ENGINEERING EVALUATION/COST ANALYSIS EE/CA

FOR

OPERABLE UNIT 1 (OU-1) BUILDINGS AND DEBRIS

SAFETY LIGHT CORPORATION SITE BLOOMSBURG, COLUMBIA COUNTY, PENNSYLVANIA

EPA WORK ASSIGNMENT NUMBER 061-RICO-03DG
CONTRACT NUMBER 68-S7-3002

TETRA TECH NUS PROJECT NUMBER 00499

OCTOBER 2006

TETRA TECH NUS, INC.

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EXECUTIVE SUMMARY

This engineering evaluation/cost analysis (EE/CA) for Operable Unit 1 (OU-1) (buildings and debris) at the Safety Light Corporation (SLC) Site, located in Bloomsburg, Columbia County, Pennsylvania, has been prepared by Tetra Tech NUS (TtNUS) for the United States Environmental Protection Agency (EPA) under Work Assignment Number 064-RICO-03DG under Contract Number 68-S6-3003. This report serves to meet the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986. An EE/CA is required under the National Oil and Hazardous Substances Pollution Contingency Plan [Section 300.415(b)(4)(I)] for all non time-critical-removal actions. The EE/CA identifies the objectives of the removal action, analyzes the various alternatives that may be used to satisfy these objectives, and recommends the most appropriate response option to mitigate potential exposures to any contaminants and potential migration of any contaminants into the environment.

PURPOSE

The purpose of this EE/CA is to present removal alternatives for contaminated buildings which are inaccessible due to deteriorating and unsafe conditions. A historical site assessment has identified the nature of contamination and presented an evaluation of the potential human health risks associated with the inaccessible buildings at the SLC site. Based on the available information and data, it has been determined that removal actions for addressing unacceptable risks posed by the contamination and physical condition of the buildings containing the contamination can be selected at this time. This EE/CA presents the removal alternatives as part of the remedy selection process.

BACKGROUND

The SLC facility is located at 4150-A Old Berwick Road, Bloomsburg, Pennsylvania, within the South Centre Township of Columbia County in central Pennsylvania. The site is about 10-acres in extent and contains numerous structures and contaminated areas, including lagoons, dumps, an abandoned canal, and buildings. SLC utilizes a 2-acre area of the site for its current manufacturing operations. In a small portion of the 8-acres not under NRC license, USR Metals, Inc. and Multimetals Products Corporation, conduct nonradiological manufacturing processes that include metal finishing and plating.

Activities at the site have varied over time and involved a number of different radionuclides including radium-226 (^{226}RA), tritium (^{3}H), strontium-90 (^{90}Sr), and cesium-137 (^{137}Cs). Fuel oil, solvents, and heavy metals were also used at the site. During site operations, buildings, soils, and groundwater at the site have become contaminated with radionuclides.

Remedial investigation/feasibility studies (RI/FS) are currently being performed for three operable units (OU) at the site. OU-1 includes buildings and debris located within the buildings, OU-2 includes groundwater, OU-3 includes soils, surface water, and sediment. The objective of the OU-1 investigation is to determine the nature and extent of radiological contamination in buildings and evaluate the buildings and structures for remedial alternatives leading to Superfund remedy selection in accordance with CERCLA and decommissioning in general accordance with NRC requirements. Previous investigations conducted by SLC have identified numerous areas of radiological contamination; these results have been used to guide the building characterization survey.

Twenty buildings or structures have been identified for characterization at the SLC. Although most of these buildings are accessible, many contain debris (e.g., equipment, files) that is or may be contaminated with radionuclides. However, the following on-site structures are considered to be inaccessible at this time due to their physical condition: the floor of the Personnel Office Building has collapsed into the basement where a source of contamination is present; therefore access is unsafe. The Old House has a collapsed roof and unstable side walls. A tree has also fallen into the structure. This building is inaccessible. The Radium Vault has a collapsed roof and is therefore inaccessible. Large portions of the Etching Building have collapsed roofs; therefore, portions of this building present significant safety concerns for access. The roof beams of the Lacquer Storage Building have deteriorated so they no longer support the roof. The ceiling and portions of the walls of the Well House have collapsed, and portions of the ceiling of the Pipe Shop have collapsed.

It should be noted that the Well House is no longer in use and is not utilized for water supply at the site. Public water is provided to the site. The well will be abandoned in accordance with regulatory requirements.

Therefore, these seven buildings will not be characterized as part of the RI/FS and are the focus of this EE/CA. Site plans, including a Removal Action Work Plan (RAWP) detailing the scope, schedule, and budget for the removal action, a Quality Assurance Project Plan (QAPP), and a Health and Safety Plan (HASP) will be prepared during the removal action planning process. These plans will provide details on procedures to be implemented to safely perform the demolition work without impacting current site operations, including site tenants and EPA Remedial and Removal program activities.

NATURE AND EXTENT OF CONTAMINATION

During the Historical Site Assessment performed by TtNUS in December 2004, SLC licenses, operating records, and radiation surveys were reviewed to identify those radionuclides of concern for OU-1. From these reviews, numerous radioisotopes were determined to be present or potentially present at the site including, but not limited to tritium, americium, and isotopes of cesium and strontium.

The current activity of the building materials and debris in the seven buildings is unknown due to the inaccessibility of these structures to adequately characterize the radioactivity. Based on the operational history, it is assumed that contamination is present in these structures. In order to characterize the materials for either release or disposal at a low-level radioactive waste facility, the structures need to be demolished, and the materials scanned. Previous investigations have revealed static measurements in six of the seven buildings in excess of 15,000 dpm/100cm^2. Radioactivity in excess of this criteria are considered radioactive waste and should be disposed at an approved facility. Section 1.5 summarizes the levels of contamination detected during previous investigations.

RISK EVALUATION

The seven structures at the SLC that are inaccessible due to occupational safety and structural integrity concerns preclude the performance of characterization surveys on these buildings by health physics personnel. Historical site assessment documents reviewed for this project provide details on the radioisotopes that have been used during facility operations. However, there is no clear definition of where all of the isotopes were used or whether they were used singly, singly but collocated with other operations, or in conjunction with other isotopes.

The activity of the building materials and debris in the seven buildings is unknown due to the inaccessibility of these structures to adequately characterize the radioactivity. Based on the operational history, it is assumed that contamination is present in these structures. In order to characterize the materials for either release or disposal at a low-level radioactive waste facility, the structures need to be demolished, and the materials scanned.

In addition, in order to complete the RI/FS and NRC decommissioning activities at the site, these structures require removal in order to gain access to the soils located beneath the footprints of these buildings. The structures also present potential physical hazards as site activities continue to operate near the buildings, including site tenants and EPA Remedial and Removal program activities. Unsafe conditions in these structures include collapsed or partially collapsed roofs, walls, and floors. These structures continue to deteriorate due to increased exposure to weather and their overall unstable condition which could result in potential threats to workers from falling objects or unsound flooring.

Another potential risk is the potential for offsite release of radiological contamination should fire occur at any of these structures. The presence of combustible materials and likelihood of radiological contamination associated with the structures could result in an airborne release to the surrounding community. Residential dwellings are located adjacent to three sides of the site property and could be potentially affected. In addition, a fire has already occurred at one structure (Old House) indicating that the potential for fires at the site is significant.

The data presented in Sections 1.5 and 1.6 of this EE/CA indicate that the radiological contamination present in the structures, with the possible exception of the radium vault, could exceed release criteria as fixed contamination in these structures exceed the maximum release criteria of 15,000 dpm/100cm^2. Specific radioisotope data is incomplete; however, based on this evaluation, these structures present increased risk of exposure to radiological contamination as well as physical and fire hazards.

REMOVAL ACTION OBJECTIVES

The overall objective of any removal performed at the SLC Site is to protect human receptors from contaminants of concern, protect workers and visitors from unsafe structures, and enable characterization of the soils under the footprint of the inaccessible buildings for release or identification of remedial actions. Therefore the removal action objectives for this portion of OU-1 are:

- Prevent potential human exposure to radionuclides.
- Eliminate potential physical threats to workers and site visitors conducting activities near unsafe buildings/structures.
- Enable further characterization of contaminants at the site.

REMOVAL ALTERNATIVES DEVELOPMENT

This EE/CA was prepared based on data obtained through a review of site records, site visits, and in accordance with EPA Guidance for Conducting Non-Time-Critical Removal Actions Under CERCLA (OSWER Publication 9360.0-32, August 1993) and the revised National Oil and Hazardous Substances Pollution Contingency Plan (NCP) (40 CFR 300, March 1990).

Based on site contaminants, characteristics, and removal action objectives, removal technologies and options were identified. These were screened for effectiveness, implementability, and relative cost. Removal alternatives were assembled using those technologies and options that passed the screening. The alternatives that were assembled are briefly described below:

<u>Alternative 1: Demolition of the seven structures with transportation and disposal as radioactive waste.</u>

This alternative includes standard demolition practices using excavators, loaders and other equipment. Dust suppression will be required to contain any potential airborne radioactivity. Dust suppression methodology will be developed and presented in the RAWP and HASP. Demolition areas would be maintained as potentially contaminated until radiological release surveys could be performed. Building materials and debris would require size reduction to achieve the 12 inch maximum size requirement specified in the proposed disposal facility's Waste Acceptance Criteria (WAC). This can generally be achieved using demolition equipment (i.e., crushing with the excavator bucket or shearing). The proposed disposal facility's WAC also allows for wastes to be reduced to a size of not greater than 10 inches for any one dimension and a maximum length of 12 feet. Materials such as pipes could be cut to conform to this requirement.

Debris such as boilers that may be difficult to reduce in size to meet the WAC could be disposed at the facility's bulk waste disposal area at additional cost. These materials must be segregated from the standard size waste stream. For this alternative, cost savings could be obtained by implementing radiological screening for these large items. The radiological screening process is detailed in Alternative 2. Uncontaminated debris would be cleared for free release for salvage or disposal. Debris that contains radiological contamination would be subject to decontamination, re-evaluated for radiological contamination, and, cleared for free-release for salvage or non-rad disposal. Materials that could not be cleared for free release would be subject to the WAC for bulk materials.

Other potentially hazardous materials such as asbestos, mercury, or polychlorinated biphenyls (PCBs) may be present in the demolition waste. The facility's WAC accepts asbestos (friable and non-friable), mercury, and PCB-contaminated materials (providing PCB fluids have been drained). Any materials potentially containing PCBs (e.g., transformers, large capacitors) or mercury should be segregated, screened and decontaminated for radioactivity, and evaluated for contents. PCB fluids should be drained, although small capacitors may be sent to the facility's mixed-waste facility without processing.

This information will be included in the RAWP along with a contingency for manual size reduction using hand tools should the demolition equipment not provide adequate size reduction of debris. Processed debris would be containerized in 40 yd^3 intermodal shipping containers and staged awaiting disposal facility approval for shipment. Samples of the debris would be submitted to a qualified laboratory for waste stream certification in accordance with the disposal facility's WAC and license requirements.

Alternative 2: Demolition of the seven structures, segregation of the materials into radioactive waste and demolition waste, and transportation and disposal at appropriate facility.

Demolition of the seven structures would be completed using mechanical equipment (excavators, loaders, etc.). In order to implement this option, demolition debris would require gross radiological screening to determine activity levels. This screening process would be performed using standard field instrumentation (i.e., α and β-γ detectors) and smears to identify materials contaminated with the easily detected isotopes. By identifying and segregating these materials, additional characterization screening for the hard to detect isotopes would not be required. These materials could be size reduced, containerized and sampled for WAC certification.

Typically, contamination levels are determined using portable field equipment. Total contamination levels are measured by performing scanning or static measurements of the suspect material. Removable contamination is measured by performing a smear or swipe of the material surface and evaluating using a counter such as an α-β scaler. These methods are adequate to determine levels for the easily detected isotopes such as Cs-137 or Ra-226. However, for the hard to detect isotopes (H-3, C-14, Ni-63) there are no portable field instruments capable of detecting total contamination and removable contamination determinations require techniques that are not suitable to field applications (liquid scintillation counting of smears). For these isotopes, material and smear samples would require analysis at an offsite facility.

Materials that are screened negative for the easily detected isotopes would be segregated as suspect and sampled for offsite analysis. A primary concern during this step is the number of samples that would be required to provide certainty that the materials are not radiologically contaminated.

Materials that have radioactivity above release criteria would be disposed at an NRC-licensed facility. Materials that may be released due to levels below regulatory criteria would be disposed in a demolition waste landfill. Minimal decontamination of heavy equipment would be required. Demolition and decontamination wastes would be disposed of in the same fashion.

EVALUATION OF ALTERNATIVES

Each alternative was evaluated using seven of the nine criteria specified in the NCP and the previously referenced EPA guidance. The nine evaluation criteria are grouped into three categories: effectiveness, implementability, and cost. Effectiveness criteria include overall protection of human health and the environment; compliance with ARARs; long-term effectiveness and permanence; reduction of toxicity, mobility, and volume through treatment; and short-term effectiveness. An alternative must achieve these criteria to be considered for selection. Implementability criteria include the technical and administrative feasibility of implementing the removal action; availability of services and materials; and state and community acceptance of the removal action technology. Costs include direct and indirect capital costs and long-term maintenance and operating costs. These criteria, with the exception of state and community acceptance, are used to differentiate among alternatives during the selection process. State and community acceptance are evaluated in determining the final removal action selection in the action memorandum.

In general, both alternatives are protective of human health and the environment and would comply with ARARs. Alternatives 1 and 2 also meet the long-term effectiveness and permanence criteria. Neither alternative includes treatment; however, both are effective in the short-term.

Alternatives 1 and 2 are implementable using commonly available and proven methods; however, Alternative 2 requires a high level of additional waste segregation and characterization.

Alternative 2 is the lower cost alternative. This alternative requires the lower initial capital cost to implement. Neither alternative requires annual or long-term O&M components, but both require a significant initial cost to implement. The lower costs are associated with decreased disposal costs assuming 50 percent of the material is not contaminated by radioisotopes. The greater the actual volume of radioactive-contaminated debris, the less cost savings offered by Alternative 2.

The costs associated with these items have been estimated for a 30-year period and are presented in the following table. All total costs are shown as present worth based on a 30-year duration.

Cost Element	Alternative 1	Alternative 2
Capital Costs	$3,000,766	$2,501,626
O&M Costs	$0	$0
5-Year Review Costs	$0	$0
Present Worth	$3,000,766	$2,501,626

RECOMMENDED ALTERNATIVE

The recommended alternative for the non-time-critical removal action for the SLC Site is Alternative 1, which includes demolition of the buildings and disposal of all debris as radioactive waste. This alternative complies with ARARs and is protective of human health and the environment. Although Alternative 2 is potentially less costly than Alternative 1 as estimated in this EE/CA, unknown factors such as the levels of radioactive contamination and extent or contamination throughout the inaccessible structures could result in Alternative 2 being more costly than Alternative 1. Alternative 1 eliminates the requirements for extensive characterization of debris for release or disposal as radioactive material (with the exception of large items such as boilers) which would expedite the removal action.

1.0 SITE CHARACTERIZATION

1.1 INTRODUCTION

This engineering evaluation/cost analysis (EE/CA) for Operable Unit 1 (OU-1) (buildings and debris) at the Safety Light Corporation (SLC) Site, located in Bloomsburg, Columbia County, Pennsylvania, has been prepared by Tetra Tech NUS (TtNUS) for the United States Environmental Protection Agency (EPA) under Work Assignment Number 064-RICO-03DG under Contract Number 68-S6-3003. This report serves to meet the requirements of the Comprehensive Environmental Response, Compensation, and Liability Act of 1980 (CERCLA), as amended by the Superfund Amendments and Reauthorization Act (SARA) of 1986. An EE/CA is required under the National Oil and Hazardous Substances Pollution Contingency Plan [Section 300.415(b)(4)(I)] for all non time-critical-removal actions. The EE/CA identifies the objectives of the removal action, analyzes the various alternatives that may be used to satisfy these objectives, and recommends the most appropriate response option to mitigate potential exposures to any contaminants and potential migration of any contaminants into the environment.

This EE/CA incorporates the results of the RI investigation for OU-1 to date, as well as the site characterization reports prepared by various parties including the site operators, the Nuclear Regulatory Commission (NRC), and EPA.

1.2 SITE DESCRIPTION AND BACKGROUND

The 10-acre SLC site is located off Old Berwick Road in Bloomsburg, within the South Centre Township of Columbia County, Pennsylvania (Figure 1-1). The active site currently uses tritium (^3H) to manufacture self-illuminating signs. Past operations at the site which began in 1948 have resulted in soil and groundwater contamination with radionuclides. Buildings also contain contaminated equipment and other materials.

The site was required by the United States Nuclear Regulatory Commission (NRC) to begin remediating radiological waste disposed in two underground silos. The NRC has requested EPA's assistance for the cleanup of the property because SLC had insufficient funds to complete this remediation project and proceed with any other cleanup action. EPA evaluated the potential risks from this site and proposed SLC to the National Priorities List (NPL) in September 2004. The Site was finalized on the NPL on April 27, 2005. EPA is performing an RI/FS at the site to evaluate the extent of contamination and remedial alternatives. The RI/FS activities will be conducted in accordance with EPA CERCLA and, as appropriate, NRC requirements.

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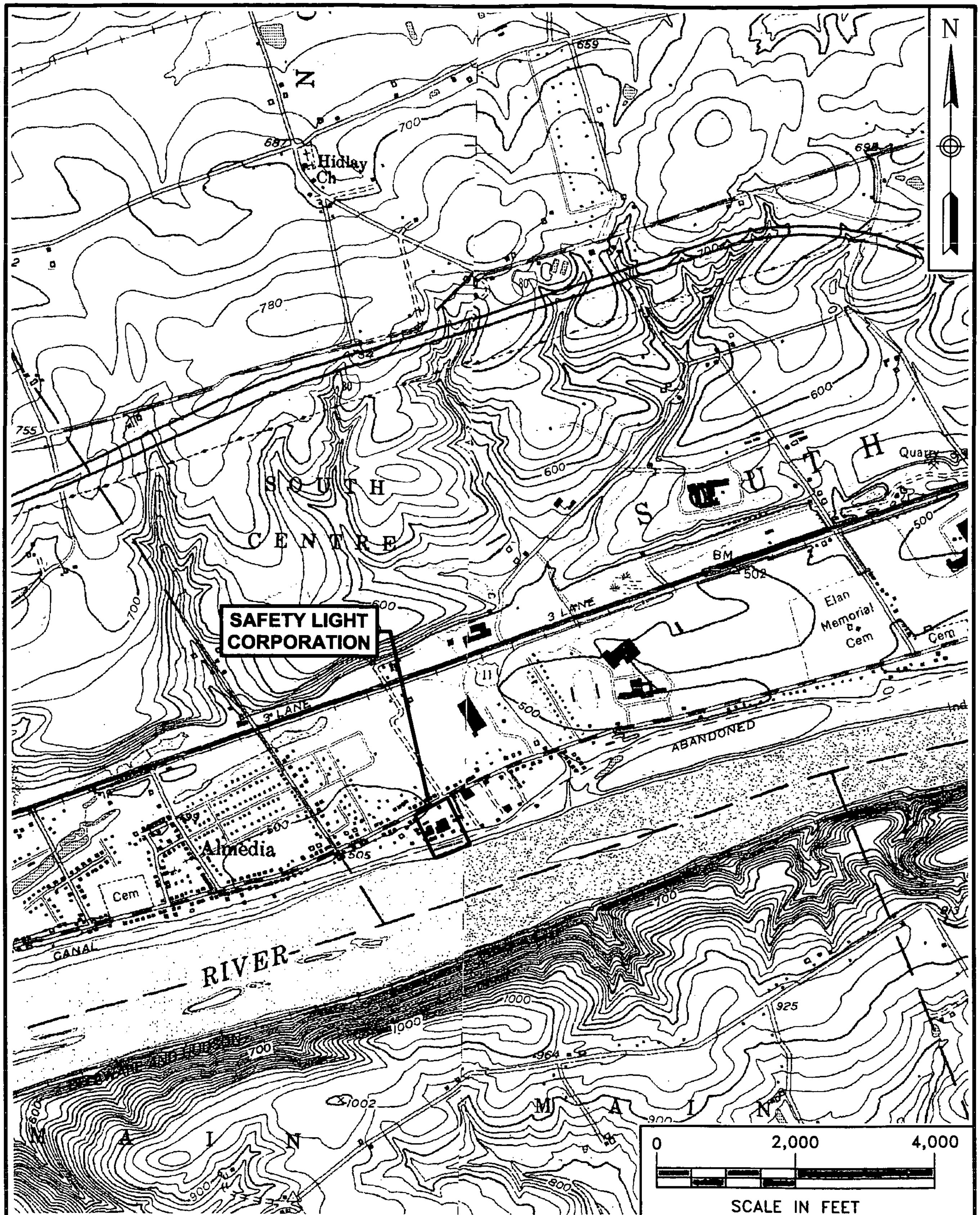

TETRA TECH NUS, INC.

SITE LOCATION MAP
SAFETY LIGHT CORPORATION
BLOOMSBURG, COLUMBIA COUNTY,
PENNSYLVANIA

SCALE	AS NOTED
FILE	7673GM01.DWG
REV 0	DATE 03/24/05
FIGURE NUMBER	FIGURE 1–1

Applicable guidance includes the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) in addition to applicable Superfund guidance documents.

Based on RI/FS scoping activities, it has been determined that a phased approach to the RI/FS will be required to obtain the data to satisfy both EPA and NRC requirements. For example, MARSSIM states that a radiological survey of all surfaces in buildings and structures is required where there is a potential for contamination by radionuclides. In many cases, contaminated debris is contained in these structures presenting a potential interference for radiological characterization. Debris must be removed prior to performing the building surveys. In addition, several buildings have collapsed roofs or floors and present unsafe access to conduct the surveys. Soils under the footprint of contaminated buildings also must be evaluated; therefore, either soil borings will be taken under and adjacent to buildings, or structurally unsafe contaminated buildings would be razed prior to conducting any soil investigation. This EE/CA evaluates removal alternatives for these unsafe buildings and debris contained in these buildings. Buildings (and debris contained within) that are safe to enter for evaluation will be included in the OU-1 RI/FS.

1.2.1 Site History

The SLC facility was first used to manufacture wooden toys during World War II. In the late 1940s, United States Radium Corporation (USRC) purchased the facility to manufacture self-illuminating light sources containing radioactive materials (e.g., luminous paint).

The facility has also been used for metal finishing and plating. Early operations involved the handling of a wide variety of radionuclides and chemicals, including radium-226 (^{226}Ra), tritium (^{3}H), strontium-90 (^{90}Sr), and cesium-137 (^{137}Cs), fuel oil, solvents, and heavy metals.

Activities at the site have varied over time and involved a number of different radionuclides. In 1948, the USRC radium operations were relocated from Brooklyn, New York, to the Bloomsburg site. At the time, USRC used mainly ^{226}Ra and minor amounts of polonium 210 (^{210}Po) in the manufacture of self-illuminating watch and instrument dials.

From 1948 until 1954, USRC used the east lagoon for the disposal of sewage and process wastewater from the old radium laboratory located in the main building. During the early 1950s, USRC expanded its operations to include the manufacturing of civil defense check sources and radiation sources utilizing ^{137}Cs and the production of deck markers for the U.S. Navy involving the use of ^{90}Sr. During this time period, ^{226}Ra was also used primarily for clocks and watches (dials and hands) and in the production of high level neutron and radiation therapy sources.

During the 1950s, USRC began producing light sources using ^{3}H, carbon-14 (^{14}C), Thallium-204 (^{204}Tl), and Krypton-85 (^{85}Kr); low-level ionization sources using Nickel-63 (^{63}Ni) and ^{3}H; and radiation beta sources using ^{85}Kr. Wastes from these operations were buried in two underground silos (each 10 feet in diameter by 10 feet deep) south of the main building. Use of the silos was stopped in 1960 when the company began to ship the wastes offsite to licensed radioactive waste burial facilities. The company routed liquid wastes produced on the site to a nearby abandoned canal associated with the Susquehanna River or to a holding tank and evaporator system.

In 1956, the Atomic Energy Commission (AEC), a predecessor of the NRC, issued AEC License No. 37-00030-02 to USRC. The discussions of radionuclides covered by the original license are conflicting. However, it appears that this license may have authorized the use and distribution of products containing a wide variety of other radionuclides, including ^{14}C, Iron-55 (^{55}Fe), Cobalt-60 (^{60}Co), ^{63}Ni, Zinc-65 (^{65}Zn), ^{90}Sr, ^{137}Cs, ^{210}Po, Neptunium-237 (^{237}Np), Uranium-238 (^{238}U), Promethium-147 (^{147}Pm), Cerium-144 (^{144}Ce), Ruthenium-106 (^{106}Ru), Actinium-227 (^{227}Ac), and Americium-241 (^{241}Am).

In the late 1960s, work with all radionuclides other than ^{3}H was discontinued. From 1969 to date, operations involving the production of ^{3}H devices have been carried out in a limited area of the site. As a result of operations, the site has become contaminated with the radioisotopes used. Studies of the site have found contamination by radioactive material in buildings, soil, and groundwater.

Prior to 1980, USRC created a new corporation known as USR Industries (USR). USRC subsequently became a subsidiary of USR. On November 24, 1982, following a complex series of reorganizations, corporate name changes, and sales of corporate entities, USRC activities were transferred to SLC without prior approval from the NRC. SLC is licensed by the NRC to use ^{3}H in the production of luminous signs and dials, paints, gas chromatograph foils, and accelerator targets. Although only ^{3}H has been used in the SLC facilities, most of the buildings on the USRC site were used for the previously discussed radioactive materials work. Non-radiological operations are conducted in space leased to USR Metals, Incorporated (USRM), and Multimetals Products Corporation (MPC). The leased space was historically used by USRC. USRM manufactures dials, nameplates, and other specialty materials, and MPC operations include anodizing aluminum products and applying protective films on metal surfaces. USRM and MPC are subsidiaries of USR.

1.2.2 Waste Disposal History

Wastes generated at the SLC facility include solid and liquid waste streams contaminated with radioactive materials, including ^{226}Ra, ^{90}Sr, ^{137}Cs, and ^{3}H. Contaminated laboratory glassware was buried on the property. Contaminated solids were placed inside two old silos buried in the ground (refer to building number 14 on Figure 1-2). According to groundwater analytical data collected by Foster Wheeler in 2000 and Monserco in 1995, the old silo shows a ^{90}Sr and ^{137}Cs plume migrating towards the Susquehanna River. Concentrated liquid wastes were allowed to evaporate, and the dry residuals were transferred to the Radiological Services Company. Additionally, plant effluent was discharged into the abandoned canal, located adjacent to the Susquehanna River. The former canal bed was divided into a series of five individual impoundments or lagoons. The impoundments or lagoons were filled with river water, allowing the wastes in them to be diluted prior to discharge into the Susquehanna River.

From 1948 to 1954, the east lagoon was used for the disposal of sewage and process wastewater from the radium laboratory in the main building (Figure 1-2). In 1960, the contents of the east lagoon were pumped into the west lagoon. During the May 2001 NRC site visit, an oily spot was observed in the middle of the base of the east lagoon. Also, an 8 or 10-inch diameter outfall was observed in the east lagoon; origin unknown.

The west lagoon was used for the disposal of liquid waste including silver plating wastes and anodizing solutions from USR operations (Figure 1-2). Low-level radioactive waste reportedly was buried in the west lagoon. Also as noted above, in 1960 the east lagoon was pumped into the west lagoon.

The east and west lagoons are located in the 100-year floodplain and were reportedly flooded in 1972, mixing with flood waters. Contents of the lagoons were dispersed on the site property and in the Susquehanna River.

Three disposal areas are located on the facility; the abandoned canal, the two disposal pits (east and west plant dumps), and two underground silos (Figure 1-2). The abandoned canal was used for the disposal of ^{226}Ra contaminated ductwork and liquid waste from radiological production activities. The east plant dump encompasses areas between the east and west lagoons, and was identified in 1972 during a storm sewer installation. The west plant dump is adjacent to the western property line and fence. During a May 2001 NRC site visit, the east plant dump contained piles of pallets, old chain-link fences, old pipes, windows, cinder blocks, and sheet metal. In 1948 and 1949, the west plant dump was used for the disposal of solid waste. The west plant dump also was used for the disposal of ^{226}Ra dials and possibly ^{90}Sr deck markers. The silos were exhumed in 1989, but the area had not been remediated.

Applicable guidance includes the Multi-Agency Radiation Survey and Site Investigation Manual (MARSSIM) in addition to applicable Superfund guidance documents.

Based on RI/FS scoping activities, it has been determined that a phased approach to the RI/FS will be required to obtain the data to satisfy both EPA and NRC requirements. For example, MARSSIM states that a radiological survey of all surfaces in buildings and structures is required where there is a potential for contamination by radionuclides. In many cases, contaminated debris is contained in these structures presenting a potential interference for radiological characterization. Debris must be removed prior to performing the building surveys. In addition, several buildings have collapsed roofs or floors and present unsafe access to conduct the surveys. Soils under the footprint of contaminated buildings also must be evaluated; therefore, either soil borings will be taken under and adjacent to buildings, or structurally unsafe contaminated buildings would be razed prior to conducting any soil investigation. This EE/CA evaluates removal alternatives for these unsafe buildings and debris contained in these buildings. Buildings (and debris contained within) that are safe to enter for evaluation will be included in the OU-1 RI/FS.

1.2.1 Site History

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The facility has also been used for metal finishing and plating. Early operations involved the handling of a wide variety of radionuclides and chemicals, including radium-226 (^{226}Ra), tritium (^{3}H), strontium-90 (^{90}Sr), and cesium-137 (^{137}Cs), fuel oil, solvents, and heavy metals.

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During the 1950s, USRC began producing light sources using ^{3}H, carbon-14 (^{14}C), Thallium-204 (^{204}Tl), and Krypton-85 (^{85}Kr); low-level ionization sources using Nickel-63 (^{63}Ni) and ^{3}H; and radiation beta sources using ^{85}Kr. Wastes from these operations were buried in two underground silos (each 10 feet in diameter by 10 feet deep) south of the main building. Use of the silos was stopped in 1960 when the company began to ship the wastes offsite to licensed radioactive waste burial facilities. The company routed liquid wastes produced on the site to a nearby abandoned canal associated with the Susquehanna River or to a holding tank and evaporator system.

In 1956, the Atomic Energy Commission (AEC), a predecessor of the NRC, issued AEC License No. 37-00030-02 to USRC. The discussions of radionuclides covered by the original license are conflicting. However, it appears that this license may have authorized the use and distribution of products containing a wide variety of other radionuclides, including ^{14}C, Iron-55 (^{55}Fe), Cobalt-60 (^{60}Co), ^{63}Ni, Zinc-65 (^{65}Zn), ^{90}Sr, ^{137}Cs, ^{210}Po, Neptunium-237 (^{237}Np), Uranium-238 (^{238}U), Promethium-147 (^{147}Pm), Cerium-144 (^{144}Ce), Ruthenium-106 (^{106}Ru), Actinium-227 (^{227}Ac), and Americium-241 (^{241}Am).

In the late 1960s, work with all radionuclides other than ^{3}H was discontinued. From 1969 to date, operations involving the production of ^{3}H devices have been carried out in a limited area of the site. As a result of operations, the site has become contaminated with the radioisotopes used. Studies of the site have found contamination by radioactive material in buildings, soil, and groundwater.

Prior to 1980, USRC created a new corporation known as USR Industries (USR). USRC subsequently became a subsidiary of USR. On November 24, 1982, following a complex series of reorganizations, corporate name changes, and sales of corporate entities, USRC activities were transferred to SLC without prior approval from the NRC. SLC is licensed by the NRC to use ^{3}H in the production of luminous signs and dials, paints, gas chromatograph foils, and accelerator targets. Although only ^{3}H has been used in the SLC facilities, most of the buildings on the USRC site were used for the previously discussed radioactive materials work. Non-radiological operations are conducted in space leased to USR Metals, Incorporated (USRM), and Multimetals Products Corporation (MPC). The leased space was historically used by USRC. USRM manufactures dials, nameplates, and other specialty materials, and MPC operations include anodizing aluminum products and applying protective films on metal surfaces. USRM and MPC are subsidiaries of USR.

1.2.2 Waste Disposal History

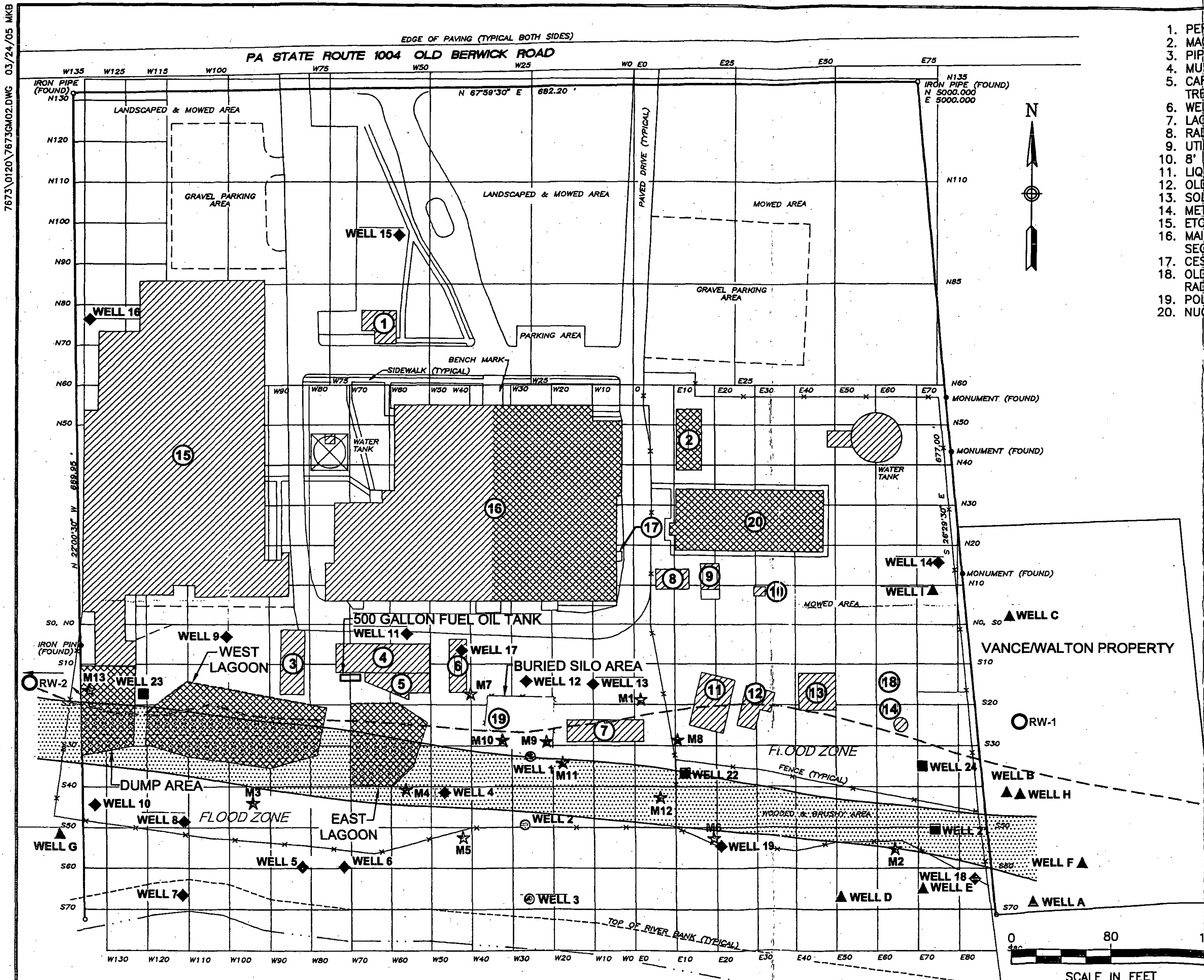
Wastes generated at the SLC facility include solid and liquid waste streams contaminated with radioactive materials, including ^{226}Ra, ^{90}Sr, ^{137}Cs, and ^{3}H. Contaminated laboratory glassware was buried on the property. Contaminated solids were placed inside two old silos buried in the ground (refer to building number 14 on Figure 1-2). According to groundwater analytical data collected by Foster Wheeler in 2000 and Monserco in 1995, the old silo shows a ^{90}Sr and ^{137}Cs plume migrating towards the Susquehanna River. Concentrated liquid wastes were allowed to evaporate, and the dry residuals were transferred to the Radiological Services Company. Additionally, plant effluent was discharged into the abandoned canal, located adjacent to the Susquehanna River. The former canal bed was divided into a series of five individual impoundments or lagoons. The impoundments or lagoons were filled with river water, allowing the wastes in them to be diluted prior to discharge into the Susquehanna River.

From 1948 to 1954, the east lagoon was used for the disposal of sewage and process wastewater from the radium laboratory in the main building (Figure 1-2). In 1960, the contents of the east lagoon were pumped *into the west lagoon. During the May 2001* NRC *site visit, an oily spot was observed in the middle of the* base of the east lagoon. Also, an 8 or 10-inch diameter outfall was observed in the east lagoon; origin unknown.

The west lagoon was used for the disposal of liquid waste including silver plating wastes and anodizing solutions from USR operations (Figure 1-2). Low-level radioactive waste reportedly was buried in the west lagoon. Also as noted above, in 1960 the east lagoon was pumped into the west lagoon.

The east and west lagoons are located in the 100-year floodplain and were reportedly flooded in 1972, mixing with flood waters. Contents of the lagoons were dispersed on the site property and in the Susquehanna River.

Three disposal areas are located on the facility; the abandoned canal, the two disposal pits (east and west plant dumps), and two underground silos (Figure 1-2). The abandoned canal was used for the disposal of ^{226}Ra contaminated ductwork and liquid waste from radiological production activities. The east plant dump encompasses areas between the east and west lagoons, and was identified in 1972 during a storm sewer installation. The west plant dump is adjacent to the western property line and fence. During a May 2001 NRC site visit, the east plant dump contained piles of pallets, old chain-link fences, old pipes, windows, cinder blocks, and sheet metal. In 1948 and 1949, the west plant dump was used for the disposal of solid waste. The west plant dump also was used for the disposal of ^{226}Ra dials and possibly ^{90}Sr deck markers. The silos were exhumed in 1989, but the area had not been remediated.



1. PERSONNEL OFFICE BUILDING (OLD NURSES STATION)
2. MACHINE SHOP
3. PIPE SHOP
4. MULTI-METALS WASTE TREATMENT PLANT
5. CARPENTER SHOP (ADJACENT TO MULTI-METALS WASTE TREATMENT PLANT)
6. WELL HOUSE
7. LACQUER STORAGE BUILDING
8. RADIUM VAULT
9. UTILITY BUILDING (SR-90 SOURCE VAULT)
10. 8' X 8' BUILDING
11. LIQUID WASTE BUILDING (INCLUDING UNDERGROUND TANKS)
12. OLD HOUSE
13. SOLID WASTE BUILDING
14. METAL SILO (ABOVE-GROUND)
15. ETCHING BUILDING
16. MAIN BUILDING - INCLUDES BASEMENT, FIRST FLOOR, SECOND FLOOR, AND ATTIC
17. CESIUM ION EXCHANGE HUT (ATTACHED TO MAIN BUILDING)
18. OLD GARAGE FOUNDATION (WHERE DRUMS OF REMOVED RADIOACTIVE WASTE WERE PREVIOUSLY STORED)
19. POLE BUILDING
20. NUCLEAR BUILDING (TRITIUM BUILDING)

LEGEND

- MONITORING WELL LOCATION, GILES DRILLING (1978)
- MONITORING WELL LOCATION, MEISER & EARLE (1979)
- MONITORING WELL LOCATION, SLC
- MONITORING WELL LOCATION, CNSI (1990)
- MONITORING WELL LOCATION, MONSERCO (1995)
- RESIDENTIAL WELL LOCATION
- PROPERTY CORNER
- WIRE FENCE
- STREAM/WATER EDGE
- 100 YEAR FLOOD ZONE
- BUILDING NUMBER
- CURRENT SLC OPERATIONS
- ABANDONED CANAL

TETRA TECH NUS, INC.

SITE MAP
SAFETY LIGHT CORPORATION
BLOOMSBURG, COLUMBIA COUNTY, PENNSYLVANIA

FILE	SCALE
7673GM02.DWG	AS NOTED
FIGURE NUMBER: FIGURE 1-2	REV: 0 DATE: 03/24/05

7673\0120\7673GM02.DWG 03/24/05 MKB

AR100021

Another potential source for onsite contamination is an underground storage tank (UST) formerly used to store ^{3}H contaminated wastewater. Prior to 1972, ^{3}H contaminated wastewater was previously contained in below-ground tanks in a vault in the basement of the Liquid Waste Building. In 1972, the North Branch of the Susquehanna River flooded the building and a tank containing ^{3}H contaminated wastewater was uprooted from its location and dispersed in the flood water. Before the flood, the tank contained about 500-gallons of ^{3}H contaminated wastewater. The flood water was sampled and detected ^{3}H contamination. The remaining tank was subsequently filled and the vault was capped. The remainder of the vault was filled with soil and covered with a concrete slab.

Since 1972, four 2,400-gallon aboveground storage tanks (ASTs) housed in the Liquid Waste Building contain ^{3}H contaminated wastewater from the Tritium or Nuclear Building (refer to building number 11 on Figure 1-2). The wastewater is transported through a below-grade drain line and enters a concrete sump that is about 7 feet deep. The wastewater is then pumped into one of the 2,400-gallon ASTs for dilution. The ^{3}H contaminated wastewater is diluted, then is released to the North Branch of the Susquehanna River under a NPDES permit. According to groundwater analytical data collected by Monserco in 1995, a volatile organic compound (VOC) plume containing vinyl chloride, 1,1,1-trichlorethane, 1,1-dichloroethane, and cis-1,2-dichloroethane emanates from the area of the Liquid Waste Building and flows toward the Susquehanna River.

In addition, four septic tanks are located at various areas throughout the site. These tanks are believed to have received and continue to receive effluent from sewers/drains from the Main Building, Tritium Building, Multi-Metals Building and perhaps the Etching Building, with discharge to the lagoons and/or Susquehanna River. The Multi-Metals Building is used to treat USR Metals' liquid waste. This building contains tanks for neutralizing wastewater and a sump. It is believed that the sump discharges to a septic tank and ultimately the lagoons and Susquehanna River.

1.2.3 Previous Investigations

Since the 1960 time frame, the company has undertaken various clean-up efforts including decontamination of buildings, backfilling of on-site lagoons and removal of soils contaminated with ^{226}Ra. These clean-up efforts are not well documented.

According to site documents, eight environmental investigations of the SLC site have been conducted since 1978. Six environmental summary reviews were also prepared from available data. These investigations and environmental reviews are further described below.

1978 Giles Drilling Corporation, on behalf of USRC, initiated groundwater monitoring with the installation of monitoring wells 1, 2, and 3 located in the southern portion of the facility south of the underground silo area. Soil and groundwater from these wells provided initial data on contamination levels and suggested that additional monitoring was required. No investigational report or initial groundwater monitoring data is available from this investigation; however boring logs for these wells are included in the Meiser & Earl Report discussed below.

1979 Meiser & Earl Hydrogeologists, on behalf of USRC, conducted a hydrogeological investigation, including installation of thirteen monitoring wells and three wells for background (wells 4 through 19). The thirteen monitoring wells were located around the abandoned canal, the east and west lagoons, and the disposal pits. Investigation activities commenced on January 29, 1979, and were completed in March 1979. Objectives of the investigation were to determine the depths to groundwater, water-table gradients and flow directions, existing water quality, extent of any radiological contamination from abandoned disposal areas, and to propose appropriate pollution abatement techniques. Investigation activities included the collection of interval soil samples for textural classification and radioactivity analysis and the construction of screened or cased wells from which water samples could be collected. The investigation activities revealed hydrogeological information at the site; the site is underlain by fluvio-glacial deposits and static water levels revealed that water flow across the site is essentially from the north to the south (towards the Susquehanna River), except during limited periods when flooding occurs and flow is temporarily blocked locally by a groundwater mound.

1979 Radiation Management Corporation (RMC) conducted a radiological investigation in conjunction with the Meiser & Earl Investigation. RMC reportedly used soil and groundwater collected both by Meiser & Earl and by themselves for radiological analysis. This report concluded that although contamination was evident, no significant public health hazard was present and remediation was neither appropriate nor justified at that time. However, continued and additional environmental monitoring was suggested.

1981 Oak Ridge Associated Universities (ORAU) performed an environmental survey under contract to the NRC. ORAU conducted survey activities at the SLC site in June and August, 1981. This survey reviewed the SLC's program for controlling and monitoring radiation and radioactivity levels. Data were collected to confirm measurements performed by the licensee, to evaluate the adequacy and accuracy of environmental controls and monitoring procedures, and to determine if environmental contamination was occurring. Survey activities include the measurement of direct radiation levels in unrestricted areas around the entire property, monitoring routine releases of tritium in stack air and liquid effluents from SLC activities and measurement of radionuclide concentrations in the environment as a result of present and previous operations of SLC and USRC. Boreholes were drilled for the collection of subsurface soils; however no monitoring wells were installed. Media sampled were surface and subsurface soil, groundwater, vegetation, surface water, and aquatic organisms, both on and off-site.

The main conclusions of this study were that direct radiation levels were above the regional background levels at the site, but were below federal guidelines for unrestricted use. However, on-site soil sampling indicated elevated levels of ^{226}Ra, ^{90}Sr, and ^{137}Cs and groundwater sampling showed levels of ^{3}H and ^{90}Sr exceeding NRC and EPA guidelines for unrestricted use. The study concluded that contaminants were migrating into soil and groundwater, but did not appear at that time to be accumulating off-site although ORAU indicated this to be a potential future concern.

1988 NRC performed an environmental evaluation of the site using available monitoring data. The objective of this evaluation was to compile information about on-site contamination, to assess the hazards to nearby residents, and to make recommendations about further remediation actions. The NRC concluded that the disposal of radioactive wastes at the SLC site had caused extensive contamination of groundwater on and off-site, and of soil on-site. The study identified areas where decontamination work should be focused. Decontamination efforts should focus on cleanup and control of the disposal silos, open dumps, and contaminated soils in order to minimize further contamination spread. The NRC evaluation also identified that further characterization work was necessary, covering both radiological and non-radiological hazardous constituents.

1990 Chemical Nuclear Systems, Inc. (CNSI) conducted a hydrogeological and radiological evaluation of the SLC facility in June and July 1990. This study was a response to a Partial Interim Settlement Agreement between USR Industries and the NRC. This settlement required partial studies of the nature, scope, location, and movement of radioactive contamination at the SLC facility. This evaluation was also intended to provide characterization data required to be collected by the NRC according to the settlement agreement. The evaluation was not considered comprehensive in scope. The primary objectives of this study were to assess the hydrogeologic flow regime and the potential for off-site radiological migration from the site. Activities conducted include soil coring, installation of 9 monitoring wells (wells A through I) and groundwater and rainwater sampling.

The study indicated that groundwater flow is in a southerly direction toward the Susquehanna River, and confirmed the presence of radioactive contamination within the soil and groundwater. Off-site wells showed evidence of ^{3}H and the highest level was measured at the Vance-Walton well. Groundwater samples also showed evidence of ^{90}Sr from adjacent properties to the east and west of the SLC site. Levels of radionuclides detected were below drinking water standards. The study recommended further environmental monitoring and site characterization work.

1991 NUS Corporation Superfund Division prepared Preliminary Assessment (PA) for EPA using all existing SLC reports. This document concluded that the soil and groundwater remained contaminated primarily with ^{226}Ra, ^{90}Sr, ^{137}Cs, and ^{3}H as a result of waste disposal practices employed during the history of the site.

1993 Roy F. Weston Technical Assistance Team (TAT), tasked by EPA Region 3, conducted soil and groundwater sampling at the SLC property and vicinity. The TAT recommended the following upon completing the sampling activities: to clean out a tub full of blue-colored residue with standing liquid in the Metal Etching Building; to remove empty, rusting drums scattered along the west lagoon edge; to check state regulations for applicable laws regarding tank removal due to a tank overfill located east of MW11; and to place a filter/screen at the outlet of a compressor exhaust in the Carpenter shop. The soil samples detected some contaminants, however none met or exceeded EPA action levels.

Ecology and Environment, Inc. (E&E), tasked by the NRC Region I office, conducted a file review in support of the Hazard Ranking System (HRS) Package which was being prepared by E&E. The file review found that several inspection reports, two in 1980 and one in 1986, prepared by NRC indicated elevated ^{3}H concentrations in the neighboring residential wells, including the Vance Walton and Murphy wells; however, levels detected were below drinking water standards. It was also noted that NRC inspection reports revealed that ^{3}H, ^{226}Ra, and ^{90}Sr had been detected consistently in on-site groundwater at concentrations exceeding NRC guidelines for unrestricted area.

In 1994, Monserco Limited prepared a Characterization Plan for SLC to quantify the physical and radiochemical characteristics of radiological contamination and it's distribution, assess non-radiological constituents and their effect on radiological constituents, evaluate environmental impacts, assess associated hazards from existing and potential future radiological contamination under the conditions of unrestricted use, and finally to provide sufficient information to develop a closure plan for the site. This plan outlined the methods and technologies to be used as part of the site survey and detailed each survey location in regards to area to be sampled and quantity of samples to be taken.

1995 SLC commissioned Monserco Limited to conduct a site characterization. These activities were conducted between May 1995 and December 1995. Objectives of the site characterization were to determine the extent of radiological contamination on ground surfaces, determine whether radioactive contaminated items are buried under the SLC grounds, gain access to the two underground silos and obtain information on their contents, drill new boreholes and wells (wells M1 through M13), sample and analyze the subsurface soils and waters, and determine the extent of radiological contamination inside the buildings.

Monserco conducted electromagnetic surveys at the site. Four anomalies indicating large metallic objects were detected using the survey: two underground silos, an anomaly located east of the Well House indicative of an underground storage tank, and linear anomalies located in the same vicinity that may be buried pipes associated with the underground storage tank. Two anomalies representing large metallic objects were located south of the Etching Building and west of the Pipe shop. Numerous anomalies associated with isolated buried objects were detected. The highest density of these anomalies was located south of the Solid Waste Building and Liquid Waste Building in the abandoned canal. A number of linear anomalies identified across the property may indicate buried pipes or cables.

Eight trenches were excavated revealing the canal bottom, metal debris, and glass. Thirteen boreholes were drilled at various locations on the SLC site to assess the radiological and non-radiological condition of the subsurface soils and to install additional groundwater monitoring wells. Cored material was monitored every two feet for radiation using a contamination probe. Positive radiation readings were recorded for soils from boreholes M2, M3, M4, M5, M6, M7, M9, M10, M11, M12, and M13. Hydrocarbon odors were reported by the field crew during drilling at boreholes M1, M8, M9, and M13. Organic vapors were monitored using a photo ionization detector (PID). Positive results were obtained from boreholes M1 and M7.

Results from monitoring well sampling showed elevated levels of radionuclides, most notably ^{137}Cs, in groundwater near the buried silos (M9, M13) and in a southerly (downgradient) direction at wells M4 and M5. Vinyl chloride (up to 30 ug/l) was also detected in monitoring wells in the vicinity of the Liquid Waste Building in wells M1, M8, and M11.

2000 A Health Consultation Report documenting past sampling data was issued by the Agency for Toxic Substances and Disease Registry (ATSDR) in April 2000. The report concluded that radioactive materials, specifically ^{226}Ra, ^{90}Sr, ^{137}Cs, ^{3}H and ^{241}Am, have been used and disposed in silos, lagoons, and holding tanks associated with the SLC. From these disposal practices, radioactive material has contaminated the on-site areas of the SLC and perhaps nearby off-site residential wells (^{3}H only). The contaminants in the residential wells are not at levels of public health concern. The amount of land contaminated has been exacerbated by a flood of the Susquehanna River in 1972.

ATSDR reviewed environmental sampling data collected during three characterization events from 1980 until 1996. The results indicated that surface soils are contaminated with ^{226}Ra and ^{137}Cs and that the contamination has apparently seeped from the soils to the groundwater. Soil contamination is mostly to the south and southeast of the main buildings. Although the contamination has not yet reached the river, data strongly suggest the contamination is migrating in that direction. Additional contamination associated with the site is predominately between the main site buildings and the river but external exposure to ionizing radiation is localized along the outside of the buildings.

2000-2001

The Pennsylvania Department of Environmental Protection (PADEP) implemented a Hazardous Sites Cleanup Act (HSCA) funded assessment of the SLC property. Foster Wheeler Environmental Corporation was contracted to conduct the site assessment activities, which were completed in August 2000. The primary objectives of this assessment were to perform sample collection and analysis of surface water and groundwater in and around the site. Activities included collection of groundwater from monitoring wells, collection of surface water from the adjacent Susquehanna River, and collection of water from nearby residential wells. Sample results indicate that the groundwater and potentially the surface water at the SLC site are impacted by previous site activities.

Analytical results indicate that groundwater is impacted by radionuclides and some inorganic analytes. The majority of groundwater sample results confirm the presence of radionuclides above non-detect levels. Comparison of the groundwater analytical results indicated that many samples exceeded the EPA drinking water maximum contaminant levels (MCLs) for gross alpha, gross beta, ^{226}Ra, ^{228}Ra, and ^{90}Sr. The highest concentrations of radionuclides were found in the groundwater collected from the monitoring wells closest to the location of the underground waste disposal silos, wells M9 and M10. None of the residential well sample results were found to exceed the EPA MCLs for radionuclides. There were inorganic analytes detected above the PADEP Act 2 Medium-Specific Concentration (MSCs). Some of these exceedences may be attributed to the elevated level of suspended solids in the groundwater samples. Lead and copper exceeded the PADEP Act 2 MSCs in one of the residential well water samples. As copper was not detected in other groundwater samples, the elevated copper levels may be attributed to the residential plumbing system.

Low-level organic contaminants were detected in the groundwater samples collected from the site. Vinyl chloride and bis(2-ethylhexyl)phthalate were the only organic contaminants to exceed the PADEP Act 2 MSCs, and were detected in samples from only one monitoring well, M9. None of the residential well samples exceeded the PADEP Act 2 MSCs for VOCs or SVOCs. Analyses for radionuclides in surface water collected from the Susquehanna River show that low concentrations are present. Standards for radionuclide concentrations in surface water were not used for data comparison, as none were determined applicable for this event by PADEP. All surface water sample results were below the inorganics Water Quality Criteria for Toxic Substances and surface water samples were not analyzed for VOCs or SVOCs.

2001 ICF Consulting submitted a Review and Evaluation of Characterization Data for SLC in October 2001. This report was prepared under contract to the NRC. The report presented prior characterization data, an evaluation of the completeness of the data, and suggested where additional data could increase the current understanding of the site and refine future cost estimates. The ICF report concluded that operations have resulted in the radiological contamination of every building (except for the Old Radium Vault) at the site. It should be noted that, although it is believed that radioactive sources have been removed from the Old Radium Vault, access to the building was not possible due to a collapsed roof. Due to structural damage at some buildings, remediation is most likely not possible due to entry restrictions. Many buildings still contain contaminated waste, equipment, and source material. The majority of the surface soils at the site are contaminated with at least one radionuclide at levels exceeding the Derived Concentration Guidance Levels (DCGLs) as reported as either actually detected concentrations or presumed by analytical detection limits in excess of the DCGLs. The DCGLs were calculated in the Monserco report using guidelines in effect at that time. The DCGLs were considered remediation goals to achieve acceptable levels of radiological levels to return the property to unrestricted use. The primary radioactive isotopes of concern in surface and subsurface soils are ^{226}Ra, ^{137}Cs, ^{241}Am, and ^{90}Sr. The primary radioactive isotopes of concern in groundwater are ^{3}H, ^{226}Ra, ^{137}Cs, ^{241}Am, and ^{90}Sr. Daughter isotopes of ^{226}Ra, such as ^{214}Pb and ^{214}Bi, have also been found in the surface and subsurface soils and groundwater.

2002-2004

A 1994 settlement by NRC with SLC required SLC to remove and dispose radioactive wastes stored in the underground silos. By June 2000, SLC had removed the waste and placed it in 176 55-gallon drums and 26 containers each containing approximately 3.55 cubic yards of material. These waste drums and containers; however, were placed in the floodplain of the Susquehanna River approximately 200 feet from the river. In 2002 EPA conducted a removal assessment of these materials and entered into an administrative order of consent with SLC to relocate the waste in a secure area on the property outside the floodplain and arrange for disposal at an NRC-licensed facility. SLC did not comply with the consent order and EPA commenced implementation of a removal action (RA). The drums and containers were moved to a secure location (Pole Building) in December 2004 and are waiting for further processing, transport, and disposal at a licensed facility. Containers filled with gravel have been placed adjacent to the outside wall of the Pole Building to provide additional shielding from the stored materials.

2004 Lockheed Martin Services, under contract to EPA, submitted an Aerial Photographic Analysis of SLC in December 2004, showing site conditions from 1938 until 1999. Significant site features, including lagoons and dump areas are shown, although resolution of several of the photographs is poor.

2005-2006

EPA commenced RIFS activities at the SLC site. Work plans for OU1 and OU-2 have been approved and the field investigations have been initiated. Results from groundwater monitoring indicate that groundwater contamination by tritium, strontium, and cesium is present. The OU-2 investigation commenced in November 2005 and the OU-1 investigation was initiated in July 2006. The OU-3 investigation is expected to begin in 2006. EPA also commenced removal activities of the wastes previously stored in the underground silos and now contained in the Pole Building.

1.3 SCOPE OF OU-1 EE/CA

Twenty buildings or structures have been identified for characterization at the SLC. Although most of these buildings are accessible, many contain debris (e.g., equipment, files) that is or may be contaminated with radionuclides. However, the following on-site structures are considered to be inaccessible at this time due to their physical condition: the floor of the Personnel Office Building has collapsed into the basement where a source of contamination is present; therefore access is unsafe. The Old House has a collapsed roof and unstable side walls. A tree has also fallen into the structure. This building is inaccessible. The Radium Vault has a collapsed roof and is therefore inaccessible. Large portions of the Etching Building have collapsed roofs; therefore, portions of this building present significant safety concerns for access. The roof beams of the Lacquer Storage Building have deteriorated so they no longer support the roof. The ceiling and portions of the walls of the Well House have collapsed, and portions of the ceiling of the Pipe Shop have collapsed.

It should be noted that the Well House is no longer in use and is not utilized for water supply at the site. Public water is provided to the site. The well will be abandoned in accordance with regulatory requirements.

Therefore, these seven buildings will not be characterized as part of the RI/FS and are the focus of this EE/CA. Site plans, including a Removal Action Work Plan (RAWP) detailing the scope, schedule, and budget for the removal action, a Quality Assurance Project Plan (QAPP), and a Health and Safety Plan (HASP) will be prepared during the removal action planning process. These plans will provide details on procedures to be implemented to safely perform the demolition work without impacting current site operations, including site tenants and EPA Remedial and Removal program activities.

1.4 PREVIOUS REMOVAL ACTIONS

There have been no previous removal actions associated with the portions of OU-1 that are the focus of this EE/CA. EPA is currently proceeding with removal of the wastes contained in the Pole Building.

1.5 NATURE AND EXTENT OF CONTAMINATION

During the Historical Site Assessment performed by TtNUS in December 2004, SLC licenses, operating records, and radiation surveys were reviewed to identify those radionuclides of concern for OU-1. From these reviews, the following radionuclides were present or potentially present at the SLC site:

H-3	Ce-144
C-14	Pm-147
Fe-55	Tl-204
Co-60	Pb-210
Ni-63	Po-210
Zn-65	Ra-226
Kr-85	Ac-227
Sr-90	Np-237
Ru-106	U-238
Cs-137	Am-241

Since 1969, SLC has only been authorized to possess tritium (H-3). Therefore, using a criterion of 10 half-lives, any radionuclide other than tritium with a half life shorter than 3.6 years (10 half-lives from 1969) would have decayed away in the intervening 36 years. The following radionuclides were used solely prior to 1969 and have half-lives less than 3.6 year; thus, these radionuclides will not be considered further in this EE/CA:

Radionuclide	Half Life
Fe-55	2.73 years
Zn-65	243.8 days
Ru-106	1.02 years
Pm-147	2.62 years
Ce-144	284.6 days
Po-210	138 days

In addition, SLC possessed and/or used Kr-85. However, since this radionuclide is a noble gas, it is not likely to be present at the site as a contaminant at this time. Therefore, the radionuclides listed in Table 1-1 constitute the list of radionuclides of concern for OU-1.

TABLE 1-1
RADIONUCLIDES OF CONCERN
SAFETY LIGHT CORPORATION SITE (OU-1)

Radionuclide	Half Life (years)	Radiation Emitted
H-3	12.3	Beta
C-14	5,730	Beta
Co-60	5.271	Beta, Gamma
Ni-63	100	Beta
Sr-90	29.1	Beta
Cs-137	30.17	Beta, Gamma
Tl-204	3.78	Beta
Pb-210	22.3	Beta, Gamma
Ra-226	1,600	Alpha, Beta, Gamma
Ac-227	21.77	Alpha, Beta, Gamma
Np-237	2.14×10^6	Alpha, Beta, Gamma
U-238	4.47×10^9	Alpha, Gamma
Am-241	432.7	Alpha, Gamma

Because the buildings that are to be evaluated under this EE/CA are inaccessible and actual current levels of contamination cannot be ascertained, it is assumed that these radionuclides are present in these buildings as site history indicates radionuclides were used in these areas and contamination has been previously identified. Table 1-2 presents a summary of radiological contamination identified during previous investigations (ICF, 2001).

1.6 RISK EVALUATION

The seven structures at the SLC that are inaccessible due to occupational safety and structural integrity concerns preclude the performance of characterization surveys on these buildings by health physics personnel. Historical site assessment documents reviewed for this project provide details on the radioisotopes that have been used during facility operations. However, there is no clear definition of where all of the isotopes were used or whether they were used singly, singly but collocated with other operations, or in conjunction with other isotopes.

The activity of the building materials and debris in the seven buildings is unknown due to the inaccessibility of these structures to adequately characterize the radioactivity. Based on the operational history, it is assumed that contamination is present in these structures. In order to characterize the materials for either release or disposal at a low-level radioactive waste facility, the structures need to be demolished, and the materials scanned.

In addition, in order to complete the RI/FS and NRC decommissioning activities at the site, these structures require removal in order to gain access to the soils located beneath the footprints of these buildings. The structures also present potential physical hazards as site activities continue to operate near the buildings, including site tenants and EPA Remedial and Removal program activities. Unsafe conditions in these structures include collapsed or partially collapsed roofs, walls, and floors. These structures continue to deteriorate due to increased exposure to weather and their overall unstable condition which could result in potential threats to workers from falling objects or unsound flooring.

Another potential risk is the potential for offsite release of radiological contamination should fire occur at any of these structures. The presence of combustible materials and likelihood of radiological contamination associated with the structures could result in an airborne release to the surrounding community. Residential dwellings are located adjacent to three sides of the site property and could be potentially affected. In addition, a fire has already occurred at one structure (Old House) indicating that the potential for fires at the site is significant.

TABLE 1-2

SUMMARY OF RADIOLOGICAL CONTAMINATION IN UNSAFE BUILDINGS SAFETY LIGHT CORPORATION SITE (OU-1)

BUILDING	SUMMARY OF RADIOLOGICAL CONTAMINATION
Personnel Building	Transferable contamination > 1,000 dpm/100cm^2 Hot Spot (Fixed contamination) up to 20,272,016 dpm/100cm^2 Cs-137, Ra-226, Sr-90 suspected
Etching Building	Transferable contamination > 1,000 dpm/100cm^2 Fixed contamination >15,000 dpm/100cm^2 at several locations
Old House	Fixed contamination >15,000 dpm/100cm^2 at several locations Cs-137, Ra-226 suspected
Radium Vault	19 pCi/g Cs-137 and 47 pCi/g Ra-226 from roof
Well House	Fixed contamination >15,000 dpm/100cm^2 at several locations Cs-137, Ra-226 suspected
Lacquer Storage Building	Fixed contamination >15,000 dpm/100cm^2 at one location
Pipe Shop	Transferable contamination > 1,000 dpm/100cm^2 Fixed contamination >15,000 dpm/100cm^2 at several locations (up to 23,000 dpm/100cm^2) H-3, Ra-226 suspected

Materials can be released for disposal in a demolition waste landfill if they meet the release criteria identified in Table 1-3. Materials with activity greater than those specified in Table 1-3 are considered radioactive waste and must be disposed at an approved facility. These Derived Concentration Guideline Levels for the debris and materials are from Table 1 of NRC Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors".

The data presented in Table 1-2 indicates that the radiological contamination present in the structures, with the possible exception of the radium vault, could exceed release the criteria presented in Table 1-3 as fixed contamination in these structures exceed the maximum criteria of 15,000 dpm/100cm^2. Specific radioisotope data is incomplete; however, based on this evaluation, these structures present increased risk of exposure to radiological contamination as well as physical and fire hazards.

TABLE 1-3

ACCEPTABLE SURFACE CONTAMINATION LEVELS FOR DEBRIS AND MATERIALS (dpm/100 cm^2)

Radionuclide	Average	Maximum	Removable[a]
H-3	5,000	15,000	1,000
C-14	5,000	15,000	1,000
Co-60	5,000	15,000	1,000
Ni-63	5,000	15,000	1,000
Sr-90	1,000	3,000	200
Cs-137	5,000	15,000	1,000
Tl-204	5,000	15,000	1,000
Pb-210	5,000	15,000	1,000
Ra-226	100	300	20
Ac-227	100	300	20
Np-237	100	300	20
U-238	5,000	15,000	1,000
Am-241	100	300	20

a. The amount of removable radioactive material per 100 cm^2 of surface area should be determined by wiping that 100 cm^2 area with dry filter of soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument.

2.0 IDENTIFICATION OF REMOVAL ACTION OBJECTIVES

This section describes the objectives of the removal action for the unsafe buildings associated with OU-1 at the SLC Site. The removal action objectives are derived from the specific media under consideration, the contaminants of concern (COCs), risk characterization, and applicable or relevant and appropriate requirements (ARARs). Potential removal action technologies are evaluated for their ability to meet the removal action objectives in Section 3.0.

The radiological COCs identified in Section 1.4 are the contaminants which are expected to pose the greatest potential threat to human health and the environment at the SLC site. Removal action objectives were developed to address these risks by identifying the clean up goals for the COCs.

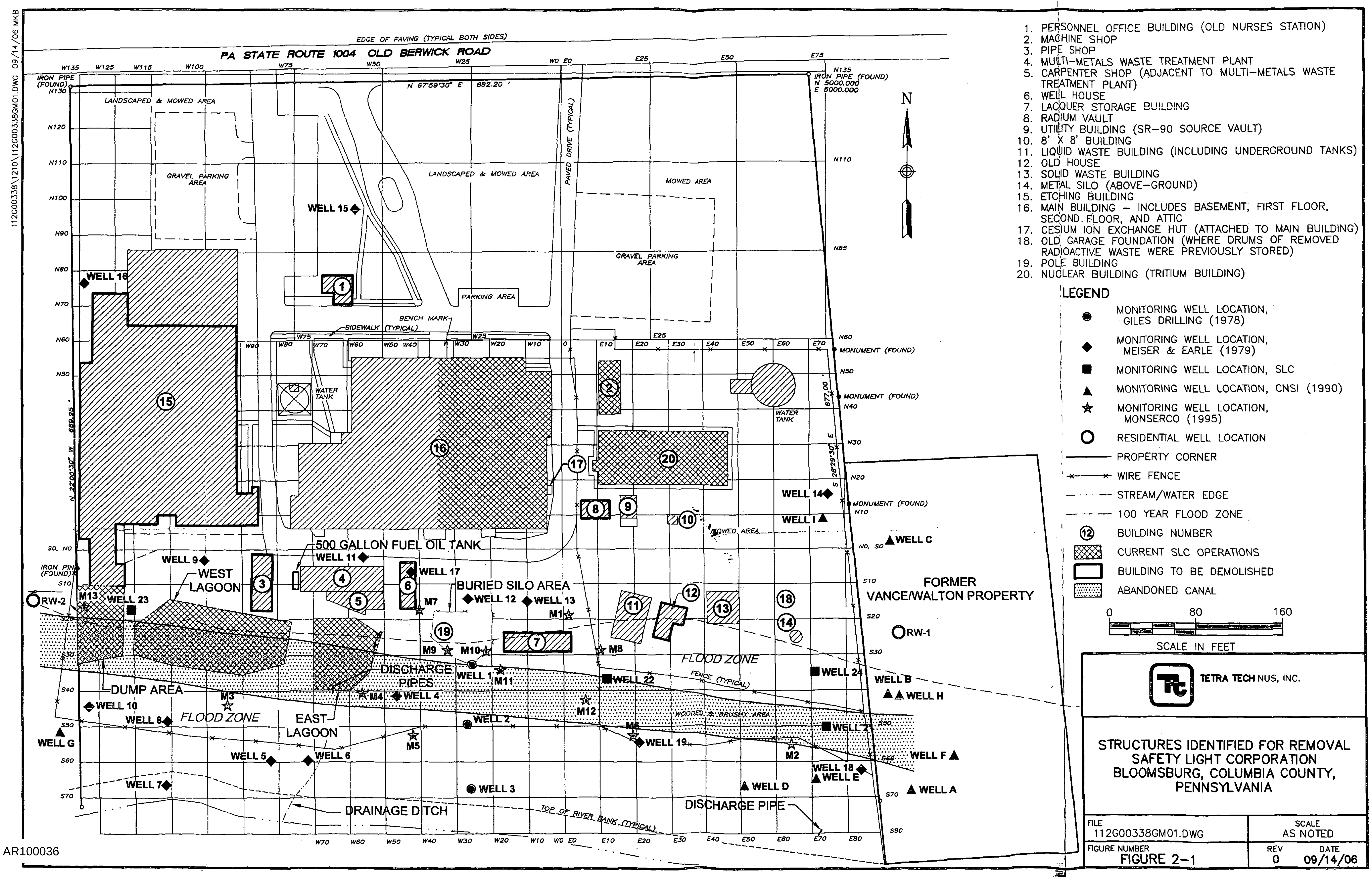
Section 2.1 presents the removal action objectives for the removal action at the SLC Site. Section 2.2 presents COCs for building materials and debris. Section 2.3 provides a preliminary listing of ARARs and other guidance to be considered (TBCs) in establishing clean up goals and proposed removal actions. Section 2.4 identifies the preliminary remediation goals (removal action goals) and clean-up goals for the removal, and Section 2.5 presents a discussion of the estimated volume of contaminated media potentially requiring removal.

2.1 REMOVAL ACTION OBJECTIVES

The overall objective of the proposed removal action at the SLC site, outlined in this EE/CA, is to protect human receptors from contaminants of concern, protect workers and visitors from unsafe structures, and enable characterization of the soils under the footprint of the inaccessible buildings for release or identification of remedial options.

2.2 CONTAMINANTS AND MEDIA OF CONCERN

This EE/CA addresses only the seven structures and associated debris that are considered unsafe for entry to characterize the building materials for radioactive contamination. These structures are the Personnel Office Building, the Old House, the Radium Vault, portions of the Etching Building, the Lacquer Storage Building, the Well House, and the Pipe Shop (see Figure 2-1). Table 1-1 lists the radionuclides of concern and Table 1-3 the levels for release of these materials.


112G00338\1210\112G00338GM01.DWG 09/14/06 MKB
EDGE OF PAVING (TYPICAL BOTH SIDES)
PA STATE ROUTE 1004 OLD BERWICK ROAD
IRON PIPE (FOUND)
N 67°59'30" E 682.20'
IRON PIPE (FOUND) N 5000.000 E 5000.000
LANDSCAPED & MOWED AREA
GRAVEL PARKING AREA
PAVED DRIVE (TYPICAL)
MOWED AREA
PARKING AREA
BENCH MARK
SIDEWALK (TYPICAL)
WATER TANK
MONUMENT (FOUND)
N 22°00'30" W 669.95
677.00
S 26°29'30" E
WELL 15
WELL 16
WELL 14
WELL I
WELL C
500 GALLON FUEL OIL TANK
WELL 9
WELL 11
WELL 17
WEST LAGOON
BURIED SILO AREA
WELL 12
WELL 13
FORMER VANCE/WALTON PROPERTY
IRON PIN (FOUND)
RW-2
M13
WELL 23
M7
M1
RW-1
M9
M10
M8
FLOOD ZONE
DISCHARGE PIPES
WELL 1
M11
WELL 22
FENCE (TYPICAL)
WELL 24
WELL B
WELL H
DUMP AREA
M3
M4
WELL 4
M12
WELL 10
WELL 8
FLOOD ZONE
EAST LAGOON
WELL 2
WOODED & BRUSHY AREA
WELL 21
WELL G
M5
M6
WELL 19
M2
WELL F
WELL 5
WELL 6
WELL 18
WELL E
WELL 7
WELL 3
WELL D
WELL A
DRAINAGE DITCH
TOP OF RIVER BANK (TYPICAL)
DISCHARGE PIPE
1. PERSONNEL OFFICE BUILDING (OLD NURSES STATION)
2. MACHINE SHOP
3. PIPE SHOP
4. MULTI-METALS WASTE TREATMENT PLANT
5. CARPENTER SHOP (ADJACENT TO MULTI-METALS WASTE TREATMENT PLANT)
6. WELL HOUSE
7. LACQUER STORAGE BUILDING
8. RADIUM VAULT
9. UTILITY BUILDING (SR-90 SOURCE VAULT)
10. 8' X 8' BUILDING
11. LIQUID WASTE BUILDING (INCLUDING UNDERGROUND TANKS)
12. OLD HOUSE
13. SOLID WASTE BUILDING
14. METAL SILO (ABOVE-GROUND)
15. ETCHING BUILDING
16. MAIN BUILDING – INCLUDES BASEMENT, FIRST FLOOR, SECOND FLOOR, AND ATTIC
17. CESIUM ION EXCHANGE HUT (ATTACHED TO MAIN BUILDING)
18. OLD GARAGE FOUNDATION (WHERE DRUMS OF REMOVED RADIOACTIVE WASTE WERE PREVIOUSLY STORED)
19. POLE BUILDING
20. NUCLEAR BUILDING (TRITIUM BUILDING)
LEGEND
MONITORING WELL LOCATION, GILES DRILLING (1978)
MONITORING WELL LOCATION, MEISER & EARLE (1979)
MONITORING WELL LOCATION, SLC
MONITORING WELL LOCATION, CNSI (1990)
MONITORING WELL LOCATION, MONSERCO (1995)
RESIDENTIAL WELL LOCATION
PROPERTY CORNER
WIRE FENCE
STREAM/WATER EDGE
100 YEAR FLOOD ZONE
BUILDING NUMBER
CURRENT SLC OPERATIONS
BUILDING TO BE DEMOLISHED
ABANDONED CANAL
0 80 160
SCALE IN FEET
TETRA TECH NUS, INC.
STRUCTURES IDENTIFIED FOR REMOVAL
SAFETY LIGHT CORPORATION
BLOOMSBURG, COLUMBIA COUNTY, PENNSYLVANIA
FILE 112G00338GM01.DWG
SCALE AS NOTED
FIGURE NUMBER FIGURE 2-1
REV 0
DATE 09/14/06

AR100036

2.3 COMPLIANCE WITH ARARs AND TBCs

ARARs are promulgated, enforceable federal and state environmental or public health requirements that are determined to be legally applicable or relevant and appropriate to the hazardous substances, removal actions, or other circumstances at a CERCLA site. The two classes of ARARs, "applicable" and "relevant and appropriate," are defined below.

- **Applicable Requirements** - Section 300.5 of the NCP defines applicable requirements as those removal standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that specifically address a hazardous substance, pollutant, contaminant, removal action, location, or other circumstance at a CERCLA site. Only those state standards that are identified by a state in a timely manner, are enforced in a consistent manner, and are more stringent than federal requirements may be considered as applicable requirements.

- **Relevant and Appropriate Requirements** - Section 300.5 of the NCP defines relevant and appropriate requirements as those removal standards, standards of control, and other substantive environmental protection requirements, criteria, or limitations promulgated under federal or state law that, while not directly applicable to a hazardous substance, pollutant, contaminant, removal action, location, or other circumstance at a CERCLA site, address problems or situations sufficiently similar to those encountered at a CERCLA site that their use is well suited to the particular site. Only those state standards that are identified by a state in a timely manner and that are more stringent than federal requirements may be considered as relevant and appropriate requirements.

ARARs fall into three categories, based on the manner in which they are applied. The characterization of these categories is not perfect, because many requirements are combinations of the three types of ARARs. The categories are as follows:

- Contaminant-Specific: Health-risk-based numerical values or methodologies that establish concentration or discharge limits for particular contaminants. Examples of contaminant-specific ARARs include maximum contaminant levels (MCLs) and Clean Water Act (CWA) Ambient Water Quality Criteria (AWQCs).

- Location-Specific: Restrictions based on the concentration of hazardous substances or the conduct of activities in specific locations. These may restrict or preclude certain removal actions or may apply only to certain portions of a site. Examples of location-specific ARARs include wetland regulations and floodplain management regulations.

- Action-Specific: These are regulations and guidelines that must be followed depending on the activity performed on site. For example, proper handling, storage, and disposal of hazardous substances may be regulated by EPA or state guidelines.

TBCs (standards and guidance to be considered) are non-promulgated advisories or guidance issued by federal or state governments that are not legally binding but may be considered during development of removal alternatives. For example, EPA Health Advisories and Reference Doses are non-promulgated criteria that are used to assess health risks from contaminants present on CERCLA sites.

Summaries of the potential federal and state ARARs and TBCs and their consideration in the EE/CA are provided in Table 2-1.

2.4 REMOVAL ACTION GOALS

Materials can be released for disposal in a demolition waste landfill if they meet the release criteria identified in Table 1-2. Materials with activity greater than those specified in Table 1-2 are considered radioactive waste and must be disposed at an approved facility. These Derived Concentration Guideline Levels for the debris and materials are from Table 1 of NRC Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors". These levels should be considered as the removal action goals for these structures.

2.5 DETERMINATION OF REMOVAL ACTION SCOPE

The seven unsafe buildings must be demolished and the materials disposed of in order to mitigate the physical and environmental threat posed to on-site workers from potential building collapse, and off-site residents from potential building fires. In addition, the seven unsafe buildings must be demolished and the materials disposed of off-site to allow for completion of the RI/FS. The estimated volume of debris from these buildings is 1,366 cubic yards. Volume calculations may be found in Appendix A.

2.6 DETERMINATION OF REMOVAL ACTION SCHEDULE

The removal action at the SLC Site is scheduled to be a non-time-critical removal action. The duration of the removal action is estimated to be approximately 3 months, including preparation of site plans, subcontractor procurement, and waste characterization. This estimated time does not including shipping and disposal of materials. Demolition activities, after preparation of planning documents, is estimated to be completed in 15 days.

TABLE 2-1
SUMMARY OF ARARs AND TBC CRITERIA
SAFETY LIGHT CORPORATION (OU-1)
BLOOMSBURG, COLUMBIA COUNTY, PENNSYLVANIA

Requirement	Citation	Status	Synopsis	Comment
Contaminant-Specific ARARs and TBC				
Standards for Protection Against Radiation	10 CFR Part 20.1101	Applicable	Nuclear Regulatory Commission guidance to implement as low as reasonably achievable constraints on air emissions of radioactive material to the environment	Applicable during demolition activities.
Termination of Operating Licenses for Nuclear Reactors	NRC Regulatory Guide 1.86	Applicable	Nuclear Regulatory Guidance for release of radiological contaminated materials	Applicable during demolition activities.
Pennsylvania Residual Waste Management Regulations	PA Code, Title 25, Chapter 287.1 - 299.232	Applicable	Provides requirements for remedial actions that may generate non-hazardous materials that are characterized as residual waste.	Remedial activities performed in connection with management of residual waste will comply with these requirements.
Pennsylvania Radiological Health – General Provisions	PA Code, Title 25, Chapters 215, 219	Applicable	Provides for protection of public health and safety from exposure to radiological sources	Applicable during demolition activities.
Location-Specific ARARs and TBC				
NONE IDENTIFIED	--	--	--	--
Action-Specific ARARs and TBC				
RCRA Subtitle D	40 USC 6901	Potentially Applicable	Establishes design and operating criteria for solid waste (nonhazardous) landfills.	Potentially applicable if building debris is determined to be nonhazardous.
National Emissions Standards for Hazardous Air Pollutants (NESHAP)	40 CFR 61	Potentially Applicable	Establishes standards for owners or operators of sources of hazardous pollutants.	Potentially applicable during demolition of buildings.
Identification and Listing of Hazardous Waste	40 CFR 261	Potentially Applicable	Defines criteria for determining whether a waste is a RCRA hazardous waste.	Applicable for the management and transportation of RCRA hazardous waste.
Transportation of Licensed Material	49 CFR Parts 107, 171-180, 390-397	Applicable	DOT criteria for packaging and transportation of licensed material	Applicable for transportation of demolition debris to NRC-regulated facility.
Occupational Safety and Health Act	29 USC 651-678	Applicable	Governs worker health and safety during implementation of remedial actions.	Applicable to any investigative or remedial action at the site.
Pennsylvania Standards for Contamination for Fugitive Particulate Matter	PA Code, Title 25, Chapter 123.2	Applicable	Prohibits release of visible fugitive particulate matter from outside the property.	Applicable during demolition activities.
Pennsylvania Hazardous Waste Management Regulations	PA Code, Title 25, Article VII	Potentially Applicable	Regulations (similar to RCRA Subtitle C) that may be relevant to on-site removal actions and applicable to the transport of hazardous waste off site.	Applicable for removed site wastes determined to be hazardous.
Pennsylvania Regulations for Packaging and Transport of Radioactive Materials	PA Code, Title 25, Chapter 230	Applicable	PADEP criteria for packaging and transportation of licensed material	Applicable for transportation of demolition debris to NRC-regulated facility.
Pennsylvania Solid Waste Disposal Regulations	PA Code, Title 25, Chapter 75	Potentially Applicable	Regulate the disposal of solid wastes including municipal and industrial materials.	Applicable for removal of site solid wastes including municipal and industrial materials.
Pennsylvania Storm Water Management Act	Act No. 167	Potentially Applicable	Requires measures to control stormwater runoff during removal alternatives or development of land.	Required if removal actions take place.
Pennsylvania Water Well Abandonment Guidelines	PADEP Groundwater Monitoring Guidance Manual, Chapter 7	TBC	Provides guidelines for well abandonment.	Guideline for abandonment/sealing of well in the Well House

3.0 IDENTIFICATION AND SCREENING OF REMOVAL ACTION ALTERNATIVES

3.1 INTRODUCTION

This section identifies, develops, and screens applicable technologies and process options to assemble removal action alternatives for unsafe buildings and debris associated with these seven buildings at the SLC Site. The basis for technology identification and screening began in Section 2.0 with the following:

- Identification of ARARs
- Development of removal action goals
- Calculation of volumes of media of concern

The technology screening and subsequent technology evaluations performed in this section involve the following steps:

- Identification of general response actions
- Identification and screening of remedial technologies and process options
- Evaluation and selection of representative process options

In an effort to streamline the EE/CA process dictated by the NCP, EPA has undertaken the presumptive remedies initiative to speed up selection of response actions at certain categories of waste sites. Presumptive remedies are preferred technologies for common categories of sites, based on historical patterns of remedy selection and EPA's scientific and engineering evaluations of performance data on technology implementation. The buildings and debris at the SLC Site however, are not candidates for evaluation of presumptive remedies due to the types of media (buildings) and nature of contaminants (radionuclides) present at the site.

3.2 GENERAL RESPONSE ACTIONS

General response actions (GRAs) describe categories of actions that could be implemented to satisfy the removal action objectives for the SLC Site. Typically, the formation of remedial action alternatives represents the coupling of general response actions to fully address remedial action objectives. When implemented, the coupled GRAs are capable of achieving the removal action goals that have been generated for contaminated media at the site. For the SLC Site, the contaminated medium of concern is demolition waste (building materials and debris). The GRAs, were evaluated for their applicability to site-specific conditions, environmental media, the nature of the contaminants, and how the potential risks would be mitigated for this removal action.

GRAs that may be applicable to the buildings and debris at the SLC Site include only demolition and disposal. No other response action (e.g., institutional controls, containment, treatment, etc.) would meet the RAOs for elimination of physical threats and potential exposure to radionuclides to workers or site visitors and allow for further evaluation of media under the footprint of the buildings.

3.3 IDENTIFICATION, SCREENING, AND EVALUATION OF REMOVAL ACTION TECHNOLOGIES

3.3.1 <u>Preliminary Screening</u>

During this phase of alternative formulation, preliminary screening is performed to reduce the universe of potentially applicable technology types and process options. The purpose of screening is to investigate all available technologies and process options and eliminate those that obviously are not applicable to site-specific conditions based on the established removal action objectives and general response actions. The technology identification considers the demonstrated performance of each technology with site conditions and contaminants. Potential remedial technologies and process options are identified and screened according to their overall applicability to the media, primary contaminants of concern, and conditions present at the site. The preliminary screening of removal action technologies is presented and summarized in Table 3-1.

3.3.2 <u>Evaluation of Removal Action Technologies</u>

A detailed evaluation of technologies and process options retained after the preliminary screening step is conducted to further focus the alternatives development process. In this step, process options are evaluated with respect to other processes in the same technology category. One representative process option is selected, if possible, for each technology type, to simplify the subsequent development and evaluation of alternatives without limiting flexibility during remedy selection or remedial design.

TABLE 3-1
PRELIMINARY SCREENING OF TECHNOLOGIES AND PROCESS OPTIONS
SAFETY LIGHT CORPORATION (OU-1)
BLOOMSBURG, COLUMBIA COUNTY, PENNSYLVANIA

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	DESCRIPTION	SCREENING COMMENTS
Removal (Demolition)	Demolition	Mechanical Removal	Mechanical removal of building materials and debris using conventional equipment such as bulldozers and front-end loaders.	Retained. Mechanical removal is an accepted method of demolition. Would need to be combined with a disposal alternative.
Disposal	On Site Disposal	Consolidation/ Engineered Disposal Cell	Excavation and deposition of all contaminated material in an engineered disposal cell.	Eliminated, based on the high capital costs and the availability of less costly technologies. Would not comply with ARARs, or NRC licensing requirements.
	Off Site Disposal	Permitted Radioactive Waste Disposal Facility	Disposal of contaminated debris at a permitted commercial radioactive waste disposal facility.	Retained. Disposal of radioactive debris may be conducted only at licensed facilities.
		Solid Waste Disposal Facility	Disposal of building debris at an off-site permitted demolition waste facility.	Retained. If characterization indicates levels of radioactivity are below release guidelines, demolition waste may be disposed at a permitted solid waste facility.

The evaluation of technologies and process options utilizes three criteria: effectiveness, implementability, and relative cost. These criteria emphasize that remedies should be protective of human health and the environment and should consider the technical and administrative requirements to implement the remedy. In addition, capital costs and O&M costs should be considered in screening alternatives. Evaluations of the removal action technologies and process options are presented in Table 3-2.

3.4 REMOVAL ACTION ALTERNATIVES

Removal action alternatives are derived from those technologies/process options that are considered viable based on the initial screening above. The following removal action alternatives are further evaluated below and in Section 4.0:

- Demolition of the seven structures with transportation and disposal as radioactive waste (Alternative 1).

- Demolition of the seven structures, segregation of the materials into radioactive waste and demolition waste, and transportation and disposal at appropriate facility (Alternative 2).

3.4.1 <u>Alternative 1: Demolition of the seven structures with transportation and disposal as radioactive waste</u>

Demolition of inaccessible facilities and shipment as radioactive waste would provide access to the surface soils under the facility footprint and mitigate the unsafe conditions of the structures. This approach would require standard demolition practices with dust suppression to contain any potential airborne radioactivity and release of friable asbestos-containing materials. Demolition areas would be maintained as potentially contaminated until radiological release surveys could be performed. Building materials and debris would require size reduction to achieve the 12 inch maximum size requirement specified in the proposed disposal facility's Waste Acceptance Criteria (WAC). This can generally be achieved using demolition equipment (i.e., crushing with the excavator bucket or shearing).

The proposed disposal facility's WAC also allows for wastes to be reduced to a size of not greater than 10 inches for any one dimension and a maximum length of 12 feet. Materials such as pipes could be cut to conform to this requirement.

Debris such as boilers that may be difficult to reduce in size to meet the WAC could be disposed at the facility's bulk waste disposal area at additional cost. These materials must be segregated from the standard size waste stream. For this alternative, cost savings could be obtained by implementing radiological screening for these large items. The radiological screening process is as detailed for all debris in Alternative 2. Uncontaminated debris would be cleared for free release for salvage or non-rad disposal. Debris that contains radiological contamination would be subject to decontamination, re-evaluated for radiological contamination, and, cleared for free-release for salvage or non-rad disposal. Materials that could not be cleared for free release would be subject to the WAC for bulk materials.

Other potentially hazardous materials such as asbestos, mercury, or polychlorinated biphenyls (PCBs) may be present in the demolition waste. The facility's WAC accepts asbestos (friable and non-friable), mercury, and PCB-contaminated materials (providing PCB fluids have been drained). Any materials potentially containing PCBs (e.g., transformers, large capacitors) or mercury should be segregated, screened and decontaminated for radioactivity, and evaluated for contents. PCB fluids should be drained, although small capacitors may be sent to the facility's mixed-waste facility without processing.

This information will be included in the RAWP along with a contingency for manual size reduction using hand tools should the demolition equipment not provide adequate size reduction of debris. Processed debris would be containerized in 40 yd^3 intermodal shipping containers and staged awaiting disposal facility approval for shipment. Samples of the debris would be submitted to a qualified laboratory for waste stream certification in accordance with the disposal facility's WAC and license requirements. Based on this certification, dose-to-curie calculations would be performed to determine shipment activity.

Due to the relatively low levels of activity expected during demolition activities, minimal decontamination of heavy equipment would be required to provide for unconditional release. It is not expected that significant amounts of liquid decontamination waste would be generated. Any waste associated with demolition or decontamination activities would be processed and disposed of with the demolition debris. In addition, the well at the Well House will be abandoned in accordance with regulatory requirements including removal of pumps and piping and grouting the borehole.

TABLE 3-2
DETAILED EVALUATION OF TECHNOLOGIES AND PROCESS OPTIONS
SAFETY LIGHT CORPORATION (OU-1)
BLOOMSBURG, COLUMBIA COUNTY, PENNSYLVANIA

GENERAL RESPONSE ACTION	TECHNOLOGY	PROCESS OPTION	EFFECTIVENESS	IMPLEMENTABILITY	COST	CONCLUSION
Removal	Demolition	Mechanical Removal	Effective method for removing structures.	Implementable with standard construction equipment. Equipment and resources are readily available from various contractors.	Capital: Volume dependent O & M: None	Retained.
Disposal	Off Site Disposal	Permitted Radioactive Waste Disposal Facility	Effectively eliminates direct contact exposure potential. Reduces volume of contamination at site.	Implementable using licensed vendors/disposal facility	Capital: High O & M: None	Retained
	Off Site Disposal	Solid Waste Disposal Facility	Effectively eliminates physical hazards at site.	Implementable with standard equipment. Equipment and resources are readily available from various contractors. Various disposal facilities are available.	Capital: Low, but volume dependant O & M: None	Retained

3.4.2 Alternative 2: Demolition of the seven structures, segregation of the materials into radioactive waste and demolition waste, and transportation and disposal at appropriate facility.

Demolition of the seven structures would be completed using mechanical equipment (excavators, loaders, etc.). In order to implement this option, demolition debris would require gross radiological screening to determine activity levels. This screening process would be performed using standard field instrumentation (i.e., α and β-γ detectors) and smears to identify materials contaminated with the easily detected isotopes. By identifying and segregating these materials, additional characterization screening for the hard to detect isotopes would not be required. These materials could be size reduced, containerized and sampled for WAC certification.

Typically, contamination levels are determined using portable field equipment. Total contamination levels are measured by performing scanning or static measurements of the suspect material. Removable contamination is measured by performing a smear or swipe of the material surface and evaluating using a counter such as an α-β scaler. These methods are adequate to determine levels for the easily detected isotopes such as Cs-137 or Ra-226. However, for the hard to detect isotopes (H-3, C-14, Ni-63) there are no portable field instruments capable of detecting total contamination and removable contamination determinations require techniques that are not suitable to field applications (liquid scintillation counting of smears). For these isotopes, material and smear samples would require analysis at an offsite facility.

Materials that are screened negative for the easily detected isotopes would be segregated as suspect and sampled for offsite analysis. A primary concern during this step is the number of samples that would be required to provide certainty that the materials are not radiologically contaminated.

Materials that have radioactivity above release criteria would be disposed at an NRC-licensed facility. Materials that may be released due to levels below regulatory criteria, would be disposed in a demolition waste landfill. Minimal decontamination of heavy equipment would be required. Demolition and decontamination wastes would be disposed of in the same fashion. In addition, the well at the Well House will be abandoned in accordance with regulatory requirements including removal of pumps and piping and grouting the borehole.

4.0 DETAILED ANALYSIS OF ALTERNATIVES

This section discusses the removal action alternatives outlined in Section 3.4 and analyzes these alternatives in detail.

4.1 CRITERIA FOR DETAILED ANALYSIS

The following nine criteria were used for the detailed analysis for each removal action alternative:

- Overall protection of human health and the environment
- *Compliance with ARARs and TBCs*
- Long-term effectiveness and permanence
- Reduction of toxicity, mobility, and volume through treatment
- Short-term effectiveness
- Implementability
- Cost
- State and EPA acceptance
- Community acceptance

The nine evaluation criteria are grouped into three categories: effectiveness, implementability, and cost. Effectiveness criteria include overall protection of human health and the environment; compliance with ARARs; long-term effectiveness and permanence; reduction of toxicity, mobility, and volume through treatment; and short-term effectiveness. An alternative must achieve these criteria to be considered for selection. Implementability criteria includes the technical and administrative feasibility of implementing the removal action; availability of services and materials; and state and community acceptance of the removal action technology. Costs include direct and indirect capital costs and long-term maintenance and operating costs. These criteria, with the exception of state and community acceptance, are used to differentiate among alternatives during the selection process. State and community acceptance are evaluated in determining the final removal action selection in the action memorandum.

1. Overall Protection of Human Health and the Environment. The primary requirement for CERCLA removal actions is that they be protective of human health and the environment. A removal action is protective if it adequately eliminates, reduces, or controls all current and potential health risks. All pathways of exposure must be considered when evaluating the removal alternative. After the removal action is implemented, if hazardous substances remain without engineering or institutional controls, then the evaluation must consider unrestricted use and unlimited exposure for human and environmental receptors. For those sites where hazardous substances remain and unrestricted use and unlimited exposure are not allowable, engineering controls, institutional controls, or some combination of the two must be implemented to control exposure and thereby ensure reliable protection over time. In addition, implementation of a removal action cannot result in unacceptable short-term risks or cross-media impacts with regard to human health and the environment.

2. Compliance with ARARs and TBCs. Compliance with ARARs and TBCs is one of the statutory requirements for removal action selection. Alternatives are developed and refined throughout the EE/CA process to ensure that they will meet all of their respective ARARs or that there is good rationale for obtaining a variance or exemption. During the detailed analysis, information on federal and state action-specific ARARs will be assessed, along with previously identified chemical-specific and location-specific ARARs. Alternatives will be refined to ensure compliance with these requirements.

3. Long-Term Effectiveness and Permanence. This criterion reflects CERCLA's emphasis on implementing remedies that will ensure protection of human health and the environment in the future, and in the near term. In evaluating alternatives for their long-term effectiveness and the degree of permanence they afford, the analysis should focus on the residual risks that will remain at the site after the completion of the removal action. This analysis should include consideration of the following:

- Degree of threat posed by the hazardous substances remaining at the site.

- Adequacy of any controls (e.g., engineering and institutional controls) used to manage the hazardous substances remaining at the site.

- Reliability of those controls.

- Potential impacts on human health and the environment should the removal action fail, based on assumptions included in the reasonable maximum exposure scenario.

4. Reduction of Toxicity, Mobility and Volume through Treatment. This criterion addresses the statutory preference for remedies that employ treatment as a principal element by ensuring that the relative performance of the various treatment alternatives in reducing toxicity, mobility, or volume will be assessed. Specifically, the analysis should examine the magnitude, significance, and irreversibility of reductions.

5. Short-Term Effectiveness. This criterion examines the short-term impacts of the alternatives (i.e., impacts of the implementation) on the neighboring community, the workers, or the surrounding environment, including the potential threat to human health and the environment associated with excavation, treatment, and transportation of hazardous substances. The potential cross-media impacts of the removal action and the time to achieve protection of human health and the environment are also evaluated. The time required to meet removal action objectives is also evaluated under this criterion.

6. Implementability. Implementability considerations include the technical and administrative feasibility of the alternatives, as well as the availability of the goods and services (e.g., treatment, storage, or disposal capacity) on which the viability of the alternative depends. Implementability considerations often affect the timing of various removal action alternatives (e.g., limitations on the season in which the removal action can be implemented, the number and complexity of materials-handling steps that must be followed, the need to obtain permits for off-site activities, and the need to secure technical services such as well drilling and excavation).

7. Cost. Cost encompasses all capital costs and operation and maintenance costs incurred over the life of the project. The focus during the detailed analysis is on the net present value of these costs. Costs are used to identify the least expensive (or most cost-effective) alternative that will achieve the removal action objectives. For purposes of calculating the present worth for the annual operating and maintenance costs, a 30-year maintenance life and a 7 percent annual discount factor are used (EPA, 1996).

8. State and EPA Acceptance. This criterion, which is an ongoing concern throughout the removal action process, reflects the statutory requirement to provide for substantial and meaningful state involvement.

9. Community Acceptance. This criterion refers to the community's comments on the removal action alternatives under consideration, where "community" is broadly defined to include all interested parties. These comments are taken into account throughout the EE/CA process.

4.2 DESCRIPTION AND ANALYSIS OF ALTERNATIVES

This section describes and analyzes each of the removal action alternatives selected in Section 3.4.

4.2.1 Alternative 1: Demolition of the seven structures with transportation and disposal as radioactive waste

Demolition of inaccessible structures and shipment as radioactive waste would provide access to the surface soils under the facility footprint and mitigate the unsafe conditions of the structures. This approach would require standard demolition practices using excavators, loaders and other equipment. Dust suppression will be required to contain any potential airborne radioactivity and friable asbestos-containing materials. Demolition areas would be maintained as potentially contaminated until radiological release surveys could be performed. Building materials and debris would require size reduction to achieve the 12 inch maximum size requirement specified in the proposed disposal facility's Waste Acceptance Criteria (WAC).

The proposed disposal facility's WAC also allows for wastes to be reduced to a size of not greater than 10 inches for any one dimension and a maximum length of 12 feet. Materials such as pipes could be cut to conform to this requirement.

Debris such as boilers that may be difficult to reduce in size to meet the WAC could be disposed at the facility's bulk waste disposal area at additional cost. These materials must be segregated from the standard size waste stream. For this alternative, cost savings could be obtained by implementing radiological screening for these large items. The radiological screening process is detailed in Alternative 2. Uncontaminated debris would be cleared for free release for salvage or disposal. Debris that contains radiological contamination would be subject to decontamination, re-evaluated for radiological contamination, and, cleared for free-release for salvage or non-rad disposal. Materials that could not be cleared for free release would be subject to the WAC for bulk materials.

Other potentially hazardous materials such as asbestos, mercury, or polychlorinated biphenyls (PCBs) may be present in the demolition waste. The facility's WAC accepts asbestos (friable and non-friable), mercury, and PCB-contaminated materials (providing PCB fluids have been drained). Any materials potentially containing PCBs (e.g., transformers, large capacitors) or mercury should be segregated, screened and decontaminated for radioactivity, and evaluated for contents. PCB fluids, if present, should be drained, although small capacitors may be sent to the facility's mixed-waste facility without processing.

Due to the relatively low levels of activity expected during demolition activities, minimal decontamination of heavy equipment would be required to provide for unconditional release. It is not expected that significant amounts of liquid decontamination waste would be generated. Any waste associated with demolition or decontamination activities would be processed and disposed of with the demolition debris. Processed debris would be containerized in 40 yd^3 intermodal shipping containers and staged awaiting disposal facility approval for shipment. Samples of the debris would be submitted to a qualified laboratory for waste stream certification in accordance with the disposal facility's WAC and license requirements. Based on this certification, dose-to-curie calculations would be performed to determine shipment activity. A broker/shipper subcontracted to perform waste certification and shipping activities could expedite waste disposal activities.

Overall Protection of Human Health and the Environment

Alternative 1 would be protective of human health by eliminating the potential for exposure to contaminated building materials as well as eliminating the physical hazards posed by these structures.

Compliance with ARARs and TBCs

Alternative 1 should comply with all relevant and appropriate ARARs and TBCs including, but not limited to, PADEP, DOT and NRC regulations for waste classification, transportation and disposal of low-level radioactive waste.

Long-Term Effectiveness and Permanence

Alternative 1 is effective and permanent. It would prevent exposure to contaminated media by removal of materials and eliminate the physical hazards posed by these structures. Demolition of the buildings will allow continuation of site investigation and decommissioning activities.

Reduction of Toxicity, Mobility, and Volume through Treatment

Excavated materials identified as radioactive waste will not be treated prior to disposal. Burial would result in a reduction of mobility of contaminants.

Short-term Effectiveness

Removal activities are not expected to have an adverse impact on the community, workers, or the environment. Inhalation, dermal, and ingestion risks during excavation would be controlled through the use of dust suppression techniques, use of personal protective equipment (PPE), and restricted site access. It may be necessary to conduct removal activities at some of the structures located near current site operations (e.g., Well House, Etching Building, Lacquer Storage Building) during weekend or other non-working hours for SLC and USR Metals personnel. Truck routes for the transportation of the excavated material could be arranged to minimize any impact or potential impact on residential areas.

It is estimated that demolition and packaging of the materials for transport would take approximately 15 days to complete after preparation of work plans and specifications. Final shipping and disposal may not be completed in that timeframe.

Implementability

Alternative 1 is implementable and reliable. Demolition, transportation and disposal services for radioactive materials are available, although disposal sites are limited. Site workers would require radiation worker training prior to performing any demolition activities.

Cost

Estimated costs for this alternative are as follows:

- Estimated capital costs $3,000,766
- Estimated annual operation and maintenance costs $0
- Estimated costs for five-year reviews $0
- Estimated 30-year net present worth $3,000,766

Appendix B presents a detailed cost estimate for this alternative.

4.2.2 Alternative 2: Demolition of the seven structures, segregation of the materials into radioactive waste and demolition waste, and transportation and disposal at appropriate facility.

Demolition of the seven structures would be completed using mechanical equipment (excavators, loaders, etc.) with dust suppression. In order to implement this option, demolition debris would require gross radiological screening to determine activity levels. This screening process would be performed using standard field instrumentation (i.e., α and β-γ detectors) and smears to identify materials contaminated with the easily detected isotopes. By identifying and segregating these materials, additional characterization screening for the hard to detect isotopes would not be required. These materials could be size reduced, containerized and sampled for WAC certification.

Typically, contamination levels are determined using portable field equipment. Total contamination levels are measured by performing scanning or static measurements of the suspect material. Removable contamination is measured by performing a smear or swipe of the material surface and evaluating using a laboratory counter such as an α-β scaler. These methods are adequate to determine levels for the easily detected isotopes such as Cs-137 or Ra-226. However, for the hard to detect isotopes (H-3, C-14, Ni-63) there are no portable field instruments capable of detecting total contamination and removable contamination determinations require techniques that are not suitable to field applications (liquid scintillation counting of smears). For these isotopes, material and smear samples would require analysis at an offsite facility.

Materials that are screened negative for the easily detected isotopes would be segregated as suspect and sampled for offsite analysis. A primary concern during this step is the number of samples that would be required to provide certainty that the materials are not radiologically contaminated.

Materials that have radioactivity above release criteria would be disposed at an NRC-licensed facility. Materials that may be released due to levels below regulatory criteria, would be disposed in a demolition waste landfill. Minimal decontamination of heavy equipment would be required. Demolition and decontamination wastes would be disposed of in the same fashion.

Overall Protection of Human Health and the Environment

Alternative 2 would be protective of human health by eliminating the potential for exposure to contaminated building materials as well as eliminating the physical hazards posed by these structures.

Compliance with ARARs and TBCs

Alternative 2 should comply with all relevant and appropriate requirements and TBCs including, but not limited to, PADEP, DOT and NRC regulations for waste classification, transportation and disposal of low-level radioactive waste.

Long-Term Effectiveness and Permanence

Alternative 2 is effective and permanent. It would prevent exposure to contaminated media by removal of materials and eliminate the physical hazards posed by these structures. Demolition of the buildings will allow continuation of site investigation and decommissioning activities.

Reduction of Toxicity, Mobility, and Volume through Treatment

Excavated materials identified as radioactive waste will not be treated prior to disposal. Burial would result in a reduction of mobility of contaminants.

Short-term Effectiveness

Removal activities are not expected to have an adverse impact on the community, workers, or the environment. Inhalation, dermal, and ingestion risks during excavation would be controlled through the use of dust suppression techniques, use of personal protective equipment (PPE), and restricted site access. It may be necessary to conduct removal activities at some of the structures located near current site operations (e.g., Well House, Etching Building, Lacquer Storage Building) during weekend or other non-working hours for SLC and USR Metals personnel. Truck routes for the transportation of the excavated material could be arranged to minimize any impact or potential impact on residential areas.

It is estimated that demolition and packaging of the materials for transport would take approximately 15 days to complete after preparation of work plans and specifications. Final shipping and disposal may not be completed in that timeframe.

Implementability

Alternative 2 is implementable and reliable. Demolition, transportation and disposal services for both radioactive materials and demolition waste are available, although radioactive waste disposal sites are limited. A primary concern during this step is the number of samples that would be required to provide certainty that the materials are not radiologically contaminated. Although 100 percent screening is typically required for unconditional release of materials, it is possible that a negotiated statistical sample number could be obtained through discussion with regulatory agencies. Site workers would require radiation worker training prior to performing any demolition activities.

Cost

Estimated costs for this alternative are as follows:

- Estimated capital costs $2,495,884
- Estimated annual operation and maintenance costs $0
- Estimated costs for five-year reviews $0
- Estimated 30-year net present worth $2,495,884

Appendix B presents a detailed cost estimate for this alternative.

5.0 COMPARATIVE ANALYSIS OF ALTERNATIVES

This section provides a review of the alternatives and presents a comparative analysis of the alternatives relative to the specific evaluation criteria. This section provides for a comparison to identify the advantages and disadvantages of each alternative relative to one another. Table 5-1 presents summaries of the evaluation for each alternative.

5.1 OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT

Both alternatives provide the same level of protection of human health and the environment. In each case, unsafe structures would be razed, and the debris disposed at an approved facility depending on the waste characteristics of the debris.

5.2 COMPLIANCE WITH ARARs

Alternatives 1 and 2 can be implemented to comply with all ARARs and TBCs.

5.3 LONG-TERM EFFECTIVENESS AND PERMANANCE

Both Alternative 1 and Alternative 2 are effective and permanent. They would prevent exposure to contaminated media by removal of materials and eliminate the physical hazards posed by these structures. Demolition of the buildings will allow continuation of site investigation and decommissioning activities.

5.4 REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT

Neither of the alternatives contain treatment components as a part of the alternative. The nature of the site, the waste materials, and the land use are not conducive to the selection of a treatment-only alternative.

TABLE 5-1
COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES
SAFETY LIGHT CORPORATION (OU-1)
BLOOMSBURG, COLUMBIA COUNTY, PENNSYLVANIA

CRITERION	ALTERNATIVE 1: DEMOLITON AND DISPOSAL AS RADIOACTIVE WASTE	ALTERNATIVE 2: DEMOLTION, SEGREGATION AND DISPOSAL AS RADIOACTIVE AND DEMOLITION WASTES
OVERALL PROTECTION OF HUMAN HEALTH AND THE ENVIRONMENT		
Prevent Human Exposure to Contaminated Subsurface and Surface Soils.	Eliminates potential exposure by demolition and offsite disposal of contaminated media.	Eliminates potential exposure by demolition and offsite disposal of contaminated media.
COMPLIANCE WITH ARARs		
Compliance with ARARs	Complies with all ARARs and TBCs.	Complies with all ARARs and TBCs.
LONG-TERM EFFECTIVENESS AND PERMANENCE		
Magnitude of Residual Risk	Residual risk from remaining soil under building footprint; but demolition allows investigation of these soils	Residual risk from remaining soil under building footprint; but demolition allows investigation of these soils
Adequacy and Reliability of Controls	All contaminated building material removed from site; no controls needed	All contaminated building material removed from site; no controls needed
Need for 5-Year Review	None needed; all contaminated materials removed.	None needed; all contaminated materials removed.
REDUCTION OF TOXICITY, MOBILITY, AND VOLUME THROUGH TREATMENT		
Reduction of Toxicity, Mobility, or Volume Through Treatment	No treatment	No treatment
SHORT-TERM EFFECTIVENESS		
Community Protection	No significant risk to community anticipated. Engineering controls would be used during implementation to mitigate risks.	No significant risk to community anticipated. Engineering controls would be used during implementation to mitigate risks.
Worker Protection	No risk to workers anticipated if proper PPE/dust suppression used during demolition.	No risk to workers anticipated if proper PPE/dust suppression used during demolition.
Environmental Impacts	No adverse impacts to the environment anticipated.	No adverse impacts to the environment anticipated.
Time Until Action is Complete	Less than 1 month.	Less than 1 month.
IMPLEMENTABILITY		
Ability to Construct and Operate	No difficulties anticipated. Demolition/disposal is a readily implementable technology.	No difficulties anticipated. Demolition/disposal is a readily implementable technology. Segregation of wastes could be more difficult to implement.
Ease of Doing More Action if Needed	No anticipated additional action required other than continued investigation for RI/FS.	No anticipated additional action required other than continued investigation for RI/FS.
Ability to Monitor Effectiveness	Complete demolition of unsafe buildings and offsite disposal would result in effective implementation.	Complete demolition of unsafe buildings and offsite disposal would result in effective implementation.
Ability to Obtain Approvals and Coordinate with Other Agencies	Coordination with local/state regulators may be required and would be obtainable.	Coordination with local/state regulators may be required and would be obtainable.
Availability of Treatment, Storage Capacities, and Disposal Services	Transportation, and disposal capacity for radioactive-contaminated materials is available; although disposal sites are limited.	Transportation, and disposal capacity for radioactive-contaminated materials is available; although disposal sites are limited.
Availability of Equipment, Specialists, and Materials	Equipment and personnel to perform demolition, safety oversight, and decontamination are available.	Equipment and personnel to perform demolition, safety oversight, and decontamination are available.
Availability of Technology	Common demolition techniques required.	Common demolition techniques required.

TABLE 5-1
COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES
SAFETY LIGHT CORPORATION (OU-1)
BLOOMSBURG, COLUMBIA COUNTY, PENNSYLVANIA

CRITERION	ALTERNATIVE 1: DEMOLITON AND *DISPOSAL AS RADIOACTIVE* WASTE	ALTERNATIVE 2: DEMOLTION, SEGREGATION AND DISPOSAL AS RADIOACTIVE AND DEMOLITION WASTES
COST		
Capital Cost	$3,000,766	$2,495,884
Annual O&M Cost	---	---
Five Year Reviews	---	---
Estimated 30-Years Net Present Worth Cost*	$3,000,766	$2,501,626

* Present worth cost is based on discount rate of 7 percent.

5.5 SHORT-TERM EFFECTIVENESS

Removal activities for either Alternative 1 or Alternative 2 are not expected to have an adverse impact on the community, workers, or the environment. Inhalation, dermal, and ingestion risks during excavation would be controlled through the use of dust suppression techniques, use of personal protective equipment (PPE), and restricted site access. It may be necessary to conduct removal activities at some of the structures located near current site operations (e.g., Well House, Etching Building, Lacquer Storage Building) during weekend or other non-working hours for SLC and USR Metals personnel. Truck routes for the transportation of the excavated material could be arranged to minimize any impact or potential impact on residential areas.

5.6 IMPLEMENTABILITY

Alternatives 1 and 2 are implementable using existing and proven technologies, but these require coordination, planning, and management. The availability of off-site disposal locations for the completion of these alternatives makes the implementation of this alternative more uncertain and complicated. A primary concern for Alternative 2 is the number of samples that would be required to provide certainty that the materials are not radiologically contaminated.

5.7 COST

Alternative 2 is the lowest cost alternative. This alternative requires the lowest initial capital cost to implement. Neither alternative requires annual or long-term O&M components, but both require a significant initial cost to implement. The lower costs are associated with decreased disposal costs assuming 50 percent of the material is not contaminated by radioisotopes. The greater the actual volume of radioactive-contaminated debris, the less cost savings offered by Alternative 2.

6.0 RECOMMENDED REMOVAL ACTION ALTERNATIVE

The recommended alternative for the non-time-critical removal action for the SLC Site is Alternative 1, which includes demolition of the buildings and disposal of all debris as radioactive waste. This alternative complies with ARARs and is protective of human health and the environment. Although Alternative 2 is potentially less costly than Alternative 1 as estimated in this EE/CA, unknown factors such as the levels of radioactive contamination and extent of contamination throughout the inaccessible structures could result in Alternative 2 being more costly than Alternative 1. Alternative 1 eliminates the requirements for extensive characterization of debris for release or disposal as radioactive material (with the exception of large items such as boilers) which would expedite the removal action.

REFERENCES

ICF Consulting, 2001. Review and Evaluation of Characterization Data for SLC.

Tetra Tech NUS, Incorporated, 2005. Site-Wide Remedial Investigation/Feasibility Study Work Plan for Safety Light Corporation.

Tetra Tech NUS, Incorporated, 2006. Field Sampling Plan for Operable Unit 1 (OU-1), Buildings and Debris, Safety Light Corporation Remedial Investigation/Feasibility Study.

United States Environmental Protection Agency, National Oil and Hazardous Substances Pollution Contingency Plan (NCP), 40 C.F.R. Part 300.

United States Environmental Protection Agency, October 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies under CERCLA. OSWER Directive 9355.3-01.

United States Environmental Protection Agency, August 1993. Guidance for Conducting Non-Time Critical Removal Actions under CERCLA. EPA/540/R-93/067, Publication 9360.0-32.

United States Environmental Protection Agency, 1998. Risk Assessment Guidance for Superfund, Volume 1, Human Health Evaluation Manual (Part D). Office of Emergency and Remedial Response, Washington, DC.

APPENDIX A

VOLUME CALCULATIONS

WASTE VOLUME CALCULATIONS
SAFETY LIGHT CORPORATION
BLOOMSBURG, PENNSYLVANIA

BUILDING	sq. ft.	cu. ft. (1)	cu. yd.
Personnel Office Building (aka Nurse's Station)	625	1562.5	58
Etching Building	12500	31250	1157
Old House	625	1562.5	58
Radium Vault	1000	2500	93
Laquer Storage Building	900	2250	83
Well House	400	1000	37
Pipe Shop	1000	2500	93
TOTAL VOLUME	17050	42625	1579

(1) Square footage (taken from site plan) multiplied by 2.5 to calculate volume

Alternative 1 assumes all material will be disposed at NRC-licensed facility
Alternative 2 assumes 50% of the material will be disposed at NRC-licensed facility

APPENDIX B

COSTS

SAFETY LIGHT CORPORATION SITE
BLOOMSBURG, PENNSYLVANIA
FEASIBILITY STUDY
ALTERNATIVE 1: DEMOLITON & RAD DISPOSAL/Limited Segregation
CAPITAL COSTS

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING											
1.1 Prepare Constructions/Specifications	80	hours			$25.00		$0	$0	$2,000	$0	$2,000
2 MOBILIZATION/DEMOBILIZATION AND FIELD SUPPORT											
2.1 Office Trailer	1	mo		$202.50			$0	$203	$0	$0	$203
2.2 Storage Trailer (1)	1	mo		$105.00			$0	$105	$0	$0	$105
2.3 Vehicles	1	mo				$2,500.00	$0	$0	$0	$2,500	$2,500
2.4 Equipment Mobilization/Demobilization	1	ea			$73.50	$175.00	$0	$0	$74	$175	$249
3 DECONTAMINATION											
3.1 Temporary Equipment Decon Pad	1	ls		$2,000.00	$3,325.00	$350.00	$0	$2,000	$3,325	$350	$5,675
3.2 Radiation Decontamination Services	1	mo	$50,000.00			$0.00	$50,000	$0	$0	$0	$50,000
3.3 Pre/Post Decontamination Survey	30	ea		$375.00			$0	$11,250	$0	$0	$11,250
4 BUILDING DEMOLITION											
4.1 Miscellaneous Equipment/Tools	1	mo				$2,000.00	$0	$0	$0	$2,000	$2,000
4.2 Excavator, Crawler Mounted, 1 1/2 cy	1	mo				$12,000.00	$0	$0	$0	$12,000	$12,000
4.3 Front End Loader, 80 HP	1	mo				$6,500.00	$0	$0	$0	$6,500	$6,500
4.4 Well abandonment	1	ls	$3,000.00				$3,000	$0	$0	$0	$3,000
4.5 Radiation/safety Monitoring Instruments & Supplies	1	mo				$10,000.00	$0	$0	$0	$10,000	$10,000
5 DISPOSAL & TRANSPORTATION											
5.1 Waste Acceptance Criteria Certification Testing	2	ea	$5,000.00				$10,000	$0	$0	$0	$10,000
5.2 Segregated Waste Characterization	50	ea	$375.00				$18,750	$0	$0	$0	$18,750
5.3 Transportation (per container)	48	ea	$7,100.00				$340,800	$0	$0	$0	$340,800
5.4 Roll Off Rental	480	days	$10.00				$4,800	$0	$0	$0	$4,800
5.5 Container Liner	48	ea		$35.00			$0	$1,680	$0	$0	$1,680
5.6 Waste Burial	42,625	cu. ft.	$32.00				$1,364,000	$0	$0	$0	$1,364,000
6.0 LABOR											
6.1 Project Manager/CHP	210	hours			$35.00		$0	$0	$7,350	$7,350	$14,700
6.2 Radiation Technicians (3-4)	550	hours			$20.00		$0	$0	$11,000	$11,000	$22,000
6.3 Laborers (5-6)	890	hours			$15.00		$0	$0	$13,350	$13,350	$26,700
6.4 Equipment Operators (2-3)	380	hours			$25.00		$0	$0	$9,500	$9,500	$19,000
7 MISCELLANEOUS											
7.1 Post Construction Documents	40	hr			$25.00		$0	$0	$1,000	$0	$1,000
Subtotal							$1,791,350	$15,238	$47,599	$74,725	$1,928,911
Overhead on Labor Cost @ 30%									$14,280		$14,280
G & A on Labor Cost @ 10%									$4,760		$4,760
G & A on Material Cost @ 10%								$1,524			$1,524
G & A on Subcontract Cost @ 10%							$179,135				$179,135
G & A on Equipment Cost @ 10%										$7,473	$7,473
Total Direct Cost							$1,970,485	$16,761	$66,638	$82,198	$2,136,082
Indirects on Total Direct Cost @ 35% (Total Direct Cost minus Transportation and Disposal Costs)											$150,949
Profit on Total Direct Cost @ 10%											$213,608
Subtotal											$2,500,638
Total Field Cost											$2,500,638
Contingency on Total Field Costs @ 20%											$500,128
TOTAL COST											**$3,000,766**

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SAFETY LIGHT CORPORATION SITE
BLOOMSBURG, PENNSYLVANIA
FEASIBILITY STUDY
ALTERNATIVE 2: DEMOLITON/SEGREGATION/DISPOSAL
CAPITAL COSTS

Item	Quantity	Unit	Unit Cost Subcontract	Unit Cost Material	Unit Cost Labor	Unit Cost Equipment	Extended Cost Subcontract	Extended Cost Material	Extended Cost Labor	Extended Cost Equipment	Subtotal
1 PROJECT PLANNING											
1.1 Prepare Constructions/Specifications	80	hours			$25.00		$0	$0	$2,000	$0	$2,000
2 MOBILIZATION/DEMOBILIZATION AND FIELD SUPPORT											
2.1 Office Trailer	1	mo		$202.50			$0	$203	$0	$0	$203
2.2 Storage Trailer (1)	1	mo		$105.00			$0	$105	$0	$0	$105
2.3 Vehicles	1	mo				$2,500.00	$0	$0	$0	$2,500	$2,500
2.4 Equipment Mobilization/Demobilization	1	ea			$73.50	$175.00	$0	$0	$74	$175	$249
3 DECONTAMINATION											
3.1 Temporary Equipment Decon Pad	1	ls		$2,000.00	$3,325.00	$350.00	$0	$2,000	$3,325	$350	$5,675
3.2 Radiation Decontamination Services	1	mo	$50,000.00			$0.00	$50,000	$0	$0	$0	$50,000
3.3 Pre/Post Decontamination Survey	30	ea		$375.00			$0	$11,250	$0	$0	$11,250
4 BUILDING DEMOLITION											
4.1 Miscellaneous Equipment/Tools	1	mo				$2,000.00	$0	$0	$0	$2,000	$2,000
4.2 Excavator, Crawler Mounted, 1 1/2 cy	1	mo				$12,000.00	$0	$0	$0	$12,000	$12,000
4.3 Front End Loader, 80 HP	1	mo				$6,500.00	$0	$0	$0	$6,500	$6,500
4.4 Well abandonment	1	ls	$3,000.00				$3,000	$0	$0	$0	$3,000
4.5 Radiation/safety Monitoring Instruments & Supplies	1	mo				$10,000.00	$0	$0	$0	$10,000	$10,000
5 DISPOSAL & TRANSPORTATION											
5.1 Waste Acceptance Criteria Certification Testing	2	ea	$5,000.00				$10,000	$0	$0	$0	$10,000
5.2 Segregated Waste Characterization	1,050	ea	$375.00				$393,750	$0	$0	$0	$393,750
5.3 Transportation/Rad Waste (per container)	29	ea	$7,100.00				$205,900	$0	$0	$0	$205,900
5.4 Roll Off Rental	480	days	$10.00				$4,800	$0	$0	$0	$4,800
5.5 Container Liner	48	ea		$35.00			$0	$1,680	$0	$0	$1,680
5.6 Waste Burial (Rad)	21,313	cu. ft.	$32.00				$682,016	$0	$0	$0	$682,016
5.7 Demolition Waste Transport & Disposal	790	cu yd	$17.00				$13,430	$0	$0	$0	$13,430
6.0 LABOR											
6.1 Project Manager/CHP	170	hours			$35.00		$0	$0	$5,950	$5,950	$11,900
6.2 Radiation Technicians (3)	510	hours			$20.00		$0	$0	$10,200	$10,200	$20,400
6.3 Laborers (5)	850	hours			$15.00		$0	$0	$12,750	$12,750	$25,500
6.4 Equipment Operators (2)	340	hours			$25.00		$0	$0	$8,500	$8,500	$17,000
7 MISCELLANEOUS											
7.1 Post Construction Documents	40	hr			$25.00		$0	$0	$1,000	$0	$1,000
Subtotal							$1,362,896	$15,238	$43,799	$70,925	$1,492,857
Overhead on Labor Cost @ 30%									$13,140		$13,140
G & A on Labor Cost @ 10%									$4,380		$4,380
G & A on Material Cost @ 10%								$1,524			$1,524
G & A on Subcontract Cost @ 10%							$136,290				$136,290
G & A on Equipment Cost @ 10%										$7,093	$7,093
Total Direct Cost							$1,499,186	$16,761	$61,318	$78,018	$1,655,282
Indirects on Total Direct Cost @ 35%			(Total Direct Cost minus Transportation and Disposal Costs)								$263,878
Profit on Total Direct Cost @ 10%											$165,528
Subtotal											$2,084,688
Total Field Cost											$2,084,688
Contingency on Total Field Costs @ 20%											$416,938
TOTAL COST											**$2,501,626**

10/9/2006; 10:07 AM