Saxton Nuclear Experimental Corporation Facility

Decommissioning Environmental Report
Revision 1

February 2000

TABLE OF CONTENTS

LIST OF TABLES AND FIGURES

1.0 INTRODUCTION AND SUMMARY

1.1 Introduction

The Saxton Nuclear Experimental Corporation (SNEC) plans to decommission the SNEC Facility. The SNEC Facility consists of the Containment Vessel (CV), the concrete shield wall located around the northwest and northeast quadrant of the CV, the tunnel sections that are immediately adjacent to the outer circumference of the CV and between the CV and the previous Saxton Steam Generating Station (SSGS) and remaining portions of the septic system, weirs, and associated underground piping. This decommissioning program is in preparation for release of the site for unrestricted use. In addition the discharge tunnel from the SSGS will also be decontaminated and released for unrestricted use.

The SNEC Facility is a deactivated, pressurized water reactor (PWR), that was originally licensed to operate at 23.5 megawatt thermal (23.5 MWT). The SNEC Facility is maintained under a Title 10 Code of Federal Regulations Part 50 License and associated Technical Specifications. The license was amended to possess but not operate the reactor in 1972. The license expires on February 11, 2000 or upon expiration of the SNEC corporate charter, whichever occurs first.

The facility was built from 1960 to 1962 and operated from 1962 to 1972 primarily as a research and training reactor. The facility was placed in a condition equivalent to a status later defined by the United States Nuclear Regulatory Commission (NRC) as SAFSTOR after it was shutdown in 1972. Since then, it has been maintained in a monitored condition.

All fuel was removed from the CV in 1972 and shipped to the Atomic Energy Commission (AEC) facility at Savannah River, South Carolina, who remained owner of the fuel. As a result, neither SNEC nor GPU Nuclear Corporation has any responsibility relative to the spent fuel from the SNEC Facility. In addition, the control rod blades and the superheated steam test loop were shipped offsite. Following fuel removal, equipment, tanks, and piping located outside the CV were removed. The buildings and structures that supported reactor operations were partially decontaminated in 1972 through 1974 (Reference 1).

Radiological decontamination of reactor support structures/buildings was performed in 1987, 1988, and 1989, in preparation for demolition of these structures (Reference 2). This included the decontamination of the Control and Auxiliary Building, the Radioactive Waste Disposal Facility, Yard Pipe Tunnel, and the Filled Drum Storage Bunker, and the removal of the Refueling Water Storage Tank. Upon acceptance of the final release survey by the NRC (Reference 3), these buildings were demolished in 1992.

In November 1994, the Soil Remediation Project was completed. This was a comprehensive project of soil monitoring, sampling, excavation, packaging and shipment of radiologically contaminated site soil. This program successfully reduced radiological soil contamination levels below the NRC current and presently proposed levels required to meet site cleanup criteria for unrestricted use (Reference 4).

1.2 Purpose

The purpose of this Updated Environmental Report (ER) is to present an updated evaluation of the actual or potential environmental impacts resulting from the decommissioning of the facility, including decontamination, dismantlement, and site restoration activities. This report updates the SNEC Facility Decommissioning Environmental Report issued on April 17, 1996 as evaluated in the NRC's Environmental Assessment and Finding of No Significant Impact dated March 1998. Changes to the April 1996 Environmental Report are identified by Change Bar. The potential environmental effects of the construction and operation of the SNEC Facility were reported in the "Final Safeguards Report" (Reference 5).

This updated Environmental Report is submitted in accordance with the requirements of 10CFR50.82 (a) (9) and 10CFR51.53 (d) to address the post operating license stage of the facility. As required by these regulations this updated ER addresses new information and significant environmental change associated with the proposed termination activities.

The NRC prepared a generic environmental impact statement (GEIS), NUREG-0586, "Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities" (Reference 6) to assess the environmental effects associated with decommissioning alternatives for various types of nuclear facilities. This evaluation led to the following conclusions:

1) The technology for decommissioning nuclear facilities is well in hand and while technical improvements in decommissioning techniques are to be expected, decommissioning at the present time can be performed safely and at reasonable cost. Radiation dose to the public due to decommissioning activities should be very small and be primarily due to transportation of decommissioning waste to waste burial facilities. Radiation dose to decommissioning workers should be a small fraction of their exposure experienced over the operating lifetime of the facility and be well within the occupational exposure limits imposed by regulatory requirements. Decommissioning costs are reasonable and are, at least for the larger facilities such as reactors; a small fraction of the present worth commissioning costs (i.e., less than 10%).

2) Decommissioning of nuclear facilities is not an imminent health and safety problem. However, planning for decommissioning as an integral activity prior to commissioning as well as during facility life is a critical item that can have an impact on health and safety as well as cost. Essential to such planning activity is reasonable assurance that funds will be available for performing required decommissioning activities at the cessation of facility operations.

3) Decommissioning of a nuclear facility generally has a positive environmental impact. At the end of the facility life, termination of a nuclear license is the goal. Termination requires decontamination of the facility so that the level of any residual radioactivity remaining in the facility or on the site is low enough to allow unrestricted use of the facility and site. Commitment of resources, compared to operational aspects, is generally small. The major environmental impact of

decommissioning is the commitment of small amounts of land for waste burial in exchange for reuse of the facility and site for other purposes. Since in many instances, such as at a reactor facility, the land is a valuable resource, return of this land to the commercial or public sector is highly desirable.

Where applicable, the SNEC Facility information is compared to the generic assessments of NUREG-0586.

1.3 Regulatory Basis

Decommissioning of nuclear power plants is a regulated process whereby the radioactive materials contained in structures, systems, components, and portions of the site are reduced to residual levels, and the 10CFR50 license is terminated by the NRC. The termination of the Part 50 license requires NRC approval as specified in 10CFR50.82. Pursuant to the version of 10CFR50.82 in effect at that time, GPU Nuclear Corporation prepared a SNEC Facility Decommissioning Plan (Reference 8). This Environmental Report supported the SNEC Facility Decommissioning Plan submittal. In a subsequent letter (Reference 30), GPU Nuclear reconciled these submittals with the modifications to 10CFR50.82 which was issued in July 1996.

Decommissioning activities will be accomplished in accordance with all applicable regulations. Radiation exposures to both plant personnel and the public will be controlled and monitored in accordance with 10CFR20. The shipment and disposal of all radioactive materials will be accomplished in accordance with 10CFR61, 10CFR71, and the appropriate parts of 49CFR. A quality assurance program will be implemented to assure decommissioning activities are conducted in a safe and controlled manner.

This Updated ER has been prepared in accordance with the requirements outlined, in 10CFR50.82(a)(9) and 10CFR51.53(d). The report is also intended to assist the NRC meet the National Environmental Policy Act (NEPA) requirements of Title 10 CFR Part 51.

Additionally, those federal, state, and local regulations that are required for safety and environmental purposes are also identified.

1.4 Decommissioning Alternatives

The decommissioning alternatives described in NUREG-0586, "Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities" are: NO ACTION, DECON (immediate dismantlement), and SAFSTOR (long term storage followed by dismantlement).

The SNEC Facility was placed in a condition equivalent to a status later defined by the NRC as SAFSTOR when it was shutdown in 1972. Since then, it has been maintained in a monitored condition and the plant structures, external to the containment vessel, have been dismantled. The present NRC possession-only license for the facility expires on February 11, 2000. In recognition of this, SNEC has evaluated several options for decommissioning of the facility in light of current facility conditions and factors external to the facility.

Since the facility has been maintained in a condition equivalent to SAFSTOR for more than 20 years, radioactivity levels at the facility have decayed naturally, thereby reducing occupational radiation exposure during future decontamination activities.

The two decommissioning alternatives that have been evaluated are: SAFSTOR with dismantlement deferred an additional 30 years; and DECON - Immediate Dismantlement and Site Restoration.

The NO ACTION alternative, as described in NUREG-0586, implies that a licensee would abandon or leave a facility as is. This is not a viable decommissioning alternative and, therefore, is not considered.

As described in Section 4.2, the most appropriate alternative for the facility is Immediate Dismantlement and Site Restoration for the following reasons:

- It can be accomplished at this time with no significant impact to the health and safety of the workers, public, and the environment.
- Radioactive materials are removed from the site which is located in a 100 year flood plain and transported to a facility designed for long term disposal, thereby reducing overall environmental risk.
- Twenty years of radioactive decay have already reduced radiation exposure rates. The majority of personnel exposure savings to be gained from deferring dismantlement has already been achieved.
- A high groundwater condition could lead to loss of containment which could either cause an unmonitored release path or groundwater flooding of the lower elevations of the containment vessel.
- Degradation of containment vessel systems and structural components (e.g., polar crane and related equipment) which are needed to support dismantlement activities could start to occur.
- The people who worked on the SNEC Facility and the TMI2 Post-Defueling Monitored Storage (PDMS) projects have skills and knowledge directly applicable to the remaining work and are currently available.
- A low level radwaste disposal facility is available now. Its future availability and costs are uncertain.
- It eliminates the ongoing maintenance expense.

1.5 Final Release Criteria

GPU Nuclear Corporation will meet the site release criteria of 10CFR20 for release of the site for unrestricted use. The dose to an average member of the critical public will not exceed 25 millirem in any year for the following 1000 years due to any residual radioactive material of plant origin.

1.6 Summary And Conclusions

This Environmental Report demonstrates that the decommissioning of the SNEC Facility will not result in any significant impact to the health and safety of the workers and public or to the environment. Removal of radioactive materials from the site and placement in a facility designed for long term disposal along with restoration of the site will result in a positive benefit to the environment.

The following is projected for the decommissioning of the facility:

- Decommissioning activities will be conducted within the bounds evaluated by the GEIS (NUREG-0586).
- Occupational radiation exposures are now lower following the 20 years of radioactive decay and within the bounds evaluated by the GEIS (NUREG-0586).
- Exposure to onsite workers and the offsite public as a result of waste transportation are expected to be maintained well below the levels projected by the GEIS (NUREG-0586).
- The use of Low-Level Radioactive Waste (LLRW) disposal land will be much less than projected by the GEIS (NUREG-0586).
- Radiological effluents will be monitored and minimized through engineering controls and treatment, and will be much lower than federal regulatory limits. Doses to the public will also be far below limits established by federal regulations.
- Radiological environmental monitoring will be conducted to confirm that effluents are minimal and that controls and treatment are effective.
- Residual radioactivity will be limited such that upon release of the site for unrestricted use following decommissioning, an individual of a critical population group, living on the site, would not be expected to receive a dose greater than 25 millirem per year from all combined environmental exposure pathways in accordance with 10CFR20.
- Accident analyses demonstrate that no adverse public health and safety or environmental impacts are expected from accidents that might occur during decommissioning operations.
- Ecological impacts (wildlife, plants, etc.) will be minimal.
- The proposed SNEC Facility Decommissioning Plan is environmentally sound and will result in the removal of radioactive materials from the site and permit unrestricted access.
- Non-radiological effluents will be permitted and discharged in accordance with the National Pollutant Discharge Elimination System (NPDES).
- The generation of hazardous waste and the potential for hazardous material spills will be minimized.

2.0 SITE AND FACILITY DESCRIPTION

2.1 Location of the Site

The site of the SNEC Facility is located about 100 miles east of Pittsburgh and 90 miles west of Harrisburg, Pennsylvania in the Allegheny Mountains, three fourths of a mile north of the Borough of Saxton in Liberty Township, Bedford County, Pennsylvania. The site is on the north side of Pennsylvania Route 913, 17 miles south of U. S. Route 22, and about 15 miles north of the Breezewood Interchange of the Pennsylvania Turnpike (Figure 2.1-1).

2.2 Description of SNEC Facility Site

The SNEC Facility was built adjacent to the Saxton Steam Electric Generating Station of the Pennsylvania Electric Company, a subsidiary of General Public Utilities. This coal fired station operated from 1923 to 1974 and was demolished between 1975 and 1977 (See property map, Figure 2.2-1). The SNEC Facility site consists of 1.148 fenced acres of the approximate 150 acres owned by Pennsylvania Electric Company. An additional 9.6 acre area is fenced in around the electrical switchyard and buildings under Pennsylvania Electric Company control. The site as well as a portion of the Pennsylvania Electric Company area and the surrounding uncontrolled lands are in the 100-year floodplain of the Raystown Branch of the Juniata River, which borders the north and west portion of the property. A small stream known as Shoup's Run crosses the central portion of the property and joins the Juniata River. Normal elevation of the River near the facility is about 794 feet mean sea level (MSL), the site and adjacent property lie about 17 feet above river level. Much of the property is comprised of gently sloping open land of grasses that are a result of restoration activities following the demolition of the Saxton Steam Electric Generating Station.

2.3 Facility Description

The only remaining structures of the original facility are the Containment Vessel (CV), the concrete shield wall located around the northwest and northeast quadrants of the CV, tunnel sections that are immediately adjacent to the outer circumference of the CV and portions of the septic system, weirs, and associated underground discharge piping (Figure 2.3-1). Concrete barrier walls have been installed to isolate the open ends of the tunnel that were connected to the Control & Auxiliary Buildings, the Radioactive Waste Disposal Facility, and the Steam Plant. Portions of the Steam Plant Tunnel still exist beyond the location where it is blocked off and will require decontamination for release for unrestricted use. In addition, as part of the decommissioning process a Decommissioning Support Facility was constructed adjacent to the CV.

<u>Containment Vessel</u>
The Containment Vessel (CV) (Figure 2.3-1) is a circular steel structure approximately 109 feettall by 50 feet in diameter with approximately 50 percent of the structure below grade. The CV is subdivided into a reactor compartment/storage well, primary compartment, auxiliary compartment, and an operating floor. These areas are separated from each other by concrete walls, floors, and ceilings. Additionally the below grade portion of the CV is lined with concrete.

Concrete Shield Wall
The concrete shield wall is a small exterior wall built along the northwest and northeast quadrant of the containment vessel. It is slightly radiologically contaminated.

Tunnel
The tunnel section immediately adjacent to the CV originally carried system piping between the CV and other facility buildings. This piping was removed as part of decommissioning activities that occurred following plant shutdown in 1972. The tunnel interior is slightly radiologically contaminated.

Decommissioning Support Facility
This pre-engineered facility was constructed to support decommissioning operations at the site. It consists of a steel "Butler" type building approximately 40' x 60', constructed on a slab located against the CV on the south side. The building consists of three sections; the Decommissioning Support Building (DSB), the Material Handling Bay (MHB), and the Personnel Access Facility (PAF). Various doors are provided and an opening was cut into the CV shell to provide access between the CV and the MHB to facilitate removal of components for packaging and shipment. A 10 ton removable ten hoist is installed between the CV and MHB to aid in removal of these components.

Saxton Steam Generating Station Discharge Tunnel
This tunnel is adjacent to the CV tunnel and was used as the mixing and dilution point for radioactive liquid discharges during plant operation. The tunnel interior is slightly contaminated and contains some radioactively contaminated sediment.

Other Plant Structures
Portions of the septic system, weirs, and associated underground piping still exist at the site.

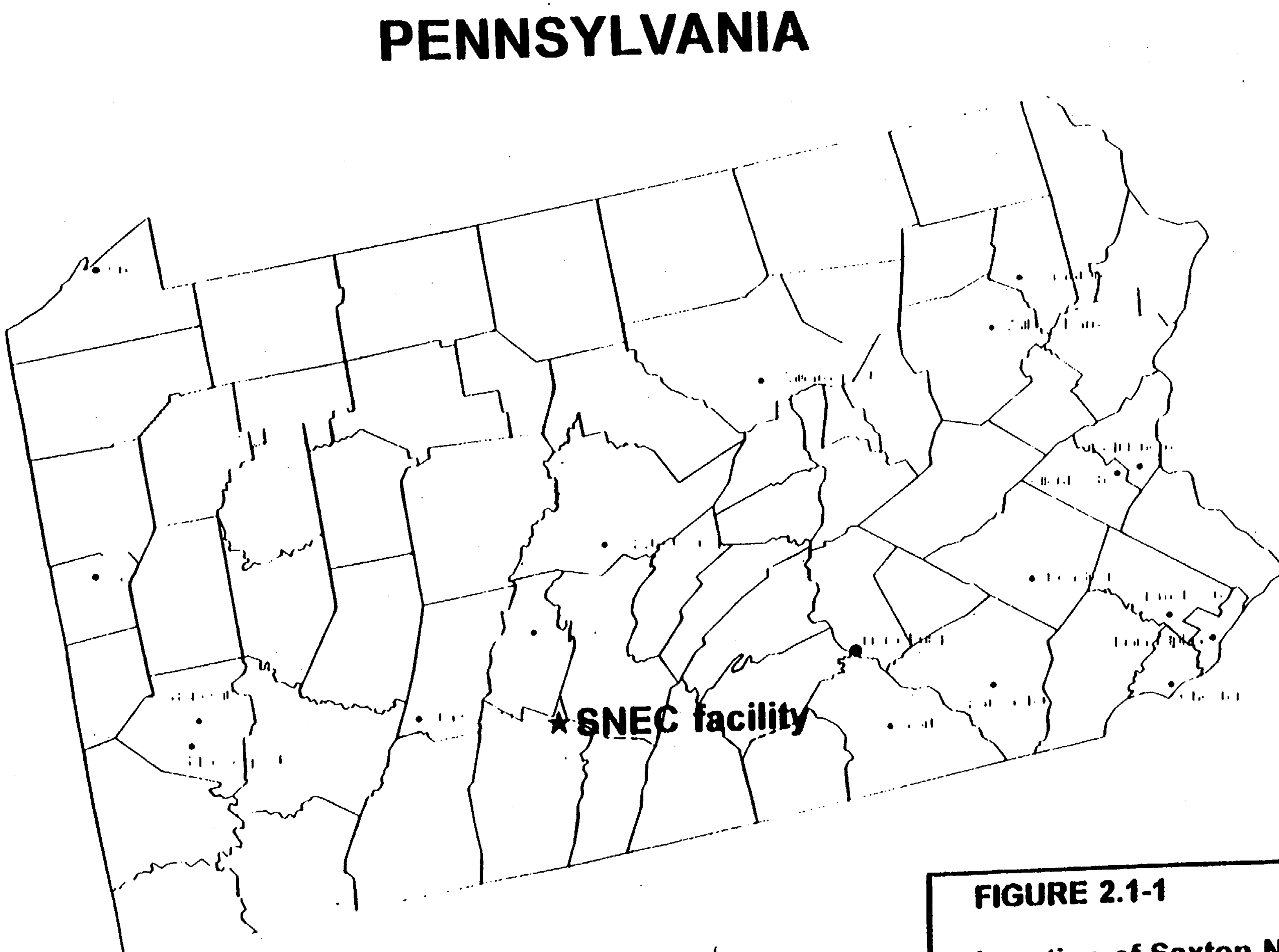


FIGURE 2.1-1

FIGURE 2.1-1

Location of Saxton Nuclear Experimental facility Saxton, Pennsylvania

FIGURE 2.2-1

PROPERTY MAP – SAXTON SITE

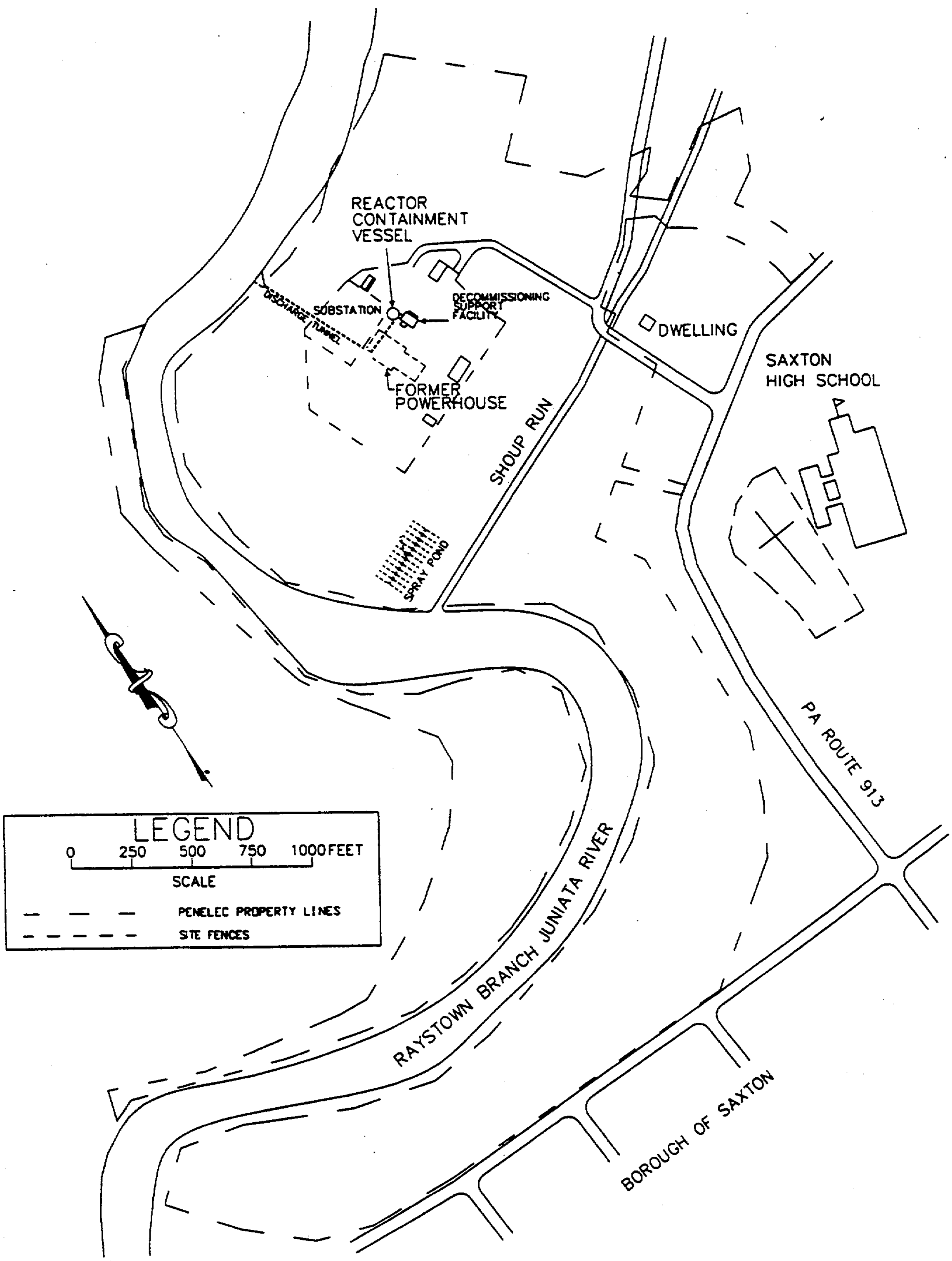
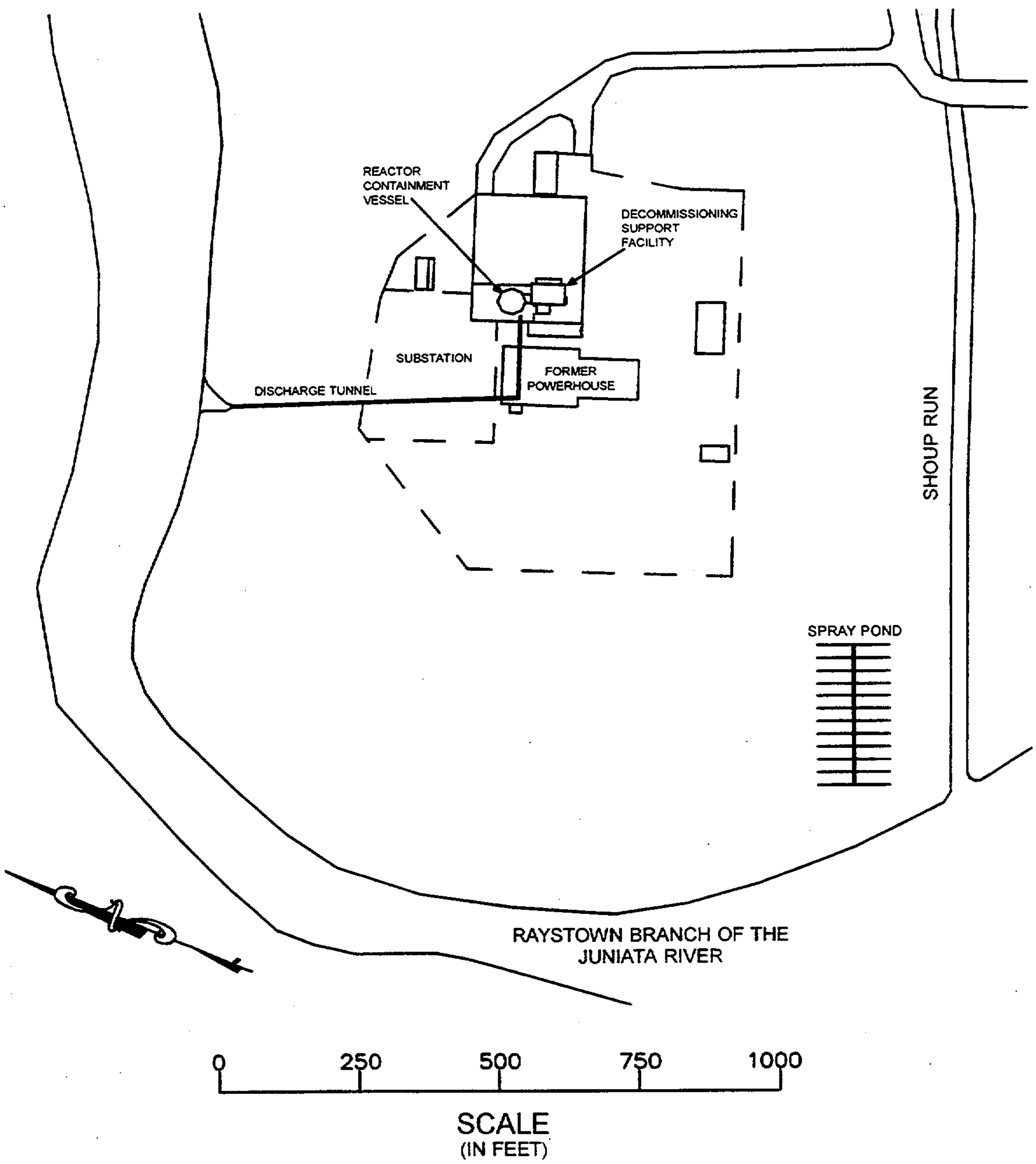


Figure 2.3-1

SAXTON SITE LAYOUT



3.0 PLANT ENVIRONMENTAL INTERFACES

3.1 Demography - Human Activities in the Environs

The area surrounding the site is generally rural, forested and mountainous terrain. The population density of the area is low with small concentrations in the valleys and along main highways. The site lies about three-fourths of a mile north of the Borough of Saxton in Liberty Township, Bedford County, Pennsylvania. The population and population trends for the Borough of Saxton, Bedford County and the adjacent counties of Blair and Huntingdon are shown in Table 3.1-1. The population of these three surrounding counties has decreased between 1980 and 1990. At the time the SNEC Facility was constructed, the estimated population of the Borough of Saxton was 975, as recorded during the 1960 census. Thirty years later the population as recorded during the 1990 census was 838, a decline of 16.3%.

The nearest population center (as defined by 10CFR100) of 25,000 or more is the city of Altoona which lies about 20 miles north-northwest of the SNEC Facility site. The 1990 population of Altoona was 51,881. The closest incorporated towns other than the Borough of Saxton are Coalmont Borough about 2.5 miles to the east, Dudley Borough about 3.4 miles to the east and Broad Top about 5.3 miles also to the east.

Current uses of adjoining properties include undeveloped wooded and residential areas. A cemetery is present along the eastern property boundary, undeveloped wooded and residential areas along the northern, southern, and western property boundaries.

The Raystown Branch of the Juniata River in the vicinity of the site is widely used for recreation by local residences primarily for boating and fishing. However the vast majority of recreational activities along the river are centered downstream of the site on Raystown Lake.

Approximately 34 miles downstream from the site the Raystown Branch of the Juniata River is dammed impounding the river to form Raystown Lake. The dam was built by the US Army Corps of Engineers (COE) from 1968 to 1973 for flood control, recreation, and water quality purposes. At normal pool level the lake is 27 miles long and has an area of 8,300 acres. The lake provides one of the better recreational areas in this part of Pennsylvania. The lake has been intensively developed by the Federal Government for recreational activities including boating, fishing, camping, hunting, and picnicking. Over 475,000 visitors annually make use of the many recreational activities offered.

3.2 Geology

The site lies in the Appalachian highlands in the Ridge and Valley physiographic province. This province comprises alternate successions of narrow ridges and broad or narrow valleys trending generally northeast. This is a region of alternating hard and soft sedimentary rocks that have been severely folded by lateral compression into a series of anticlines and synclines. The ridge is of Tuscarora quartzite and small amounts of Pleistocene gravel and recent alluvium are found along the river. Most of the area is underlain by strata of Upper Devonian age. A generalized geologic cross section of the region is shown in Figure 3.2-1. This geologic cross section is drawn at a northwest -

southeast orientation and shows that the SNEC Facility is located on the limb of a major syncline that dips generally towards the east (Reference 7). Although coal is mined in the general area of the site, no coal has been reported to lie beneath the site, nor has the site been undermined. The ridges immediately to the northwest of the site rise to 1,300 feet and to the southeast rise to 1,500 feet with site elevation being about 811 feet MSL. (Figure 3.2-2).

Soil Description

Split-spoon samples collected during an extensive hydrogeological investigation (Reference 7) and samples from hand-dug pits indicate that the surficial soil, in the vicinity of the CV, is composed of two types of construction backfill: (1) well graded reddish silty fine to coarse sand with some fine to medium gravel and (2) a well graded mixture of ash and cinders. Both of these fill materials were placed during station construction. The depth of the fill generally ranges from three to six feet, although the fill may be deeper at locations where building construction excavation took place.

Underlying the fill materials is a boulder layer. This layer is generally four to six feet thick and separates the fill material from the top of the bedrock. The material making up the boulder matrix is a silty clay. The silt and clay were found to be localized in the boulder layer and did not appear to be present in the fractured bedrock below that zone (Reference 7).

Bedrock Geology

The bedrock underlying the facility has been identified as "marine beds" of upper Devonian age per the Pennsylvania Geological Survey (PaGS). The PaGS assigned this bedrock as the "Foreknobs Formation" but this unit has also been called a lower member of the "Catskill Formation". The bedrock is composed of interlayered red and green siltstone and sandstone (also identified as gray to olive brown shales, graywackes and sandstones). Depth to bedrock at the site is generally about 8 to 12 feet below the surface (Reference 9).

During the 1981 hydrogeologic investigation (Reference 7) many bedrock outcrops were examined throughout the region. These outcrops substantiate the premise that the plant site is located on the western limb of a major syncline which strikes (is aligned) generally N 25° - 42° E and dips (tilts) approximately 15° – 45°E Some minor internal folding is present within various bedding members though the overall dip of the major structure is to the east. The bedrock orientations along with various fracture patterns of these Devonian rocks are important in understanding the groundwater flow directions in the bedrock as discussed in the following section.

3.3 Hydrology

Surface Water

The primary water body in the vicinity of the facility is the Raystown Branch of the Juniata River, which meanders along its water course in an overall flow direction to the northeast and generally borders the northern and western edges of the property. Approximately 34 miles downstream from the site the Raystown Branch of the Juniata River is dammed impounding the river to form Raystown Lake. The dam was built by the COE from 1968 to 1973 for flood control, recreation, and water quality purposes. At normal pool level the lake is 27 miles long and has an area of 8,300 acres. Normal elevation of the river near the site is about 794 feet MSL in comparison to the site which lies at about 811 feet MSL. A small stream known as Shoup's Run flows west and transects the Company property to the south of the SNEC Facility and empties into the Raystown Branch of the Juniata River. The watershed extending upstream from Saxton, Pennsylvania is about 756 square miles.

Because the vicinity of the site contains old field and forest vegetation and very little impervious cover, precipitation falling on the SNEC Facility generally will percolate into the local soils and become incorporated into the groundwater regime as opposed to direct overland flow into the adjacent streams. Significant precipitation will cause minor intermittent ponding in the immediate site area, further demonstrating that surface runoff from the site is minimal. Therefore, an understanding of groundwater hydrology at the SNEC Facility is of primary importance. Extensive groundwater monitoring in the site vicinity has been undertaken to ensure that groundwater degradation is not occurring.

A detailed description of the hydrology of the major surface water bodies in the vicinity of the site is provided in the SNEC Final Safeguards Report (Reference 5).

Ground Water

Underlying the site are three distinct subsurface zones that have different water-bearing and transmitting properties. As previously mentioned in Section 3.2 ("Geology"), the site is immediately underlain by a fill layer comprised of fly ash, cinders and/or silt and sand-size sediment. This fill layer is underlain by a layer of boulders in a silty clay matrix. Bedrock lies beneath this boulder layer. Field permeability tests were conducted in selected bore holes and laboratory mechanical analyses were performed on construction fill material to obtain a relative indication of the ability of the various subsurface zones to transport water (Reference 7).

The red silty sand fill material was well-graded, containing about 45% passing a #200 sieve. The well graded nature of the fill suggests a very low permeability, probably ranging between 1E-6 cm/sec to 1E-8 cm/sec. The ash fill material, however, is believed to have substantially greater permeability than the red silty sand fill. Actual permeability values for the ash fill are unavailable since the friable particles may have been altered by the mechanical analysis technique.

In general, the construction fill and boulder layers were less permeable than the bedrock. Tests indicated that the boulder layer acted as a barrier or confining layer to the flow of groundwater between the construction fill and the bedrock. Essentially isolating the shallow groundwater from the deeper, bedrock groundwater. The permeability of the bedrock varied with depth. Results indicated rock permeability ranging from moderate values (about 1.06E-3 cm/sec), to negligible values (no flow recorded in the test sections). The highest permeability was at the boulder layer-bedrock interface. This probably was a function of the weathered, fractured nature of the top of the bedrock. Other zones of comparatively high permeability may be present in the bedrock based on test borings.

Groundwater was measured at depths of about three to five feet below the surface in the immediate site vicinity. Ground water level observations in test borings also indicate a groundwater gradient of 10 to 15 feet over a distance of 600 to 800 feet from the site to the river. An additional hydrogeological investigation was conducted in 1992 to determine the actual groundwater flow direction in the shallow aquifer of the SNEC Facility (Reference 10). Eight overburden (shallow) groundwater monitoring wells were installed for this purpose. Groundwater elevation contour maps indicating the groundwater flow direction can be seen on Figures 3.3-1 and 3.3-2. The contour maps indicate that groundwater within the overburden soil flows west, towards the Raystown Branch of the Juniata River. Additional information was gathered during the 1992 investigation for installing deeper, bedrock monitoring wells for reliably monitoring the CV with a minimal number of wells. The CV is seated approximately 50 feet into the bedrock which warrants special attention to these types of deeper, bedrock monitoring wells.

Groundwater movement within the bedrock beneath the site is predominantly controlled by fractures in the bedrock. Groundwater also moves within the spaces (bedding planes) between the individual rock layers of the bedrock. The direction of groundwater is controlled by the orientation of these fractures and bedding planes.

The 1992 hydrogeologic investigation revealed specific orientations of the two dominant fracture patterns and of the bedding planes. One fracture pattern trended northeast-southwest, and dipped (tilted) moderately to the northwest. The second fracture pattern trended northwest-southeast, and dipped steeply toward the southwest. The bedding planes trended northeast-southwest, and dipped moderately toward the southeast. This information was essential for the proper placement of bedrock monitoring wells which are discussed in Section 7.5 ("Environmental Radiological Surveillance Program").

3.4 Meteorology

Applicable references for this section are contained in references 12, 13, and 14.

Regional Climate

The climate of the south-central Pennsylvania region can best be described as a region of contrast. During the late spring, summer and early fall, the region is dominated by air masses that originate from the southeastern United States. Warm and humid conditions are normal during this time along with air mass thunderstorms and precipitation associated with cold fronts. These frontal boundaries are more active (weather-wise) during the spring and autumn, when the polar jet stream is over the region. The winter season is cold and often times overcast. Air masses are generally cold and dry. Winds associated with these air masses are generally from the west-northwest. They originate from central Canada and move into the region behind active cold fronts and low pressure systems that move north along the Atlantic seaboard. The region will experience a large percentage of cloud cover, in part, due to its close proximity to the Great Lakes. As the cold, polar air passes over the relatively warm lakes, condensation occurs along with lake-effect snows close to the shore of these large bodies of water. Drying will occur as the distance increases from the lakes and a constant cloud cover will dominate in western Pennsylvania. In addition, in this region of steep-sided valleys, mountain winds during the day will lead to an increase in clouds as daytime heating will cause rising air motions and subsequent condensation (clouds).

Precipitation in the region is mainly due to air mass thunderstorms, cold front passages from the west and low pressure storms that move along the Appalachian Mountains through the St. Lawrence Valley region.

These storms will generally produce copious amounts of rain from a northeast direction. Annual amounts can range from 30 - 40 inches. One quarter of the winter precipitation is snowfall. The major fall and winter coastal storms that produce large amounts of precipitation in the eastern half of the state have minimal effect on the site.

Winds in the Saxton region are influenced by topographic features. The facility lies in the main valley formed by the Terrace and Saxton Mountains to the east, and Tussey Mountain to the west. The Allegrippis Ridge is also located to the west. The mountains and valley are generally southwest to northeast. With the large scale wind flow out of the west, "Wind channeling" occurs at the lower levels which give rise to a small-scale southwesterly flow up the valley. On a smaller scale, the varying topographic regime will cause valley-slope circulation patterns. During the daytime, beginning in mid-morning and continuing until near sunset, the wind will cross the valley and blow up the sides of the mountain as daytime heating near the surface creates unstable, rising air and, as previously mentioned, an increase in clouds. Beginning around midnight and continuing until shortly after sunrise, the wind tends to blow down the mountain slope as the land surface along the slopes cools more rapidly than at the base of the valley. This cooler, more dense, stable air will sink towards the valley and move down the canyon. Wind speeds are generally light at the SNEC Facility site (below ten miles per hour), primarily due to the wider valley around the site.

Past Meteorological Facility Operations

An onsite meteorological program at the SNEC Facility site was instituted in 1960 and operated for one year. Data from the program were used to establish estimates of dispersion and diffusion characteristics of the site. The network contained three towers located east, west and north of the site. Instrumentation at each location included wind speed, wind direction and ambient temperature. Temperature probes were mounted at different vertical levels to try and obtain a better understanding and determination of the inversion stable layer that develops with valley flow at night. Other readings from the site such as barometric pressure, river water temperature, relative humidity and rainfall were available.

Meteorological Dispersion Assessment

Due to the steep mountain slopes in the Saxton region, direct heating, which leads to unstable meteorological conditions and strong mixing (dispersion), are minimal. In fact, conditions of strong mixing occur only 3 percent of the time. Air dispersion in the region is either neutral or stable. The former condition is synonymous with a cloud cover or moderate wind while the latter condition is characteristic of cold air "pooling" due to mountain winds at night.

Under neutral conditions in which mixing throughout the layer occurs, the ultimate dispersion is in a direction determined by the wind direction in the main valley. As previously mentioned, the two wind directions are southerly, along the mountain-valley range and westerly, blowing up out of the valley through the gap between Terrace and Saxton Mountains to the east. These winds range between 5-10 miles per hour.

Under stable conditions, the stratification of air isolates the valley flow from the large-scale wind flow of the main valley. Cold air "pooling" in the valley will cause a temperature inversion to develop. This inversion will tend to "trap" dispersion within a well-mixed region in the first several hundred feet. Fifty percent of the time, these stable conditions exist. Of this, approximately 25 percent are extreme in that pollutant "trapping" or fumigation in the lower levels will occur. Wind speeds will be 3-5 miles per hour with flow generally down the valley away from the Saxton region. Since daytime heating takes place in the region, prolonged periods of pollutant "trapping" do not exist.

Since the release from the SNEC Facility is considered "ground" in nature, highest radioactive dispersion values will be close to the site boundary and in the direction of the prevailing wind flow. It can be expected that the major portion of the particulate matter originating at the site will be deposited in the valley north-northeast of the site. These areas are sparsely occupied and almost completely covered by forests. It should be noted that an elevated release, by definition, is a release that is 2-2.5 times the height of the nearest adjacent building structure.

Wet deposition of radioactive particulate matter will occur during periods of precipitation. Since most major precipitation events occur from a northeast direction, radioactive material would be deposited towards the south and southwest directions. In addition, with a ground release, this washout will occur close to the source and within the plants property line.

3.5 Other Environmental Features

Historical

The SNEC Facility site and adjoining Pennsylvania Electric Company property do not contain any known historical or archaeological areas. The project site has been previously disturbed by the construction of the SNEC Facility.

Endangered Species

There are no known endangered or threatened plant or animal species on the SNEC Facility site or adjacent Pennsylvania Electric site.

Table 3.1-1

Population and Population Trends
for the Borough of Saxton,
Bedford and Adjacent counties

Saxton Borough

Year	Population
1960	975
1980	814
1990	838
1994 (est.)	837

Year	Bedford County	Blair County	Huntingdon County
1980	46,784	136,621	42,253
1990	47,919	130,542	44,168
1994 (est.)	48,984	131,819	44,529

FIGURE 3.2-1

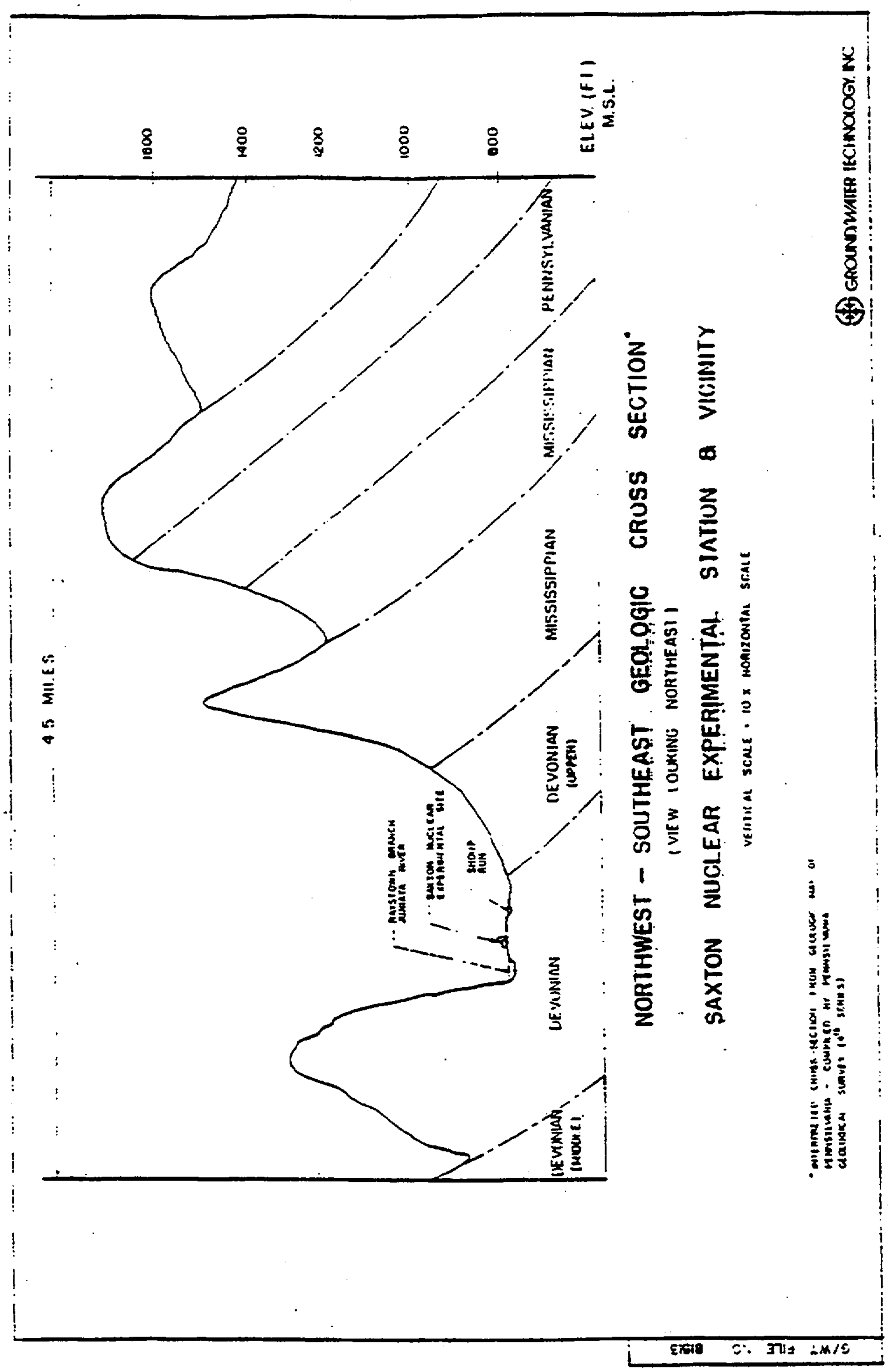
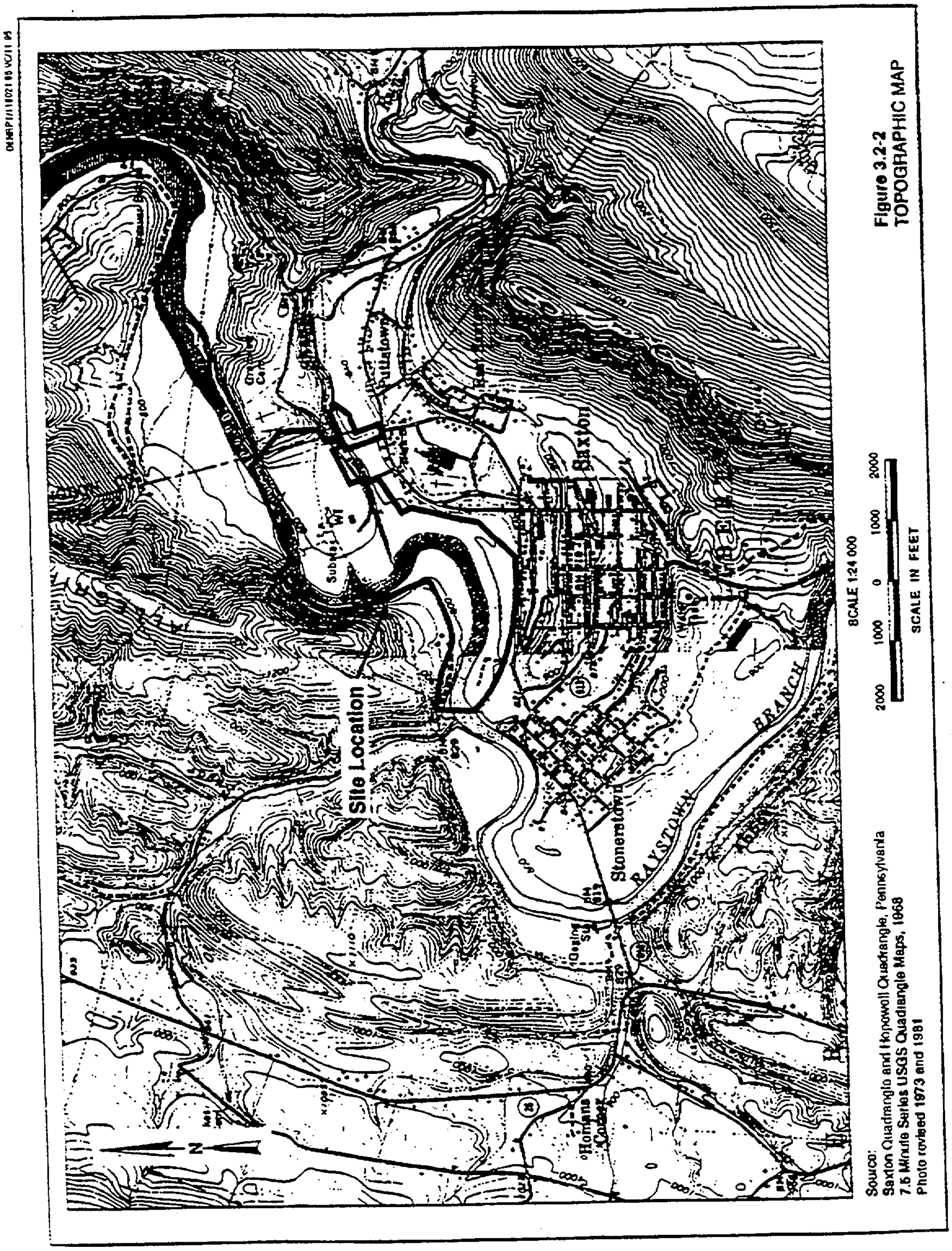
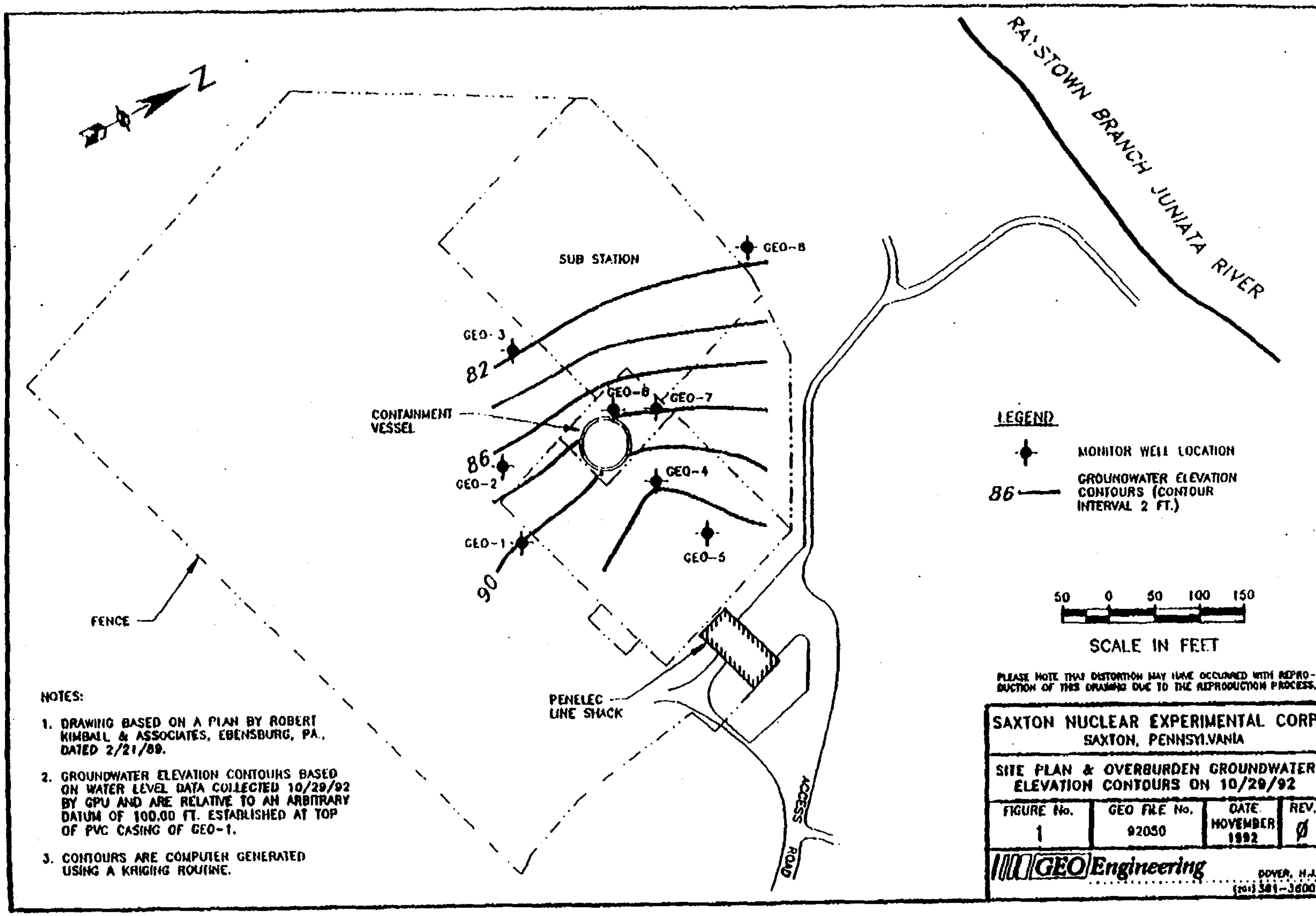

NORTHWEST – SOUTHEAST GEOLOGIC CROSS SECTION*
(VIEW LOOKING NORTHEAST)
SAXTON NUCLEAR EXPERIMENTAL STATION & VICINITY
VERTICAL SCALE = 10 X HORIZONTAL SCALE
4.5 MILES
ELEV. (FT) M.S.L.
1800
1400
1200
1000
800
PENNSYLVANIAN
MISSISSIPPIAN
MISSISSIPPIAN
DEVONIAN (UPPER)
DEVONIAN
DEVONIAN (MIDDLE)
GROUNDWATER TECHNOLOGY, INC.

FIGURE 3.2-2

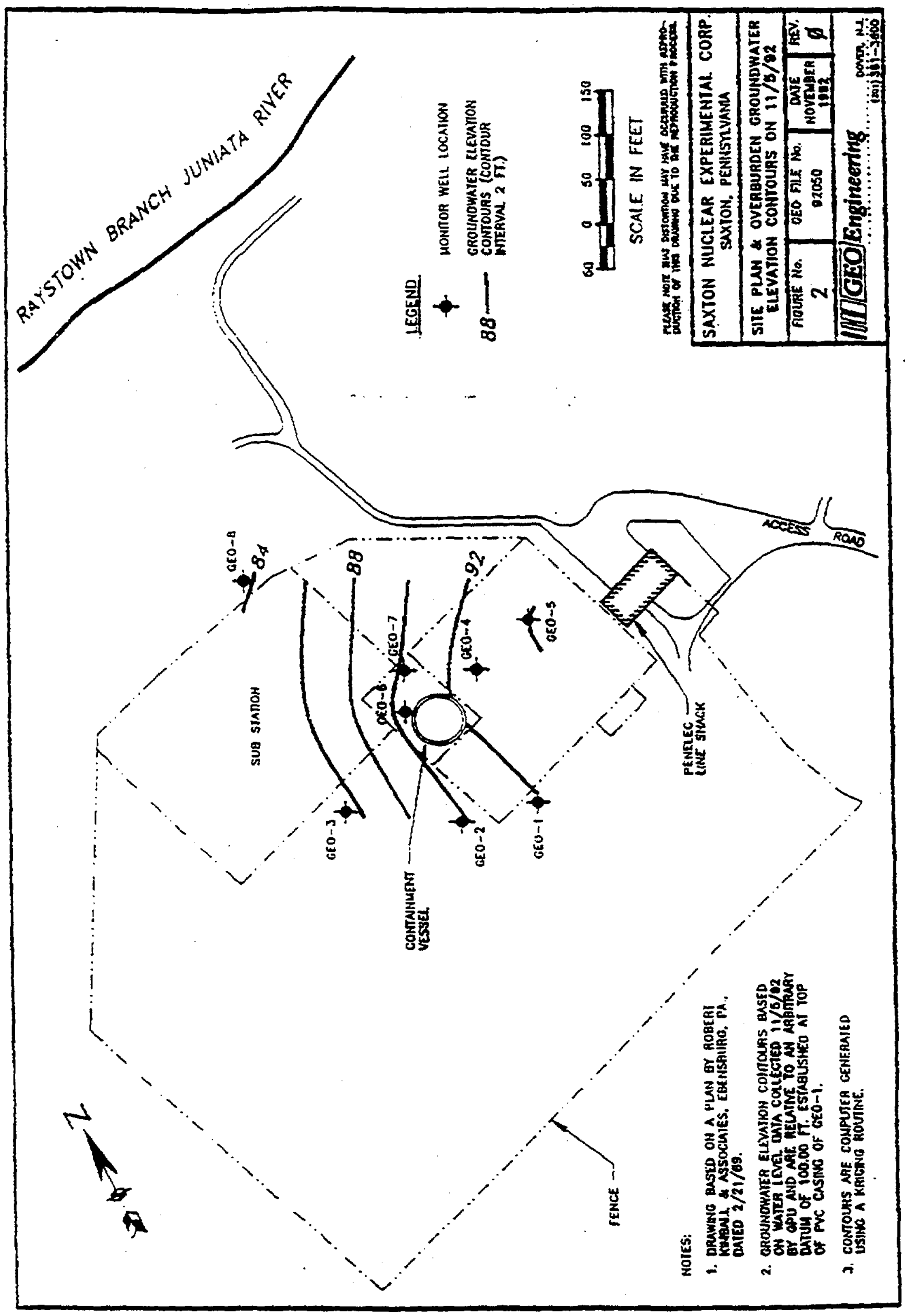

Site Location
Saxton
Stonerstown
RAYSTOWN
BRANCH
SCALE 1:24 000
2000 1000 0 1000 2000
SCALE IN FEET
Source:
Saxton Quadrangle and Hopewell Quadrangle, Pennsylvania
7.5 Minute Series USGS Quadrangle Maps, 1968
Photo revised 1973 and 1981
Figure 3.2-2
TOPOGRAPHIC MAP



N
RAYSTOWN BRANCH JUNIATA RIVER
SUB STATION
GEO-8
GEO-3
82
GEO-6
GEO-7
CONTAINMENT VESSEL
86
GEO-2
GEO-4
GEO-1
GEO-5
90
FENCE
PENELEC LINE SHACK
ACCESS ROAD
LEGEND
MONITOR WELL LOCATION
86 GROUNDWATER ELEVATION CONTOURS (CONTOUR INTERVAL 2 FT.)
50 0 50 100 150
SCALE IN FEET
PLEASE NOTE THAT DISTORTION MAY HAVE OCCURRED WITH REPRODUCTION OF THIS DRAWING DUE TO THE REPRODUCTION PROCESS.
NOTES:
1. DRAWING BASED ON A PLAN BY ROBERT KIMBALL & ASSOCIATES, EBENSBURG, PA., DATED 2/21/89.
2. GROUNDWATER ELEVATION CONTOURS BASED ON WATER LEVEL DATA COLLECTED 10/29/92 BY GPU AND ARE RELATIVE TO AN ARBITRARY DATUM OF 100.00 FT. ESTABLISHED AT TOP OF PVC CASING OF GEO-1.
3. CONTOURS ARE COMPUTER GENERATED USING A KRIGING ROUTINE.
SAXTON NUCLEAR EXPERIMENTAL CORP.
SAXTON, PENNSYLVANIA
SITE PLAN & OVERBURDEN GROUNDWATER ELEVATION CONTOURS ON 10/29/92
FIGURE No. 1
GEO FILE No. 92050
DATE NOVEMBER 1992
REV. Ø
GEO Engineering
DOVER, N.J.
(201) 361-3600

FIGURE 3.3-1

FIGURE 3.3-2


RAYSTOWN BRANCH JUNIATA RIVER
LEGEND
MONITOR WELL LOCATION
88 GROUNDWATER ELEVATION CONTOURS (CONTOUR INTERVAL 2 FT.)
SCALE IN FEET
60 0 50 100 150
ACCESS ROAD
SUB STATION
CONTAINMENT VESSEL
PENELEC LINE SHACK
FENCE
GEO-1
GEO-2
GEO-3
GEO-4
GEO-5
GEO-6
GEO-7
GEO-8
84
88
92
N
NOTES:
1. DRAWING BASED ON A PLAN BY ROBERT KIMBALL & ASSOCIATES, EBENSBURG, PA., DATED 2/21/89.
2. GROUNDWATER ELEVATION CONTOURS BASED ON WATER LEVEL DATA COLLECTED 11/5/92 BY GPU AND ARE RELATIVE TO AN ARBITRARY DATUM OF 100.00 FT. ESTABLISHED AT TOP OF PVC CASING OF GEO-1.
3. CONTOURS ARE COMPUTER GENERATED USING A KRIGING ROUTINE.
SAXTON NUCLEAR EXPERIMENTAL CORP.
SAXTON, PENNSYLVANIA
SITE PLAN & OVERBURDEN GROUNDWATER ELEVATION CONTOURS ON 11/5/92
FIGURE No. 2
GEO FILE No. 92050
DATE NOVEMBER 1992
REV. Ø
GEO Engineering
DOVER, N.J.

4.0 DECOMMISSIONING ACTIVITIES AND PLANS

4.1 Introduction

This section describes the selection of the decommissioning alternative that is most appropriate for the SNEC Facility and the decommissioning activities required to implement it.

4.2 Selection of Decommissioning Alternative

GPU Nuclear Corporation has selected DECON with Immediate Dismantlement as the alternative for decommissioning the facility. The following sections provide a detailed description of the selection of this alternative.

4.2.1 No Action

The NO ACTION alternative, as described in NUREG-0586, implies that a licensee would abandon or leave a facility as is. This is not a viable decommissioning alternative and, therefore, is not considered.

4.2.2 Further Deferral of Dismantlement

The SNEC Facility has been shut down since 1972, therefore, dismantlement has already been deferred for greater than 20 years. The option of deferral of dismantlement for an additional 30 years has been evaluated.

Thirty (30) year additional deferral has the advantage of further radioactive decay thus reducing overall radiation exposure during dismantlement. Table 4.2-1 provides a comparison of radiation exposure for the various alternatives.

In spite of this advantage, deferral for 30 years has several overriding disadvantages. The first is the loss of an experience base currently available. SNEC's parent company, General Public Utilities (GPU), currently employs individuals who worked at the SNEC Facility while it operated. Their knowledge of the plant from that era has proven and will continue to be invaluable. In addition, GPU Nuclear Corporation has recently remediated and demolished the reactor support buildings and structures at the facility and placed Three Mile Island Unit 2 in Post-Defueling Monitored Storage (PDMS). The skills of the people who worked on these projects are directly applicable to the remaining work at the SNEC Facility and those same people will not be available in 30 years.

In addition, a high groundwater condition could lead to loss of containment which could either cause an unmonitored release path or groundwater flooding of the lower elevations of the containment vessel. As shown on Figure 4.2-1, much of the CV is located below ground level and groundwater flooding would create an extremely difficult dismantlement scenario, increase the quantity of resulting radwaste, thus increasing the overall cost. Further, since the inside of the steel liner below grade is covered by concrete on the inside, degradation of the liner could go undetected. Additionally, the high moisture content of the atmosphere inside the facility would hasten degradation of containment vessel systems and structural components (e.g., polar crane and related equipment) which will be needed to support dismantlement activities. This would result in making decommissioning activities less safe for workers as the components continue to deteriorate.

There is also the disadvantage of the continuing maintenance requirements including an escalating effort to manage the deterioration of the facility over the next 30 years. It makes no economic sense to spend money to monitor and maintain a facility that will never be used again.

Finally, the cost of the radioactive waste disposal in 30 years is likely to be much greater than the cost of disposal at the presently available facilities. The cost of the radioactive waste disposal has been rising at a much higher rate than that of inflation and therefore, it would be more expensive to wait until later to decommission the facility. Sites for the disposal of low level radioactive waste generated in Pennsylvania are currently available at the Barnwell, South Carolina Waste Management Facility and/or Envirocare of Utah, therefore the waste can be sent directly to burial. Future waste disposal choices are less certain, introducing the possibility of long term radioactive waste storage at the site. This is clearly undesirable due to the location of the site in a flood plain. The facility was never intended to be a long-term radioactive waste storage site.

For these reasons, the 30 year additional deferral of dismantlement was not selected.

4.2.3 Immediate Dismantlement

The major advantages of immediate dismantlement of the SNEC Facility are that it most quickly removes components from below ground level, stabilizes the radiological conditions at the site and allows the site to be released for unrestricted use. Immediate dismantlement also allows GPU Nuclear Corporation to make use of GPU's remaining SNEC Facility and TMI-2 expertise for planning and implementing dismantlement activities. In addition, sites for the disposal of low level radioactive waste generated in Pennsylvania are currently available at the Barnwell, South Carolina Waste Management Facility and/or Envirocare of Utah under present contracts, therefore the waste can be sent directly to burial, thus further minimizing decommissioning costs.

The major disadvantage to proceeding with immediate dismantlement is that radiation exposure to dismantlement personnel is the highest for this option as compared to additional deferral. Since the SNEC Facility has been shutdown for over 20 years, the majority of personnel exposure savings to be gained from deferring dismantlement have already been achieved. The person-rem determination for the immediate dismantlement option is reasonable and in-line with current industry experience. The 12.1 person-rem difference is small and provides no overall benefit compared with removing the site as a source of radioactive material.

Radiological conditions at the facility now are at a level that allows workers to safely remove components from the facility without threat to the safety of workers or local residents. Additionally, the technology exists to safely and efficiently decommission the site now.

Immediate dismantlement places the SNEC Facility in a stable and secure condition in the shortest amount of time. It has been chosen as the preferred option.

4.3 Decommissioning Schedule

The general schedule for decommissioning/site restoration activities is presently in Section 2.2 of the SNEC Facility Decommissioning Plan (Reference 8).

4.4 Plant Dismantlement Activities

It is the objective of GPU Nuclear Corporation to complete the decommissioning of the SNEC Facility in a safe and efficient manner that protects the health and safety of the workers, public and environment.

The scope of work includes the following major activities associated with the proposed decommissioning of the facility, some of which has been completed : removal and disposal of the steam generator, pressurizer, and the reactor pressure vessel, dismantlement and disposal of system components, the decontamination/disposal of radiologically contaminated facility structures, waste management demolition of non-contaminated plant structures, and site restoration.

Based on the results of the site characterization study, conceptual engineering and planning have been performed to determine the most advantageous approach to decommissioning. Both conceptual and detailed engineering and planning have and will incorporate such considerations as: regulatory guidance, maintenance of occupational radiation exposure as low as reasonably achievable (ALARA), management of low level radioactive waste (LLRW), industrial safety, environmental impacts, cost and schedule. Another aspect considered is the use of field-proven and state-of-the-art dismantlement techniques. Saxton decommissioning activities will be performed under a quality assurance program.

<u>Temporary Support Facilities</u>
In order to facilitate decommissioning activities, temporary support facilities: such as trailers and a Decommissioning Support Facility were located on previously disturbed areas of the property. The Decommissioning Support Facility was constructed adjacent and connected to the containment vessel and used for segregating and packaging of waste for transportation to offsite licensed disposal sites.

<u>System and Structure Dismantlement</u>
Those systems or structures that do not meet the release criteria will be dismantled and removed. Pipe and metal dismantlement and removal will be performed using shears, portable band saws, diamond wire saws, abrasive wheel cutting, OD milling machine, or other suitable techniques. Scabblers and C02 blasters are options for removal of fixed radiological contamination from concrete. Evaluations of the best alternatives are continuing as part of the further detailed engineering and planning. The use of water will be minimized due to the cost and schedule impact of disposing of the water.

Radiological surveys, after dismantlement of systems and structures, will be performed to ensure that all radiological contamination levels are at or below the release criteria. If radiological contamination levels are discovered above the release criteria, remedial measures will be evaluated and implemented.

Steam Generator and Pressurizer

The steam generator and pressurizer required that all process piping attachments to the vessels be cut. Openings created by cutting the attached piping were sealed to prevent release of radiological contamination to the surrounding areas during handling. Removal of the steam generator and pressurizer vessels from the containment was through an opening cut in the containment dome. The vessels were prepared for shipment by removing, fixing, or covering any external radiological contamination.

Reactor Vessel

An opening was cut in the steel containment vessel dome above the reactor vessel. Piping and instrumentation lines attached to the reactor vessel were cut using appropriate cutting technologies. Openings created by cutting operations were sealed to preclude the release of surface radioactive contamination. The reactor vessel was removed through the dome opening from the containment vessel and placed into a sheltered laydown area to package the vessel for transportation to a licensed disposal facility. The internals were contained within the vessel and the internal void space was filled with concrete/grout. When not transferring material through the dome opening, it was covered to ensure the weather-tight integrity of the containment vessel dome. Appropriate radiological contamination and airborne control measures were implemented to prevent the spread of such material prior to removal of the reactor vessel. Any external loose radiological contamination was removed or fixed to meet federal shipping regulations.

Demolition of Non-Contaminated Structures and Site Restoration

When all systems, components, radiologically contaminated concrete and other internal building structures, and exposed steel have been removed from the CV, the building demolition and site restoration phase will begin. This phase will start once the facility has been released by the NRC from the requirements of the NRC license. This phase includes:

- removal and scrapping of the Containment Vessel steel shell to three feet below grade;
- demolition of all remaining concrete to three feet below grade;
- backfilling of CV and other facility voids with uncontaminated concrete from facility demolition and additional structural fill;
- removal of all temporary support facilities; and
- grading and placement of soil and the revegetation of the site.

Structural fill and soil will be used as necessary to fill the CV void, and to grade and revegetate the site.

Control Of Airborne Radioactivity and Effluents

All work performed as part of SNEC Facility decommissioning will be in accordance with current industry standards and practices. These include appropriate radiological controls, radiological monitoring, radiological contamination control envelopes, local ventilation control with High Efficiency Particulate Air (HEPA) filters, etc., as necessary to prevent the spread of radiological contamination and radiation exposure to both workers, members of the public, and the environment.

Releases of radioactive liquid and airborne effluents during decommissioning will be minimized by the use of temporary effluent treatment systems. Decontamination and dismantlement of facility system and structures will result in the generation of radioactive liquid waste. These wastes will be processed as necessary by GPU Nuclear Corporation or by experienced vendors and contractors where appropriate to meet NRC effluent requirements.

4.5 Decommissioning Workforce

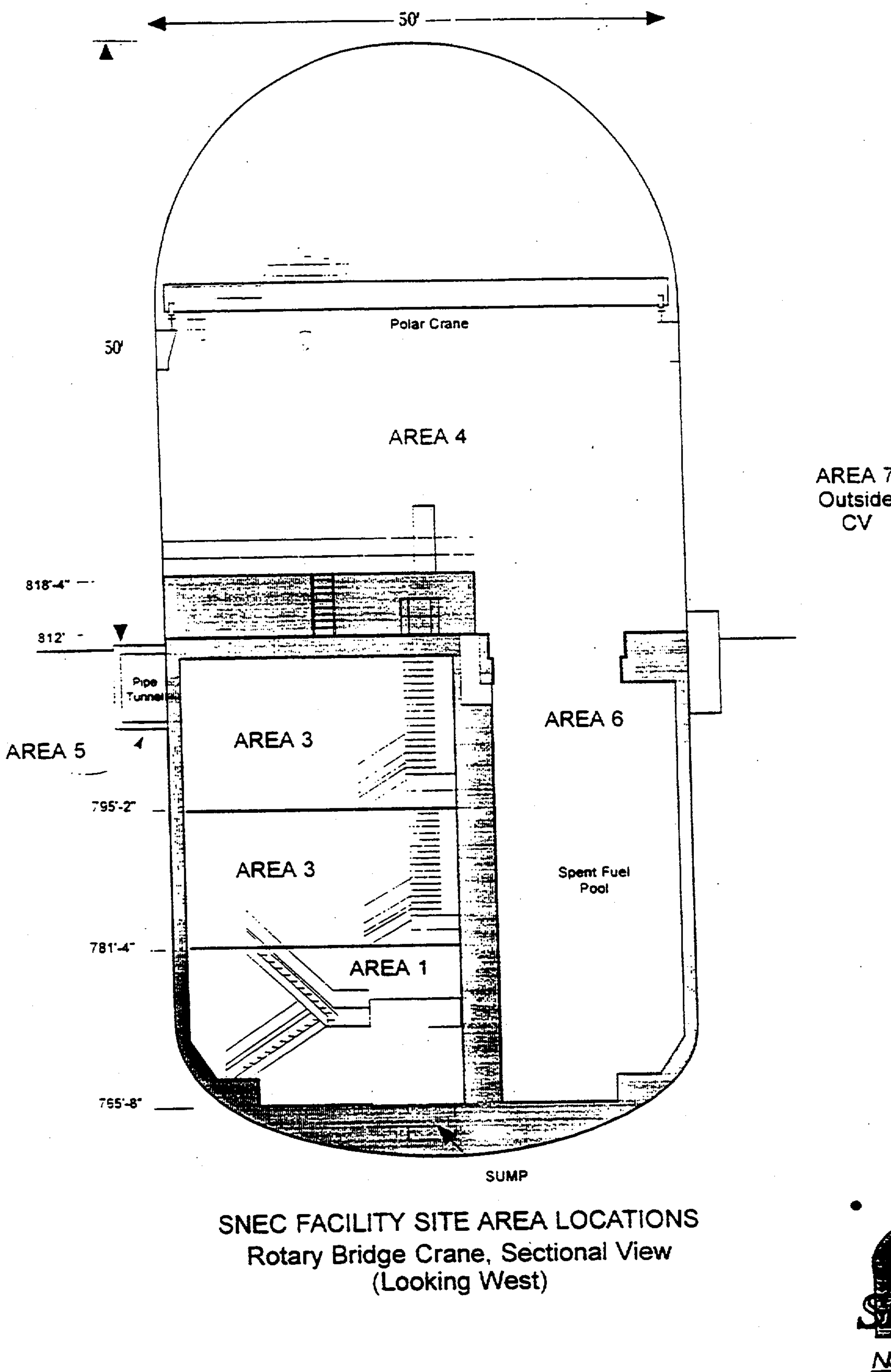
The make up of the workforce during decommissioning is expected to be GPU Nuclear Corporation employees and several contractors due to the specialized nature of some work involved with demolition/construction activities. It is expected that the maximum number of workers at any one time will be approximately 40.

TABLE 4.2-1

Occupational Dose Comparison between Decommissioning Alternatives

Task	30 Year Deferral Person-Rem	Immediate Person-Rem
Asbestos Remediation	2.68	2.97
System Dismantlement	9.42	12.83
Reactor Vessel and Steam Generator Removal	3.37	7.38
Structure Decontamination and Dismantlement	0.35	2.75
Waste Management	1.28	1.75
Miscellaneous Support Activities	2.36	2.75
Scaffold and Shielding	4.94	5.75
Other Characterization	0.54	0.63
Total	24.83	36.93

FIGURE 4.2-1



SNEC FACILITY SITE AREA LOCATIONS
Rotary Bridge Crane, Sectional View
(Looking West)

5.0 ENVIRONMENTAL EFFECTS OF DECOMMISSIONING ACTIVITIES[1]

5.1 Effects On Human Activities

The number of workers is expected to be approximately 40. Due to the small number of workers required there are no significant adverse impacts expected on temporary housing or schools as a result of the decommissioning activities.

Transmission lines in the vicinity of the site will be unaffected by decommissioning activities.

5.2 Effects On Terrain, Vegetation and Wildlife

No endangered or threatened plant or animal species occur on or make use of the SNEC Facility site. That portion of the 1.148 acre site not occupied by facility structures is composed primarily of open grassland that does not provide good habitat for wildlife. No endangered or threatened species are known to occur on the adjacent Pennsylvania Electric Company property. This property is essentially composed of open grassland with scrub vegetation and trees along the property boundaries. Areas that have remained undisturbed following the cessation of the coal-fired station's operations and razing are generally open field or wooded and provide better wildlife habitat.

The decommissioning activities will take place on the previously developed areas of the site or adjacent open areas of the Pennsylvania Electric Company property. This includes temporary support facilities such as office trailers, the construction of a Decommissioning Support Building needed for segregating and packaging of waste, and the borrow of fill material needed to backfill the CV void. Those areas of the site that have been left in their natural state will not be disturbed by activities required for decommissioning. Therefore there will be no effect on the existing terrain or vegetation in the previously undeveloped areas of the site.

During the removal/demolition of the facilities, waterfowl and other wildlife may from time to time make use of adjacent areas and will be disturbed and or displaced by demolition activities. However demolition activity in the area will last a very short period of time, will be limited to as small an area as necessary thus disturbing as little area as possible.

5.3 Effects on Adjacent Waters and Aquatic Life

The decommissioning activities of the facility are not expected to have any adverse impact on the adjacent surface waters or associated aquatic life. Given that the majority of the decommissioning work will be done in previously developed areas of the site, the adjacent river and the aquatic life therein will not be adversely affected by decommissioning activities.

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[1] In addition to the information provided in Section 5, supplemental information was provided in response to several questions from the Nuclear Regulatory Commission. These questions and their associated responses are provided in Appendix 1.

Although decommissioning activities will involve minor construction activities to remove/demolish facilities, a comprehensive Soil Erosion and Sedimentation Control Plan will be implemented to minimize the area of disturbance and potential siltation of the river. The content and implementation of the Soil Erosion and Sedimentation Control Plan will meet the requirements of Pennsylvania Code 102.4.

5.4 Effects Of Released Radioactive Materials

As part of routine decommissioning operations, limited quantities of radioactivity are released to the environment in liquid and airborne effluents. An effluent control program is implemented to ensure radioactivity released to the environment is minimal and does not exceed release limits. Federal effluent limits are set at low levels to protect the health and safety of the public. GPU Nuclear Corporation conducts operations in a manner that holds radioactive effluents to small percentages of the federal limits.

The Offsite Dose Calculation Manual (ODCM) is a support document of the Technical Specifications and implements SNEC Facility radiological effluent controls. The ODCM contains the controls, bases, and surveillance requirements for liquid and gaseous radiological effluents. This document also describes the methodology used for calculations of the liquid and gaseous effluent monitoring instrumentation alarm and trip set points. The ODCM follows the methodology and models suggested by NUREG-0133 and Regulatory Guide 1.109, Revision 1, for calculation of offsite doses due to plant effluent releases. Simplifying assumptions have been applied in this manual where applicable to provide a more workable document for implementation of the Radiological Effluent Controls requirements.

Airborne Radioactive Effluents
Radiation doses to the public were calculated for the airborne releases from routine decommissioning operations of the Reference PWR in NUREG/CR-0130, "Technology, Safety and Costs of Decommissioning a Reference Pressurized Water Reactor Power Station" (Reference 16). The calculations show that decommissioning results in extremely small airborne radionuclide releases and the radiation dose to the public is expected to be negligible.

Since termination of the SNEC Facility operation in 1972 and prior to dismantlement of all radiological waste systems, radioactive gas had been decayed and released. Therefore, processing of gaseous waste will not be necessary.

However a Temporary high-efficiency particulate air-purifying (HEPA) filtration system was installed to contain airborne particulate radionuclides that may be generated during the performance of various decommissioning activities. The Decommissioning Support Building (DSB) is vented through the wall opening between the DSB and the CV to the CV atmosphere. The CV atmosphere is monitored by portable air samplers and, if necessary, by Continuous Air Monitors (CAMs). The CV ventilation exhausts via a HEPA filtered ventilation system. If other activities require control of airborne radiological contamination, portable HEPA filtration units, including those built into vacuum cleaners, will be used. The effluent monitoring instrumentation is used to monitor discharges of airborne effluent as required, and to demonstrate compliance with the SNEC Facility ODCM limits as promulgated by applicable regulations.

Liquid Radioactive Effluents
Radioactive liquid wastes will be generated during the decontamination and dismantlement of the SNEC Facility systems and structures.

Liquid radioactive wastes generated during decommissioning will be processed as necessary using temporary systems supplied by GPU Nuclear Corporation or by experienced vendors and contractors where appropriate. The temporary waste treatment system will be connected to tanks for storage of processed water prior to discharge. Once it has been verified that the stored processed water meets the allowable discharge limits specified in the ODCM, the water will be released. These systems may include temporary ventilation with filtration for airborne radiological contamination control.

The liquid waste stream will be processed using techniques which are cost effective and meet ALARA goals. During earlier demolition activities, installed plant equipment used to process liquid radwaste had been removed. Therefore, temporary filtration units or demineralizers will be used, if necessary, as the primary means of treatment for all planned releases. Any processed liquids may then be discharged after it has been monitored and approved for release. The effluent monitoring instrumentation will be used to monitor discharges of liquid effluent as required, and to demonstrate compliance with the SNEC Facility ODCM limits as promulgated by applicable regulations.

Additionally, compliance with applicable Pennsylvania Department of Environmental Protection (PaDEP) National Pollutant Discharge Elimination System (NPDES) requirements will be accomplished.

No impact on the existing quality of the nearby water resources is expected.

5.5 Effects on Groundwater

The generation of radiologically contaminated water at the SNEC Facility will be minimized to keep water processing costs as low as possible and to minimize liquid effluent discharges. Some radiologically contaminated water, however, will be generated during the decontamination and decommissioning of the SNEC Facility. The majority of this water will likely be generated during decontamination activities. Groundwater that has infiltrated the CV pipe tunnel and the Saxton Steam Generating Station discharge tunnel contains low levels of radioactive materials, and will need to be dispositioned. These liquid wastes will be processed as necessary using temporary systems supplied by GPU Nuclear Corporation or by experienced vendors and contractors. Any processed water may then be discharged after it has been monitored and approved for release. All discharges of processed water will be verified to be within the limits of the ODCM prior to approval for release.

Radionuclide concentrations in groundwater at the facility will not be significantly impacted by the presence of radiologically contaminated water on the site. Processed water will not intentionally be directed to the ground, so the only mechanism for the transport of radionuclides to the groundwater will be a spill of radiologically contaminated water. Temporary systems used for processing of water will be designed to minimize the possibility of spills to the ground. Procedures and work instructions at the facility will be written so as to minimize the potential for spills. These procedures will also be written to mitigate the spillage in a timely fashion should a spill occur.

If a spill of radiologically contaminated water occurs, groundwater at the facility should not be adversely affected. Fission and activation products in the water (primarily cesium-137, cobalt-60 and small quantities of transuranics) will be adsorbed onto the soil as the water percolates through the ground. Numerous studies of the retention by soil for these radionuclides (Reference 24) show that they are typically retained in the first 10 to 30 cm of soil. As a result they are not immediately available for transport to the groundwater. Should such a spill occur at the SNEC Facility, the affected soil would be sampled and analyzed for radionuclide content. Soil containing appreciable quantities of these nuclides would be excavated and disposed of offsite. As a result, these types of
radionuclides would not find their way into the groundwater at the site.

The only radionuclide that could reach the groundwater would be tritium, since this nuclide is not retained by the soil. Concentrations of tritium in the water that is currently at the SNEC Facility are relatively low. The highest concentrations were found in the Containment Vessel Sump which has been decontaminated. These concentrations ranged from 3E-4 to 6E-4 uCi/cc. Since there is no source of tritium production at the site, the concentration of tritium will not increase with time. In fact, as decontamination activities create radiologically contaminated water, the concentration of tritium in liquid wastes will decrease through dilution. The low concentrations of tritium in this water, coupled with the finite nature of such a spill, will not appreciably affect tritium concentrations in groundwater at the site.

The tunnel which surrounds the Saxton Nuclear Experimental Facility Site Containment Vessel (C.V.) contains significant quantities of groundwater. The tunnel is a below grade concrete structure whose location is shown in figures 2.3-1 and 4.2-1. The tunnel ceiling is at grade, approximately 811 feet, 6 inches above MSL, while the floor of the tunnel is at approximately 805 feet above MSL or about six feet below grade. Groundwater levels vary at the site depending upon season and weather but generally average about 807 feet above MSL, (Reference 7). Hydraulic pressure forces groundwater into the tunnel through the construction joint between the tunnel floor and the C. V. shell. Water levels in the tunnel have been observed to fluctuate considerably with the groundwater changes. During periods of severe drought the tunnel has been dry while at other times the water level has reached the ceiling. The current water level is about 808 feet, 6 inches above MSL. Contamination on the inner concrete tunnel surfaces, principally Cs-137, has leached into the water leading to minor contamination of the water.

The recently excavated Saxton Steam Generating Station Discharge Tunnel is adjacent to the service tunnel and was primarily used as the river water discharge for the Saxton Steam Generating Station. This tunnel was also used for liquid radwaste discharges from the SNEC Facility. Recent surveys in the Discharge tunnel indicate that there is some residual contamination in the tunnel with concentrations similar to the service tunnel.

In 1986 a similar situation existed in the other below grade structures at the site which have since been demolished. At that time approximately 210,000 gallons of very slightly radioactively contaminated groundwater was removed from these structures and discharged to the Raystown Branch of the Juniata River (Reference 2).

It is anticipated that a similar process will be used to remove the groundwater from the service and discharge tunnels. A bounding calculation has been performed to determine the maximum possible dose to a member of the public if this water were to be discharged under the worst conditions (Reference 29). Under these conditions of maximum batch release flow rate and historic minimum river flow, the maximum organ dose would be 6.82E-3 millirem (0.00682 millirem) while the maximum whole body dose would be 4.47E-3 millirem (0.00447 millirem). These levels are significantly below any applicable release limits. All releases will be in accordance with the Saxton Off-site Dose Calculation Manual and applicable procedures.

5.6 Effects of Released Chemical and Sanitary Wastes

During decommissioning, water from an existing groundwater well, located on the adjacent Pennsylvania Electric Company property, will be the source for sanitary water. The use of groundwater for sanitary and drinking water is regulated by the Pennsylvania Department of Environmental Protection (PaDEP). If the groundwater well is used as a drinking water source, it may be necessary to provide water treatment to permit it as a drinking water source.

The use of water during decommissioning will be kept to a minimum. No chemical radiological decontamination is planned and the use of hazardous chemicals is not anticipated during the decommissioning process. Liquid discharges from the facility are regulated by the NPDES permitting system administered by the PaDEP. All liquid waste streams will be sampled, tested and processed as necessary prior to discharge to ensure effluents are in compliance with applicable PaDEP - NPDES permit limits. No impact on the existing quality of the nearby water resources is expected.

Holding tanks will be used during decommissioning for the collection of sanitary waste. These tanks shall be closely monitored and pumped out by a PaDEP licensed contractor for offsite disposal at a licensed facility.

5.7 Radioactive Waste[2]

Members of the public will be exposed to small amounts of direct radiation associated with the shipment of low-level radioactive waste for burial. The GEIS (NUREG-0586), (Reference 6), estimates this radiation exposure to total 2.2 person-rem. The estimated cumulative radiation exposure to the public is the sum of the small individual radiation exposures that are assumed to occur when members of the public are in the vicinity of a low-level radioactive waste shipment (truck) for brief periods. The packaging and amount of radioactive waste in each shipment is restricted by NRC regulations (10CFR71) and U.S. Department of Transportation (DOT) regulations (49CFR170-189).

[2] See updated information in Appendix 1, Supplement 1 response to Question 77 and Appendix 1, Supplement 2 response to Question 7.

NUREG-0586 estimate for radiation exposure to the public was based on the shipment of an estimated volume of 4,930 cubic meters of low-level radioactive waste for burial. The current estimated volume of low-level radioactive waste to be shipped to offsite burial facilities is 580 cubic meters, or less than twelve percent of the bounding conditions of NUREG-0586. The projected cumulative radiation exposure to the public is well within NRC estimates and regulations. The SNEC Facility Decommissioning Plan calls for shipment of LLW by truck from the site to the final burial sites. The radiation exposure levels of each individual low level radioactive waste shipment will be below the regulatory limits established by the NRC and DOT.

5.8 Non Radiological Waste

Asbestos

Surveys for asbestos were conducted in the containment vessel during May 1995. Bulk insulation samples were taken of various components, piping systems and vessels throughout the containment building. Asbestos removal activities started in 1996 and are complete. Both the U.S. Environmental Protection Agency, (EPA) and the Occupational Safety and Health Administration (OSHA) have established regulations that apply to the removal of asbestos-containing material. These regulations contain requirements for asbestos removal notification, record keeping, handling, air emissions limits and disposal. Activities involving asbestos at the facility were conducted in accordance with Federal and State regulations. The asbestos was disposed of as low-level radioactive waste.

Hazardous Waste

The generation, storage, transportation and disposal of hazardous waste are regulated by the PaDEP under Pennsylvania's Solid Waste Management Act (35 P.S. 6018.101 et. Seq.). Decommissioning of the facility may be expected to generate very small amounts of hazardous waste. Decontamination and dismantlement activities primarily utilize non-hazardous chemicals or mechanical processes. Potential sources of hazardous waste include lead-based paint that was used to cover much of the painted surfaces of the facility and mercury-containing instruments and switches. Other minor sources of hazardous waste may be encountered during decommissioning; however it is expected that the amount of waste generated will be well less than the limit for a small quantity generator under Pennsylvania hazardous waste regulations.

5.9 Socioeconomic Effects

The socioeconomic impacts were mainly from the shutdown of the facility in 1972 which resulted in the loss of certain jobs and income to the community. Decommissioning of the SNEC Facility should provide a short term small increase in income to the community.

5.10 Other Effects

The total estimated occupational radiation exposure associated with the planned decommissioning activities at the facility is 37 person-rem. This is well within the bounds of the estimated total occupational exposure of 344 person-rem contained in the

NRC's Generic Environmental Impact Statement. The occupational radiation dose to any individual worker will be limited by federal regulations and SNEC Facility administrative procedures. The as low as reasonably achievable or "ALARA" principle will be used to minimize occupational radiation dose associated with decommissioning activities.

5.11 Summary of Environmental Effects of Decommissioning Activities

The environmental impact due to decommissioning of the facility is generally favorable. In most cases, dismantlement eliminates or further reduces the already small environmental effects that are associated with maintaining the facility in its current condition. In addition, decommissioning by immediate dismantlement avoids potential environmental impacts associated with alternative decommissioning options that defer dismantlement. There are certain short term environmental effects which will be increased due to decommissioning activities. These include the occupational radiation exposure necessary for dismantlement activities, the radiation exposure to the public associated with transportation of low-level radioactive waste and small radiological effluent releases, and the commitment of small amounts of land at the burial site for disposal of this low-level radioactive waste. However, these estimated effects for the proposed SNEC Facility decommissioning are well below those which have been previously evaluated by the NRC on a generic basis (NUREG-0586).

FINAL GENERIC ENVIRONMENTAL IMPACT STATEMENT (GEIS)
NUREG-0586
ENVIRONMENTAL CONSEQUENCES *[3]

1. Summary of Radiation Safety Analysis for Decommissioning the Reference Test Reactor (Person-Rem)

	DECON	SAFSTOR 10 years	SAFSTOR 30 years	SAFSTOR 100 years
Occupational Exposure	344	212	130	125

2. The Volume of Low-Level Radioactive Waste to be Disposed of for the Reference Test Reactor (cubic meters)

DECON	SAFSTOR 30 years	SAFSTOR 50 years	SAFSTOR 100 years
4930	4930	2960	2940

3. The dose to the public from routine releases during DECON or SAFSTOR activities at the reference test reactor is estimated to be negligible.

4. The dose to the public from truck transport of wastes during DECON activities from the reference test reactor is estimated to be 2.2 person-rem. During SAFSTOR activities, the doses are estimated to be 0.35, 0.14, and 0.11 person-rem for storage periods of 10, 30, and 100 years respectively.

5. The waste volumes requiring burial would represent a use of about one-half acre for the reference test reactor.

[3] A comparison of SNEC Facility decommissioning with NUREG-0586 was provided in response to a question from the Nuclear REGULATORY Commission and is included in Appendix 1

6.0 ENVIRONMENTAL EFFECTS OF ACCIDENTS AND DECOMMISSIONING EVENTS

The EPA has established protective action guidelines (Reference 15) that specify the potential offsite dose levels at which actions should be taken to protect the health and safety of the public. The EPA protective action guidelines (PAGS) are limiting values based on the total effective dose equivalent (TEDE) resulting from exposure to external sources and the committed effective dose equivalent (CEDE) incurred from the significant inhalation pathways during the early phase of an event. The EPA PAG limits are:

EPA PAGs (millirem)

Total Whole Body (TEDE)	**1,000**
Thyroid Committed Dose Equivalent	**5,000**
(CEDE) Skin (CDE)*	**50,000**

*Committed dose equivalent

Because there is no irradiated fuel stored at the site, there are no radioactive noble gases or radioiodines available for release from the facility. This preempts the possibility of accidental offsite radiological releases that could approach the PAGs for the skin and thyroid. As a result, the PAG for TEDE is the limiting criteria for decommissioning activities at the facility.

GPU Nuclear Corporation has analyzed the decommissioning activities described in the SNEC Facility Decommissioning Plan (Reference 8) to ensure that they will not create the potential for accidental releases that could cause doses at the site boundary to be more than a small fraction of the EPA PAGS. Performing decommissioning activities in a manner that keeps offsite doses from even the most unlikely events at a small fraction of the EPA PAGs provides for the protection of the health and safety of the public without the need for protective actions.

Section 3.4 of the SNEC Facility Decommissioning Plan (Reference 8) analyzes a number of potential events which could be postulated to occur during decommissioning activities and result in the release of radioactive materials.

The decommissioning activities evaluated included events with the potential for liquid and/or airborne radioactive releases.

The analyses of these events used very conservative approaches in treating the source terms, as well as in the methods of calculation. To the extent applicable, these analyses are consistent with approaches used in the NRC's examination of postulated accidents during the decommissioning of the Reference PWR (Reference 16).

The accident analyses demonstrate that no adverse public health and safety or environmental impacts are expected from accidents that might occur during decommissioning operations. The highest calculated dose to an individual located at the site boundary was 1.5 millirem to the whole body during a postulated materials handling accident. The results of other onsite accidents are below this value. As a result, it is concluded that there are no significant radiological consequences to the general public from postulated credible accidents during the planned decommissioning operations at the SNEC Facility.

Offsite radiological events related to decommissioning activities are limited to those associated with the shipment of radioactive materials. Radioactive shipments will be made in accordance with the applicable regulatory requirements. The facility's Radioactive Waste Management Program will ensure compliance with these requirements. The facility's Quality Assurance Program (QAP) is further implemented to assure decommissioning activities are conducted in a safe and controlled manner. Compliance with these requirements ensures that both the probability of occurrence and the consequences of an offsite event do not significantly affect health and safety of project workers, the public or the environment.

7.0 FACILITY RADIOLOGICAL STATUS AND ENVIRONMENTAL MONITORING[4]

7.1 Introduction

Operation and decommissioning of nuclear power plants results in releases of small amounts of radioactive materials to the environment. Radiological environmental monitoring is conducted to monitor radiation and radioactive materials in the environment. The important objectives of this monitoring are:

- to verify controls for the containment of radioactive materials,
- to assess dose impacts to the public,
- to determine buildup of long-lived radionuclides in the environment and changes in background radiation levels,
- to provide reassurance to the public that the program is capable of adequately assessing impacts and identifying noteworthy changes in the radiological status of the environment.

Once released, radioactive materials move through the environment in a variety of ways and may eventually reach humans via breathing, drinking, eating, and direct exposure. Samples may be collected from the aquatic, atmospheric, and terrestrial environments and may include air, soil, river water, precipitation, sediment, finfish, milk, vegetables, and groundwater. They are analyzed for the various types of radiation such as alpha, beta, and gamma.

A preoperational radiological survey of the environment around the SNEC Facility was initiated in 1960. Data gathered in the preoperational survey was used as a basis for evaluating radiation levels and radioactivity in the vicinity of the plant after the plant became operational. The data documented the natural background radiation levels and naturally occurring and fallout radioactive materials in the environment.

The operational phase began in 1962 at the time the SNEC Facility became operational and concluded in 1972. Releases of radioactive materials to the environment were within the bounds of the hazards analysis in the Final Safeguards Report (Reference 5).

Five unplanned releases of radioactive materials have been identified which occurred during the operation of the SNEC Facility. These releases occurred in August 1963, May 14 and August 26, 1970, and November 29 and December 15, 1971. These releases were reported to the AEC/NRC as required. The maximum amount of exposure to anyone standing at the site boundary from each of the later four releases would have been 0.387 millirem, 0.0018 millirem, 4.28 millirems, and 1 millirem, respectively. An exposure calculation was not performed for the August 1963 release which was at least one order of magnitude less than the next smallest release. To put the radiation exposure due to these releases into perspective, the average individual may receive up to 300 millirems a year from a variety of natural sources in the environment. On average, an individual also receives about 60 millirems a year from radiation use in the medical and dental fields.

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[4] In addition to information provided in Section 7, supplemental information was provided in response to several questions from the Nuclear Regulatory Commission. These questions and their associated responses are provided in Appendix 1

The SNEC Facility was placed in a condition equivalent to a status later defined by the NRC, as SAFSTOR after it was shutdown in 1972. All fuel was removed from the containment vessel (CV) in 1972. Following fuel removal, equipment, tanks, and piping located outside the CV were removed. The buildings and structures that supported reactor operations were partially decontaminated in 1972 through 1974. Since that time, the SNEC Facility no longer produced radioactive liquid or gaseous effluents in the conventional manner of operating nuclear plants. The radiological environmental monitoring program confirmed there were no offsite adverse effects on the environment or public health and safety.

7.2 Final Release Survey of the Reactor Support Buildings

Radiological decontamination of the reactor support structures/buildings was performed in 1987, 1988, and 1989, in preparation for demolition of these structures. A final release survey documented that the NRC release criteria guidelines were met. One component of the final release survey was the measurement of offsite background radiation and radioactivity. Exposure rate measurements were made and soil samples were collected at 12 locations around the site at distances ranging from 0.61 to greater than 3.0 kilometers. The results are documented in a report to the NRC (Reference 2). Oak Ridge Associated Universities performed a confirmatory radiological survey of the reactor support buildings for the NRC. They also performed offsite exposure rate measurements and soil sample analyses. Exposure rates and radionuclide concentrations were typical of normal background levels (Reference 28).

7.3 Demolition of the Reactor Support Buildings

Upon acceptance of the final release survey by the NRC, the reactor support buildings were demolished in 1992. Controls were put in place to minimize fugitive emissions and soil erosion. Environmental air particulate sampling stations were operated during this evolution. The particulate filters were analyzed for gross alpha, gross beta, and gamma radioactivity. Three indicating air stations are located around the site and one control station is located 10 miles from the site. Generally, the weekly trends of gross alpha and gross beta activity at all stations were similar. Gamma-emitting radionuclides related to the SNEC Facility were not detected in any of the samples during the demolition process.

Aquatic sediment samples were collected near the SNEC Facility storm water discharge to the river. Low levels of cesium-137 and cobalt-60 were detected in samples following the demolition of the support buildings when site soil was carried to the river from the site storm drain discharge. Upon detection that a small amount of soil erosion was occurring, the storm drain discharge line was plugged.

7.4 Soil Remediation

Operation of the SNEC Facility resulted in low levels of radioactive contamination in the soil surrounding the facility. Some of this soil was transported outside the SNEC Facility fence but within the property limits of GPU due to construction activities, erosion, etc. Various radiological surveys were conducted. If radiologically contaminated soil was found outside the SNEC Facility fence, it was excavated and either disposed of as low level radwaste or stored inside the fenced area.

In late 1987, GPU Nuclear Corporation conducted a radiation survey of the restricted area onsite, which showed a greater-than-normal background activity of cesium-137 (Cs-137), as well as detectable amounts of another radioactive by-product material cobalt-60 (Co-60). The Pennsylvania Bureau of Radiation Protection, Department of Environmental Resources (DER), was concerned that the soil could have been dispersed to offsite areas by natural forces over the years since operations had ceased. The DER contacted the U.S. Department of Energy (DOE) requesting assistance in evaluating the extent, in any, of offsite Cs-137 radiological contamination, possibly through the use of an aerial survey. DOE responded by tasking EG&G Energy Measurements, Inc., (EG&G/EM) to determine the feasibility of an aerial survey.

EG&G/EM aerial operations dispatched a field team to the Saxton area to make *in-situ* measurements to determine the relative Cs-137 concentrations. The measurements were made in June 1988 (Reference 25) using a high purity germanium (HPGe) detector.

The prevailing winds at the site flow from the southwest to the northeast, up the valley. Since the site is so heavily influenced by the surrounding terrain, it is unlikely that any radiologically contaminated material would have escaped the valley under normal weather conditions.

Additionally, an aerial radiological survey was conducted from July 5 through July 22, 1989, over the SNEC Facility and surrounding area (Reference 26). The survey covered an 83-square-kilometer (32-square-mile) area around the plant. The purpose of the survey was to map the gamma environment of the area surrounding the SNEC Facility. Particular attention was to be paid to the possible presence of Cs-137 in the areas surveyed.

The survey was conducted at a nominal altitude of 61 meters (200 feet) with line spacing of 91 meters (300 feet).

Pressurized ion chamber measurements and soil samples were collected during the survey at six sites within the survey boundaries.

The isotopic and ion chamber measurements generally agree with the inferred aerial data for each site.

A contour map of the terrestrial gamma exposure rate (extrapolated to 1 meter above ground) was prepared. The Cs-137 activity inferred from aerial data was within the limits of the deposition from world-wide fallout. No other man-made contaminants were detected in the survey area.

In November 1993 comprehensive soil monitoring and sampling work was performed at the site to assess the extent of radioactive contamination levels present on the site. NUREG/CR-5849 (Reference 19) was used as a basis document for the development of methods and guidelines in establishing survey and assessment protocols. After completion of the soil characterization work radiologically contaminated soil was excavated, packaged, and shipped offsite and disposed at both an NRC licensed low level radwaste (LLRW) and a state licensed low activity radwaste (LARM) facility.

Approximately 105 cubic feet of soil containing 1.2 millicuries of radioactivity was shipped to Barnwell, South Carolina, LLRW facility on May 26, 1994. Between July 25 and October 26, 1994, 56,161 cubic feet of soil containing 9.8 millicuries was shipped to the Envirocare LARM facility located in Clive, Utah. Soil containing radioactivity in concentrations below 560 pCi/g was shipped to Envirocare and soils containing greater concentrations was shipped to Barnwell.

Non-radiological analysis results indicated all chemical constituents for hazardous material classification were below EPA 40CFR261.21-24 limits. Soil density analysis indicated that moisture content ranges were within a suitable range to ensure adequate disposal compatibility.

The results of radiological analyses for transuranics and "hard to detect" radionuclides (strontium-90, nickel-59-63, iron-55, carbon-14, niobium-94, technetium-99, and iodine-129) indicate that these materials were present in quantities at or below background levels or the lower limit of detection (LLD). The results of the remaining radiological analyses of site soil indicated that the predominant radionuclides were Cs-137 and Co-60.

The pre-remediation site average concentrations of predominant radionuclides were 15 pCi/g for Cs-137 and 0.5 pCi/g for Co-60. Approximately 14 percent of the soil samples contained Cs-137 in concentrations greater than 5 pCi/g with 3393 pCi/g being the highest concentration, and 10 percent contained detectable quantities of Co-60 with 23.7 pCi/g being the highest concentration. From a public dose perspective, the pre-remediation postulated dose rates to a theoretical onsite resident would have been 40.2 millirem per year due to Cs-137 and 5.6 millirem per year due to Co-60, for a total of 45.8 millirem per year, (total of all pathways as analyzed using the RESRAD Code [Reference 23]).

The current site average concentration of Cs-137 is below 1.0 pCi/g and Co-60 is below 0.1 pCi/g. However, small pockets of residual radiological contamination of Cs-137 in the range of 5-10 pCi/g remain in the exclusion area adjacent to the CV. These areas will be remediated during subsequent decommissioning activities. The current postulated dose rates to a theoretical onsite resident would be below 3 millirem per year due to Cs-137 and below 1 millirem per year due to Co-60, for a total of less than 4 millirem per year.

7.5 Environmental Radiological Surveillance Program

GPU Nuclear Corporation continues to conduct a comprehensive radiological environmental monitoring program (REMP) at the SNEC Facility to monitor radiation and radioactive materials in the environment. The information obtained from the REMP is available to determine the effects of the SNEC Facility, if any, on the environment and the public. The results of the REMP to date indicate that the operation and maintenance of the facility has not had a significant radiological impact on the environment and the public.

Environmental monitoring at the SNEC Facility currently involves high volume air sampling; sediment, groundwater, potable water, soil, pipe-tunnel water, surface water and thermoluminescent dosimeter (TLD) monitoring.

Gamma radiation exposure rates near SNEC are measured using thermoluminescent dosimeters (TLDs). There are 28 TLDs that surround the SNEC Facility. Sixteen Indicator Stations, one per compass sector, are located on the SNEC outer perimeter fence. One station is located in the GPU Energy Line Department Garage. There are nine offsite indicators in various sectors within two miles of the site. There are also two control stations, each about two miles from the site. Each TLD station consists of two TLD badges (Panasonic Model 814), each of which has three phosphors or elements. Since each TLD phosphor responds to radiation independently, this provides six independent detectors at each station.

The current groundwater monitoring program includes ten overburden monitoring wells and four deeper, bedrock monitoring wells. The initial two bedrock wells were installed in 1994 after extensive investigations into the bedrock hydrology were performed (Reference 11). These deeper wells were drilled into bedrock at an angle to maximize the interception of significant fractures and bedding planes as discussed in Sections 3.2 ("Geology") and 3.3 ("Hydrology"). Construction specifications for these angled wells can be found on Figure 7.5-1. Gas displacement samplers were installed into the boreholes (MW-1 and MW-2) for the bedrock groundwater detection system (refer to Figure 7.5-2 for well locations). The eight original overburden monitoring wells (GEO-1 through GEO-8) were retrofitted with gas displacement samplers in 1994 as an upgrade to the monitoring system. The major advantage to using gas displacement samplers in MW-1 and MW-2 is that discrete areas of significance (i.e., fractures and bedding planes) are able to be monitored. Monitoring well MW-1 was installed at a diagonal along a northeast southwest trend (from the northeast toward the southwest), whereas MW-2 was installed along a southwest-northeast trend (from the southwest toward the northeast). In addition, a vertical piezometer (GEO-9) was installed in 1994 to solely monitor bedrock groundwater elevation.

Periodically, low levels of tritium (200-760 pCi/l) have been detected in environmental groundwater monitoring well GEO-5. Upon review of the GEO-5 results, it appears that the activity in the GEO-5 area can be attributed to pockets of tritiated water trapped in fractures leading to the overburden groundwater. In order to assess the possibility of other contaminates in this area supplemental monitoring wells were added in this location. In May 1998, three additional monitoring wells were drilled. Two bedrock wells (MW-3 and MW-4) were installed to determine if there was contamination in the vicinity of the former Radiological Waste Disposal Facility. These new walls showed infrequent tritium activity slightly above minimum detectable ranging from 120-180 pCi/l. An additional overburden well (GEO-10) was installed to supplement the existing monitoring wells to monitor for the possible migration of trace amounts of tritium or other contaminants. Nevertheless, tritium concentrations from this station are well below the United States Environmental Protection Agency Primary Drinking Water Standard of

20,000 pCi/l. Gamma scans from this station, as well as all other groundwater well stations, have always resulted in less than detectable limits.

Other environmental monitoring currently employed at the SNEC Facility includes two potable groundwater stations, four sediment stations, four high volume air samplers for measuring air particulate activity and two surface water stations. Soil sampling is conducted on an as needed basis.

During decommissioning, GPU Nuclear Corporation will continue to monitor the environment in the vicinity of the site for the presence of radioactivity. It is anticipated that the current REMP may change during the course of decommissioning to reflect changes in site conditions.

The REMP includes the monitoring, sampling, analysis and reporting of radiation and radionuclides in the environment in accordance with the methodologies and parameters as contained in SNEC Facility Procedures.

7.6 Final Radiation Survey and Release Criteria

Final Survey Plan

After completion of decommissioning activities, GPU Nuclear Corporation will conduct a final radiation survey of the site to verify that surface radiological contamination levels, concentrations of radioactive materials in the soil and water, and direct radiation levels have been reduced to levels that will allow release of the site for unrestricted use. GPU Nuclear Corporation will design its survey plan using current technical documents published by the NRC. These documents are discussed in more detail in the 'Final Release Criteria' and 'Documentation' sections of this report.

Radiation monitoring instruments used during the conduct of the final radiation survey will be selected as appropriate for the physical and environmental conditions and the type of radiation being measured. The radiation surveys will be performed by properly trained individuals using calibrated survey instruments. The survey instrumentation will be controlled by specific procedures that define accuracy requirements, and calibration techniques.

Applicable portions of the facility's Quality Assurance Program (QAP) will be implemented during the conduct of the final survey plan and periodic audits will be performed in accordance with the QAP to verify survey activities comply with established procedures and applicable aspects of the QAP.

Final Release Criteria

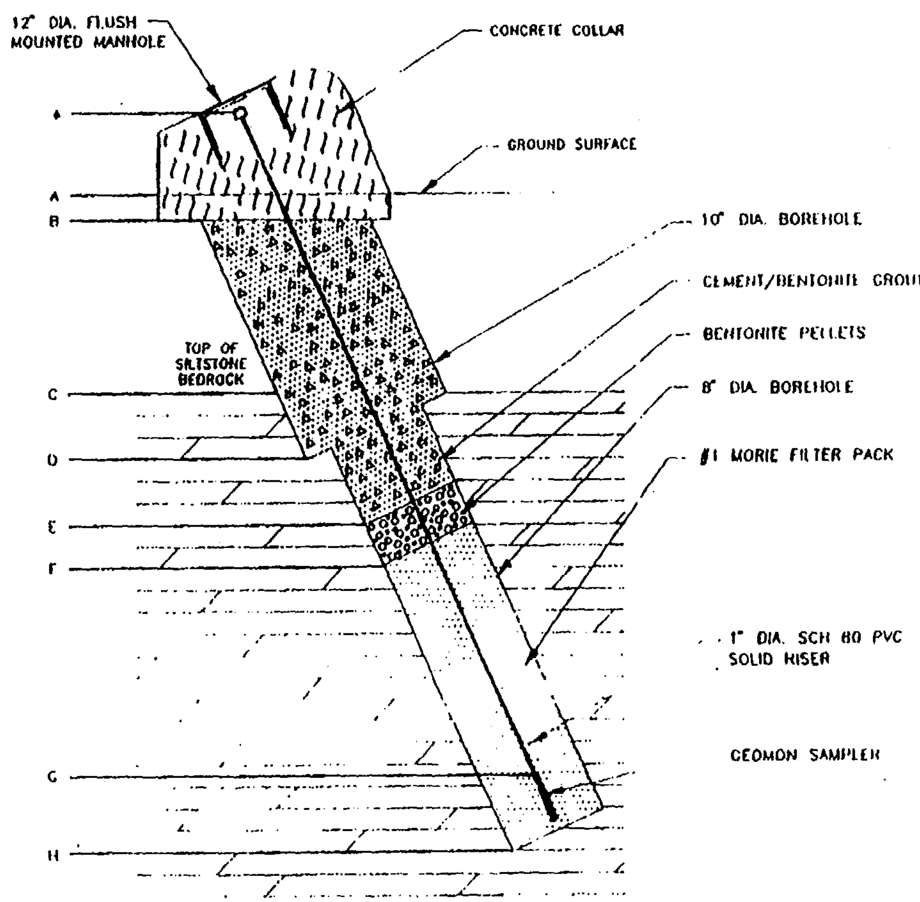
A rule covering explicit radiological criteria for decommissioning is contained in 10CFR20. GPU Nuclear Corporation intends to meet the criteria of 10 CFR 20 for site release through implementation of a survey plan incorporating guidance contained within current and proposed regulatory documents. The regulation requires the residual radioactive contamination at the site attributed to licensed operations to contribute not greater than 25 millirem per year total effective dose equivalent to an average individual of the critical population group during the period of 1000 years following site release.

This plan will include a description of the technical considerations and methods to be used for design and implementation of the final survey. The methods to be described are derived from regulatory guidance contained within Draft Regulatory Guide 4006 "Demonstrating Compliance with the Radiological Criteria for License Termination (Reference 31). Appropriate instrumentation and modeling methods will be utilized for attainment of release limits for surface activity, exposure rate and pathway analysis requirements as specified by these guidelines. For example, rubble, debris, soil and structures remaining onsite will be analyzed using RESRAD (Reference 23) or, equivalent methodology to calculate the total effective dose equivalent. Residual radiological contamination types not applicable to RESRAD methodology will be analyzed by guidance deemed appropriate at time of use. At present such guidance is given in NUREG/CR-5512 "Residual Radioactive Contamination from Decommissioning (Reference 17) and Draft NUREG –1549 "Guidance on Using Decision Methods for Dose Assessment to Comply with Radiological Criteria for License Termination," (Reference 18).

As a project goal, radiological contamination and/or migration of radioactive contamination into ground and surface waters with the potential to be used as a source of drinking water will be evaluated against the 4mrem/year dose criteria referenced in the National Primary Drinking Water Standards contained in 40CFR141

Documentation

GPU Nuclear will prepare a final survey plan and implementing procedures which will follow the guidance contained in NUREG-1575 "Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM)" (Reference 20). Radiological survey results will be compiled into a report. This report will provide a complete record of the radiological status of the site and comparison to the established guidelines for termination of the license. The report will also contain sufficient information to enable an independent re-creation and evaluation of the survey and the results derived from the survey. GPU Nuclear Corporation will submit the final report to the NRC.



TYPICAL BEDROCK MONITOR WELL DETAILS

NOT TO SCALE

FILE: ANGLEWEL

DEPTH BELOW GROUND SURFACE (LINEAR FEET)		
	MW-1	MW-2
A	0	0
B	1	1
C	19	13
D	23	20
E	25	25
F	30	30
G	54	54
H	55	55

* TOP OF SOLID RISER AND MANHOLE ARE APPROXIMATELY 1 FOOT ABOVE GROUND SURFACE.

NOTE: MW-1 DRILLED AT AN APPROXIMATE ANGLE OF 25° FROM VERTICAL TO THE SOUTHWEST. MW-2 DRILLED AT AN APPROXIMATE ANGLE OF 25° FROM VERTICAL TO NORTHEAST.

SAXTON NUCLEAR EXPERIMENTAL CORP.
SAXTON, PENNSYLVANIA

GPUN CORPORATION
PARSIPPANY, NEW JERSEY

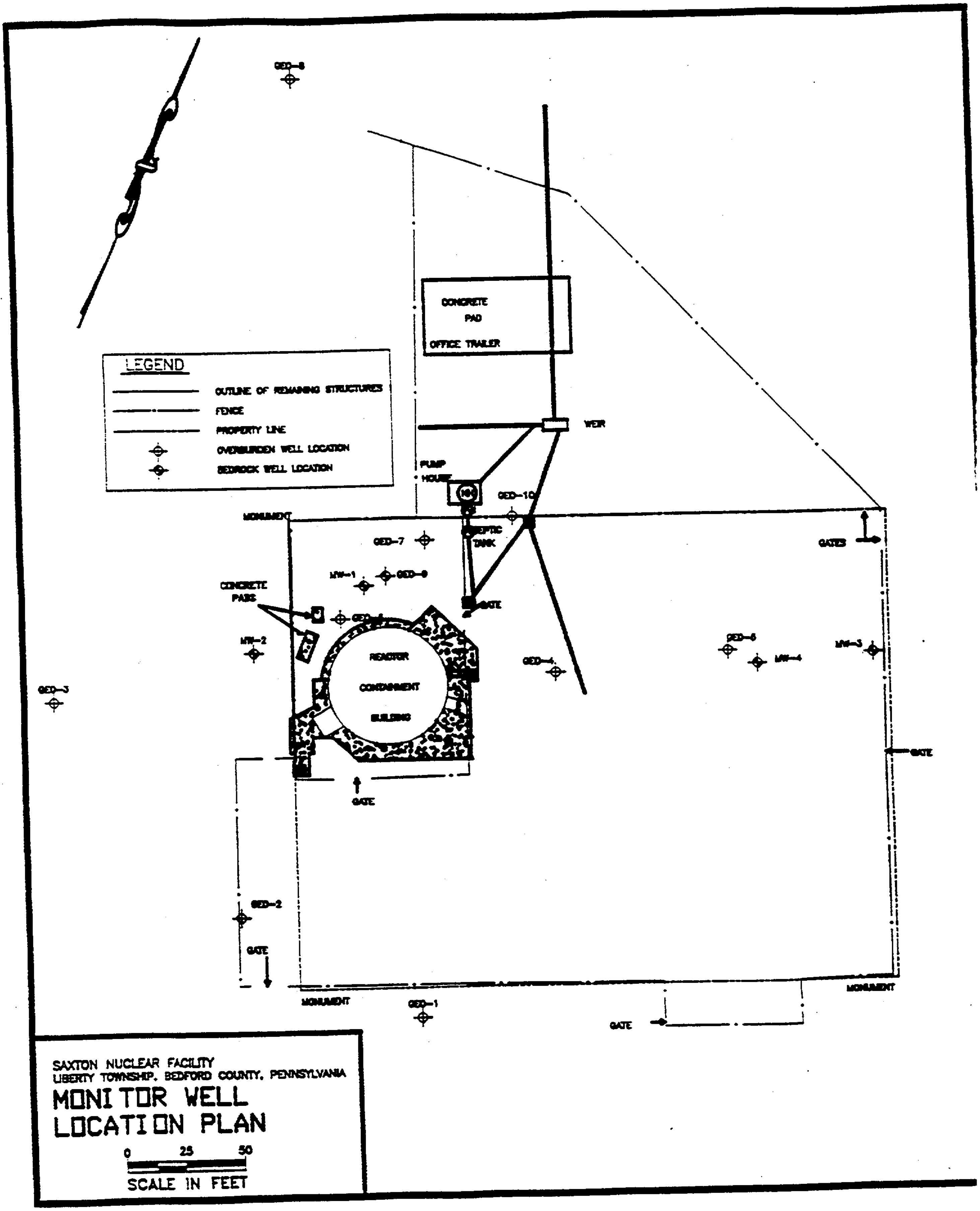
BEDROCK MONITOR WELL
CONSTRUCTION DETAILS

FIGURE No.	GEO FILE No.	DATE	REV.
	93120	MAY 1994	Ø

GEO Engineering DOVER, N.J. (201)361-3600

FIGURE 7.5-1

FIGURE 7.5-2



LEGEND
OUTLINE OF REMAINING STRUCTURES
FENCE
PROPERTY LINE
OVERBURDEN WELL LOCATION
BEDROCK WELL LOCATION
CONCRETE PAD
OFFICE TRAILER
WEIR
PUMP HOUSE
SEPTIC TANK
GATE
GATES
MONUMENT
CONCRETE PADS
REACTOR CONTAINMENT BUILDING
MW-1
MW-2
MW-3
MW-4
GED-1
GED-2
GED-3
GED-4
GED-5
GED-7
GED-8
GED-9
GED-10
SAXTON NUCLEAR FACILITY
LIBERTY TOWNSHIP, BEDFORD COUNTY, PENNSYLVANIA
MONITOR WELL LOCATION PLAN
0 25 50
SCALE IN FEET

8.0 ENVIRONMENTAL APPROVALS

8.1 Federal Requirements

NRC approval for performing decommissioning of the SNEC Facility was received on April 20, 1998 via License Amendment No. 15

Decommissioning activities that are subject to Federal regulations, permits, licenses, notification, approvals or acknowledgments include:

- Handling, packaging and shipment of radioactive waste
- Worker radiation protection
- Worker health and safety
- Liquid effluent and stormwater releases
- Hazardous waste generation, storage, transportation and disposal
- Handling, removal and disposal of asbestos
- Handling and removal of lead paint
- Stream encroachment

The majority of radiological activities fall under Title 10 of the Code of Federal Regulation (CFR) and are administered by the Nuclear Regulatory Commission (NRC). Applicable Title 10 regulations include:

- Part 50 - decommissioning activities
- Part 20 - radiation protection
- Part 51 - environmental protection
- Part 61 - disposal of radioactive waste
- Part 71 - packaging and transportation of radioactive waste (regulations in 49CFR171 to 174 also apply)

Worker health and safety protection during decommissioning is subject to Occupational Safety and Health Administration (OSHA) regulations. The regulations applicable to construction are 29CFR1910 and 1926. These regulations include requirements for respiratory protection (non-radiological), hearing protection, illumination, scaffold safety, crane and rigging safety, chemical usage and release response, and clean-up operations.

The Environmental Protection Agency (EPA) regulations outlined in Title 40 of the Code of Federal Regulations apply as follows:

- Part 61 - asbestos handling and removal
- Parts 122 to 125 - National Pollutant Discharge Elimination System (NPDES)
- Part 141 - safe drinking water standards
- Part 190 - radiation protection standards for nuclear power operations
- Parts 260 to 272 - Resource Conservation & Recovery Act (RCRA)

Asbestos and lead paint handling and removal is subject to OSHA regulations 29CFR1910 and 1926, and EPA regulations 40CFR61, Subpart M. Hazardous waste generation, storage, transportation, are subject to the regulations outlined 40CFR260 through 272 of the Resource Conservation & Recovery Act (RCRA).

8.2 State and Local Requirements

Permits and approvals from or notifications to several State and local agencies are required for safety and environmental protection purposes. Many of the State and local requirements apply to activities that are also subject to Federal regulations previously identified. Decommissioning activities and related site operations that fall under State and local jurisdiction include:

- Air emissions
- Hazardous waste generation, storage, transportation and disposal
- Asbestos removal notification and disposal
- Lead paint removal and disposal
- Solid waste generation, storage, shipment and disposal
- Sanitary waste
- Liquid effluents, including storm water
- Liquid waste shipment
- Fuel oil storage
- Building permits
- Domestic water wells
- Soil erosion and sedimentation control

Air emissions and asbestos removal for the facility are regulated under the Pennsylvania Air Pollution Control Act in addition to the Federal Clean Air Act. Notification of asbestos removal was prepared and submitted to the Pennsylvania Department of Environmental Protection (PaDEP), as required. Air emissions were evaluated by the PaDEP and a waiver was issued due to the minor quantities of emissions from the SNEC Facility during decommissioning operations.

Liquid discharges from the facility are regulated by the NPDES Permitting System administered by the PaDEP, Bureau of Water Quality Management. Pennsylvania NPDES regulations are promulgated under the Clean Streams Law (35 P.S. Sections 691.1-691.701).

Generation and disposition of hazardous waste and lead paint removal and disposal are subject to regulations promulgated under Pennsylvania's Solid Waste Management Act (35 P.S. 6018.101 et. Seq.).

Shipment and disposal of solid wastes including asbestos are governed by Pennsylvania's Residual Waste regulations, also promulgated under the Solid Waste Management Act.

At the local level, building permits were not required for temporary waste handling and packaging or other facilities necessary to support decommissioning activities.

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21) Deleted

22) Deleted

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24) Eisennbud, M., Environmental Radioactivity, Third Edition, Academic Press Inc., 1987.

25) In-Situ Survey General Public Utilities Facilily and Surrounding Area, EG&G Energy Measurements, June 1988.

26) An Aerial Radiological Survey of the Saxton Nuclear Experimental Corporation Facility and Surrounding Area, EG&G Energy Measurements, July 1989.

27) DELETED, Superseded by Reference 2

28) Confirmatory Radiological Survey for Portions of the Saxton Nuclear Experimental Facility, Saxton, PA, Oak Ridge Associated Universities, June 1991.

29) Radiological Analysis File Number 6612-96-007. "Maximum Offsite Dose from Release of Saxton Pipe Tunnel Water", B.A. Parfitt, March 22, 1996

30) GPU Nuclear Letter No. C301-96-2045, SNEC Decommissioning, September 30, 1996.

31) Draft Regulatory Guide 4006, Demonstrating Compliance with the Regulatory Criteria for License Termination. United States Nuclear Regulatory Commission, August 1999.

Saxton Nuclear Experimental Corporation Facility

Decommissioning Environmental Report Appendix 1

Appendix 1
Table of Contents

Saxton Nuclear Experimental Corporation Facility

Decommissioning Environmental Report Appendix 1, Supplement 1

SNEC Decommissioning Environmental Report Questions

71. Page 5-1, Section 5.1 - Please discuss the potential impact on the local transportation conditions of increased commuter traffic and movement of materials in and out of the SNEF as a result of decommissioning activities.

Response: Other than the additional staffing, transportation related issues may include waste shipments and the arrival of heavy operating equipment. However, most of the heavy equipment needed for the decommissioning project has been used already at the Saxton facility. And no local traffic related issues occurred. Within the waste shipment category, only the disposal of the reactor vessel, steam generator and pressurizer present transportation challenges. All other activities will follow standard procedures in effect throughout earlier dismantlement projects.

Disposal of the steam generator, pressurizer and reactor vessel is discussed in sections 2.2.1.3, 2.2.1.4 and 3.3.3.4 of reference 8. The disposal of these large components will likely require three oversized shipments to an appropriate rail terminal. All routes will be inspected for adequacy and will be identified on the shipping permit. As with all oversized shipments, a trip plan will be filed with local officials. Other waste shipments will utilize normal freight vehicles.

No adverse impact to local transportation is expected from other shipments. Fewer than 100 total waste shipments are anticipated over the 2½ year decommissioning schedule. For comparison, 165 waste shipments were completed within a three-month schedule during the Saxton Soil Remediation Project (reference 4). The soil shipments were completed without incident or complaint. Additionally, radwaste shipments have been made from the Saxton facility since 1962.

Because much of the anticipated transportation activities occurred without incident during prior Saxton projects, no adverse impact is expected to the local traffic conditions. Traffic increases from the increased staffing also should have minimal effect. The proposed staffing will be comparable to staffing levels during operation of the facility.

72. Page 5-2, Section 5.3 - Please make specific comparisons between local and/or State of Pennsylvania requirements and the SNEC Soil Erosion and Sedimentation Control Plan.

Response: Under the Pennsylvania Code of Regulations relating to erosion control (25 PA Code Chapter 102), requirements for an erosion and sedimentation control plan are listed (Section 102.5). They are as follows:

Pennsylvania Environmental Regulations Section. 102.5.

Erosion and sedimentation control plan.

(a) The erosion and sedimentation control plan shall be prepared by a person trained and experienced in erosion and sedimentation control methods and techniques.
(b) The erosion and sedimentation control plan shall be designed to prevent accelerated erosion and sedimentation and shall consider all factors which contribute to erosion and sedimentation, including, but not limited to, the following:

(1) The topographic features of the project area.
(2) The types, depth, slope and areal extent of the soils.
(3) The proposed alteration to the area.
(4) The amount of runoff from the project area and the upstream watershed area.
(5) The staging of earthmoving activities.
(6) Temporary control measures and facilities for use during earthmoving.
(7) Permanent control measures and facilities for long term protection.
(8) A maintenance program for the control facilities including disposal of materials removed from the control facilities or project area.

Guidelines for compliance with the above requirements are described in the April 1990 Erosion and Sediment Pollution Control Program Manual and the November 1996 Erosion and Sedimentation Control Plan Development Checklist and Worksheets. Both of these documents were developed by Pennsylvania's Bureau of Soil and Water Conservation, Division of Soil Resources and Erosion Control.

The regulations first require the preparer of the plan to be trained and experienced in erosion and sedimentation control methods and techniques. The preparers of the SNEC Soil Erosion and Sedimentation Control Plan hold relevant degrees; one having a Master's Degree in Environmental Pollution Control and the other having a Bachelor's Degree in Biology which includes courses in Ecology. The main contributor to the plan has had intermittent experience in erosion and sedimentation control practices over the past 16 years at the Three Mile Island site located in Middletown, Pa.

The specific requirements, as listed under Section (b) above, have been incorporated into the site plan as necessary. Please see the enclosed site plan for a more detailed comparison.

73. Page 5-2, Section 5.4 - Please describe the SNEC radiological effluents, both liquid and airborne, and their controls in more detail, to provide sufficient bases for evaluation of effectiveness. Please include information about the assumed parameters, scenarios, and methods used to estimate projected doses to the public. Provide comparisons between projected doses and regulatory limits.

Response: See May 3, 1998 letter, (Supplement 2 to this report)

74. Page 5-4, Section 5.5, First Paragraph - Please provide more detail on plans for processing contaminated water expected to be generated during decontamination of the SNEF, including that currently contained in the CV pipe tunnel. What is the range of radionuclide concentrations that has been measured in this water? What is the planned pathway for water that is to be released to the environment? In view of the high groundwater level as discussed on page 5-5, has consideration been given to use of a dewatering system in order to lower the groundwater level and thus minimize or eliminate infiltration during decontamination of the pipe tunnel?

Response: Details of the processing plans are not yet finalized. However, any contaminated water processing that occurs on site will be accomplished in accordance with applicable regulatory requirements. In general, water will be sampled and analyzed in a batch manner. Any environmental pollutants will be accounted for and dispositioned in accordance with plans approved by the Commonwealth of Pennsylvania's Department of Environmental Protection. Radioactive contaminants will be analyzed and evaluated as specified in the Off Site Dose Calculation Manual (ODCM). If a given batch of water exceeds the release criteria of Technical Specifications or the ODCM, there are multiple options for dispositioning of the water. These include blending of the water with that from other on site sources to bring the aggregate into compliance with the release requirements, on-site processing by contractor supplied processes such as portable ion exchange or reverse osmosis systems, or shipping of the water off-site to a vendor operated treatment system. Water meeting release criteria will be released to the Juniata River through a temporary hose or pipe system. It will not be discharged to the ground. All releases will be sampled, analyzed, and documented in accordance with the ODCM.

The range of radionuclide concentrations in the CV pipe tunnel are given in the characterization report, table 4-31. Preliminary analysis of water of the Steam Station Circulating Water Discharge Tunnel shows that the radionuclide concentrations are on the order of E-7 uci/ml.

The closeness of Raystown Lake has significantly influenced the ground water level at the SNEC Facility site. Previous attempts to lower the ground water level using de-watering systems were unsuccessful. As work progresses, there may be efforts to locally de-water around specific structures. Once the water is shown by analysis to be only ground water comparable to water from the site monitoring wells, it will be pumped to the river and controlled in accordance with the environmental regulations of the Commonwealth of Pennsylvania.

75. Page 5-5, Top Paragraph - What volume of tritium contaminated water is currently in the CV sump? Where are the other principal sources of tritium and what are the volumes of each? What are the planned release pathways for this water?

<u>Response</u>: The CV sump currently contains approximately 116 gallons of water. This volume varies as condensation from the CV is collected in the sump.

The other principal sources of tritium are given in the SNEC Facility Site Characterization Report which is included with this submittal. From a volume perspective, the principal source of tritium would be the concrete in the facility, however the concentration is very low. The entire facility is estimated to contain 4.15 curies of tritium.

Water containing low levels of tritium may be released to the Juniata River as a normal liquid effluent in accordance with the off-site dose calculation manual. This would include releases of intrusive ground water which may become slightly contaminated. As mentioned throughout the decommissioning plan, we plan to minimize the volume of water used during the decommissioning process, small volumes of more contaminated water may be processed for off-site disposal at a licensed disposal facility after solidification or absorption.

76. Page 5-5, Second Paragraph - Please provide your best estimate of contamination levels on the inner surfaces of the pipe tunnel. Also, please provide a copy of Reference 29.

Response: The "pipe tunnel" is filled with near surface ground water as it was during characterization and so extensive measurements of surface contamination were not possible. However, surveys of loose surface contamination have been made in support of personnel entries which indicate surfaces are generally less than 5,000 dpm/100 cm^2. In addition to these surveys, core bore samples were taken at several locations in the tunnel. These samples were analyzed and the results are given in the characterization report.

The "pipe tunnel" in question was part of the same tunnel that was decontaminated and demolished in 1992. Surveys from that section prior to decontamination and from the still present "steam pipe" tunnel section indicate that loose surface contamination is less than 5,000 dpm/100 cm^2, while the fixed or total contamination ranges from <minimum detectable activity (MDA) to 230,000 dpm/100 cm^2 with an average of approximately 20,000 dpm/100 cm^2.

77. Page 5-6, Section 5.7 - The validity of the assessment of the radiation exposure of members of the public, which appears to be solely based on estimates contains on the NRCs Generic Environmental Impact Statement (GEIS) and a comparison of the volume of waste assumed to be shipped from the reference test reactor and the volume expected to be generated by SNEF. In fact, the second paragraph of section 3.1 of the GEIS states that site specific assessments will be required for the environmental report submitted with the application for license modification prior to decommissioning a specific facility. Please provide an independent assessment of the integrated radiation exposure of members of the public or demonstrate that each of the important parameters in the dose calculation for the SNEF decommissioning is bounded by the parameters assumed by Battelle Pacific Northwest Laboratories for the reference test reactor dose calculations used in the GEIS.

Response: The estimated radwaste volume (580 m^3), stated in section 5.7 of the Environmental Report, was taken from Table 3.3-2 of the proposed Saxton Decommissioning Plan. This volume figure is only an estimate of what remains onsite as part of the decommissioning process. Processed waste still needs to be estimated and therefore will add to the 580 cubic meter estimate but not more than 10% (58 cubic meters). The reason the 580 cubic meter estimate is so low when compared to the NUREG-0586 estimate (4930 cubic meters) is that radioactive materials from past site work have not been factored into the overall estimate. When considering actual radwaste shipped as a result of preliminary decon (from 1972-1974), reactor support building dismantlement and demolition (1986-1992), and radioactive soil disposal (1994) the overall radwaste volumes become more representative of the parameters calculated by Battelle Pacific Northwest Laboratories (BPNL)(reference NUREG/CR-1756, Volume 2 of 2, Table I.2-8). To date, approximately 1835 m^3 (243 m^3 of demolition debris and 1592 m^3 of soil) have been shipped off-site. The total radwaste volume generation for the entire project, including past work, is estimated to be in the area of 2400-2700 m^3. This estimate is approximately 55% of the NUREG-0586 bounding conditions and the BPNL parameters. The dose to the public is negligible (less than 0.1 person-rem), per Table 7.3-4 of NUREG-0586, for a test reactor in a 30 year safestor condition.

78. Page 7-4, Section 7.4 - The environmental report discusses both the aerial surveys and "comprehensive soil monitoring and sampling work". Can you compare the results of these two methods, and are they consistent? Please give specific values for Cs-137 deduced from the aerial surveys. Please give details of the analyses that project doses to occupants of the SNEC site, pre-remediation, now, and in the future.

    Response: Comparison of Cs-137 soil activities between the EG&G aerial survey (1989) and the on-site soil sampling work (1993) are not consistent. The purpose of the aerial survey was to measure Cs-137 concentrations in surrounding areas (outside the Saxton restricted area) to determine if there was wind blown contamination emanating from the site property. The measurements made as part of the "comprehensive soil monitoring and sampling work" were performed onsite to characterize the radiological constituents of the soil. The results of latter study showed measurements significantly higher than background and are documented in the soil remediation report. However, the aerial survey did compare favorably to other studies performed offsite, where background concentrations of Cs-137 for areas surrounding Saxton were determined. In 1988 EG&G made in-situ measurements at off-site locations which compared favorably to the 1989 aerial survey. Results of these measurements are listed in Table 1 of the "In Situ Survey General Public Utilities Facility and Surrounding Area" and in Table 2 of the "An Aerial Radiological Survey of the Saxton Nuclear Experimental Corporation Facility and Surrounding Area." Both documents are provided.

    Because of the 1993 soil characterization sampling and subsequent disposal of onsite soil (1994), the post remediation Cs-137 concentration average is <1.0 pci/g (<3 mrem/yr). Results of this work are documented in the soil remediation report.

79. Page 7-5, Last paragraph - Please provide a copy of References 7, 9, 10, and 11 and describe the rationale used in positioning the two bedrock wells. How well has the direction of groundwater flow been established in the bedrock aquifers? Has any radioactive contamination been detected in either of these wells that could be attributed to SNEC activities?

    Response: The positioning of the two bedrock wells (MW-1 and MW-2) was based on the recommendation of GEO Engineering of Dover, New Jersey. In August of 1992, GEO Engineering was contracted to investigate the extent of the overburden groundwater along with the depth to the bedrock surface and the orientations of the bedrock groundwater flow pathways. To determine the flow pathways in the bedrock, three nearby bedrock outcrops were investigated. All three outcrops were similar in fracture pattern and bedding plane orientations, indicating the direction of bedrock groundwater movement for the general area, including the SNEC facility. GEO Engineering reports, dated November 18, 1992 and June 7, 1994, discuss their findings, recommendations, and subsequent installation of the groundwater monitoring system. Please refer to References 10 and 11 cited in the SNEC Facility Decommissioning Environmental Report.

    Collection and analysis from the bedrock monitoring wells began in July 1994 and since that time no radioactive contamination has been detected from these wells. This was previously documented in the Decommissioning Environmental Report and in the SNEC

Facility Decommissioning Plan on page 3-13. Analyses of the overburden groundwater wells hydraulically downgradient of the containment vessel (GEO-3, GEO-6, GEO-7 and GEO-8) also have not detected any radioactivity. Additionally, three wells (GEO-1, GEO-4 and GEO-5) serve as background sampling points for monitoring the containment vessel (CV) since these wells are located hydraulically upgradient of the CV. Monitoring Station GEO-5 is the only point that has shown positive tritium activity intermittently, which possibly is attributed to the demolition of former reactor support buildings (e.g., Rad Waste Disposal Facility).

80. Page 7-6, First Paragraph - Please provide a description of the gas displacement sampler and how it is used to monitor significant fractures and bedding planes. Is there a means of isolating these zones in boreholes MW-1 and MW-2? Please describe the #1 Morie Filter Pack material in the bottom 25 feet of each borehole as depicted in Figure 7.5-1. Also, is there any use being made of groundwater from the overburden zone above bedrock in the vicinity of the SNEF?

Response: The gas displacement sampling system was retrofitted in all the overburden monitoring wells and initially installed in the bedrock monitoring wells during the spring of 1994. This system allows dedicated sampling to prevent the potential for cross contamination between wells and will achieve minimal agitation of subsurface waters, as is the case in a bailer-type collection system. Water is obtained from the well by injecting compressed gas (air) into a one-inch diameter schedule 80 PVC riser pipe and thus displacing the water sample up to the surface via a discharge line. There is a check valve and a 10μ pore size sintered polyethylene filter at the lower end of the riser. A high-pressure regulator is used in conjunction with the compressed gas cylinder for adjustment of the sample flow rate. The gas displacement samplers (Geomons manufactured by Aguifer Systems, Inc. of Bloomfield, New Jersey) have watertight well head fittings and oversize risers to maximize the capture of water for slow recharging wells.

As part of the analysis performed by the contracted hydrogeologic consultants (GEO Engineering), it was determined that bedrock monitoring wells should be installed at an angle in order to maximize the interception of fractures and bedding planes. The boreholes (MW-1 and MW-2) were drilled into bedrock at an angle of approximately 25° from the vertical to accomplish this. By sealing the annular space with grout and bentonite pellets above a depth of approximately 30 feet, fractures and bedding planes in the areas which would intercept potential outleakage from the containment vessel are monitored. Those areas are isolated in the boreholes and this is what is referred to as significant fractures and bedding planes (for monitoring purposes). Construction details can be seen on Figure 7.5-1 of the Decommissioning Environmental Report.

The #1 Morie Filter Pack material in the bottom 25 feet of each bedrock borehole consists of a silica quartz sand which serves as a filter medium for removing sediment. Morie Filter Pack material is sterilized before packaging for sale. Morie #1 connotates the grain size, which is a sand fine, as opposed to a coarser gravel filter material.

The only potential use of groundwater from the overburden zone in the vicinity of the SNEC Facility (i.e., encompassing those areas which the groundwater could potentially impact) is a pumped well located within the property boundary. It is located in the southern area of the property, approximately 75 meters from the containment vessel. This well is believed to have been installed in the 1920 - 1930 time frame with some recent upgrades to the pumping/storage tank system. Actual construction details of the well could not be located. It is a non-potable sanitary water source, solely used by company personnel for personal hygiene and washing vehicles and other equipment. The Pa. Department of Environmental Protection has verbally approved the well for this use and signs are posted at all distribution points preventing the consumption of this water. Nevertheless, routine analyses of this well water have indicated that radioactive contamination is not present.

81. Page 7-6, Second Paragraph - Is the detection of tritium in GEO-5 noted in this paragraph the only incidence in which radioactive material has been detected in the overburden monitoring wells? Describe the analytical methods used to detect and measure the concentration of radioactive material in water samples collected in the overburden as well as the bedrock, including the sensitivity or minimum detection limit of the instrumentation used.

    Response: The intermittent detection of tritium in Groundwater Monitoring Station GEO-5 is the only incidence in which radioactive material has been detected. All other overburden and bedrock monitoring wells have shown no positive activity for tritium nor any plant related isotope.

    Ground water samples are analyzed for tritium by filtering the sample, mixing with a scintillation fluid then counting in a liquid scintillation counter. An appropriate count time is used to reach a required sensitivity of 200 pCi/L. Samples are also placed in counting containers for gamma analysis using High Purity Germanium detectors. Required sensitivity for Co-60, Cs-134, and Cs-137 is 15 pCi/L.

    The laboratory uses approved analytical procedures, NIST traceable standards and sources, and complies with the guidance recommended in Regulation Guide 4.15 for the analysis of all samples.

82. Page 7-6, Third Paragraph - You state that soil sampling is conducted on an as needed basis. Please give some examples of when this sampling would be conducted.

    Response: Since the soil remediation work was completed in 1994, there has not been a systematic need to conduct soil sampling as part of the quarterly environmental surveillance. Future decommissioning work (such as excavations of sanitary waste systems, CV demolition and identified areas still requiring soil remediation) may impact site drainage and therefore will be evaluated to determine if routine soil sampling is required. At this time, only biased soil sampling will be performed in order to assess compliance with NRC site release limits.

83. Pages 7-7, 7-8, Section 7.6 - In accordance with discussions during the site visit on May 9, 1996, please submit the SNEC plan for the final radiological survey, including methods to provide and ensure consistency and compliance with release criteria.

Response: GPU Nuclear has requested Saxton Nuclear Experimental Corporation site free release criteria in the DP that is consistent with the proposed revision to 10 CFR 20 concerning license termination residual radioactivity limits. The NRC has not yet finalized guidance on acceptable methods of demonstrating compliance with the revised criteria. Three NUREGs are under development which will provide such guidance: NUREG- 1505 "A Nonparametric Statistical Methodology for the Design and Analysis of Final Status Decommissioning Surveys", NUREG-1506 "Measurement Method for Radiological Surveys in Support of New Decommissioning Criteria", and NUREG-1507 "Minimum Detectable Concentrations with Typical Radiation Survey Instruments for Various Contaminants and Field Conditions". It is our intent to comply with the guidance promulgated when it is available.

Final termination survey activities will not take place until the year 1999-2000 time frame. It is expected that the proposed release criteria developed as part of the enhanced participatory rulemaking process and the compliance guidance will be approved before then. If it is not, we intend to use that guidance which is available (at this time, NUREG/CR-5849 "Manual for Conducting Radiological Surveys in Support of License Termination" and NUREG/CR-5512 "Residual Radioactive Contamination From Decommissioning").

Per our discussions with your staff, it is our intention to submit a separate "Saxton Final Survey Plan" for NRC approval as other licensees have done as part of the decommissioning process. We have prepared an approved final survey plan previously as part of the release of the Saxton facility outbuilding demolition and have provided input on the final survey plan for the Fort St. Vrain decommissioning project. In addition, the company participated in the enhanced participatory rulemaking process and we are very familiar with the requirements.

The final survey plan will incorporate the use of data quality objectives as called for in the draft guidance to demonstrate compliance with the release criteria. The plan will incorporate the following items:

- A detailed description of the types, extent, and locations of the measurements and samples that will be obtained.
- A description of the equipment and techniques that will be used for measuring, sampling, and analyzing the data.
- A description of the methods for interpreting and evaluating the data quality.
- A list of quality control requirements for ensuring data quality.
- Detailed implementing procedures will be in place to carry out the final survey plan requirements.

Instrumentation will be selected which will be capable of measuring levels sufficiently below the release or action guideline values. These instruments will be calibrated using standards and sources that are traceable to the National Institute of Standards and Technology (NIST). These calibrations and operability checks will be made using sources which are representative of the radionuclide mix or mixes encountered at the site. All instrument calibration and maintenance will be conducted in accordance with industry recognized practices and standards and approved procedures.

All aspects of the survey will be documented in accordance with the plan requirements and approved procedures. The final survey report will be presented in a format which will stand alone and not require the use of other supporting data or documents to conclude that the applicable release criteria has been met.

The quality assurance program detailed in Section 7.0 of the Decommissioning Plan will be implemented during all phases of the final survey to ensure the validity of the results.

Given the changes which are pending relative to the regulations on termination release criteria and the compliance guidance, we feel it is prudent to wait to incorporate those aspects in the Final Survey Plan rather than submit a document which would be outdated and inadequate prior to the start of such survey activities.

Saxton Nuclear Experimental Corporation Facility

Decommissioning Environmental Report Appendix 1, Supplement 2

March 3, 1998
6L20-98-20105

U. S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, D.C. 20555

Gentlemen:

Subject: Saxton Nuclear Experimental Corporation Facility
Operating License No. DPR-4
Docket No. 50-146
SNEC Facility Response to Question 7 of the Fourth Request for Additional Information

The purpose of this letter is to provide a response to Question 7 of the Request for Additional Information (RAI) dated January 28 1998. The response to the question will be incorporated as Supplement I to the SNEC Facility Decommissioning Environmental Report. For additional information regarding the content of this submittal, contact William Heysek of the TMI Licensing Department at (717)-948-8191.

Sincerely,

Vice President SNEC

WGH
Attachment

cc: NRC Project Manager NRR - Alexander Adams
NRC Project Scientist, NRR - Thomas F. Dragoun
File 96516

The following table was developed to provide a side-by-side comparison of the results of the scenarios posed by Question 7 for both the SNEC facility decommissioning case and the Generic Environmental Impact Statement case (NUREG-0586). The responses to the individual parts of Question 7 contain the basis and assumptions, which were used in determining the SNEC facility decommissioning case results. Note: the terms "man-rem" and "man-mrem" have been replaced with the terms "person-rem" and "person-mrem".

Scenario	Saxton	GEIS NUREG 0586
1. Estimated Offsite Population Dose from Routine Decommissioning Activities	14.2 person-mrem	<100 person-mrem (per Section 7.3-1)
2. Estimated Offsite Dose for a Severe Transportation Accident for Decommissioning	6.8 mrem lung (max. exposed individual)	16 mrem lung (max. exposed individual) (per Table 7.4-2)
3. Estimated Total Population Dose from Radwaste Shipments During Decommissioning	0.858 person-rem	2.2 person-rem (per Section 7.3-1)
4. Estimated Dose to Maximum Exposed Individual as a Result of an Onsite Accident During Decommissioning	0.283 mrem lung 1.5-mrem whole body	16 mrem lung (per Table 7.4-2) (Whole body dose not defined in GEIS)
5. Estimated Land Area Occupied by Disposal of Radwaste	0.3 acre	~0.5 acre (per section 7.4)
6. Occupational Exposure as a Result of Decommissioning Operations	37 person-rem	344 person-rem (per Table 7.3-4)

Question 7 Part A: Please provide a person-rem estimate of the dose to the public from decommissioning activities. Discuss this dose as compared to the estimates in NUREG-0586, "Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities" (GEIS).

Question 7 Part A Response: The Estimated Offsite Population Dose from Routine Decommissioning Activities at SNEC has been evaluated and determined based on the following:

Summary: Based on a review of the Saxton Nuclear Experimental Corporation (SNEC) Decommissioning Plan (Reference 6), the following tasks and calculated population doses are considered to be the applicable sources for potential radiological effluent releases during the decommissioning of the SNEC facility.

Task		Population Dose (person-mrem)
Air Pathway		
Concrete Removal Activities		6.00
Pipe Segmentation		7.25
Structural Segmentation		7.64E-07
Decontaminate CV Liner		2.81E-06
	Subtotal	13.25
Liquid Pathway		
Pipe Tunnel Water Discharge		0.485
SSGS Discharge Tunnel		0.485
	Subtotal	0.970
	Total	14.2

There are no plans to segment major components, including the reactor vessel, steam generator and pressurizer. SNEC facility decommissioning plans call for these components to be removed in one piece after they are cut free from piping systems. As a result, removal of these large components will not generate significant amounts of airborne activity and will not contribute significantly to effluent releases. As identified in NUREG/CR-1756 Appendix F and NUREG-0586 section 7.3.1, (References 2 and 8) atmospheric release of radionuclides is assumed to be the only significant source of radiation to the public during routine decommissioning activities. NUREG-0586 (Reference 8), section 7.3.1, notes that "The dose to the public from routine releases during DECON activities at the reference test reactor are estimated to be negligible", (<0.1 person-rem), "and the dose to the public from truck transport of wastes from the reference test reactor is estimated to be 2.2 person-rem." Therefore, the calculated total population dose (both liquid and air pathways) of 14.2 person-mrem for the SNEC facility case is bounded by the estimates given in Reference 8 of: <0.1 person-rem. This calculated dose estimate is supported by radiological characterization surveys which have been documented in the SNEC Site Characterization Report (Reference 1). The dose calculation is determined using methodology from the SNEC Offsite Dose Calculation Manual (ODCM) (Reference 4) and Reg. Guide 1.109 (Reference 5).

Reference 8 does not calculate liquid dose but rather, it concludes that the dose from the liquid pathway is a fraction of the dose from the airborne pathway. In order to demonstrate that the doses attributed to both the population and maximum exposed individual, from SNEC facility liquid releases are bounded and are not the dominant pathway a conservative calculation was performed. Based on this calculation, the population dose from liquid effluents from SNEC facility decommissioning has been estimated to be 0.970 person-mrem, or approximately 7% of the total population dose. The dose to the maximum exposed individual, per section 5.5 of the SNEC Facility Decommissioning Environmental Report (Reference 10), is 6.82E-03 mrem to the reference organ (liver) and 4.47E-03 mrem to the whole body. These doses are well within 10CFR50, Appendix I limits, (i.e. 10 mrem/yr, organ and 3 mrem/yr, whole body) and therefore, are considered negligible.

Assumptions

1. Concrete Removal Activities - This work activity contributes approximately 44% of the population-dose (6.00 person-mrem). Structural concrete in the containment vessel will require decontamination and removal through means of scabbling and cutting. Airborne dust created by these activities is conservatively reduced by 30% through the use of local vacuum exhaust systems per guidance taken from Reference 2, Volume 11, Appendix N-1. This reduction is conservative since experience indicates that such techniques are typically more effective. Also, per Reference 2, it is assumed the containment vessel (CV) HEPA filtration system has a 99.95% efficiency for all isotopes except for tritium. This is somewhat conservative since the actual HEPA system is designed to be >99.97% efficient. Applying the applicable coefficients to the isotopic inventory from Table 4-13 of Reference 1 results in an estimated release of 1.29E+05 μCi of beta, gamma and alpha emitting isotopes to the environment.

2. Pipe Segmentation - This work activity contributes approximately 53% of the population dose (7.25 person-mrem). Per Reference 1 Appendix E, it is estimated that approximately 2,202 linear meters of piping is to be removed from the SNEC facility containment vessel. The piping is assumed to be cut in 2-meter sections resulting in approximately 1100 cuts. The

potential airborne material generated is estimated to be 4.51E+4 grams based upon the kerf widths of the total pipe cuts. This methodology is consistent with the approach employed in Reference 2, Appendix N and is applicable to the SNEC facility case as the same cutting parameters are to be employed. Credit for airborne reduction and environmental release fraction is the same as assumed for the concrete removal activities. Using the isotopic inventory estimates from Table 4-17 of Reference 1, results in an estimated release of 1.24E+01 μCi of beta, gamma and alpha emitters to the environment.

3. Structural Segmentation and CV Liner Decontamination - These two work activities constitute less than 0.1% of the population dose and are therefore considered inconsequential. Section 4.1.5 of Reference 1 lists the surface area of structural steel material, by area, in the containment vessel. Section 4.5 of Reference 1 lists average smearable beta, gamma and alpha contamination levels on steel components. Tables 4-5 and 4-6 of Reference 1 summarize the isotopic distribution of the radionuclides found in each area of the containment vessel. Because periodic decontamination has occurred during past maintenance of the CV, the contamination levels are several orders of magnitude lower than the estimates for the concrete removal and pipe segmentation work scenarios. As a result, it is estimated that approximately 5.9E-06 μCi from structural segmentation and 1.48E-07 μCi from CV liner decontamination, containing beta, gamma and alpha radionuclides are to be released to the environment during these activities. Credit for airborne reduction and environmental release fraction is the same as assumed for the concrete removal activities.

4. Offsite Dose Calculation Methodology (Airborne pathway) - Using the source terms discussed in each of the above work activities, applying the methodology in References 4 and 5 and using conservative average annual atmospheric dispersion factors for varying distances and compass sectors from Reference 4, a bounding estimate of offsite population dose from airborne estimates has been calculated to be 13.25 mrem.

   For the first one mile distance from the site boundary (200 to 1600 meters), the average dispersion coefficient for the south-southwest sector (1.34E-04 sec/m^3) was used. This is the sector with the highest dispersion factor in the direction of the borough of Saxton. This is the predominant population area within this distance. For the remaining distances from the site (1 to 10 miles), the north sector dispersion factor values were conservatively used for the entire population in each sector band.

   Initially, the 10-mile estimate of population distribution (16,699 people) was taken from the SNEC Final Safeguards Report of April 1961 (Reference 7). This estimate has been conservatively updated to 18,427 people based on 1996 U.S. Census Bureau data. This estimate includes the four counties (Bedford, Blair, Fulton, and Huntingdon) surrounding the site. A dose calculation was not performed beyond 10 miles as specific population data is not easily available and releases from the site are considered to be at ground level. As a result, releases of particulates beyond 10 miles will be insignificant since it is assumed diffusion and wet and dry deposition mechanisms will deplete the plume before it reaches 10 miles. Additionally, since the plant has been shut down for over 25 years, radioiodines and noble gases are no longer of concern. A rough calculation using average dispersion and 3.5 million people (Reference 8 assumption) between 10 and 50 miles shows additional dose would be less than 30 person-mrem. This is a very conservative estimate since most of the largest population centers around the SNEC facility are very close to the 50-mile radius. Additionally, the actual population in this area is much less than 3.5 million people.

5. Offsite Dose Calculation Methodology (Liquid pathway) - Dose to the maximum exposed individual and the surrounding population as a result of liquid effluents was calculated using methodology contained within Reference 5. It is assumed that approximately 39,000 to 40,000 gallons of water from the SNEC facility pipe tunnel and 40,000 gallons of water from the Saxton Steam Generating Station Discharge Tunnel are discharged to the Juniata River. The water contains H-3, Co-60 and Cs-137 with specific concentrations in the 10^{-7} μCi/ml range. The maximum exposed individual is an adult fisherman who consumes 730 kg/yr of water and 21 kg/yr of fish from the river/lake.

   The population dose from liquid effluents assumes that recreational usage and water and fish consumption are the predominate pathways. Direct exposure from shoreline sediment would not be expected to be significant at a large deep lake like Raystown. Based on 1996 data from the Pennsylvania Fish and Boat Commission, there were 34,357 fishing licenses issued in the four counties surrounding the SNEC Facility. For conservatism, this number was rounded up to 50,000. The spatial locations of the fisherman are assumed to be the following:

   - Five percent (2,500) of the fisherman fish in the section of the Juniata River between the SNEC Facility and Raystown Lake.
   - The remaining 95% (47,500) of the fisherman in the four-county area fish in the Raystown Lake.
   - An additional 50,000 fisherman who were issued licenses outside the four-county area fish on or in the Raystown Lake.

   For conservatism, it is assumed that all the fishermen obtain their drinking water in the same location they fish. However, this is very conservative since there are no drinking water stations at these locations.

Question 7 Part B.1: Your Environmental Report estimates that the amount of radioactive waste from decommissioning will be 12 percent of the GEIS Values. What is the estimate of person-rem dose to the public from waste shipments? *Following discussions with NRC to clarify the intent of this question, it was decided that the "the estimated offsite dose for a severe transportation accident for SNEC decommissioning" was the issue to be determined.*

Response to Part B.1: The Estimated Offsite Dose for a Severe Transportation Accident for SNEC facility decommissioning has been evaluated and determined based on the following:

Summary: The estimated lung dose to the maximum exposed individual resulting from a severe transportation accident is calculated to be 6.8 mrem. This scenario assumes a truck and its shipment of two SeaLand™ style containers of combustible waste materials is involved in an accident and is completely consumed by fire. This scenario is considered to be the most representative of radwaste shipments resulting from the SNEC facility decommissioning and the worst case fire scenario, since the entire shipment is consumed. Each SeaLand™ style container is assumed to contain approximately 1.79 curies. This is 99.8% of the Type A LSA limit for this type of container. Therefore, it is unlikely a shipment of this type would contain a greater curie content. The radionuclide mixture is representative of the loose surface distribution found in Area 6 of the SNEC CV (Reference 1). This is representative of the radionuclide mix to be shipped. This accident scenario is bounded by the 16 mrem lung dose for the reference test reactor found in Table 7.4-2 of Reference 8 for the severe transportation accident.

Shipment of major components including the reactor vessel, steam generator and pressurizer are assumed to be shipped as solid forms and their radioactivity would not be easily made airborne during an accident condition.

Assumptions

1. Both SeaLand™ containers are involved in the fire making a total of 3.58 curies available for release.

2. Per Table N.5-5, Reference 2, it is assumed that the fire releases the fraction of 5E-04 of the activity in both containers. This release fraction is applicable to the SNEC facility case since the parameters and circumstances of the accident are the same as those in the GEIS case.

3. Per Section N.5.1, Reference 2, it is assumed that the maximum exposed individual is located 100 meters downwind of the fire with a resulting X/Q of 3E-2 sec/m^3. The X/Q factor chosen is conservative for the SNEC facility case. As an example, the X/Q for the worst case onsite accident is 4.14E-03 sec/m^3.

4. Inhalation lung dose factors and breathing rates were obtained from Reference 4. For conservatism, adult dose factors were used. For isotopes that did not have inhalation dose factors specified in Reference 4, dose factors were generated using inhalation dose factors from Reference 5.

Question 7 Part B.2: Discuss this dose (*estimate of person-rem dose to the public*) as compared to the estimates in the GEIS.

Response to Part B.2: The Estimated Total Population Dose from Radwaste Shipments during SNEC facility decommissioning has been evaluated and determined based on the following:

Summary: The population dose from radwaste shipments during SNEC facility decommissioning is estimated to be 0.858 person-rem. This estimate falls well within the bounds of the 2.2 person-rem value specified in Section 7.3.1, of NUREG-0586 (Reference 8) for the reference test reactor.

Assumptions

1. It is assumed that a total of l00 radwaste shipments will be made from the SNEC facility. This includes shipments completed to date (those made after the completion of soil shipments in 1994) and all future shipments in support of decommissioning.

2. Per Section N.5.1 of NUREG/CR-1756 (Reference 2), it is assumed that each shipment of waste contains enough material to result in the maximum exposure rates allowed by USDOT regulations. Also, per this section, the cumulative dose to the public is 2.3E-06 person-rem/km/shipment. This value is applicable to the SNEC facility case in that the

critical parameters for the radwaste shipments are similar to those in the GEIS case. This is very conservative since it is unlikely that any shipment from the SNEC facility site will emit radiation at the maximum allowable exposure rates.

3. Per Table N.5-2, Reference 2, for DECON of the reference test reactor, the onlooker dose is 6.25E-06 person-rem/km/shipment (i.e. 5E-03 person-rem/800 km/shipment = 6.25E-06 person-rem/km/ shipment). This figure is applicable to the SNEC facility case in that the critical parameters for the radwaste shipments are similar to those in the GEIS case.

4. It is assumed each shipment travels 1003 km one way between the SNEC facility and Barnwell. This is very conservative since a portion of these shipments (approximately 80% of the concrete) will be shipped to the Envirocare facility in Clive, Utah, which, although being a greater distance away, has a lower dose rate per shipment. The dose rates from these shipments (i.e. to Envirocare) are expected to be at or near background levels and would pose little or no dose to the surrounding population along the shipping route.

5. Dose Calculation:

   The dose to onlookers during shipments is:

   (6.25E-06 person-rem/km/shipment)(1003 km)(100 shipments) = 0.627 person-rem

   The dose to the general public during the shipments is:

   (2.3E-06 person-rem/km/shipment)(1003 km)(100 shipments) = 0.231 person-rem

   The total public dose 0.858 person-rem

Question 7 Part C: Please estimate the amount of land area that would be used at the waste burial sites to dispose of radioactive waste. Discuss the comparison with the land use in the GEIS.

Response to Part C: The Estimated Land Area Occupied by Disposal of Radwaste Resulting from the Decommissioning of the SNEC Facility was evaluated and determined based on the following:

Summary: The estimated land area which will be occupied by the radwaste disposed of as a result of the SNEC Facility decommissioning is approximately 0.3 acres. This is bounded by the value given in the GEIS for the reference test reactor of.... "about one-half acre"....stated in section 7.4 of NUREG-0586 (Reference 8). The volume of radwaste to be disposed of by decommissioning the reference test reactor was assumed to be 4930 m^3, per NUREG/CR-1756 (Reference 2). The waste volume from the decommissioning of the SNEC Facility is estimated to be approximately 732 m^3.

Unlike the other consequences of decommissioning which were analyzed in References 2 and 8, the methodology used to calculate the land area occupied by the disposal of radwaste is not described. Most of the radwaste from the SNEC facility decommissioning is planned to be disposed of at the Chem Nuclear Systems Inc. (CNSI) facility near Barnwell, SC, except for contaminated/activated concrete. The majority of the concrete will be disposed of at the Envirocare facility near Clive, UT. Pending a license amendment at the Envirocare facility, additional quantities of dry active waste (DAW) may be disposed of at this facility. However, all of the radwaste to be disposed of has been accounted for and the land area would not change appreciably.

Since References 2 and 8 were published, CNSI has changed from a volume based disposal structure to one based on weight. CNSI is unable to provide a conversion from disposal volume to the resulting occupied land area. Since the Envirocare operator cannot project how waste may be layered in advance, they also would not provide a conversion from disposal volume to the resulting occupied land area. As a result, GPU Nuclear has conservatively calculated the land area by estimating the footprint which would be occupied by a single layer of the radwaste as disposed. At both the Barnwell and Envirocare facilities, waste is in fact layered to the extent possible. The area occupied by the radwaste is broken down as follows:

Category	Area (ft^2)	Area (acre)
Large components (RV, S/G, Pzr.)	811	0.0
Asbestos (Post compaction)	138	0.0
Concrete to Envirocare	8687	0.1
Concrete to Barnwell	2581	0.0
Miscellaneous Radwaste	1316	0.0
3 - 110 ft^3 High Integrity Containers(HIC)	108	0.0
Total Land Area	**13641 ft^2**	**0.3**

Assumptions - Each category was calculated as follows:

1. Large components, including the reactor vessel, steam generator and pressurizer were assumed to be buried in a single layer including their shipping skid. This follows the industry experience to date and conforms to the SNEC facility large component disposal plan. The footprint was calculated based on the size of the attached shipping skids which for each component exceeds the area occupied by the component alone. The reactor vessel skid = 360 ft^2; the steam generator skid = 247 ft^2; the pressurizer skid = 204 ft^2; total = 811 ft^2.

2. The asbestos waste volume (which has already been disposed of) is an actual value as reported by CNSI. This volume was converted into a land area value by calculating the area occupied by the six B-25 LSA boxes used to dispose of the waste. The footprint of one B-25 box = 23 ft^2, 6 x 23 ft^2 = 138 ft^2.

3. The concrete volume to be disposed of at Envirocare was calculated using the conservative estimate 307 m^3 of total concrete waste from Table 4 - 19 of the SNEC Site Characterization Report (Reference 1). As stipulated in section 3.3.3.8 of the SNEC Decommissioning Plan (Reference 6), it is estimated that 80% of the concrete waste will meet the disposal criteria at Envirocare. Therefore, approximately 246 m^3 of concrete will be disposed of at Envirocare. This equates to 8687 ft^3 of concrete. The Envirocare license requires that waste be disposed of in layers one foot thick. Without taking credit for the stacking of the layers which would probably occur, this means the concrete waste will occupy a land area of 8687 ft^2. Note that waste is disposed of "unpackaged" at Envirocare so no packaging inefficiencies are assumed for this case.

4. The concrete volume to be disposed of at Barnwell was calculated using the conservative estimate of total concrete waste from Table 4 - 19 of Reference 1. As stipulated in section 3.3.3.8 of Reference 6, it is estimated that 80% of the concrete waste will meet the disposal criteria at Envirocare. Therefore, the remaining volume of approximately 61 m^3 (2154 ft^3) of concrete is assumed to be disposed of at Barnwell. Based on experience, it is reasonable to assume this waste will be packaged in B-25 LSA boxes. When loading rubblized concrete in B-25 boxes, the net weight limit of 3125 pounds per box is reached before the box is full from a volume standpoint. Using the density of concrete of 148 lbs/ft^3, this would result in the disposal of approximately 102 such boxes ([2154 ft^3 concrete x 148 lbs/ft^3]/ 3125 lbs per box = 102 boxes). Each box has a footprint of 23 ft^2, therefore the land area occupied as a result of this is 102 x 23 = 2346 ft^2. An additional growth factor of l0% was added to account for the recent requirement for the use of a technology overpack at Barnwell. Thus, the estimated area is 2346 ft^2 x 1.10 = 2581 ft^2.

5. For the miscellaneous radwaste (DAW, structural steel, pipe, heat exchangers, pumps, tanks, etc.), the volume for these materials was taken from Table 4 - 19 of Reference 1 and assumed to be packaged for disposal with no credit for any form of volume reduction (VR). This results in a base volume of approximately 3370 ft^3. Since VR is planned where practical, this results in a conservative assumption for the base volume. A conservative packaging growth of 30% was used. Therefore, the as-packaged volume is approximately 4381 ft^3, (3370 ft^3 x 1.30 = 4381 ft^3). Based on experience, it is reasonable to assume this waste will be packaged in B-25 LSA boxes. With an internal volume of 85 ft^3 per box, this would result in the disposal of 52 such boxes (4381 ft^3 miscellaneous waste/ 85 ft^3 per box = 52 boxes). Each box has a footprint of 23 ft^2; therefore, the land area occupied as a result of this is 52 x 23 ft^2 = 1196 ft^2. An additional growth factor of 10% was added to account for the recent requirement for the use of a technology overpack at Barnwell. Thus, the estimated area is 1196 ft^2 x 1.10 = 1316 ft^2.

6. It is possible that some radwaste may be packaged in a High Integrity Container (HIC) such as the boric acid demineralizer and components with a high TRU content. It was assumed that three 110 ft^3 HICs would be required. The HIC chosen was the SEG RADLOCK - 500 model, which has an outside diameter of 64.5 inches. It was assumed that each HIC would be placed in a square technology overpack at Barnwell for disposal. With an outside dimension of 72" x 72" (footprint of 36 ft^2) for the technology overpack, this results in an estimate of 108 ft^2 of land area (3 HICs x 36 ft^2 per HIC = 108 ft^2).

This estimate of land area occupied by the radwaste disposed from the decommissioning of the SNEC Facility is conservative for the following reasons:

1. The area occupied by the disposal of the reactor vessel, steam generator, and pressurizer is assumed to be that of the transport skids for each component, which are larger than the components themselves.

2. It is assumed that all waste is disposed of in a single layer at each disposal site. In reality, waste at each site is multi-layered and co-mingled with other generators.

3. No credit is taken for volume reduction (VR) of any of the miscellaneous waste. It is expected we will use industry accepted VR techniques where practical.

4. A total packaging growth of 30% was assumed all miscellaneous waste. References 2 and 8 do not discuss radwaste packaging efficiencies; however, Appendix I section I.1.3.1 of Reference 2 describes the use of custom fabricated disposable containers to minimize volume. No such containers are assumed for the SNEC facility case. Rather, the use of standard B-25 LSA boxes is assumed.

5. The SNEC facility case assumes a very conservative total disposal volume of approximately 732 m^3 resulting in an occupied land area of approximately 0.3 acres. The GEIS test reactor case assumed a disposal volume of 4930 m^3 (References 2 and 8) which resulted in a land area of "about one half acre".

<u>Question 7 Part D</u>: Discuss the dose to the maximum exposed individual from accidental radionuclide release during decommissioning and compare that dose with the GEIS. *Following discussions with NRC to clarify the intent of this question, it was decided that the "estimated dose to maximum exposed individual as a result of an onsite accident during decommissioning" was the issue to be determined.*

<u>Response to Part D</u>: The Estimated Dose to Maximum Exposed Individual as a Result of an Onsite Accident during Decommissioning was evaluated and determined based on the following:

<u>Summary</u>: The estimated lung dose for the worst on-site decommissioning accident is estimated to be 0.283 mrem. The dose is bounded by the GEIS, NUREG-0586 (Reference 8) dose of 16 mrem to the lung per Table 7.4-2. At the SNEC facility, the best representation of a postulated accident that produces the highest lung dose is the dropped demineralizer vessel accident. In this accident scenario, a steel vessel containing resin is dropped during removal from the containment vessel per the Accident Analysis in the SNEC Decommissioning Plan (Reference 6 section 3.4.1.1).

Although this accident is the same as originally submitted to the NRC in References 6 and 10, the associated dose was previously expressed in terms of a whole body dose (1.5 mrem). This dose was calculated using ICRP-30 methodology and remains valid. ICRP-30 methodology produces higher whole body doses (the result of bone dose contribution to effective dose equivalent) due to the relatively high quantities of transuranics (TRUs) in the SNEC facility mixes. In order to bound this dose to those given in Table 7.4-2 of the GEIS for the severe accident scenario (16 mrem to the lung), it was necessary to convert the 1.5 mrem from whole body dose to a lung dose. Therefore, ICRP-2 methodology was used to correlate with the methods used in the GEIS and this conversion resulted in a lung dose estimate of 0.283 mrem. Based on the conversion results and GEIS comparison, the resin vessel drop accident poses no serious risk to the general public and has no significant environmental impact.

<u>Assumptions</u>

1. The residual activity in the resin vessel has been previously estimated to be 17 curies per the SNEC Facility Decommissioning Plan (Reference 6, Section 3.4.1.1). The nuclide mixture is primarily composed of Co-60 (5.4%), Ni-63 (29.9%), Sr-90 (1.8%), Cs-137 (9.5%), Pu-238 (1.1%), Pu-239 (3.1%), Pu-241 (43.8%), and Am-241 (3.5%).

2. When the vessel is dropped, it is assumed to split open, releasing 1.7E-06 of the activity in the vessel. This release fraction is considered conservative based on the following:

   NUREG/CR-0130 (Reference 3), page J-44, describes a release fraction of 1.7E-06 for fire or explosion in ion exchange resin. Dropping the resin vessel would not produce as great a motive force as in a fire or explosion. In addition, prior to movement, the resin vessel will be filled with grout. As a result, the contents will be more immobilized than would be the case in a normal vessel of resin.

3. No credit is taken for HEPA ventilation since the accident occurs outdoors. Per Reg. Guide 1.145 (Reference 9), an atmospheric dispersion factor (X/Q) of 4.14E-03 sec/m^3 is used to calculate the airborne concentration at the site boundary (200 meters). This X/Q factor is based on a conservative wind speed of 1 m/s and a G stability category.

4. Appendix F of Reference 2 defines the maximally exposed individual as one who resides at the location of the highest airborne radionuclide concentration. For the SNEC facility, the nearest resident is located at or beyond the site boundary (200 meters).

5. Inhalation lung dose factors and breathing rates utilized in this analysis were obtained from the SNEC ODCM (Reference 4). For conservatism, adult dose factors were used. For isotopes that did not have inhalation dose factors specified in Reference 4, dose factors were generated using inhalation dose factors from Reg. Guide 1.109 (Reference 5).

Question 7 Part E: Discuss and compare to the GEIS the total occupational dose from decommissioning activities.

Response to Part E: The occupational exposure as a result of decommissioning the SNEC facility was evaluated and determined based on the following:

As shown in Table 4.2-1 of the Saxton Nuclear Experimental Corporation facility Decommissioning Environmental Report (Reference 10), submitted April 1996, the estimated occupational dose as a result of prompt decommissioning (DECON) of the SNEC Facility is 37 person-rem. This is bounded by the GEIS, (NUREG-0586 as Reference 8), table 7.3-4, figure for prompt decommissioning (DECON) of the reference test reactor of 344 person-rem.

TLG Services, Inc. as part of the site specific cost study, performed the estimate of occupational exposure for the decommissioning of the SNEC Facility. This estimate is not necessarily conservative in that it used actual radiological data as reported in the SNEC Site Characterization Report (Reference 1) and projected person hours in each radiation area. GPU Nuclear is using this estimate as a goal and actual exposures by category, as broken down in table 4.2-1 of Reference 10, may be slightly different.

In that this estimate is not conservative but rather a projection of expected actual exposure, it should be noted that even if this figure were exceeded by 100% (63.6 person-rem) it would still be bounded by the GEIS.

References

1. Saxton Nuclear Experimental Corporation (SNEC) Site Characterization Report.

2. NUREG/CR-1756, "Technology, Safety, and Costs of Decommissioning Reference Nuclear Research and Test Reactors."

3. NUREG/CR-0130, "Technology, Safety, and Costs of Decommissioning a Pressurized Water Reactor Power Station", Volumes I and 2.

4. GPUN Procedure 6575-PLN-4542.08, "SNEC Facility Offsite Dose Calculation Manual."

5. NRC Regulatory Guide 1.109, Rev 1 and Rev 0, "Calculation of Annual Doses to Man from Routine Releases of Reactor Effluents for the Purpose of Evaluating Compliance with 10CFR Part 50, Appendix I."

6. Saxton Nuclear Experimental Corporation (SNEC) Decommissioning Plan.

7. SNEC Final Safeguards Report dated April 1961.

8. NUREG-0586, "Final Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities."

9. Regulatory Guide 1.145, "Atmospheric Dispersion Models for Potential Accident Consequence Assessments at Nuclear Power Plants", US NRC, 1983.

10. SNEC Facility Decommissioning Environmental Report, April, 1996.

Saxton Nuclear Experimental Corporation Facility

Decommissioning Environmental Report Appendix 1, Supplement 3

March 31, 1998
1920-98-20181

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555

Gentlemen:

Subject: Saxton Nuclear Experimental Corporation Facility
Operating License No. DPR-4
Docket No. 50-146
Consideration of a Dose to the Public from Tritiated Water Movement

The purpose of this letter is to docket the results of calculations performed to evaluate the dose to the public to be expected from a hypothetical spill of tritiated water being stored in the SNEC facility Containment Vessel (CV).

The water resulted from condensation inside the CV which became contaminated and collected in the sump. The sump is periodically pumped and the resultant water is being stored in containers in the CV until plans for its removal and processing are completed. Current plans include activities to pump the water from the CV to a "liner" for shipment by truck to a processor.

The hypothetical event analyzed assumes that during transfer operations, the liner containing 1000 gallons of tritiated water spills the entire volume outside the CV. The water's tritium concentration is assumed to be 1E-3uCi/ml: a value which exceeds the highest concentration of tritiated water available on site. Two scenarios were considered. The first proposes a direct spill of the 1000 gallons into the Juniata River while the second proposes a spill of the same volume to the ground. The resultant dose from each scenario was calculated as described below.

River Scenario
The Near Field Dilution Factor was obtained using NUREG-0133 methodology. A conservative instantaneous low river flow value was obtained from 1912-1994 Juniata River data and dose calculations were performed per REG GUIDE 1.109.

The resultant 50 year committed dose would be 8.55E-6 mrem.

Groundwater Scenario
RESRAD, Version 5.61 was used to calculate pathway doses from a spill directly to the ground. The water was assumed to cover 100 square meters and the main contributors to dose were consumption of water and vegetation by the residents.
The resultant 1000 year committed dose would be 6.83E-01 mrem.

Formal, reviewed calculations, supporting both scenarios, are being entered into the Radiological Engineering Data Base and will be available for USNRC review if requested.

These scenarios were analyzed and found to have no significant adverse public health and safety or environmental impact.

Sincerely,

G. A. Kuehn
Vice President, SNEC

WGH

cc: NRC Project Manager, NRR – Alexander Adams
NRC project Scientist, NRR – Thomas F. Dragoun