resulting offsite doses for this accident are 12.0 mrem at the western perimeter fence and 0.064 mrem at the site boundary. These doses are well within the limits of 10 CFR 100. The radiation sources and assumptions used for this calculation are given in Table 1.

This analysis is based on a solidified waste container with a design radiation dose of 60 rads/hr contact. Infrequently, contaminated equipment and waste containers with dose rates higher than 60 rads/hr may be transferred to, and temporarily stored in the LLRWHF. Special procedures and administrative controls will be used in these cases. The dose calculation results given in Table 4.1-1 show that waste containers with radiation levels many times higher than 60 rads/hr would still be well within the limits of 10 CFR 100.

4.1.2 Handling and Storage Accidents Inside the Trash Storage Vault

Handling and storage accidents inside the trash storage vault such as container drops or a transport vehicle collision could result in damage to the containers. Since waste materials inside the containers are in the form of dry activated waste, a breached container would not create an airborne radiation hazard. No waste material would leave the facility's confines until the required decontamination and/or repackaging was complete. Also, these accidents would have no impact on the structural integrity or the radiation shielding capabilities of the trash storage vault.

Therefore, there would be no offsite radiological consequences due to these accidents.

4.1.3 Dropping a Heavy Component onto the Solidified Waste Storage Vault

The shield panels covering the solidified waste storage vaults are not designed to withstand the drop impact of a cell cover, LLRW container or another shield panel. However, the storage vaults are designed such that the supporting steel frame members are not affected by damage to, or failure of, one or more of the vaults shield panels. Therefore, although the panel and stored waste containers could be damaged by a heavy component drop, the structural integrity of the cell and the remaining facility would not be compromised. Since the waste is solidified, this postulated accident would not create an airborne radiation hazard offsite. However, damage to the shield panels could cause a skyshine radiation dose offsite.

Assuming two fully loaded storage vaults and no shielding provided by the damaged panels, the skyshine radiation dose rates are 14.0 mrem/hr at the western perimeter fence and 0.06 mrem/hr at the site boundary.

The sources and assumptions used in this evaluation are given in Table 2.

If this accident were to occur, the damaged containers would be covered by a spare shield panel and remain in the storage vault until the required decontamination, repair and/or repackaging could be completed. The total dose for the accident duration would be well within 10 CFR 100 limits.

4.1.4 Dropping a LLRW Container into Solidified Waste Storage Cell

During storage cell loading operations, it is possible that a waste container could be dropped into a partially loaded cell and damage the container and the storage cell contents. Since all waste stored in the cells is solidified, there would be no airborne radiation hazard to unrestricted areas. The damaged waste containers would remain shielded in the cell until the required decontamination, repair and/or repackaging could be accomplished. Therefore, no offsite radiological consequences would result from this accident.

4.1.5 Collisions - Solidified Waste Container Handling

Collisions which could occur inside the LLRWHF during handling of solidified waste storage containers would be collisions involving the container transport vehicle, overhead crane or both. Inside the LLRWHF, the transport vehicle moves no faster than 10 miles per hour and the overhead crane no faster than 50 feet per minute.

Collisions occurring at these slow travel speeds would have no impact on the structural integrity or the shielding capabilities of the storage vault and truck bay walls. Also, a collision with a storage container would only result in abrasive damage to the container or shield bell. No offsite radiological consequences would result from these accidents. The offsite radiological consequences of collisions resulting in container drops are bounded by the container drop accident consequences presented in sections 4.1.1 and 4.1.3.

4.2 Other Accidents

Other accidents include fires, freezes, tornadoes, floods, earthquakes and sabotage.

4.2.1 Fires

A fire in the LLRWHF is extremely unlikely because all flammable material (DAW) is stored inside metal containers. Also, the facility is equipped with a fire detection/protection system described in Section 2.9.4. Therefore, a fire inside the facility would not result in appreciable damage to the LLRWHF or its contents.

The total curie content of DAW to be stored in the LLRWHF is given in Section II of the Susquehanna SES LLRWHF Technical Facility Description. It is estimated that at the end of four years of accumulation of DAW, the trash storage vault will contain 16,000 drums of DAW with a total activity content of 9.90 curies. In order to demonstrate that there would be no adverse radiological consequences for a fire in the trash storage vault because of the low activity levels of the DAW, an accidental release due to an unspecified incendiary event involving 100% of the stored DAW was evaluated. No credit was taken for the mitigating affects of the fire protection system. The resulting offsite doses were calculated to be 6.70 mrem whole body dose and 125. mrem thyroid inhalation dose at the western perimeter fence and 0.02 mrem whole body dose and 0.44 mrem thyroid inhalation dose at the site boundary. The radiation sources and assumptions used for this calculation are given in Table 3. Since a fire in the trash storage vault would result in significantly less damage to the DAW than was assumed for the above analysis, the radiological consequence offsite would also be significantly lower and well within the limits of 10 CFR 100.

4.2.2 Freezes

The breech of a container due to water crystallization expansion of its contents is not possible because all stored waste will be solidified and contain less than 0.5 percent free-standing water by waste container volume.

4.2.3 Tornadoes

In order to estimate the consequences of a tornado strike on the LLRWHF, a damage analysis was performed for a tornado with a wind velocity of 300 mph. The forces resulting from a tornado wind velocity of 300 mph considered in the analysis were:

Pressure on the windward side	185 psf
Suction on the leaward side	115 psf
Total force on the building	300 psf
Uplift on the roof	140 psf

In addition an atmospheric pressure drop of 3 psi over 3 seconds, remaining at 3 psi for 2 seconds, and then returning to 0 psi in another 3 seconds was considered.

Results of this analysis shows that the damage that would probably result to the LLRWHF from these forces is as follows:

1. Most of the metal roofing and siding will be blown away.

2. The structural steel framings, girts, and purlins will probably deform, however, the connection strength is sufficient to hold the structure together and prevent steel missiles from occuring.

3. Although deformations may result, the concrete walls around the vaults are sufficiently strong to withstand the tornado forces. Any missiles generated by the tornado may cause local damage, but will not affect the structural integrity of the walls.

4. When the 3 psi pressure drop occurs, the equivalent of 2 to 3 plugs will be raised off the solidified waste storage vaults. This results in an immediate decrease in the pressure differential between the inside and outside of the vaults and as a result no additional damage should occur to the vault roof. If the plugs come off only partially or are tilted, additional plugs may be raised. In the trash storage vault, there will be a continuous concrete roof, but there are labyringth openings to vent the pressure differential. The maximum uplift predicted to occur on the roof is approximately 120 psf. This is less than the dead weight of the 1'-0" thick concrete slab and as a result it will not be damaged due to this uplift force. However, when the atmospheric pressure returns to normal, the inside pressure lags behind so that a net downward pressure of approximately 120 psf could cause the roof to collapse in on top of the trash. By this time, however, there will be insufficient upward forces

to cause any of the trash to be lifted up and over the vault walls which will remain standing.

5. The walls along column 11 in the unused trash area prior to being strengthened and thickened for the new trash vault are not designed to withstand tornado loads and will probably collapse. Since there will be no trash stored in this area at this time, no other damage should result.

6. The wall at the north side of the truck bay is not designed to withstand the tornado loads and will probably collapse. However, since it is approximately 23 feet from the vault walls, the truck wall debris should cause no damage to the waste storage vaults.

4.2.4 Floods and Seismic Events

The LLRWHF is designed for the maximum plant design rainfall intensity of 6 inches per hour. The facility does not have other special flood provisions because it is well above the Susquehanna River flood stage for the probable maximum flood. 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.

The LLRWHF is a Non-Category I structure. Failure of this structure during a seismic event would not result in the release of significant radioactivity nor affect safe reactor shutdown.

4.2.5 Sabotage

Damage to the LLRWHF and its contents due to sabotage is highly improbably because of the inherently safe design. Also, the stored wastes are inert and low in radioactivity making them an unlikely sabotage target. Since the facility is within the site's secured area, is under routine surveillance by plant security patrols, and has access adminstratively controlled by a locked door, no accidents beyond those already considered are evaluated specifically for sabotage.

4.2.6 Loss of Off-Site Power

Electric power is provided to the LLRWHF from two sources. The primary source is a 12 kV underground feeder from the site construction 230/12 kV substation. The alternate source is the Berwick 66/12 kV substation overhead distribution line. Power is extended to the LLRWHF transformer via an underground duct bank from a point where manual transfer capability between the two power sources is provided.

Loss of off-site power to the LLRWHF could occur as the result of primary source failure, transformer failure or cable failure. Estimated outage durations for these failures are as follows:

Outage	Duration	
Primary source failure (transfer to alternate)	1 Hr	- Trained site personnel available
	2 Hrs	- Call-out of division trouble man
Transformer failure (replace transformer)	12 Hrs	- Occurs during normal work hours
	16 Hrs	- Occurs off-hours
Cable failure	8 Hrs	- Occurs during noraml work hours
	12 Hrs	- Occurs off-house

The longest estimated outage duration is 16 hours for a failure of the LLRWHF transformer during off-working hours and is assumed for this accident.

Loss of off-site power to the LLRWHF would not affect the safe storage of waste in the facility. However, if an outage were to occur when a solidified waste container is in the process of being loaded into a vault storage cell with the overhead crane, offsite doses could result. Since the overhead crane and auxiliary hoist are equipped with holding brakes to prevent dropping loads if electric power is lost, the shield bell and shield plug would remain suspended above the vault. Sources of radiation exposure would be a direct dose from the shield bell (depending on the location of the storage cell) and a skyshine dose from the waste in the uncovered storage cell. This would result in integrated doses off-site above those that would normally occur from solidified waste handling because of continued exposure from these sources during the outage. It is assumed for this accident that a solidified waste container with a design radiation dose rate of 60 rads/hr is in the process of being loaded into a vault storage cell when the power outage occurs. The resulting off-site doses for this accident are 7.4 mrem at the western perimeter fence and 0.008 mrem at the site boundary. These doses are well within the limits of 10 CFR 100. The radiation sources and assumptions used for this calculation are given in Table 4.

It should be noted that it is possible to manually position the shield plug directly over the open cell by using winches and cables to move the overhead crane. This would provide an effective shield against skyshine from the open cell since the cover is only 8. inches above the vault. Also, once the shield plug is positioned above the cell opening, it could be replaced by manually controlling the holding brakes on the auxiliary hoist. However, for this analysis, continuous exposure from the shield bell and the open cell for the duration of the outage is assumed.

4.3 Summary

The LLRWHF, and its associated storage containers, equipment and operating procedures provide a satisfactory interim storage facility which is capable of controlling and mitigating the radiological consequences of potential accidents and unplanned events.

5.0 REFERENCES

5.1 "Environmental Survey of Transportation of Radioactive Materials To and From Nuclear Powr Plants," WASH-1238, December, 1972.

TABLE 1

DESIGN BASIS SOURCES AND ASSUMPTIONS USED TO CALCULATE THE OFF-SITE RADIOLOGICAL CONSEQUENCES DUE TO A CONTAINER DROP FROM A TRANSPORT VEHICLE

A. Radiation Source

A design radiation level of 60 rad/hr contact is assumed for the solidified waste container and is based on a solidified reactor water clean-up spent resin activity distribution. The source for the reactor water clean-up spent resin is given in Section II of the Susquehanna SES LLRWHF Technical Facility Description.

B. Geometry of the Dropped Container

The geometry of the dropped container is based on a Hittman Container HN-600.

Diameter - 72-3/8"

Height - 40"

Volume - 83 cu. ft.

C. Distance from the Source to Receiver Point

The drop point is assumed to be at the truck bay entrance to the LLRWHF on the east side of the building. This is the closest point to the dose receptor locations that the drop could occur. Taking credit for the 240 ft. width of the LLRWHF, the source to receiver distances are as follows:

Drop point to western perimeter fence - 315 ft.
Drop point to site boundary - 1548 ft.

D. Duration of Accident

Total time the container is assumed to remain unshielded - 8 hrs.

E. Off-Site Radiological Consequences

Dose Rate at Western Perimeter Fence - 1.5 mrem/hr
Total Integrated Dose at Western Perimeter Fence - 12.0 mrem

Site Boundary Dose Rate - 0.008 mrem/hr
Total Integrated Site Boundary Dose - 0.064 mrem

TABLE 2

DESIGN BASIS SOURCES AND ASSUMPTIONS USED TO CALCULATE THE OFF-SITE RADIOLOGICAL CONSEQUENCES DUE TO DROPPING A HEAVY COMPONENT ONTO THE SOLIDIFIED WASTE STORAGE VAULT

A. Skyshine Radiation Source

Forty percent of the source is based on a solidified Reactor Water Clean-up Spent Resin activity distribution normalized to a 60 rad/hr contact container dose rate.

Sixty percent of the source is based on a solidified Condensate Demineralizer Spent Resin activity distribution normalized to a 3 rad/hr contact container dose rate.

Source terms for these spent resins are given in Section II of the Susquehanna SES LLRWHF Technical Facility Description.

B. Skyshine Source Geometry

The total activity contained by two vaults assuming maximum capacity is used to determine an equivalent point source. No credit is taken for shielding provided by the damaged panels.

C. Distance from the Source to the Receiver Point

Distance from the facility to the western perimeter fence	= 75. ft.
Distance from the facility to the site boundary	= 1308 ft.

D. Off-Site Radiological Consequences

Dose Rate at Western Perimeter Fence	= 14.0 mrem/hr
Site Boundary Dose Rate	= 0.06 mrem/hr

TABLE 3

DESIGN BASIS SOURCES AND ASSUMPTIONS USED TO CALCULATE THE OFF-SITE RADIOLOGICAL CONSEQUENCES DUE TO AN UNSPECIFIED INCENDIARY EVENT INVOLVING 100% OF DAW

A. Source Term

The activity source term for this event is based upon four years accumulation of DAW. An isotopic breakdown of this inventory is given in Section II of the Susquehanna SES LLRWHF Technical Facility Description.

B. Number of Drums Affected by the Fire

Number of drums assumed to catch fire = 16,000

(This is the 4 year compacted trash capacity of the LLRWHF).

C. Meteorology

X/Q = 3.70-1 sec/cu.m. at the western perimeter fence
X/Q = 1.3-3 sec/cu.m. at the site boundary

D. Airborne Radiation

Percent of Particulate Contamination

Assumed to be Airborne and Released (Ref 5.1) = 1%

TABLE 4

DESIGN BASIS SOURCES AND ASSUMPTIONS USED TO

CALCULATE THE OFF-SITE RADIOLOGICAL CONSEQUENCES

DUE TO LOSS OF OFF-SITE POWER TO THE LLRWHF

A. Radiation Sources

A design radiation level of 60 rads/hr contact is assumed for the solidified waste container inside the shield bell and is based on a solidified reactor water clean-up spent resin activity distribution. This source is also assumed for the waste inside the open storage cell. The source term for reactor water clean-up spent resin is given in Section II of the Susquehanna SES LLRWHF Technical Description.

The solidified waste container is a Hittman HN-600 and has the following dimensions:

Diameter - 72-3/8"
Height - 40"
Volume - 83 cu. ft.

B. Waste Handling Assumptions

It is assumed for this accident that a solidified waste container is in the process of being loaded into an open cell in the solidified waste storage vault when loss of off-site power to the LLRWHF occurs. As a result, the following conditions based on waste handling procedures for solidified waste exist at the open storage cell, and are assumed for the duration of the accident:

- A solidified waste container is inside the shield bell and is suspended eight inches above the vault by the overhead crane.
- The shield plug from the open storage cell is suspended eight inches above the vault by the auxiliary hoist.
- The shield bell and plug are in a position that results in maximum skyshine exposure from waste in the open cell. In this position, approximately two thirds of the cell opening is shielded from skhshine by the shield bell and plug. Credit is taken for the shielding effects of the shield bell and plug.
- The cell is located in the outer row of the vault at the west end of the building which minimizes distances

offsite from the sources and provides a direct exposure path from the shield bell.

C. Distances from the Sources to the Receiver Point

Distance from the facility to the western perimeter fence	- 75. ft.
Distance from the facility to the site boundary	- 1308. ft.

D. Duration of Accident

The duration of the accident is assumed to be 16 hours. This is based on the longest estimated power outage which occurs for a failure of the LLRWHF transformer during off-working hours. Continuous exposure from the shield bell and open storage cell is assumed for the duration of the accident.

E. Off-Site Radiological Consequences

Western Perimeter Fence

Direct Dose Rate from Shield Bell	- 0.33 mrem/hr
Skyshine Dose Rate from Open Storage Cell	- 0.13 mrem/hr
Total Dose Rate at Western Perimeter Fence	- 0.46 mrem/hr
Total Integrated Dose at Western Perimeter Fence	- 7.4 mrem

Site Boundary

Direct Dose Rate from Shield Bell	- 0.00015 mrem/hr
Skyshine Dose Rate from Open Storage Cell	- 0.00033 mrem/hr
Total Dose Rate at Site Boundary	- 0.0005 mrem/hr
Total Integrated Dose at Site Boundary	- 0.008 mrem

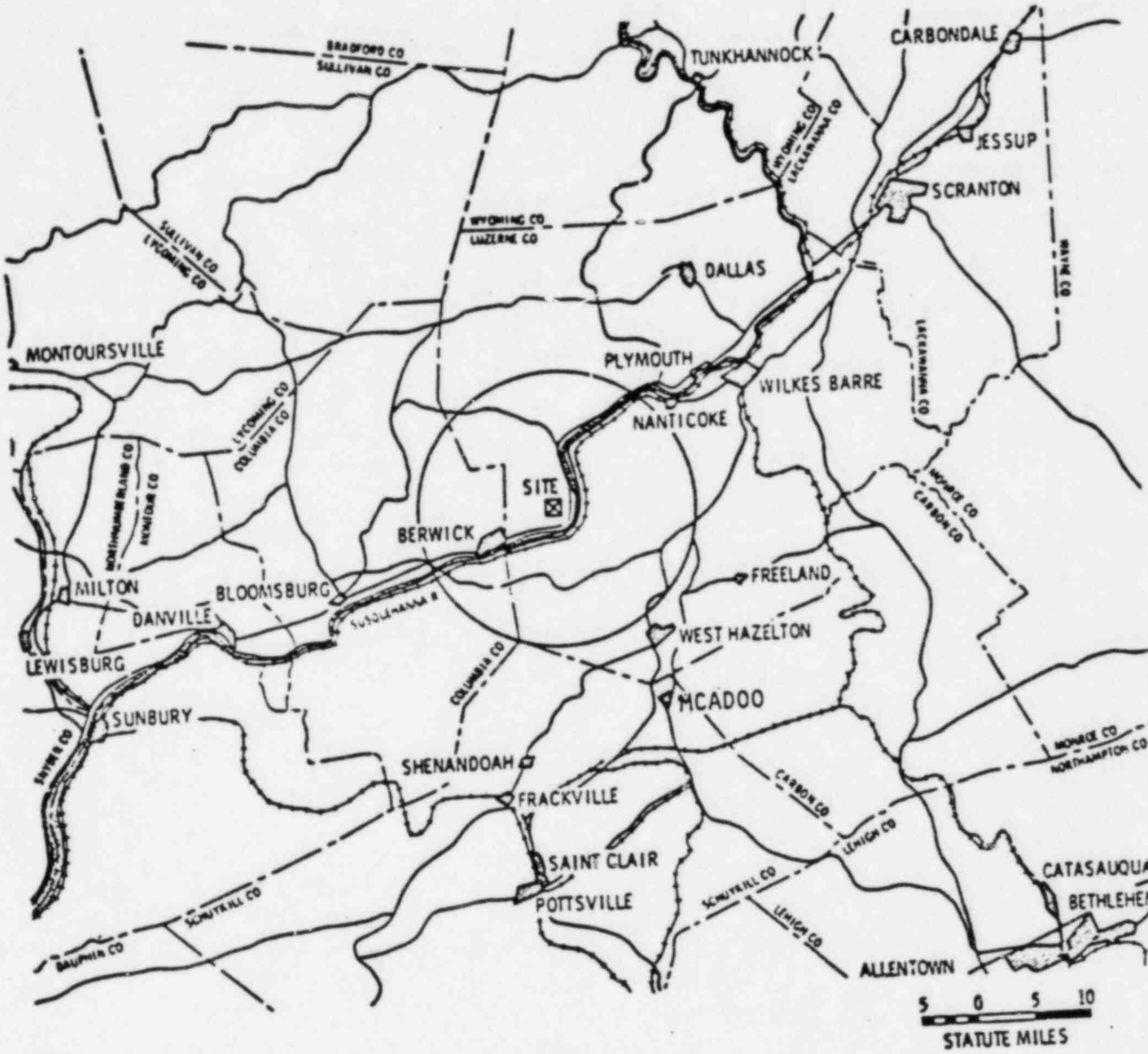
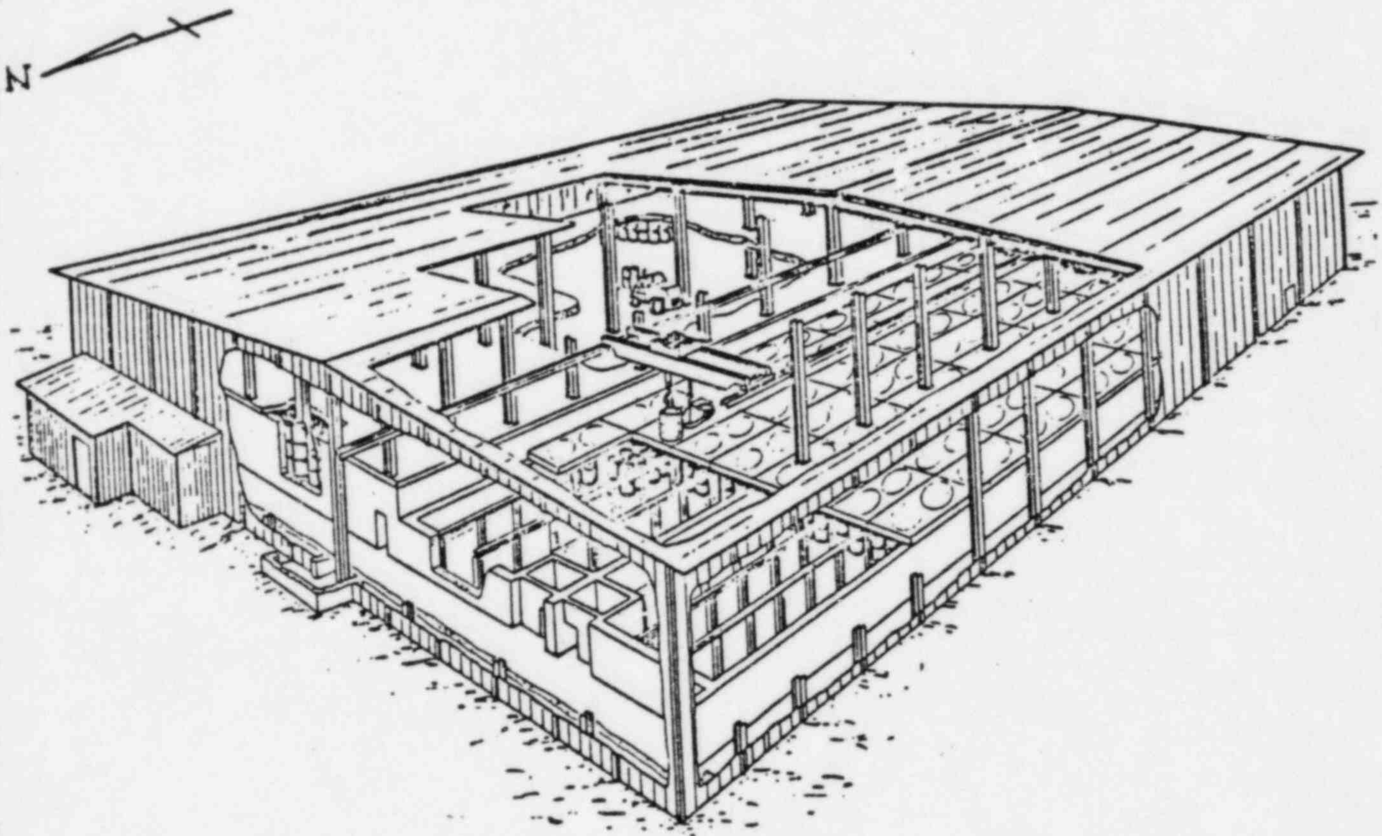


FIGURE 1

PLAN VIEW OF THE SUSQUEHANNA STEAM ELECTRIC STATION

FIGURE 2

ARTIST'S CONCEPTUAL DRAWING OF THE
LOW-LEVEL RADIOACTIVE WASTE HOLDING FACILITY



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 Assistant Superintendent of Plant. The Health Physics Supervisor is charged with the responsibility of providing the Assistant 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 Radiological Support Supervisor supervises Health Physics Specialists in the planning, organizing and directing of off line program support functions (dosimetry, whole body counting, respiratory protection, radwaste) to provide timely support to the priorities of the day-to-day program.

The Health Physics Specialist(s) assists the Radiological Support Supervisor or Health Physics Supervisor in conducting ALARA, Radwaste, or Technical Health Physics evaluations. The Specialist supervises Technicians and other personnel in Health Physics functions in the conduct of day-to-day activities.

The Health Physics Foreman supervises subordinates in the conduct of routine day-to-day job activities such as: routine surveys, health physics job coverage/coordination, RWP surveys, and Health Physics counting room activities. He coordinates and prioritizes the above activities.

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The Health Physics Technicians 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 reports from the Health Physics Supervisor through the Assistant Superintendent of Plant 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 of radiation safety to the Health Physics Supervisor. The Health Physics Supervisor has the authority to cease any work activity when, in his professional judgement, worker safety is jeopardized, or unnecessary personnel exposures are occurring.

The Health Physics Specialist-ALARA has the authority to conduct informal training and/or discussions with workers and supervisors regarding observed practices and ALARA recommendations. The Health Physics Specialist-ALARA 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 Specialist-ALARA to cease work activity when worker safety is jeopardized or unnecessary exposures are occurring.

The Health Physics Foreman 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 Foreman to cease any work activity which is not being performed in accordance with Health Physics procedures and RWP requirements.

The Health Physics Technicians implement Health Physics and RWP requirements under the direction of qualified supervision. These Technicians have the authority to stop RWP jobs in progress when worker safety is jeopardized or exposures are not ALARA, subject to concurrence of the Health Physics Supervisor.

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 and technicians required to implement such programs.

The Health Physics Supervisor will have 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 of 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 Radiological Support Supervisor 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 Radiological Support Supervisor 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 Technicians Level II will meet the qualification requirements of ANS 3.1-1978.

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 in the Control Structure. 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 Health Physics Counting Room.

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 in 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 aparatus 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. A secondary standard instrument with a N.B.S. traceable calibration 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. 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 work 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.

Facilities will be located in designated areas for storage of anti-contamination equipment, respiratory protective equipment, miscellaneous Health Physics supplies 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, 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 all, 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 Physic supplies.

12.5.2.2.3 Radwaste Building Elevation 691'6"

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

The laundry area contains washer(s) and exhausted dryer(s), 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. 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.

A clean laundry area contains a washer and an exhausted dryer, 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 collection tank.

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 may 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 North Gate House building serves principally as the primary access control to the restricted area of the plant. Alternate access control areas will be set up as required. Personnel dosimetry will normally be issued at these areas. A portal monitor and/or G-M type frisker will normally be maintained at designated locations for final monitoring prior to leaving the SSES restricted area.

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 designated areas 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 designated locations. Respiratory Protective Equipment will be available for emergency use. N.I.O.S.H./M.E.S.A. approved emergency escape devices will be placed at locations where the potential exist for an unexpected increase in radioactive or chemical airborne concentrations (such as the water treatment building and radwaste system). 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. CAMs, high volume air samplers, low volume air samplers, and 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. Volumes necessary for representative samples will be specified in Station Health Physics procedures. Filter media such as particulate filters and charcoal cartridges will be stored at the Health Physics office or other designated areas.

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 semi-annual basis and after pump replacement or repair. 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 semi-annual basis. Manufacturer's recommended calibration or voltage plateau procedures will be performed on a semi-annual 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

Breathing zone samplers will be available for use in evaluating air concentrations that radiation workers may encounter on an as-needed basis. 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 appropriate sampling media may be used with charcoal in various configurations.

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 or 0-500	Low Dose Accumulating Work or Intermediate Dose Accumulating Work	400 75
0-1000 or 0-5,000	High Dose Accumulating Work or Radiation Emergency Plan Use	50 25
0-100,000	Radiation Emergency Plan Use	25

Self-reading dosimeters and chargers will be available at the primary access control points. Dosimeters will be tested for calibration response, charging drift, and leakage prior to initial use, and on a six month frequency 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 penetrating and non-penetrating exposure and will normally be evaluated on site. Approximately one hundred (100) extremity monitoring 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 gamma emitting radionuclides of interest. The whole body counter will be calibrated in accordance with Station procedures 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.

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:

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 assempled 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 is located in 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. A sodium chloride (NaCl) aerosol generator with flame photometer, or equivalent system, will be used for quantitative testing of individuals for the Respiratory Protection Program. Irritant smoke, isoamyl acetate or other appropriate material will be available to qualitatively test user respirator fit.

12.5.2.7 Health Physics Instrumentation

Instruments for detecting and measuring alpha, beta, gamma and neutron radiation will consist of count room instrumentation, 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 (such as Sr-90, Am-241, Cs-137, Co-60, 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 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 periodic or as needed basis and after repairs affecting calibration efficiency curves for multi-channel analyzer systems will be determined on a simiannual 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 this and following 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 multi channel analyzer, using an appropriate 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.

A 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 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 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 simiconductor 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 Work Area Instrumentation

Health Physics instrumentation located in designated areas will include sufficient numbers of the following instruments, or equivalent:

Automatic and manual beta-gamma counter-scalers, 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.

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

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

G-M betta-gamma survey meters (most sensitive range 0-.2mR/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.

Ionization chamber beta-gamma survey meters 0-5 R/hr. (0-5 mR/hr. most sensitive range) used to cover the general range of dose rate measurements necessary for radiation protection evaluations.

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.

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.

Cadmium loaded polyethylene sphere, BF 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.

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

Thermal and fast neutron detectors designed to detect thermal neutrons and fast neutrons. 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 Phsics Instrumentation normally located at the Health Physics Station in the Radwaste Building will include sufficient numbers of the following instrumentation:

Thin window (2 mb/sq/cm) G-M detector with counter-scaler for gross beta-gamma measurements for smears and prepared samples.

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

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.

Remote monitoring 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 or a hand and foot monitor will be used at appropriate locations:

Thin window Beta-Gamma Count rate meters will be used to detect contamination on personnel, materials, protective clothing, and equipment.

Portal monitors with audio and/or visual alarmed detectors to provide head to foot detection capability. Count rate alarm and counting time adjustable.

Audio and/or visual alarming hand and foot monitors.

Personnel contamination monitoring instrumentation will be calibrated and/or checked 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

Secondary standard air deionization chamber(s) will be used to measure radiation levels. These instruments will be calibrated with a standard traceable to the N.B.S.

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

Pulse generator for calibrating pulse counting instruments, wet test meter and one (1) calibrated flow meter.

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, Administrative , 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/or administrative controls (as required) 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

Security check points 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(s) when not in use. The security force will assure that all personnel who enter the station are issued appropriate security badges and dosimetry devices 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.

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 10CFR29.202(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.

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 100 100 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 Health Physics 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 exposure 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 high radiation areas will be posted to reflect the requirement of a Radiation Work Permit (RWP) in accordance with limits specified in station procedures.

12.5.3.1.1.4 Surveillance

When appropriate, surveillance of work activities will be provided to assure an adequate control of access and stay time in airborne and high 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. The SRWP application will receive a survey, review and approval process in accordance with station procedures. 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 determine 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 controlled 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.

All Health Physics procedures will be periodically reviewed in accordance with the station administrative procedure or procedures.

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 instruction 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 V or higher (greater than 100 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, as defined in station procedures.

Radiological engineering controls will be used, when applicable, to minimize personnel exposures and prevent the spread of contamination and/or inhalation/ingestion 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 reasonably be reduced below levels described in station procedures, 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. In accordance with station procedures, alternative work methods will be discussed and if improvements are justified, the responsible supervisor will initiate the review, approval and implementation process.

12.5.3.2.1.3 Work Scheduling

Health Physics will provide reports to supervisors that will indicate individual exposure status to assist in work scheduling and assure individual exposures are minimized.

12.5.3.2.1.4 Reporting Requirements

This paragraph reserved. Topic covered in Section 12.5.3.1.2.3.

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. 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

One 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 is equaling or bettering the lowest total worktime expended on jobs of similar nature may be utlized when airborne concentrations or dose rates are unpredictable or subject to variations. These general goals may be modified in 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 an 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 airbirne 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. Proposed changes in methods or equipment that are anticipated to improve efficiency and reduce exposure will be reviewed, and if approved, implemented in accordance with station procedures.

12.5.3.2.2 External ALARA

12.5.3.2.2.1 Dose Recording

Each RWP issued to permit work or entry in 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. Each individual will assure required data is properly recorded on the dosimeter log sheets.

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 to 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 appropriate level of approval. 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 and 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 airborne 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 location where airborne concentrations may be generated. These samplers will be periodically checked to verify proper function and assure that unexpected airborne concentration 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 Intake

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

Intake 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 intake 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

In accordance with station procedures, 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 to radiation areas are not taken. If appropriate, Health Physics supervision will assure that proper corrective measures 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 and 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. Individual exposures incurred during the survey may be reviewed and compared with previous surveyor exposures. This dosimeter data will be udpated 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 maintenace 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 surveryor will be required to enter instrument descriptions(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 overide 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 vicintiy 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 frequency 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-readi   osimeters. The surveyor will enter the exposure incurred on the RWP 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 reasonbly 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 Intake 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 intake 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 would 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 laudering/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 drying, clothing will be re-surveyed to assure that items are within station limits. 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 removalbe and fixed contamination levels prior to disinfection, storage and/or reissue.

Exterior surfaces of other protective devices, self contained breathing apparatus and hoses, will be ckecked for contaminatyion levels following job completion in accordance with station procedures. 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".

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 limis 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 exposure 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 survey will be performed prior to any sanding, chipping, welding, grinding and sawing, or potentially contaminated Controlled Zone surfaces to establish potential airborne hazards.

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 removeable contamination. Stoves, benches, table tops, and floor surfaces will be representatively smeared to assure minimal contamination in eating areas. Removable contamination in excessof 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 contaminatoin may be maintained as contamination zone 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 minimize airborne concentrations within the plant. 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 whenever 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

Accissible 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

Posted airborne radioactivity areas will be reviewed by a member Health Physics supervision in accordance with station procedures. 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 occurrent 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 recurrent 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

At completion of sampling, the date, time, and volume 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 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. 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 reasonably 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 respiratory 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 HWP 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

In accordance with station procedures, 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. Respriators 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. Respratory 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 defected 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 respiratory 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 recurrent 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 analysed 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 disucssed 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 restuls 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 gamma dose equivalent, determined by issued extremity monitoring devices, will determine total 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 tabulated and compared to 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' accumualted 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 idenfity 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, peronnel 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.

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; conditinuous under which the exposure occurred; names of personnel involved and amount of exposure received; action taken at time of occurrentce; 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 commendation 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 results 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 radionuclides 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 in accordance with station procedures 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 presen without respiratory protection, or those experiencing respiratory failure, in a concent.ation 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 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.

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 appropriate level of Health Physics Training in accordance with station 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 into the restricted area or unescorted access to the controlled zone, but not including work on a radiation work permit 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 10CFR19.12

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

Prenatal Radiation Exposure

Completion of Level II Health Physics Training meets the requirements for Level I Health Physics Training.

12.5.3.7.2.2 Level II Training

Level II Health Physics Training will normally be administered to individuals who require unescorted access into the controlled zone. 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:

- Requirements of 10CFR19.12
- ALARA (applicable procedures), corporate commitment, meaning and individual responsibility
- Contamination Control and Self-Survey Requirements
- Radiological Control Signs and Posting Requirements
- Radiation Exposure Control and Limits
- Prenatal Radiation Exposure
- 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
- Requirements of 10CFR19.12
- Radiation Exposure Control and Limits
- Radiological Control Signs and Posting Requirements
- Prenatal Radiation Exposure

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 Health Physics supervisior. 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 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 knowledge and 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 respiratory 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 respiratory; discussion of the application of various cartridges and canisters available for air-purifying resprators; 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 respiratory fit on a annual basis. Related records will be maintained by the Training Supervisor or designated alternate.

12.5.3.7.2.5 Health Physics Technician Initial Training Program

A Health Physics Training Program will be administered to applicants for the position of Health Physics Technician 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 technician training program. All applicants must demonstrate their proficiency by successfully completing a technician monitor qualifications 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 Technician 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 Technician Qualifying Examination

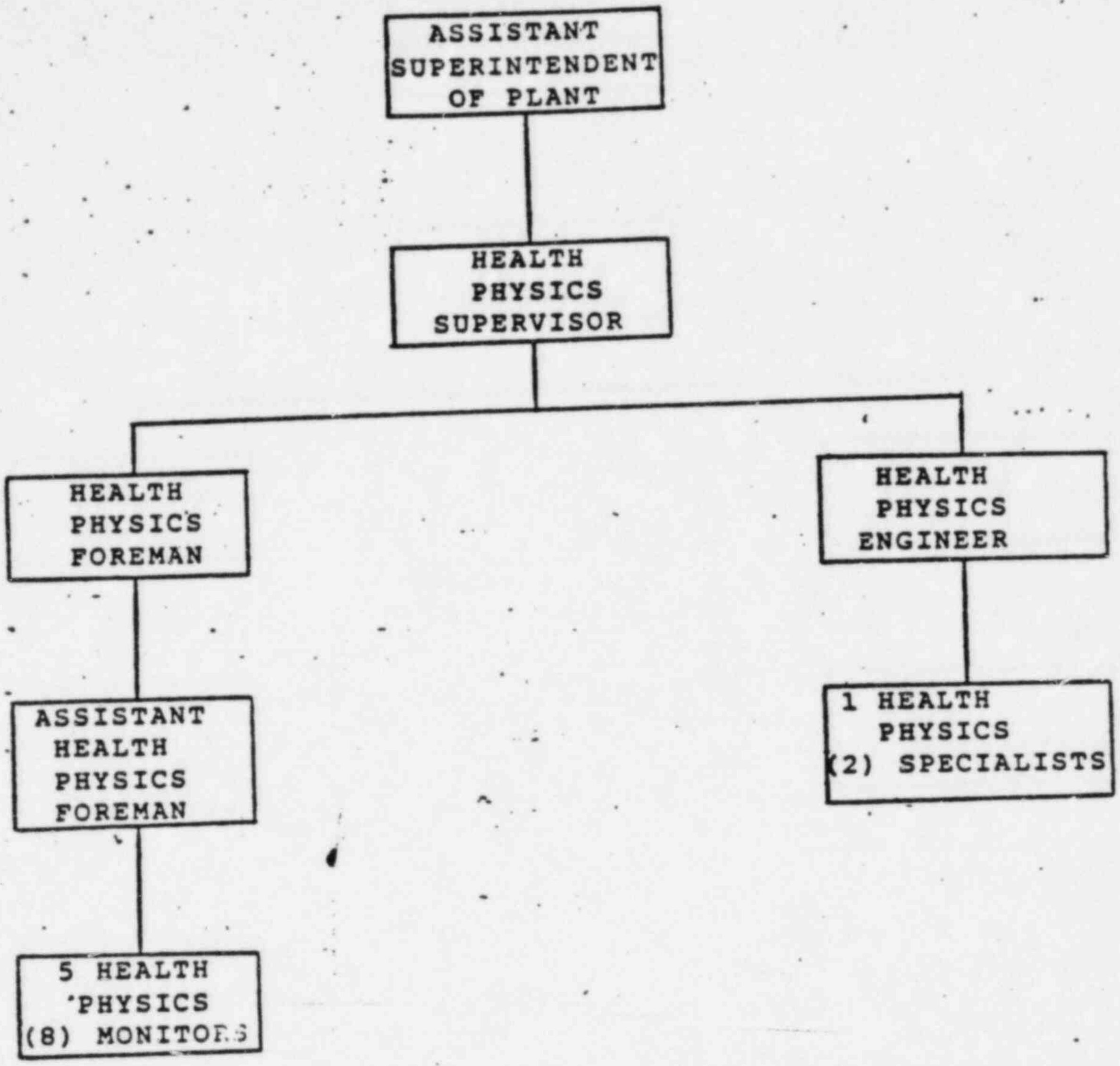
Health Physics Supervision will review the applicant's proficiency as displayed during the training programs, examinations and the technician qualification examination. The successful candidate will be assigned the responsibilities of Health Physics Technician.

12.5.3.7.2.7 Health Physics Technician Retraining Program

All Health Physics Technicians will receive a retraining review on an annual basis. The purpose of the review will be to strengthen the 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 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 by a member of Health Physics Supervision to discuss areas of individual concern and additional retraining needs.

Health Physics Technicians 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. They 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, 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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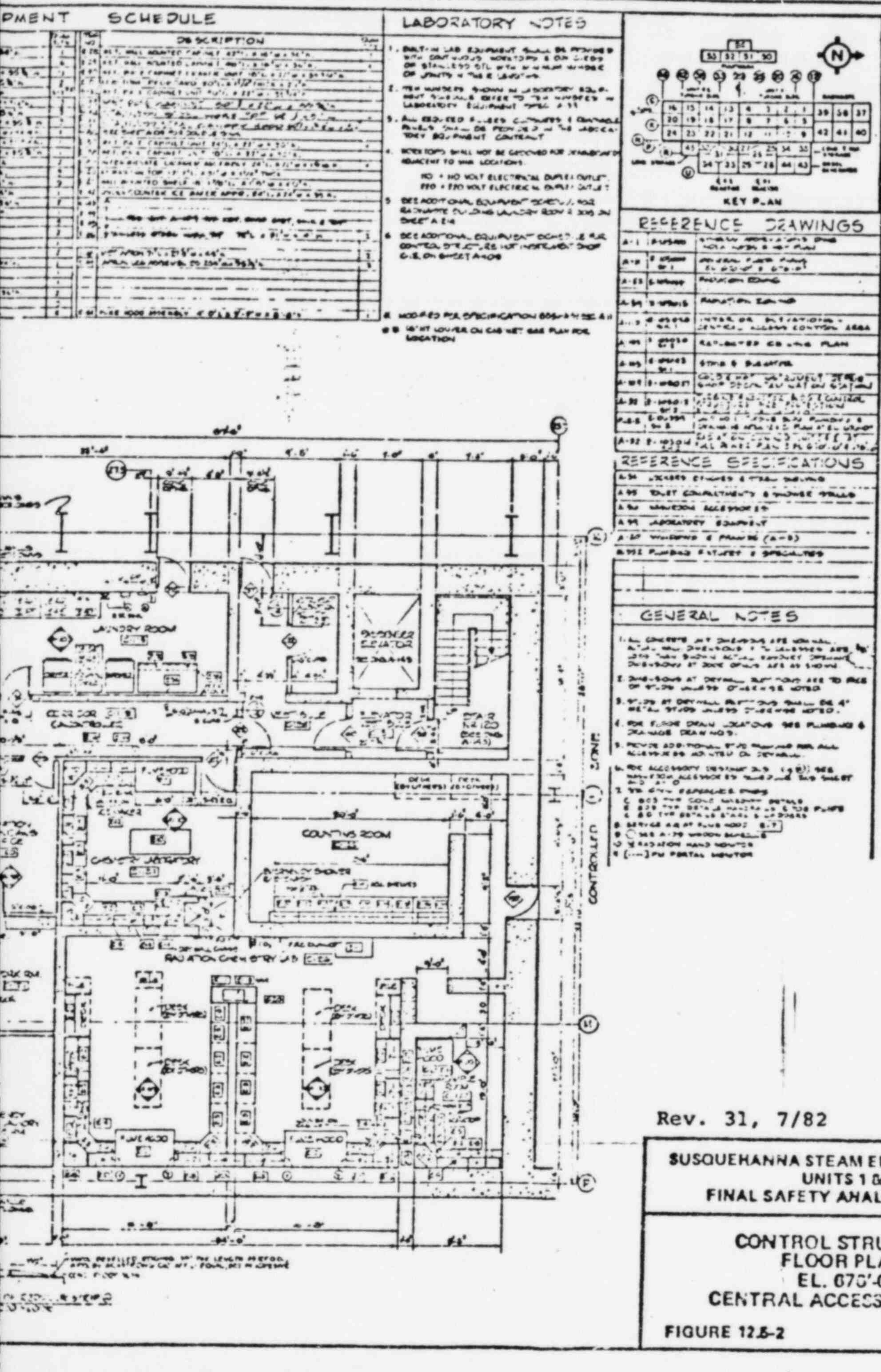
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 AND 2
FINAL SAFETY ANALYSIS REPORT

HEALTH PHYSICS ORGANIZATION

FIGURE 12.5-1



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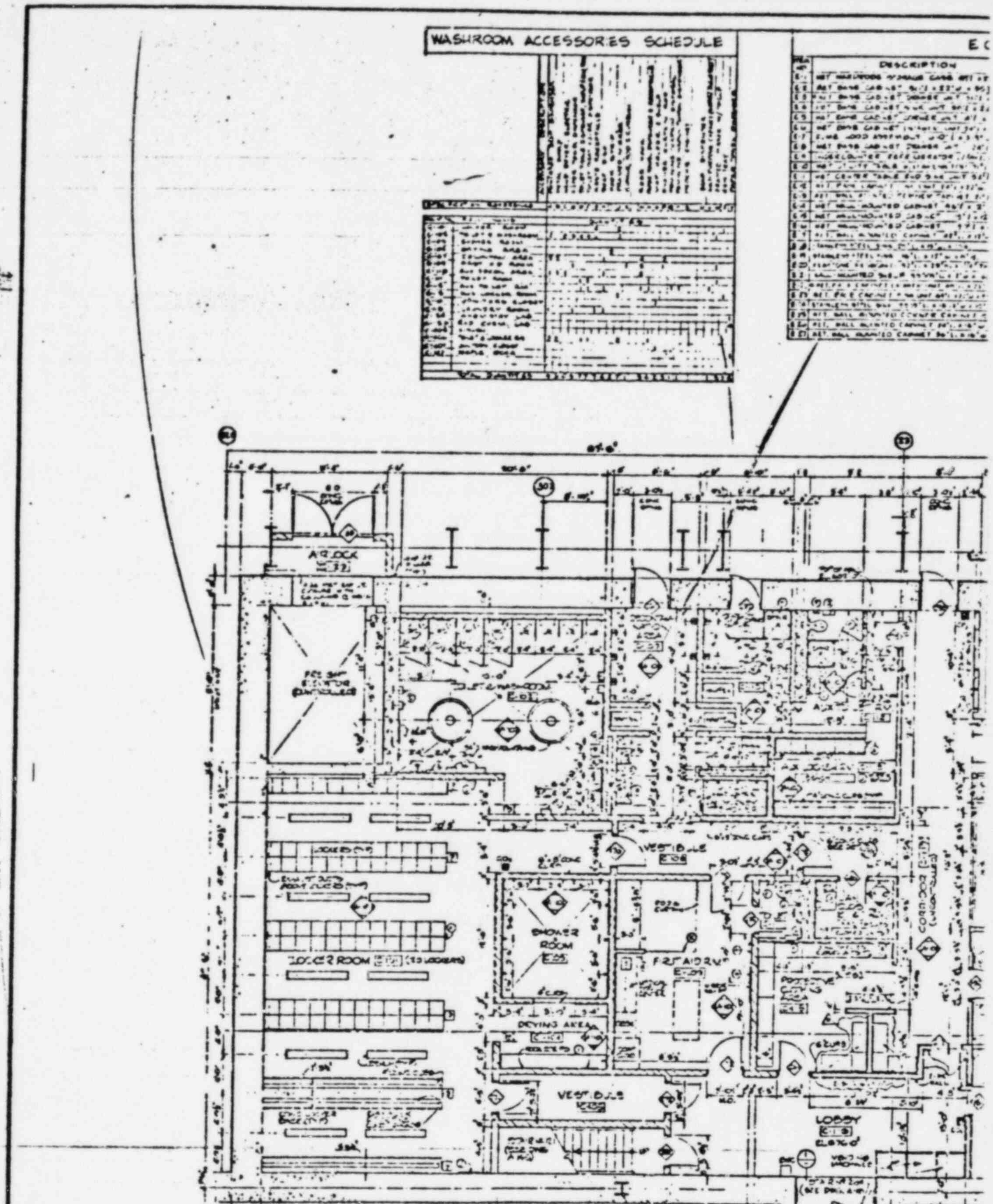
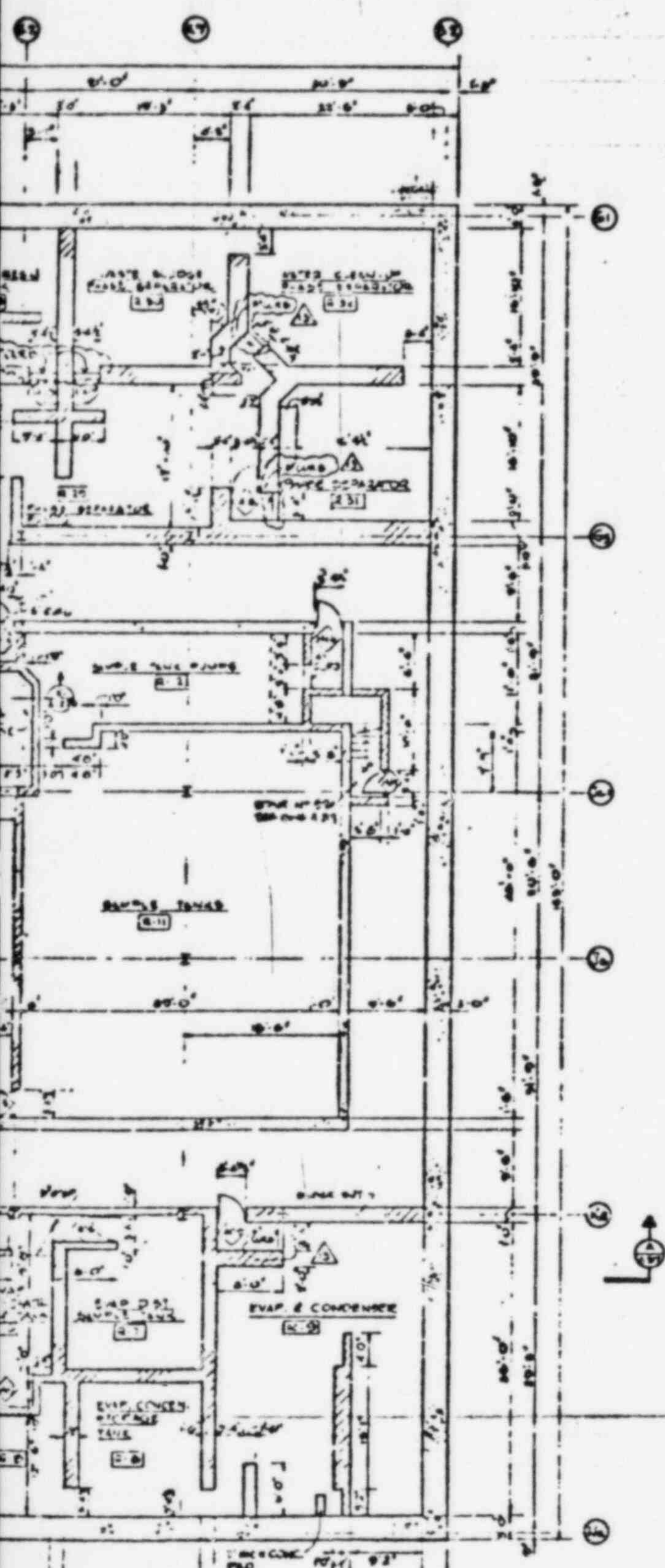
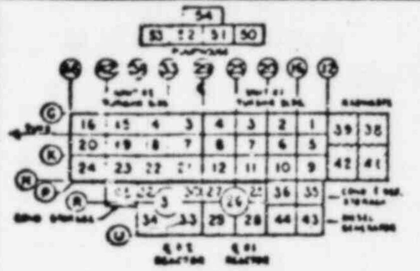
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

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

FIGURE 12.5-2


WASHROOM ACCESSORIES SCHEDULE
DESCRIPTION
AIR LOCK
VESTIBULE
SHOWER ROOM
LOCKER ROOM
DRYING AREA
VESTIBULE
LOBBY





KEY PLAN

GENERAL NOTES

1. ALL CONCRETE [illegible] DIMENSIONS ARE NOMINAL. ACTUAL [illegible] DIMENSIONS [illegible] ARE [illegible] LESS THAN SHOWN. ACTUAL MASONRY OPENING DIMENSIONS AT DOOR OPENINGS ARE AS SHOWN.
2. [illegible]
3. [illegible]
4. [illegible] WALL MOUNTED [illegible] RADIATION MONITOR [illegible]

REFERENCE DRAWINGS

[illegible]	E-055-09	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]
[illegible]	[illegible]	[illegible]

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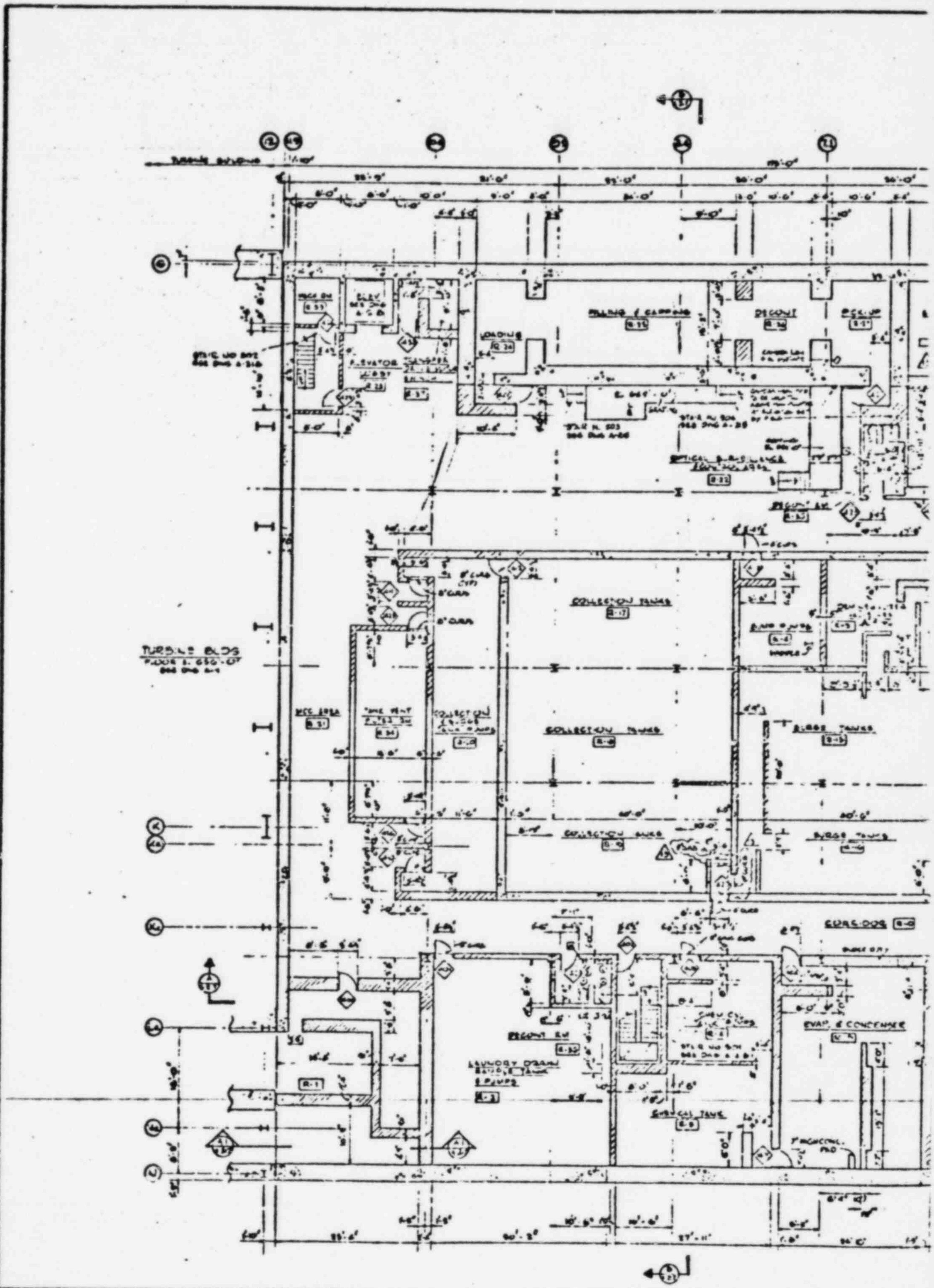
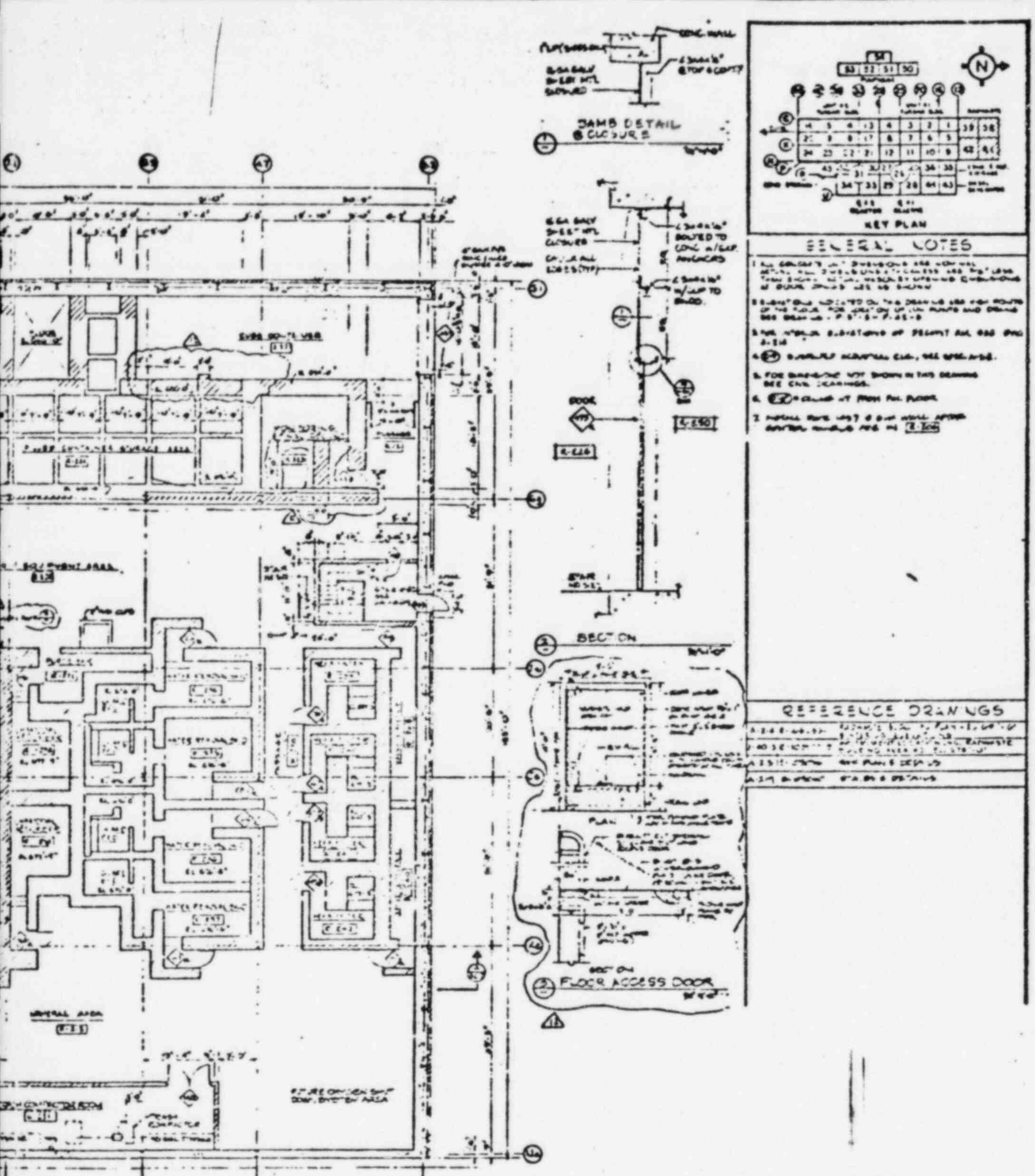
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

RADWASTE BUILDING
FLOOR PLAN
EL. 646'-0"

FIGURE 12.5-3



TURBINE BLDG
COLLECTION TANKS
COLLECTION TANKS
DECONT RM
CORRIDOR
EVAP. & CONDENSER



...BUILDING FLOOR PLAN - EL. 676'-0"

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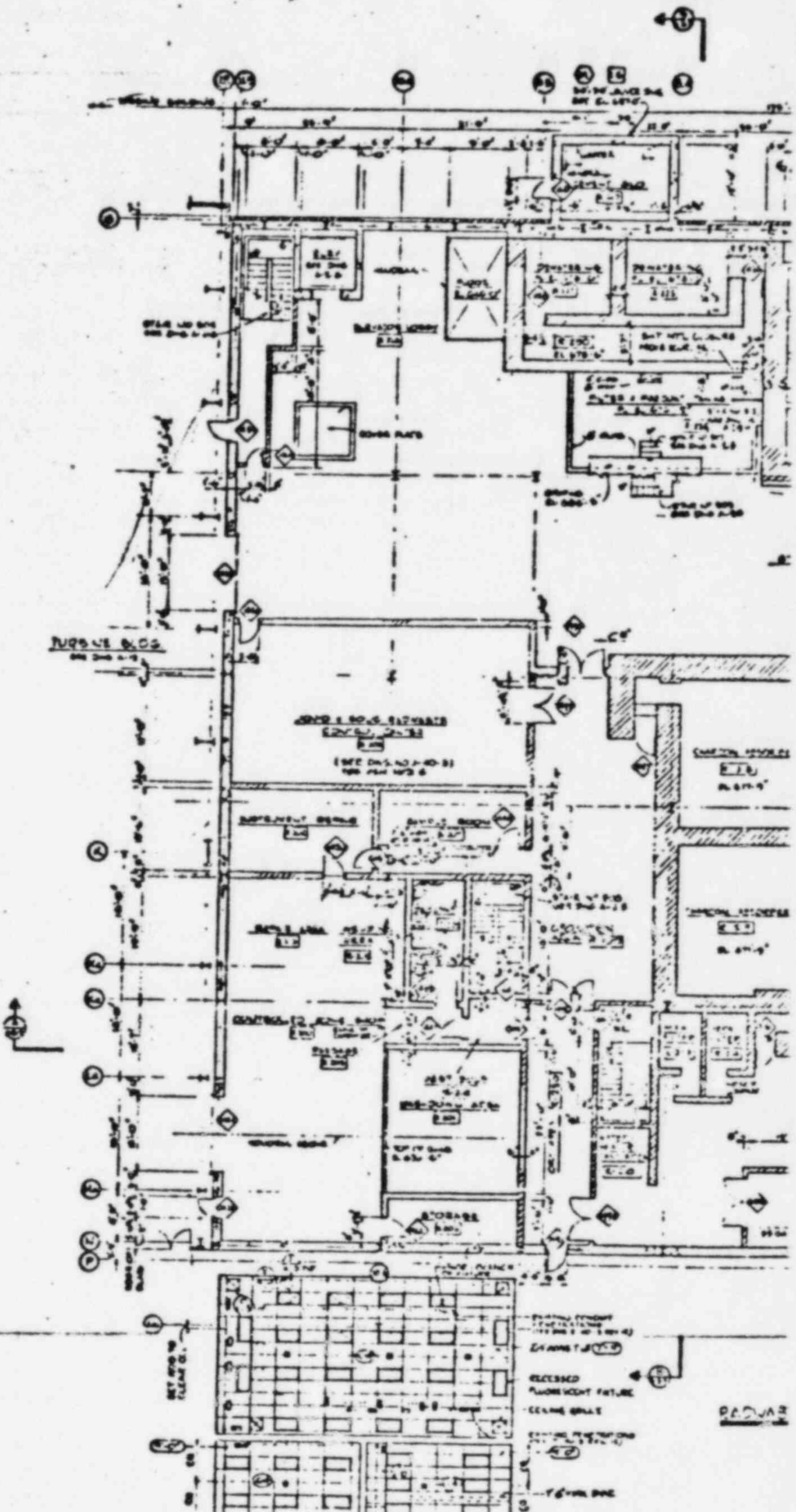
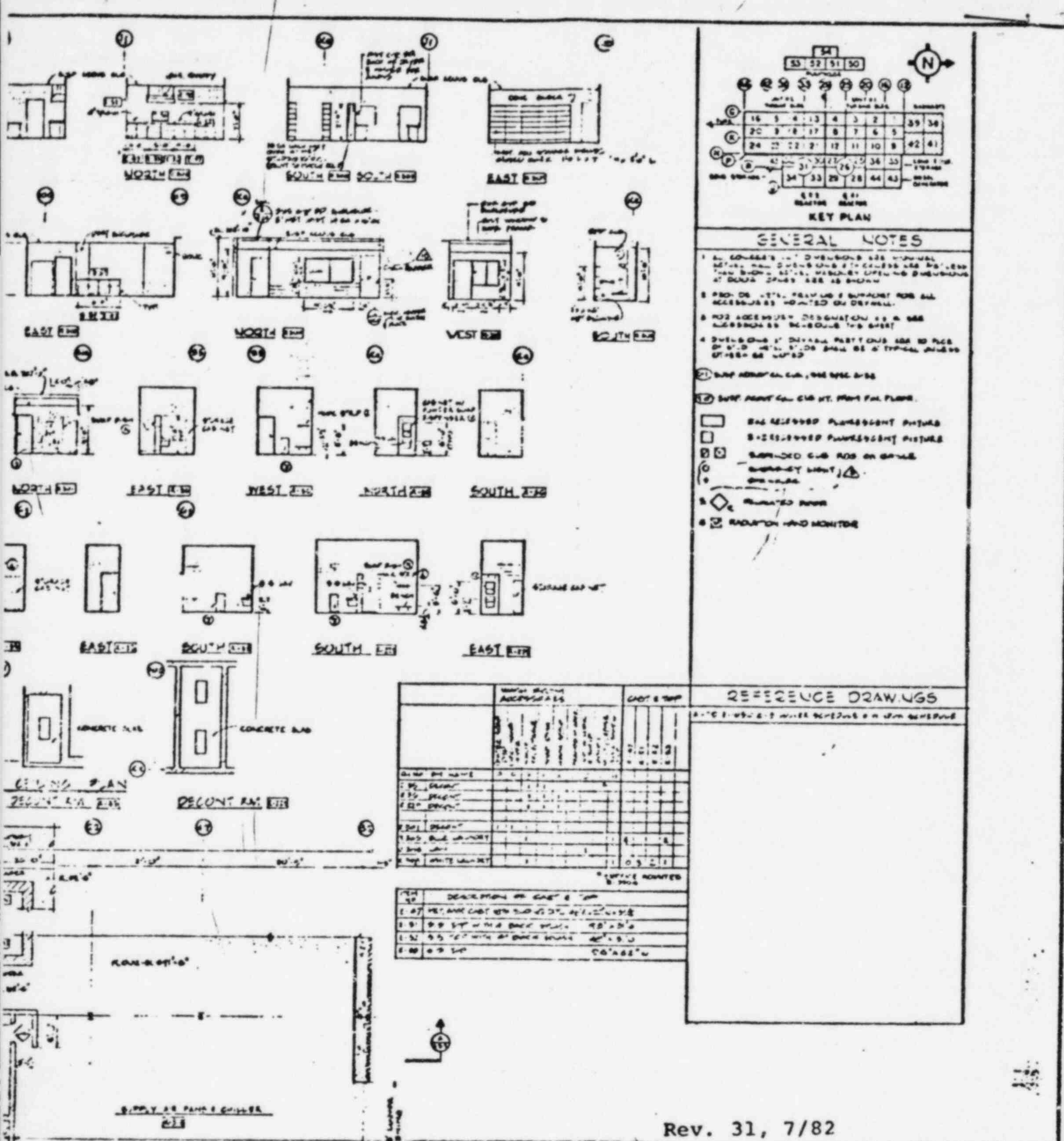
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

RADWASTE BUILDING
FLOOR PLAN
EL. 676'-0"

FIGURE 12.5-4



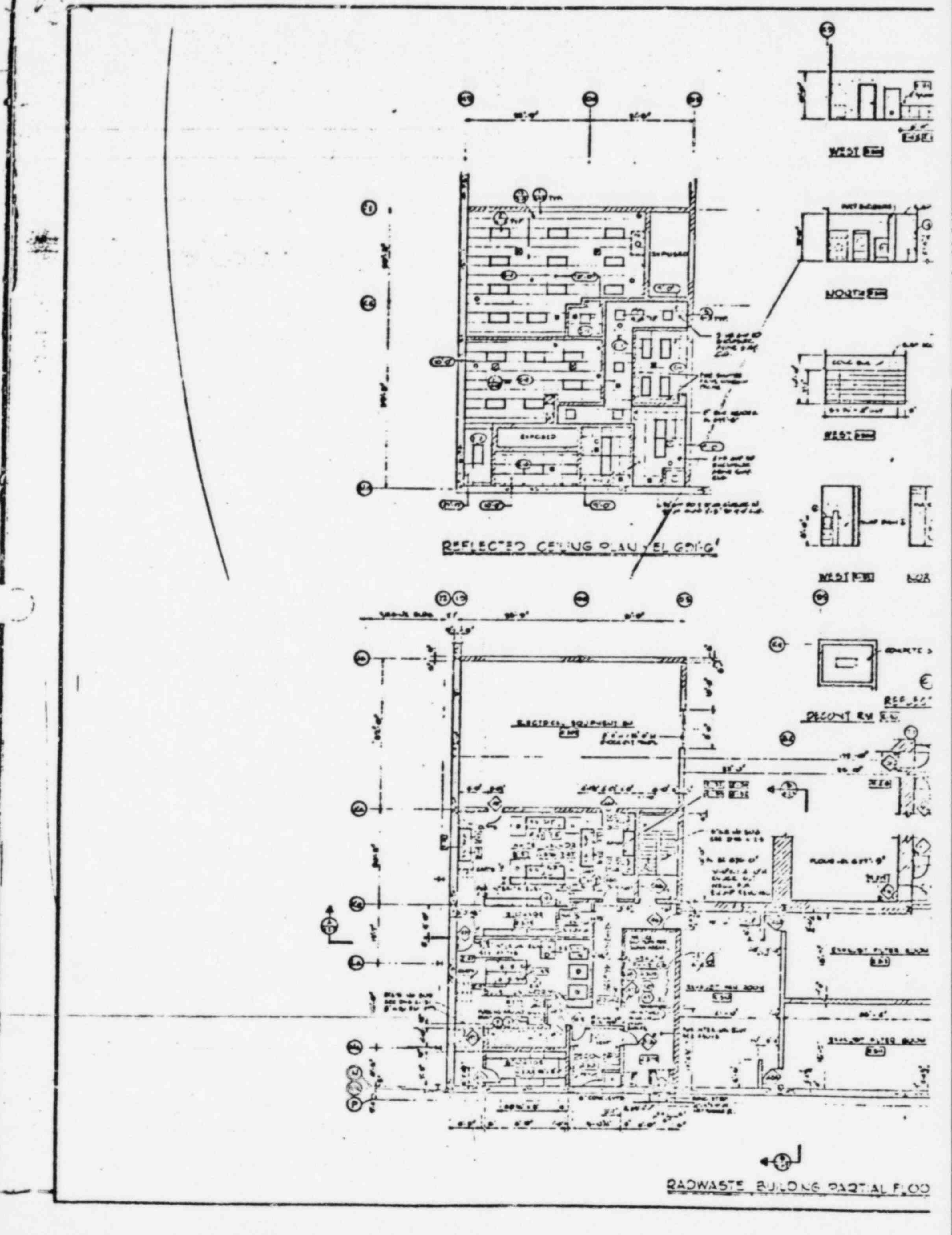
REFLECTED CEILING PLAN - RADWASTE CONTROL CENTER INSTRUMENT REPAIR & SAMPLE RM



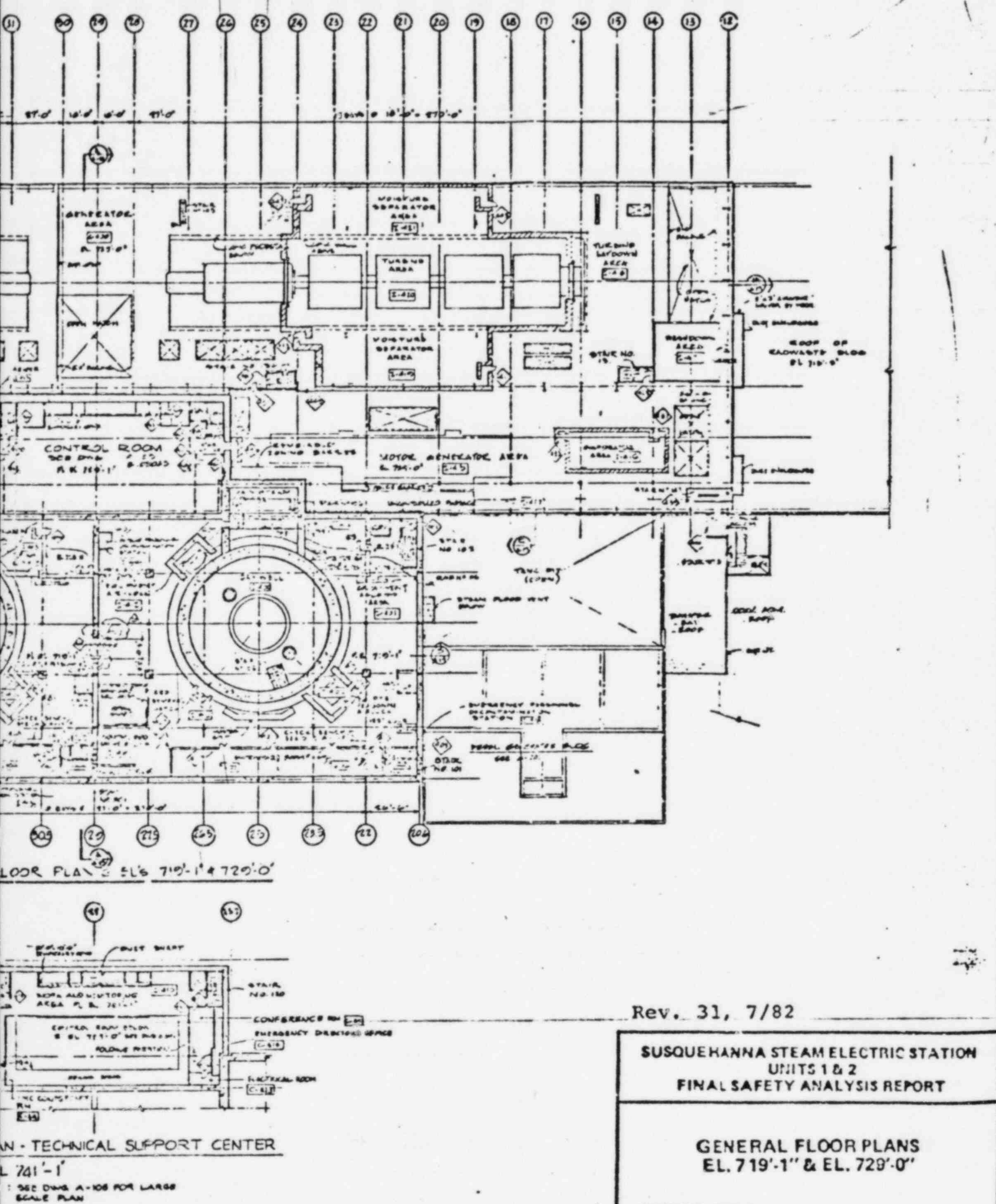
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

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

FIGURE 12.5-5



REFLECTED CEILING PLAN - EL 620'-6'
WEST
NORTH
ELECTRICAL EQUIPMENT RM
DECONT RM
EXHAUST FILTER ROOM
RADWASTE BUILDING PARTIAL FLOO



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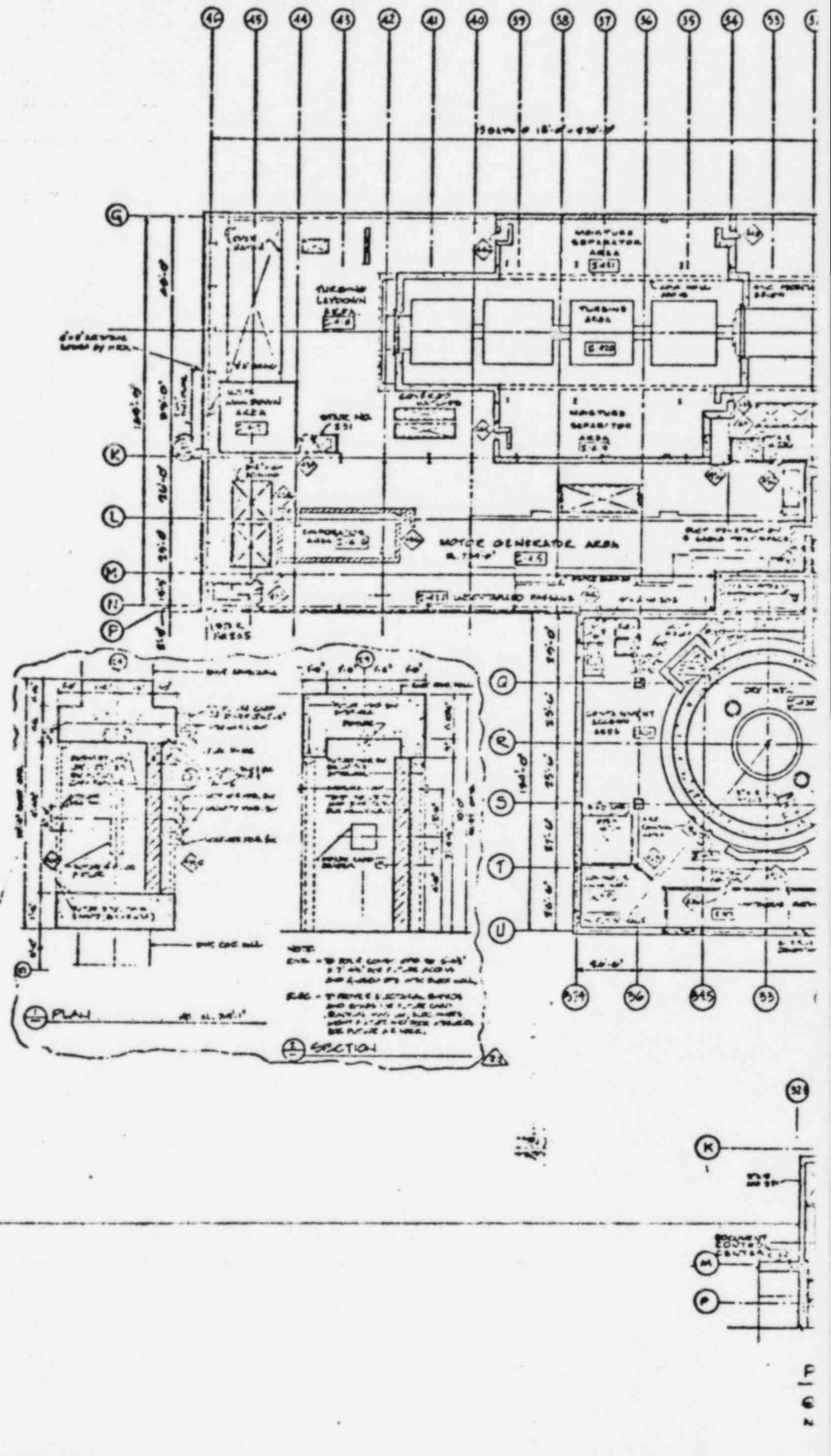
SUSQUEHANNA STEAM ELECTRIC STATION
UNITS 1 & 2
FINAL SAFETY ANALYSIS REPORT

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

FIGURE 12.5-8



TURBINE LAYDOWN AREA
MOISTURE SEPARATOR AREA
TURBINE AREA
MOTOR GENERATOR AREA
PLAN
SECTION
NOTE:
DOCUMENT CONTROL CENTER