'WHAT YOU DON'T KNOW *CAN* HURT YOU!'

A review of "Lessons Learned" from the Saxton Nuclear Experimental Facility HISTORICAL SITE ASSESSMENT

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PURPOSE

The intent of this paper is to share the "Lessons Learned" as a result of conducting the "Historical Site Assessment" for the Saxton Nuclear Experimental Corporation [SNEC] facility in accordance with the requirements of NUREG-1575 "Multi-Agency Radiation Survey and Site Investigation Manual [MARSSIM].

It is hoped that by communicating these "Lessons Learned", others will gain a more complete understanding of the significance of the Historical Site Assessment as it relates to project work scope and budgets.

The main deliverable from the MARSSIM Historical Site Assessment is a site model that depicts the *impacted* and the *non-impacted* areas of the site for use in License Termination Planning. In the case of the Saxton Facility, the 1.148 acre facility site which contained the entire facility, grew to a nearly 30 acre impacted area at the completion of the Historical Site Assessment. It is hoped that a review of the "Lessons Learned" during conduct of the SNEC facility HSA, will convince others that waiting until the License Termination Phase of decommissioning to begin the HSA, is too late in the process and that an earlier start on this important product has the potential to save both time and money.

SITE DESCRIPTION

The purpose of this section is to familiarize the reader with the size and physical location of the Saxton Nuclear Experimental Corporation Facility.

The Saxton Nuclear Experimental Corporation [SNEC] facility is a deactivated 23.5-megawatt thermal, pressurized water reactor [PWR] that is owned by GPU and operated by GPU Nuclear. The facility is situated on a 1.148-acre plot within the site of the former Saxton Steam Generating Station [SSGS] that was owned and operated by the Pennsylvania Electric Company [PENELEC], a subsidiary of GPU. The SSGS was demolished in 1975 but a PENELEC electrical substation is still in service on the site.

The SNEC facility site is located about 100 miles east of Pittsburgh and 90 miles west of Harrisburg in the Allegheny Mountains, three-fourths of a mile north of the Borough of Saxton in Liberty Township, Bedford County, and Pennsylvania.

The SNEC facility was built on the east side of and adjacent to the Saxton Steam Generating Station of the Pennsylvania Electric Company. This station was located on the east bank of the Raystown Branch of the Juniata River. The entire property comprises approximately 150 acres.

SITE USAGE HISTORY

The SSGS was a coal-fired station that was constructed between 1922 and 1923, operated between 1923 and 1975 and was taken out of service and demolished between 1974 and 1975.

The SNEC Facility was constructed between 1960 and 1962 and was operated from 1962 until May of 1972. As an experimental facility, SNEC conducted tests and experiments associated with chemical shim, failed fuel operations, and mixed-oxide fuel utilization etc. The SNEC facility was also used to train reactor operators. Candidates from all of the United States and many other nations received their initial reactor operator training at the SNEC facility.

Steam from the SNEC facility was supplied to a turbine-generator located in the SSGS and was used to produce commercial electricity. Many of the SNEC Facility components were physically located within the SSGS plant area. Since SNEC was a non-profit corporation, all revenue derived from the sale of this electricity was used to reduce electrical rates to the PENELEC ratepayers.

HISTORY OF SNEC DECOMMISSIONING ACTIVITIES

The intent of this section is to depict the various stages of decommissioning activities that have been undertaken at the SNEC facility over the past 27 years. It is hoped that the reader will gain a useful perspective on the evolution of the decommissioning process at the SNEC Facility and will therefore be better able to envision and/or construct parallels between SNEC and their own facilities.

For purposes of conducting the MARSSIM Historical Site Assessment, each of these phases presented unique research challenges. Each of these phases was essentially accomplished by a different organization within the company which increased the difficulty of reconstructing a fluid history of the facility.

The "Lessons Learned" section of this paper addresses many insights that were gathered from our collective review of these historical decommissioning activities.

DECOMMISSIONING ACTIVITIES DURING 1972 – 1973

On May 1, 1972 the SNEC reactor was shutdown for the final time. In the months following shutdown, all spent nuclear fuel was removed from the plant and shipped to the USDOE facilities at their Savannah River Site in South Carolina. During this period, all special nuclear material was also removed from the site and properly dispositioned.

Figure-1 depicts the SNEC Facility Site – Post Shutdown Configuration.

During the following period, the SNEC facility processed the remaining inventory of contaminated water [~ 30,000 gallons], removed and shipped the majority of components from the reactor support buildings, excavated and dispositioned all underground SNEC facility tanks and associated piping, removed piping systems from the yard pipe tunnel, removed the ventilation stack, drained systems within the Containment Vessel and disposed of all remaining contaminated resins and other waste materials.

The buildings and structures that supported reactor operations were partially decontaminated and the SNEC Facility was placed in a form of monitored storage that is somewhat analogous to the present condition that is referred to as "SAFESTOR".

Items and activities of interest to Final Status Survey planning personnel are:

- Removed underground storage tanks were stored in the yard areas following removal and during preparation for shipment.

- All unused piping associated with the underground liquid storage tanks was removed.

- Ashes were hauled in and used to back-fill the hole where the three liquid storage tanks were formerly buried [RWDF Liquid Storage Tanks 1 and 2 and the Decontamination Tank].

- A plastic pipeline was installed between the discharge tank pump and a valved, capped fitting on the river water return line where it enters the Saxton Steam Generating Station [3/1/73].

- The river water header at the Saxton Steam Generating station was cut and plastic pipe was run from the Saxton Steam Generating Station entrance to the SNEC C&A building tunnel [3/6/73].

- The contaminated sections of the outer tanks around the storage tanks were cut out and put in the storage tanks.

- Drained the river water system, storage well system, recirculation system, heating system, FFED, d/p cells, demineralized water system, shutdown cooling system and component cooling system. Set up demineralizer and demineralized the CV sump [5/29/73].

- The reactor support buildings of the SNEC facility were extensively surveyed in July and August of 1973. The surveys included thousands of smear samples and direct radiation readings in the RWDF, the C&A building, the yard pipe tunnel, and the RSWT and pump house. These surveys provided the post-shutdown radiological conditions in the buildings. Smearable contamination levels were all less than 1000 dpm/100cm2 beta-gamma and less than 100-dpm/100cm2 alpha. Direct radiation measurements (contact and general area) ranged from about 0.05 mR/hr to about 0.3 mR/hr on contact with the surface. The unrestricted release criterion at that time was a 0.4 mR/hr fixed activity limit. These surveys showed that most areas met the 0.4 mR/hr criterion.

- The radiological condition of the SNEC facility following shutdown is documented in a report titled "Decommissioned Status of the Saxton Reactor Facility" which was submitted to the USNRC on February 20, 1975

<u>DECONTAMINATION ACTIVITIES – 1987/1988</u>

In the late 1980s a decision was made to commence the completion of the SNEC facility decommissioning process. This decision was driven, in part, because the remaining support buildings and structures were becoming significantly deteriorated and posed an industrial safety hazard to workers.

Figure-2 depicts the SNEC Facility in its Pre-Demolition Configuration.

A technical specification change request was submitted to the NRC t remove the reactor support buildings from the SNEC Facility Technical Specifications, as a prerequisite for demolition.

Characterization surveys were performed in 1987 to locate areas in the reactor support buildings that needed additional decontamination to meet current USNRC release guidelines. Measurements were made for both fixed and removable radioactivity.

Results of these surveys showed that additional decontamination was needed in all areas/cubicles of the RWDF, the yard pipe tunnel, the RWST and in most of the first floor cubicles of the C&A building.

Based on the radiological characterization results, the appropriate release criteria were selected from USNRC Regulatory Guide 1.86 "Termination of Operating Licenses for Nuclear Reactors".

An extensive decontamination effort and a comprehensive final release survey were performed to document the radiological condition of the reactor support buildings and to demonstrate compliance with USNRC guidelines for unrestricted release and use.

The overall strategy to complete the decommissioning of the facility and to release the site for unrestricted use consisted of a multi-year, multi-phased effort containing the following elements:

- Removal of groundwater from the basement of the Radioactive Waste Disposal Facility [RWDF] and yard pipe tunnel.

- Decontamination, survey, and dismantlement of the reactor support structures and outbuildings.

- Decontamination, survey, and dismantlement of the Containment Vessel [CV] and restoration of the site.

The first phase, groundwater removal, was completed in 1987. The water from the RWDF basement and the yard pipe tunnel was first pumped into one of two 7500-gallon holding tanks. Water samples were collected and analyzed for radiological and water quality characteristics prior to discharge. A total of approximately 210,000 gallons of water were released to the Raystown Branch of the Juniata River. All such water releases were in accordance with Federal and state regulations and requirements.

Decontamination was performed in 1987, 1988, and 1989 on the Control and Administration [C&A] building, the RWDF building, and the yard pipe tunnel to ensure residual contamination was as low as reasonably achievable.

The decontamination effort involved removal of any remaining components such as ventilation duct-work, suspended ceiling tiles, control room consoles, doors, floor drains, etc. All materials were surveyed in accordance with approved procedures for survey and release of equipment, and disposed of as either clean scrap or radioactive waste.

After the buildings were gutted, more detailed radiological surveys were performed on the floors, walls, and ceilings to locate areas needing further decontamination.

The C&A building required the least amount of decontamination and as expected, the RWDF required the most extensive decontamination effort. The yard pipe tunnel also required extensive decontamination.

The Refueling Water Storage Tank [RWST] and its associated Safety Injection Pump House were dismantled and the contaminated sections were shipped off site as "Low Specific Activity" [LSA] radioactive waste to a contractor for decontamination and final disposal. The concrete pad that supported the tank was left on site at that time.

The Filled Drum Storage Bunker [FDSB] was an earthen unit with wooden cribbing. It was used to store drums of radioactive waste generated by RWDF operations. The top 6 to 12 inches of surficial materials were removed and shipped off site as LSA radioactive waste for disposal at a licensed disposal facility.

Rubble generated from decontamination activities consisted mainly of metal and concrete. A small portion of the radioactive waste was sent directly from the site for burial as LSA radioactive waste. This consisted mainly of scrap metal that was found to be contaminated. The majority of rubble was high density concrete generated during surface/structure decontamination. This rubble was packaged as LSA radioactive waste and shipped to a contractor for waste volume reduction and burial.

Approximately 16,820 cubic feet of concrete rubble was processed by the contractor, which resulted in the burial of approximately 5100 cubic feet. The total volume of radioactive waste generated by the decontamination activities in 1987 and 1989, was approximately 8500 cubic feet.

A comprehensive final release survey of these structures/buildings was conducted from October 1988 to June 1989 to verify that residual contamination was within USNRC guidelines for unrestricted use. The final exposure rate measurements of the buildings were within the variability of the off site background exposure rate measurements. In-situ gamma spectroscopy confirmed that radioactivity in the buildings is mostly naturally occurring radionuclides.

Several areas were identified that were inaccessible during the final release survey. They were designated as "Demolition Hold-Points" that were to be surveyed during the dismantlement and demolition phase.

The Penelec line shack located to the north-northeast of the FDSB contained surficial materials in the overhead structural beams, which appeared to have entered the building through a vent. The surficial materials were found to contain a maximum of 15 pCi/gm of Cs-137. All accessible beams were vacuumed, wiped down and surveyed. All survey measurements were below the USNRC guidelines.

Two Penelec buildings, a garage and a storage building, were also surveyed. The storage building was found to contain a few small radiation hot spots which were sampled and subsequently determined to be the result of natural radioactivity contained in structural materials.

The SNEC facility chlorinator pump house building was surveyed. All survey results were less that USNRC release guidelines except for one pipe that was designated as a Demolition Hold-Point.

<u>WORK ACTIVITIES PRIOR TO REACTOR SUPPORT BUILDING DEMOLITION</u>

As described above, decontamination and survey of the reactor support buildings was completed in 1989. This was documented in a report titled "Saxton Nuclear Experimental Facility Final Release Survey of the Reactor Support Buildings". Revision-0 of the report was issued on April 16, 1990, revision-1 was issued on September 6, 1990, revision-2 was issued on January 31, 1991, and revision-3 was issued on March 6, 1992.

An independent verification survey was performed in October of 1990, by Oak Ridge Associated Universities [ORAU], under contract with the NRC. The ORAU report was issued in June of 1991 and was received by SNEC in November 1991.

Upon NRC acceptance of the final release survey, the SNEC license was amended to remove the reactor support buildings and other structures from the technical specifications, thus paving the way for demolition of those buildings and structures.

REACTOR SUPPORT BUILDING DEMOLITION ACTIVITIES – 1992

In preparation for this activity the SNEC facility issued the "SNEC Demolition Plan" [6675-PLN-4542.04] and completed all required permitting, training, and safety prerequisites.

Throughout the demolition process, an on-going environmental monitoring program was conducted which concluded that the dismantlement of the SNEC outbuildings had no adverse effect on the environment or the public health and safety.

Following preparatory work, demolition of the SNEC outbuilding structures began on June 23, 1992 when a wrecking ball was first used on the Yard Pipe Tunnel roof.

Since the structures had been free released (except for Hold Points) under the guidance provided by USNRC Regulatory Guide 1.86, the demolition process was considered conventional in nature.

The Filled Drum Storage Bunker [FDSB], the Yard Pipe Tunnel, the C&A building, and the RWDF were systematically dismantled and demolished in accordance with the SNEC Demolition Plan and adherence to the Hold Points.

The Refueling Water Storage Tank [RWST] foundation pad was completely demolished and removed.

The Chlorinator/Sewage Treatment building was demolished down to grade elevation. The three underground septic style tanks remained in place for later disposition.

The Yard Pipe Tunnel was demolished to its floor elevation. The C&A building was demolished to grade elevation, and the RWDF was demolished to three feet below grade.

Soil samples were obtained and analyzed from areas beneath concrete floors, as they became accessible during demolition operations.

During the demolition process, concrete debris was crushed and utilized as fill material in the below grade portions of structures. The RWDF utilized clean soil from off site for the final three feet of back fill.

All backfilled areas were compacted in approximately 12" lifts as they were filled. Following final grading, the site was then hydro-seeded and mulched and erosion controls were installed to minimize run-off.

The excavated site soil was arranged into two piles to await future disposition. With the exception of the two soil piles, the site was recontoured and hydro-seeded (seeding included the soil piles). The south soil pile was comprised solely of FDSB soil and soil excavated from the south side of the Yard Pipe Tunnel. The north soil pile was comprised of all other soil excavated prior to demolition and soil removed from the Westinghouse area.

Demolition debris in the form of scrap metal, roof trusses, I-beams, etc., was salvaged by the demolition contractor and recycled. Non-recyclable roofing debris and excess concrete debris was transported to the Modern Landfill near York, Pa., for disposal.

Hold Point materials were dispositioned by removal, survey and free release or decontamination survey and free release or disposal as radioactive waste.

This phase of demolition activities was concluded on September 4, 1992.

Following demolition completion, an announced safety inspection was conducted by the USNRC. No safety concerns or violations of regulatory requirements were identified. Results of NRC surveys indicated that the materials in Hold Status could be released for unrestricted use or disposal.

Figure-3 depicts the SNEC Facility in its Post Demolition Configuration.

Items and activities of interest to Final Status Survey planning personnel are:

- The NRC stated in the Post-Demolition Inspection Report, "Analyses performed by the licensee on soil from the bottom of the excavations indicated the presence of radionuclides below the NRC guideline values (i.e., values that would allow that soil to be released for unrestricted use). However, no such release was requested or is being granted at this time."

- A ½-inch steel plate was installed against the concrete block wall (installed in 1974) that separates the CV Pipe Tunnel from the Yard Pipe Tunnel, to provide protection during demolition and back-fill work.

- Drainage holes were not made in the Yard Pipe Tunnel floor because the walls were demolished down to the floor elevation.

- Approximately 400 tons of clean fill limestone from off site was used to form a boundary between the free released Yard Pipe Tunnel and the adjacent soil during back-fill operations.

- The C&A building north foundation wall, approximately 12 inches south of and parallel to the CV Tunnel, was left intact to prevent inadvertent damage to the CV Tunnel structure which was not included in this phase of demolition.

- Clean fill brought in from off site was analyzed to determine a base-line radioactivity level. This fill was in the form of No.4 or 2B crushed limestone from New Enterprise

Stone & Lime Plants at either Roaring Spring or McConnelstown, Pa., or soil from a private landholder near the site.

- Clean fill soil [see above], excavated from a nearby source was used to bring the site to grade and serve as topsoil after demolition of the affected structures was completed. Up to three feet of soil was placed over the former structures, the site was recontoured to predominant grade, compacted, and hydro-seeded to complete the project.

- The complete 1992 inventory of railroad ties used in construction of the FDSB (387 total plus six 55-gallon drums of tie fragments) was removed. Of this inventory, 14 railroad ties had small sections, which were removed and disposed of, as radioactive waste. It should be noted that an access opening at the northwest corner of the FDSB was a pre-existing condition at the time of this demolition. Some railroad ties had been removed (probably in the mid to late 1980s) to facilitate this access. Disposition of these materials has not been determined.

- SNEC management had committed that no SNEC waste would be disposed of at the Bedford County Landfill. SNEC management entered into an agreement with Waste Management Inc., to dispose of all clean demolition debris at the Modern Landfill facility near York, Pa.

<u>1993/1994 SAXTON SOIL REMEDIATION PROJECT</u>

In November 1993 comprehensive soil monitoring and sampling work was performed at the SNEC facility to determine and assess the extent of radioactive contamination levels present on the site.

NUREG/CR-5849 [Manual for Conducting Radiological Surveys in Support of License Termination – February 1993 – DRAFT] was used as a basis document for the development of methods and guidelines in establishing survey and assessment protocols.

A formal plan was written [SNEC Soil Characterization Plan, 6575-PLN-4542.05] which provided specific direction and detail for the assessment of the site soil radioactivity.

Following the soil characterization work it was decided to proceed with excavation, packaging and shipment of site soil.

A soil disposal plan [SNEC Soil Disposal Plan, 6575-PLN-4542.07] was issued in July 1994, to provide specific instructions for scope of excavation work, pre-operational and post-operational radiological survey and sampling procedures, soil shipping and handling procedures, emergency and contingency plans and final soil remediation criteria.

A site survey was developed. The affected area of the SNEC site consisted of approximately 2 acres, which comprised the area surrounding the containment vessel, the yard area and the Westinghouse area. These areas were land surveyed into 10 square meter grids. Two soil piles (one contaminated and one clean) were each divided and indexed into ten equal vertical slices.

An equivalent total of 132 grids (not counting soil piles) were surveyed either as part of the initial soil characterization or as follow-up surveys immediately prior to remediation work. An equivalent of 32 grids was remediated which represented 22% of the area surveyed.

Contaminated soil was disposed of at both licensed disposal sites in South Carolina (105 cubic feet) and Utah (56,161 cubic feet). A total of 11 millicuries of radioactivity was contained in the soil that was shipped.

In an interview, the SNEC Site Supervisor stated that the 'South Soil Pile' was surveyed and released for use as fill material to restore excavated remediation areas to the normal site contour.

Figure-4 depicts the SNEC Facility in its Post Soil Removal Configuration.

Items and activities of interest to Final Status Survey planning personnel are:

- In some cases radioactive contamination extended to a soil depth of 3 feet. Removal of this contamination would have required major demolition techniques not contained within this work scope and would have delayed the project beyond the point where adequate site erosion and sedimentation controls (seeding) could be implemented. It was determined to defer this work under the decommissioning of the Containment Vessel. These areas have been capped with clean soil that will require removal prior to excavation of potentially contaminated structures and substrate.

- At the time that the project was completed it was determined that 95% of the remediated areas (with the exception of the above mentioned grid locations), would be <3 mrem/yr. (residential scenario) and would not require further remediation.

<u>1998 LARGE COMPONENT REMOVAL PROJECT</u>
During the late summer and early fall of 1998, the SNEC Facility Large Components [the Reactor Vessel, the Steam Generator, and the Pressurizer] were successfully removed from the Containment Vessel, packaged, and shipped to the Chem-Nuclear disposal facility in Barnwell, South Carolina.

Figure-5 depicts the SNEC Facility in its present configuration.

LESSONS LEARNED FROM THE HISTORICAL SITE ASSESSMENT PROCESS

This section addresses some of the important "Lessons Learned" that became evident as the SNEC Facility progressed through the MARSSIM Historical Site Assessment process.

<u>Lesson Number-1</u> Decommissioning & License Termination is '*real different*'

The Decommissioning and License Termination process is vastly different from the Plant Operation and Maintenance phase of a facility's life cycle. The traditional work centers that operated and maintained the facility during its productive lifetime, experience difficulty in transitioning into the decommissioning mode of operations. This will be particularly true when you begin to use terms such as "picocuries per gram" to reflect quantities of radioactive materials, that differ substantially from the similar but quite different terms used during operation of the facility. It is important that every member of the decommissioning team fully understand the new ways of expressing radioactive material quantities for the site and what they mean. The long-term significance of very small quantities of radioactive materials must be fully and completely understood.

<u>Lesson Number-2</u> 'Show-Time' is 'No-Time' to get Educated

It is absolutely essential that the project decision-makers have a solid understanding of the MARSSIM process *<u>before the process begins</u>*. From the Historical Site Assessment perspective, it is recommended that the project decision-makers and senior staff receive specific training and indoctrination on the MARSSIM process, with emphasis on the "Impacted Area Classification process", well in advance of actual commencement of the HSA process. This will eliminate a great deal of potential confusion as the HSA is completed and findings are presented.

<u>Lesson Number-3</u> "Due to inflation, a picture is now worth more than 1000 words"

Historical facility photographs are an invaluable part of the HSA process. This is particularly true for old facilities, facilities that have undergone significant changes over their lifetime, and multiple facility sites. Having historical photographs available is also extremely helpful when interviewing former facility employees because they stimulate recollection of important information that may otherwise not be remembered. Collecting and cataloging historical facility photographs from pre-construction up to the present is highly recommended. While it is easier said than done, such an undertaking can greatly enhance the usefulness of an HSA. Aerial photographs are of particular value in that they tend to provide a lot of detail. For instance, the site and plant photographs that were taken during the course of the various phases of SNEC Facility decommissioning, have proven to be an excellent resource in support of the Historical Site Assessment. Such photographs, when compared over time, will also hi-lite changes in the site. An additional lesson in this regard is that if a facility has not regularly taken site photographs, now is a good idea to get such a program started.

<u>Lesson Number-4</u> "Things that were released a long time should probably be rechecked if they are still around"

Radiological release criteria have continued to go down with time. Survey instrumentation and methods have undergone significant and continuous improvement over the lifetime of most nuclear facilities that are either decommissioning or are planning for decommissioning. It is not uncommon for a nuclear plant to have old storage areas that contain tools, equipment and materials that were released several years ago under a less stringent set of radiological clearance criteria. Such formerly contaminated items that were radiologically cleared for release several years ago may not be releasable by today's standards. The Historical Site Assessment process needs to be sensitive to the effect of revised radiological release criteria over the site's operating history.

For instance, the Historical Site Assessment project considered many cases in which follow-on decommissioning activities encountered radioactivity at locations that had been surveyed clear during previous decommissioning work. A combination of better survey equipment, better techniques and more stringent release criteria will often lead to the discovery of a radiological impact in an area that was considered to be releasable in the past.

<u>Lesson Number-5</u> "**If you assume the worst – then you can only be pleasantly surprised"**

The MARSSIM process classifies the various areas of a site as either *IMPACTED* or *NON-IMPACTED.* Non-impacted means exactly what it says – that a so designated area was in no way affected by the facility over its entire operating history. If you decide to declare an area or facility as "non-impacted" you had better have some very good evidence to support that decision.

The designation as "impacted" means that you either know or you suspect that a particular area or facility was affected by the facility during its operational lifetime. MARSSIM basically has three classifications that are associated with an "impacted" area. They are Class-1, Class-2 and Class-3 from the most severely impacted to the least impacted.

Once a determination of "impacted" has been reached, the task then becomes to determine the extent to which the area or facility has been impacted. MARSSIM suggests that impacted areas should initially be classified as Class-1 until proven otherwise. This is the best way to handle impacted area classification because it requires the project to develop a very complete understanding of the area. It is during this process that a complete understanding of the MARSSIM impacted area classification process is essential for all project decision-makers and senior staff.

<u>Lesson Number-6</u> **"A site within a site – gets to be a little tricky"**

The SNEC site was basically a 1.14-acre nuclear station site located adjacent to a Coal-fired steam plant. Nuclear plant steam was supplied to a turbine-generator in the steam plant. The steam plant supplied cooling water to the nuclear plant and also contained a number of nuclear plant support components. In conducting the HSA for the SNEC site, we were continually drawn into aspects of the steam plant. The nuclear plant was shutdown in 1972 and the steam plant was shutdown and demolished in 1975. This situation has produced a number of unanticipated surprises with regard to both actual and potential transport radioactive contaminations into portions of the steam plant. The resultant additional work scope for characterization and remediation is significant and was not anticipated in our original cost and budget process.

As can be seen from a review of the "Decommissioning History" section of this paper, the SNEC Facility concentrated exclusively on the 1.148-acre nuclear portion of the site and on a few areas immediately adjacent, during the earlier phases of decommissioning. No effort was expended in the SSGS areas. The present decommissioning phase has identified significant pathways between the two plants that possess the potential to transport low levels of radioactivity from the nuclear plant site to other areas of the property.

Lesson Number-7 **"Old Records generate as many questions as they answer"**

A competent HSA requires endless hours of record review. This activity involves construction era documents on up to the most recent plant records and can take a very long time. Sometimes the simple act of retrieving the records of interest can be daunting. Old records were sometimes filed via methods that have since been lost to the ages. Even recent records can sometimes be difficult to locate. This process will take much longer than you think.

Most plant records and particularly the older records are generally brief and lacking of very much explanatory narrative. Logbooks and other similar records were maintained by individuals who were highly familiar with the operations at hand and they were written for the benefit of other individuals who were equally as familiar with the particular operation or process. Consequently, many entries will be quite brief and will contain operation-specific jargon to such a degree as to make it very difficult for the HSA reviewer to extract useful information from these sources.

When reviewing historic documents, it may be useful to obtain the services of someone who is familiar with the operations in question. This type of individual may still be on the plant staff or may be available as a retiree or other former employee. In the case of SNEC, it was very useful to speak with individuals who had actually participated in the various phases of decommissioning, in order to gain first-hand perspectives on the process. This was not always achievable but was immensely useful when available.

Lesson Number-8 **"If you ask the wrong question – you'll get the wrong answer"**

Especially when dealing with an old facility such as SNEC, you may find that several generations of plant staff will have come and gone over the operating lifetime of the facility. In addition, the plant may have undergone one or more significant physical modifications etc. In cases such as this, it may be virtually impossible to obtain a reasonably complete Historical Site Assessment from a single source of information or from several sources within the same historical era.

The careful preparation of an Historical Site Assessment Questionnaire that can be distributed to a wide segment of present and former site workers can provide a potential gold mine of information. Prior to preparing the HSA Questionnaire, one must first have a good understanding of the type of information that is being sought. In other words, you need to know what you need to know. For this reason, even though you ideally would like to issue your questionnaire very early in the HSA process, it's potential value will be severely limited if it is issued before you fully understand the type of answers that are needed.

A really well designed HSA Questionnaire will contain questions that seek to give the reviewer both general and specific insights into operations and events that may have created impacted areas within the site. Because many recipients of the questionnaire may not have been at the site for a number of years, it is advantageous to include site maps and site photographs to serve as memory joggers.

Lesson Number-9 **"Who are you gonna call?"**

Because historical records are often either not available or cannot be accurately interpreted, an extremely useful assessment tool is the HSA Questionnaire. As discussed above, selection of the questions to be included is critical to maximizing the usefulness of the information received. Equally as important, is the selection of the individuals who will receive the questionnaire.

For old plants such as SNEC, it was rather simple to locate the former employees who still worked for the company. It was much more difficult to locate retirees although this can sometime be accomplished with the assistance of the Human Resources folks. The hardest to locate were the individuals who worked at the site at some point and then left the company prior to retirement.

It turns out that many former employees can be located by interviewing those that can be easily found. Many current and past employees keep in contact with their former colleagues who can then be located via this approach.

In the case of the SNEC facility, we were readily able to locate recent employees but finding the old-timers took some effort.

An additional complication at the SNEC facility was the fact that the adjacent coal-fired plant contained equipment that communicated with systems from the nuclear plant. Since processed effluent water and other types of liquid from the SNEC facility were directed into the steam plant, it became important of us to develop an understanding of how the coal-fired steam plant systems operated. Since conventional plants were not operated under the precise controls that are normally associated with nuclear plants, it is next to impossible to obtain operating procedures and instructions that are of any value. In our case it became necessary to locate former steam plant employees that would be willing to assist us in this effort. The Saxton Steam Generating Station was built in 1923 and was shutdown in 1975. Locating knowledgeable former employees that were still alive was a difficult process. Locating former employees that could knowledgeably recall the operational details of the station was even harder.

The lesson here is simple. If you have a similar situation, start the information retrieval process as soon as possible. The longer you wait, the more difficult this will become.

<u>Lesson Number-10</u> "25 mrem per year won't show up on a frisker"

An important source of information that feeds the HSA is the "spill" record file. This information is especially important when environmental spills are involved. In most cases, spill reports spend far more time addressing issues such as "how can we prevent this from happening again?" or "who's fault was this?" than they do addressing the exact location and extent of the spill.

Previously remediated areas, such as old spill areas, are classified as impacted areas per MARSSIM. This means you will have to revisit these areas during decommissioning. This is because cleaning up a spill using a frisker, while good enough for everyday operations is not sufficient to ensure that remaining activity will be under the limits for final site release.

Knowing that you will ultimately return to remediated spill areas during decommissioning should cause you to want to provide a more precise location and extent description in your spill report and investigation documents.

<u>Lesson Number-11</u> "If the potential exists for an impact, then you must take a look"

When conducting the HSA, if a potential impact is deemed to have existed, then you must follow through with an evaluation that is sufficient to either rule in or rule out, the impact. This applies *no matter how slight the potential may be.*

During the SNEC HSA, the discovery of a ten year old survey showing a very slight level of internal contamination on a flow-meter eventually lead to the discovery of 700 foot long underground tunnel leading from the old steam plant to the Juniata River. This tunnel is suspected to have been impacted by processed water that had been measured by the flow meter. Even though some project personnel were convinced that the effort to explore the underground tunnel was a waste of time, the HSA logic prevailed, the tunnel was opened and low level contamination was determined to be present in several thousand gallons of water and silt. Additionally, several components located in the tunnel were also discovered to be contaminated.

The story does not end here. Further exploration of the tunnel revealed a chamber that formerly contained large pumps that directed the tunnel water to an on-site Spray Pond during periods when river water temperature was too high to receive effluent plant cooling water. Since the potential exists that low level contaminated water may have been pumped to the Spray Pond area, additional characterization of that facility has been directed.

The story doses not end here. The Spray pond was located immediately adjacent to the Juniata River thus this area also constitutes a potential station outfall for contaminated water. Because of this, the River area adjacent to the Spray Pond has been classified as and outfall and additional characterization of that area has been directed.

The story does not end here. Since the Spray Pond is located *upstream* of the coal-fired plant's cooling water intake structure, there is a very slight potential that if measurable effluents were released at the Spray Pond outfall, some activity may have been introduced into the station cooling water intake. Because of this, additional characterization of the steam plant intake structure has been directed.

As can be seen from this example, even a seemingly insignificant piece of information can lead to the discovery of a potentially significant impacted area. And even though the contamination levels associated with this particular problem set are very low, a substantial new scope of work has been identified and along with it, an increase in decommissioning costs.

Lesson Number-12 **"Who knows what conditions lurk in an old nuclear plant?"**
"The HSA knows!" If this is true then why is the HSA first mentioned at the License Termination Plan end of decommissioning? If you take a look at the time-line that goes along with the NRC's Decommissioning Rule you can see that, following submittal of a "Site-Specific Decommissioning Cost Estimate", full access to decommissioning funding is obtained and the real bulk of decommissioning work is accomplished. At some point about two years before you plan to complete decommissioning and terminate the plant's license, you submit your License Termination Plan. It is at this point that you come face to face with the MARSSIM process and it's Historical Site Assessment.

The HSA process, if followed diligently, can and will identify areas of your site that either have been or may have been, impacted due to plant operations. These impacts may have been or may not have been recognized during your initial decommissioning planning and subsequent decommissioning operations. If they were not and they are significant, you are now confronted with the possibility of additional decommissioning work scope. If really significant, you may be confronted with additional schedule and expense that may delay completion of decommissioning and license termination.

SUMMARY

A quality Historical Site Assessment can be of significant value in the planning and cost estimating stages of a Decommissioning project. The earlier that this process is initiated – the better.

By waiting to conduct the HSA until the License Termination phase of decommissioning, you run the risk of discovering additional areas requiring potential remediation. This has a potential to add scope and cost to the decommissioning project.

An ongoing Historical Site Assessment process, initiated during the plant operational period, can be a substantial 'value added' activity over the long term.

FIGURE – 1

SNEC FACILITY POST-SHUTDOWN CONFIGURATION

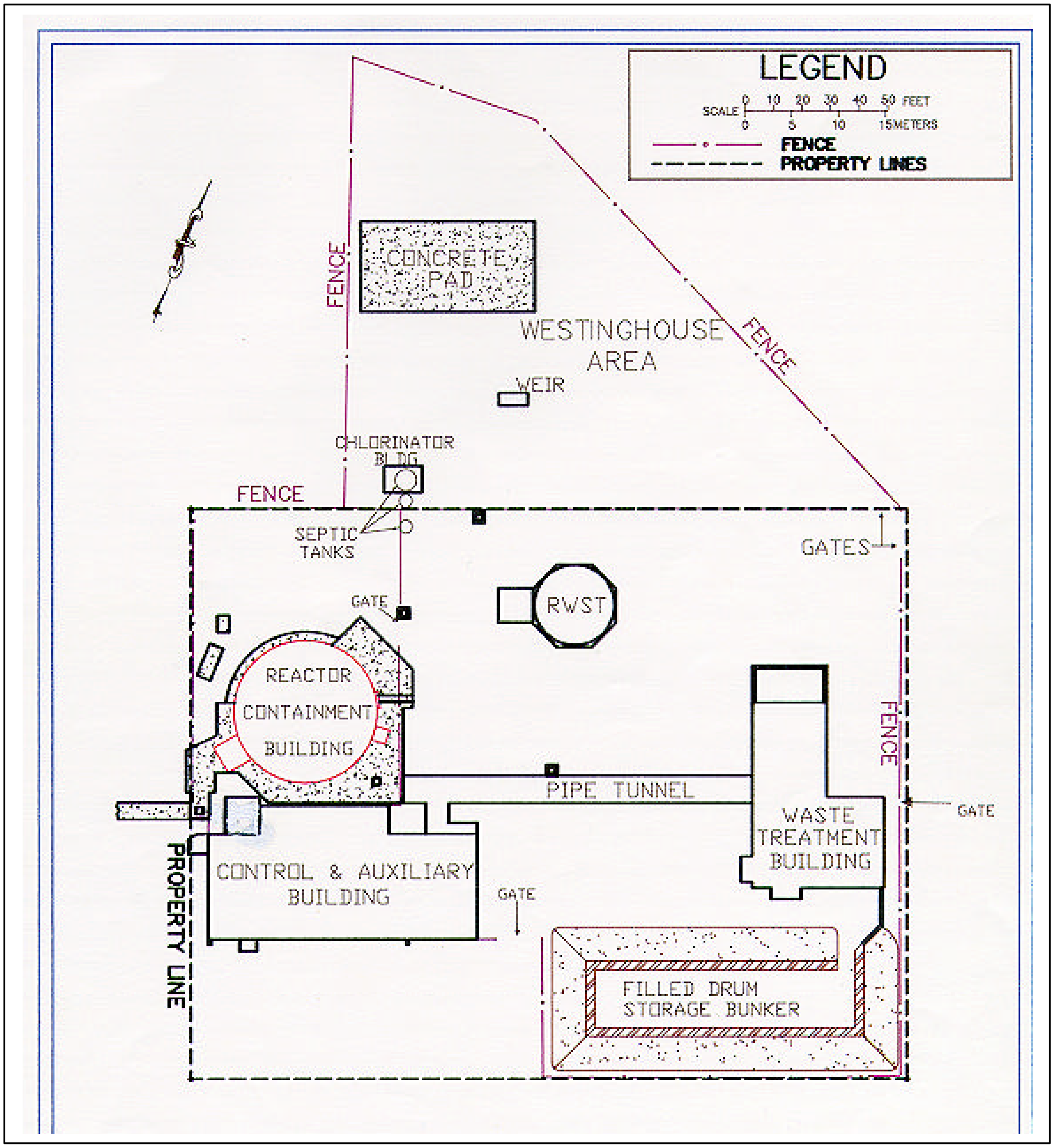

FIGURE – 2

SMEC FACILITY PRE-DEMOLITION CONFIGURATION

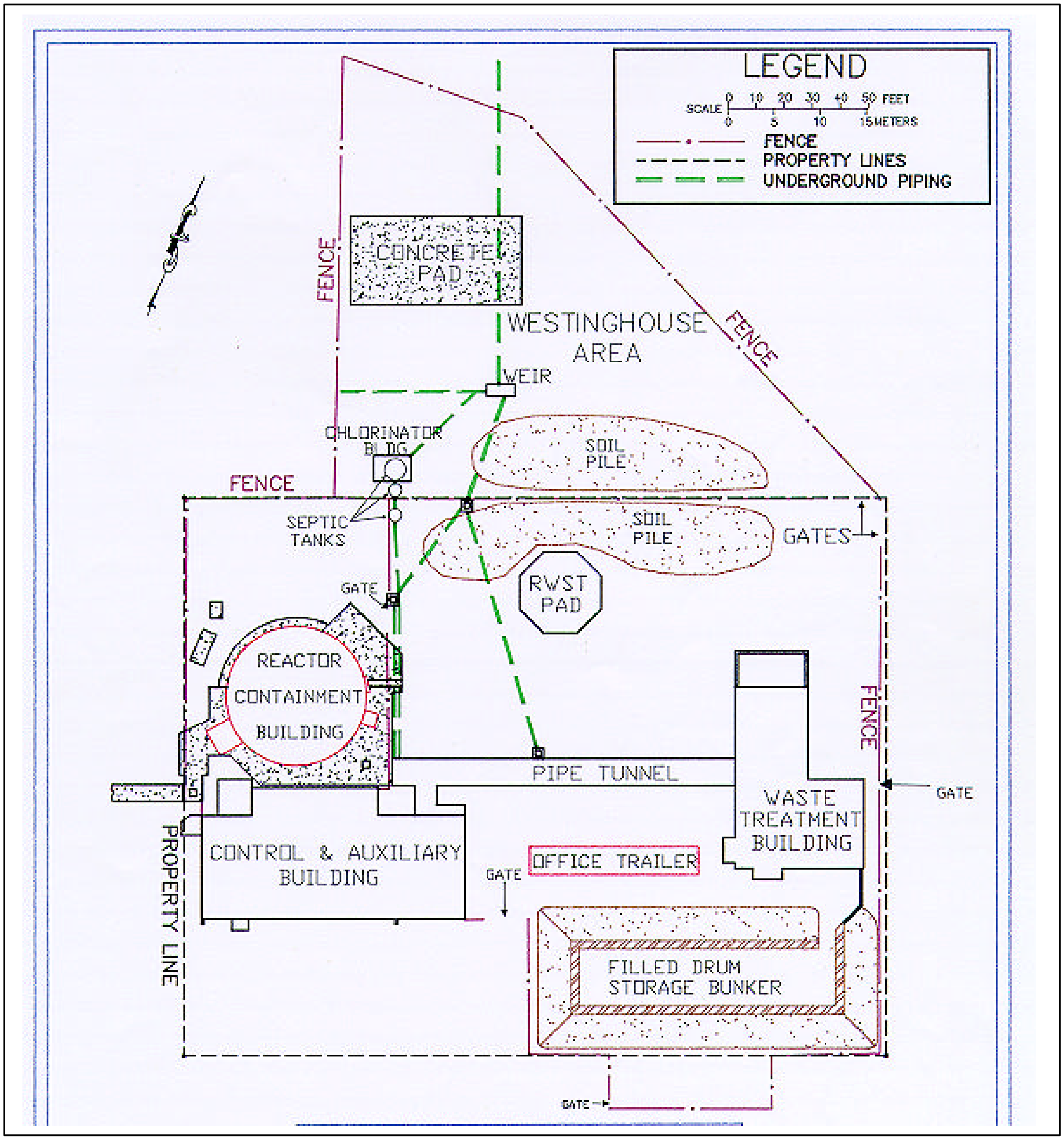

FIGURE – 3

SNEC FACILITY POST DEMOLITION CONFIGURATION

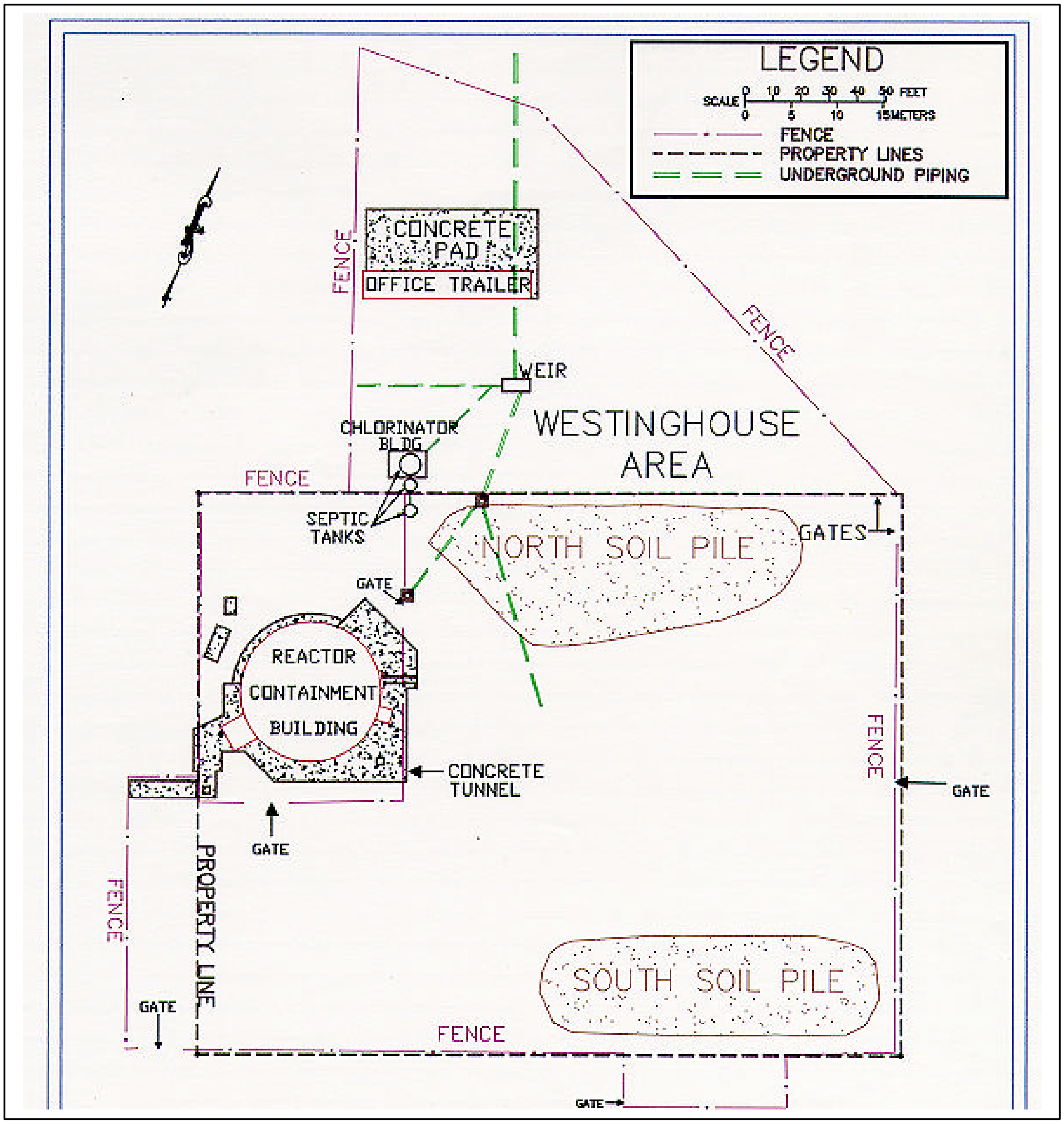

FIGURE – 4

SNEC FACILITY POST SOIL REMOVAL CONFIGURATION