September 5, 2001

MEMORANDUM TO: Ronald R. Bellamy, Chief
Decommissioning and Laboratory Branch
Division of Nuclear Materials Safety
Region I

FROM: Larry W. Camper, Chief
Decommissioning Branch
Division of Waste Management
Office of Nuclear Material Safety
and Safeguards

SUBJECT: TECHNICAL ASSISTANCE REQUEST 128861/128944 - EVALUATION OF DECOMMISSIONING COST ESTIMATES FOR SAFETY LIGHT CORPORATION'S 37-00030-02 AND 37-00030-08 LICENSES

The purpose of this memorandum is to provide a partial response to Region I's Technical Assistance Request (TAR) 128861/128944 dated April 20, 2000. The TAR requested a review of Safety Light Corporation's (SLC) Decommissioning Cost Estimates (DCEs) for their 37-00030-02 and 37-00030-08 licenses. In addition, the TAR also requested an evaluation of SLC's Derived Concentration Guideline Levels (DCGLs). This memorandum transmits the results of the review of SLC's DCEs. As discussed with Marie Miller, of your staff, on August 28, 2001, the evaluation of SLC's DCGLs will be completed in approximately two weeks, and the results will be submitted to Region I at that time.

ICF Consulting (ICF) was contracted by the Office of Nuclear Material Safety and Safeguards (NMSS) to evaluate Safety Light's October 26, 2000, and December 6, 2000, DCE submittals. On August 17, 2001, ICF submitted their evaluation of SLC's DCEs to NMSS (Attachments 1 and 2). For both licenses, ICF reviewed SLC's assumptions, evaluated the costs estimated for the decommissioning tasks identified in the DCEs, and identified decommissioning tasks that were not included in the DCEs. ICF's findings include: 1) several assumptions may not be reasonable (e.g., SLC assumes the availability of a local labor force); 2) significant components of the cost were not addressed in the DCEs (e.g., despite data indicative of subsurface contamination to a depth of 5.49 meters, 1.87 meters is the greatest depth assumed to require remediation); and, 3) significant remediation tasks were omitted from the DCEs (e.g., despite monitoring data indicating radiologic, organic, and inorganic contamination of the groundwater, the DCE does not include any cost for groundwater remediation).

As you are aware, ICF is still evaluating the SLC site. Specifically, ICF is in the process of developing a restricted release cost estimate and a revised unrestricted release cost estimate. Accordingly, I anticipate a continuing dialogue between NMSS and Region I regarding the underlying issue of the TAR (i.e., decommissioning costs for the SLC site). Please feel free to

CONTACT: Eric Pogue, DWM/NMSS
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Enclosure (3)

contact my staff if you have any questions regarding this memorandum or the future evaluations planned for the SLC site.

Attachments:
1. Review of Safety Light Corporation Decommissioning Cost Estimate, Bloomsburg, Pennsylvania (37-00030-02)
2. Review of Safety Light Corporation Decommissioning Cost Estimate, Bloomsburg, Pennsylvania (37-00030-02)

cc: (w/out attachments) Donald Cool, INMS

ICF
CONSULTING

August 17, 2001

To: Eric Pogue, U.S. Nuclear Regulatory Commission

From: Jen Mayer, Ivy Porpotage, Craig Dean, John Collier, and Howard Finkel, ICF Consulting

Subject: Review of Safety Light Corporation Decommissioning Cost Estimate, Bloomsburg, Pennsylvania

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Safety Light Corporation (SLC) submitted a decommissioning funding plan (DFP) for a portion of its facility in Bloomsburg, Pennsylvania, which is covered by 10 CFR Part 40 license 37-00030-02.[1] The DFP includes a decommissioning cost estimate (DCE) for unrestricted release in the amount of $23,508,275. ICF's review of this cost estimate is presented below, and is divided into three sections. Section 1 reviews the overlying assumptions listed in the beginning text of the licensee's DCE. Section 2 evaluates the costs estimated for the decommissioning tasks that are identified in the DCE. Section 3 identifies decommissioning tasks that are not covered by the DCE.

## 1.0 REVIEW OF OVERLYING ASSUMPTIONS

Page 1-2 of the DCE lists eight assumptions used to develop the cost estimate. While most of these assumptions seem generally reasonable, five of the assumptions may not in fact provide a reasonable basis for the DCE. These assumptions are discussed below.

### 1.1 Buildings

The DCE assumes that the Main Office Building, most of the Etching Building, and the USR Metals liquid waste building will remain in place after decommissioning. Given the number of rooms that were not characterized due to the structural condition, it seems inappropriate to assume that most of the Etching Building will remain in place. Moreover, the documented contamination of groundwater and subsurface soil may require excavation of subsurface soils. If such excavation is necessary it will not be feasible for the buildings to remain in place after decommissioning.

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[1] ICF has reviewed the decommissioning cost estimate for the remaining portions of the facility covered by license 37-00030-08 and has presented its findings under separate cover.

## 1.2 Equipment

The DCE assumes a no-cost scenario for disposition of uncontaminated equipment and an at-cost disposal scenario for disposition of contaminated equipment. However, the DCE does not include a list identifying which equipment is assumed to be uncontaminated along with the basis for its inclusion. Furthermore, the DCE does not include a complete inventory of equipment for each building. Consequently, it is not possible to evaluate whether the costs of equipment disposal are reasonable. In addition, the DCE provides no guidance or criteria for determining which disposition scenario will be selected for contaminated equipment.

Page 4-6 of the DCE states that "analysis revealed no benefit to incorporating volume reduction processes in the cost estimate." This statement seems to conflict with earlier discussions stating that contaminated equipment would be decontaminated on-site, processed at a volume reduction facility prior to disposal, or sent directly to a licensed radioactive material disposal site.

While it may be conservative to exclude volume reduction costs in the DCE, the analysis described above may be inaccurate because the rate provided may not apply to contaminated soil that requires disposal. The unit cost rate of $62.10 for waste disposal provided in Table 4-8 is given as the dry activated waste (DAW) rate.

## 1.3 Disposal Site

The DCE notes that radioactive waste not suitable for disposal at Envirocare of Utah can be sent to the Barnwell, South Carolina disposal site, but then states that all waste does qualify for disposal at Envirocare under the current license and waste acceptance criteria. The basis for this statement is unclear, given the incomplete characterization of the site (particularly with respect to mixed waste and subsurface soil contamination) and the difficulty the site is having with disposal of the silo remediation wastes. The DCE includes costs for shipping one cask of waste to Barnwell, which further suggests that not all the waste would qualify for Envirocare.

## 1.4 Labor

The DCE assumes that local decontamination technicians and supervisors will be used to staff this project. It is unclear whether a sufficient number of local qualified personnel will be available at the time of decommissioning. If local personnel are not available, additional funding may be required to cover lodging and meals.

## 1.5 Disposal Costs

The DCE assumes a radioactive waste disposal rate based on shipping to Envirocare of Utah and negotiating a "favorable rate" with Envirocare based on a large waste volume and low levels of activity. It is unclear why the licensee would be able to obtain a "favorable rate" from

Envirocare. The disposal unit cost of $62.10/ft$^3$ provided in the DCE appears to be in the low end of the range for disposal costs. The unit cost used in calculating the total waste disposal cost in the DCE appears to be closer to $77/ft$^3$. However, this unit cost is still on the low end of the range for disposal of other wastes. An independent assessment of disposal costs by ICF revealed a range of $50 - $675/ft$^3$ for soil and $75 - $315/ft$^3$ for other wastes at Envirocare and Barnwell. Because the most significant portion of the overall decommissioning cost is disposal costs, small changes in the unit cost for disposal could cause significant increases in the overall cost estimate. For example, a 10 percent increase in the unit disposal cost would increase the total waste disposal cost by approximately $1.3 million.

## 2.0 COST ESTIMATE EVALUATION

The DCE for license 37-00030-02 encompasses the following buildings and areas :

(1) Etching Building
(2) Ion Exchange Building
(3) Old Garage Foundation
(4) 8' x 8' Building
(5) Old Radium Vault
(6) Above Ground Silo
(7) Main Building
(8) Personnel Office Building
(9) Lacquer Storage Building
(10) Multi-Metals Waste Treatment Plant
(11) Well House
(12) Pipe Shop
(13) Old House
(14) Sr-90 Source Vault
(15) Drain Lines
(16) Employee Parking Area/Sidewalk Areas/Site Paved Roads
(17) Soils and Other Land Inside Fenced Area

Several significant components of decommissioning costs were not addressed by the DCE, however. Specifically, the DCE does not account for the costs of restoration, site stabilization, and long-term surveillance of the facility, if necessary. Also, the DCE does not describe a mechanism for adjusting the cost estimates and associated funding levels over the life of the facility.

Review of the DCE also revealed a number of minor gaps and/or discrepancies. However, the potential impact of these gaps on the overall cost is considered insignificant and, consequently, these issues are not documented in this review. The major gaps or issues for each building are described in Sections 2.1 through 2.17 of this memorandum, however, several general concerns apply to the estimated costs for all or most of these buildings:

- First, in most cases, the derivation of labor hour estimates or cost estimates provided in Table 4-1 is unclear, and we have been unable to reproduce them. For example, according to Table 4-1, which lists the overall costs of decommissioning, it will take 2,849 labor hours to decommission the specified rooms of the Etching Building. No detail is provided explaining the breakdown of labor hours by labor category or how many hours are needed for each specific task involved. Furthermore, decommissioning tasks for many facility buildings are lumped together under the heading "Remaining Site Buildings and Structures." Thus, in many cases it is impossible to evaluate the appropriateness of the estimated cost without creating an independent cost estimate (which we will undertake in Subtask 3 of this task order).

- Second, the decommissioning activities addressed under license 37-00030-02 have been divided into two phases according to the October 2000 decommissioning plan (DP). The first eight buildings and areas listed above will be addressed before the remaining site buildings and structures. The DP states, "Before this phase [remaining site buildings and structures] of decommissioning begins, Safety Light will determine the desired disposition of the remaining building contents (recycle/reuse or dispose)." It is unclear what assumptions were made about these contents to account for the costs of disposal in the DCE.

- A total waste volume is provided for the "Remaining Site Buildings and Structures." Waste volumes are not broken out for each of the buildings to be addressed during the second phase of decommissioning. Disposal and shipping costs have been included for this waste volume, however it is unclear what this waste volume includes. Consequently, it is difficult to estimate the contribution of each building to the total volume provided. Furthermore, the total waste volumes provided in the appendices of the DCE do not seem to correspond with those provided in Table 4-5 of the text.

- A "process cost" is provided for decontamination activities, but it is unclear whether this cost includes labor. The quantity of decontamination waste to be generated was included in the total volume for waste disposal. Due to an insufficient level of detail, however, it is difficult to ascertain whether the DCE covers appropriate levels of equipment removal and decontamination, such as for hot spots, drains, ducting, and fans.

- The cost estimate has not considered disposal costs for mixed wastes. Process knowledge combined with characterization data make the generation of mixed wastes a realistic scenario.

- The waste disposal cost used in the cost estimate calculations appears to be higher than the stated unit cost of $62.10 /ft$^3$ listed in three different places in the DCE (in Section 4.3, Table 4-8, and Appendix A-3).

The following seventeen subsections discuss the characterization data available for each building, describe the proposed decommissioning tasks, list the costs included in the DCE, and identify any inconsistencies between the proposed tasks and the included costs.

## 2.1 Etching Building

The Monserco Survey did not evaluate a number of rooms due to poor structural condition and safety concerns. Specifically, rooms 5, 6, 8, 11, 13, 21-33, 45, and 61 were not surveyed. The remaining numbered rooms through 84 were surveyed, as well as Attics 1-3 and the Attic Ramp. Loose contamination greater than 1,000 dpm/cm$^2$ was found in one or more grids for eight rooms. Fixed contamination greater than 5,000 dpm/cm$^2$ was found in one or more grids for eleven rooms. Hot spot contamination greater than 15,000 dpm/cm$^2$ was found in one or more grids for nineteen rooms. Analysis of a solid sample collected from the North Wall of Room 55 had 30 pCi/g Bi-214.

The decommissioning activities for this building have been divided into two phases according to the DP. Specified rooms for the Etching Building that are in poor structural condition are to be addressed during the first phase of this effort. For this phase, Section 5 of the DCE proposes to:

- remove equipment;
- scabble contaminated floor surfaces;
- decontaminate wall surfaces by surface cleaning or surface removal methods; and
- demolish these rooms and the contents.

The appendices of the DCE, which provide the detailed costs, include:

- disposal and shipping of 18,597 ft$^3$ waste;
- equipment removal;
- scabbling one-quarter inch from the floor and one-eighth inch from 10 percent of the walls;
- building demolition;
- slab demolition; and
- soil removal (no depth specified).

For the second phase of decommissioning activities for this building, Section 5 of the DCE proposes to:

- use temporary containment tents and ventilation systems to minimize the potential for airborne dust and radiological contaminants to affect occupied areas of the building;
- remove equipment;
- scabble contaminated concrete floors; and
- decontaminate wall surfaces by surface cleaning or surface removal methods.

The appendices of the DCE, which provide the detailed costs, include:

- limited scabbling of one-quarter inch from the floor and one-eighth inch from the walls; and
- labor for equipment removal, demolition activities, building survey, and waste disposal and shipment.

The decommissioning tasks proposed in Section 5.2 of the DCE are inconsistent with the costs provided in the appendices of the DCE. Specifically, costs for temporary containment tents and ventilation systems planned for use during decontamination do not appear to be included in the cost estimate.

Eighteen rooms in this building have not been surveyed and should not be assumed to be uncontaminated. Furthermore, given the loose, fixed, and hot spot contamination found in many rooms, the decontamination planned may be incomplete. Specifically, scabbling is not planned at all for rooms 14, 49, 63, 73, 75, and Attics 1-3, all of which have loose, fixed, or hot spot contamination. Scabbling is also not planned for either the floor or walls of rooms 2, 7, 17A, 20, 56, 65, 81, and 84, all of which have loose, fixed, or hot spot contamination. Decontamination costs for other surface cleaning methods in these rooms do not appear to be included in the cost estimate.

Given the Ra-226, Bi-214, Pb-214, and beta contamination in grids adjacent to this building and the number of rooms with loose, fixed, or hot spot contamination, it is likely that contaminants have seeped below the foundation of the building into the soil. Additional soil sampling, building demolition, foundation removal, and soil removal may be necessary. Given the large number of rooms and size of this building, additional sampling, demolition, and removal activities will increase the overall cost estimate considerably. The additional waste materials generated by such activities will also have a significant impact on cost.

## 2.2 Ion Exchange Building

The Monserco Survey found loose H-3 contamination greater than 1,000 dpm/cm$^2$ in three grids. Loose beta contamination greater than 1,000 dpm/cm$^2$ was found in one grid and on the chimney. Fixed contamination greater than 5,000 dpm/cm$^2$ was found in all nine grids. Hot spot contamination greater than 15,000 dpm/cm$^2$ was also found in all nine grids with multiple hot spots in some grids.

Section 5 of the DCE proposes to:

- demolish the building and contents;
- survey the surface and subsurface soils; and
- excavate soils in excess of the DCGL.

The appendices of the DCE, which provide the detailed costs, include:

- disposal and shipping of 242 $ft^3$ waste;
- equipment removal;
- scabbling one-quarter inch from the floor and one-eighth inch from 100 percent of the walls;
- building demolition;
- slab demolition;
- soil removal (6 inches deep); and
- labor for equipment removal, demolition activities, soil removal, building and soil survey, and waste disposal and shipment.

Given the fixed contamination and hot spots found in all grids, it is uncertain whether scabbling of one-quarter inch from the floor and one-eighth inch from the walls is adequate. Additional scabbling may be necessary to meet waste acceptance criteria. Furthermore, given the Cs-137, Bi-214, Pb-214, and beta contamination in grids near this building, soil contamination is likely to exist below the top six inches of soil below the building foundation. Consequently, additional soil removal may be necessary. Additional soil removal and decontamination will increase the overall cost estimate.

## 2.3 Old Garage Foundation

The Monserco Survey found fixed contamination greater than 5,000 dpm/$cm^2$ in all six grids. Hot spot contamination greater than 15,000 dpm/$cm^2$ was also found in all six grids with multiple hot spots in some grids.

Section 5 of the DCE proposes to:

- decontaminate the garage foundation by scabbling or complete removal;
- survey the surface and subsurface soils; and
- excavate soils in excess of the DCGL.

The appendices of the DCE, which provide the detailed costs, include:

- disposal and shipping of 1038 $ft^3$ waste;
- scabbling one-eighth inch from the foundation;
- foundation removal;
- soil removal (6 inches deep); and
- labor for foundation removal, soil survey, and waste disposal and shipment.

Given the Cs-137 and beta contamination in grids near the Old Garage Foundation, soil contamination is likely to exist below the top six inches of soil below the foundation. Consequently, additional soil removal may be necessary. Furthermore, given the fixed

contamination and hot spots found in all grids, it is uncertain whether scabbling of one-eighth inch from the foundation is adequate. Additional scabbling may be necessary to meet waste acceptance criteria. Additional soil removal and decontamination will increase the overall cost estimate.

## 2.4 8' x 8' Building

The Monserco Survey found fixed contamination greater than 5,000 dpm/cm$^2$ in two grids and on five pieces of equipment and fixtures. Fixed contamination on a wall light switch and outside lock hasp were 3,348,880 dpm/cm$^2$ and 3,400,204 dpm/cm$^2$ respectively. Hot spot contamination greater than 15,000 dpm/cm$^2$ was found in seven grids. One grid had a hot spot with contamination of 14,644,146 dpm/cm$^2$.

Section 5 of the DCE proposes to:

- remove the building contents;
- decontaminate the foundation by scabbling or completely removal if necessary;
- demolish the building;
- survey the surface and subsurface soils; and
- excavate soils in excess of the DCGL.

The appendices of the DCE, which provide the detailed costs, include:

- disposal and shipping of 426 ft$^3$ waste;
- equipment removal;
- scabbling one-quarter inch from 50 percent of the floor and one-eighth inch from 25 percent of the walls;
- building demolition;
- foundation slab demolition;
- soil removal (6 inches deep);
- labor for equipment removal, demolition activities, building and soil survey, and waste disposal and shipment.

Given the Cs-137 and beta contamination in grids near this building, soil contamination is likely to exist below the top six inches of soil below the building foundation. Consequently, additional soil removal may be necessary. Furthermore, given the fixed contamination and hot spots found in all grids, it is uncertain whether scabbling of one-quarter inch from 50 percent of the floor and one-eighth inch from 25 percent of the walls is adequate. Additional scabbling may be necessary to meet waste acceptance criteria. Additional soil removal and decontamination will increase the overall cost estimate.

## 2.5 Old Radium Vault

The Monserco Survey did not identify any contamination above NRC guideline levels, although the poor structural condition of the building prevented surveys inside the building. Solid samples collected from the roof, shelf top, and building top were contaminated with Cs-137, Bi-214, Pb-214, Ra-226, and beta.

Section 5 of the DCE proposes to:

- decontaminate the foundation by scabbling or complete removal if necessary;
- demolish the building and contents;
- survey the surface and subsurface soils; and
- excavate soils in excess of the DCGL.

The appendices of the DCE, which provide the detailed costs, include:

- disposal and shipping of 1843 $ft^3$ waste;
- equipment removal;
- building demolition;
- foundation slab demolition;
- soil removal (6" deep); and
- labor for equipment removal, soil removal, demolition activities, building and soil survey, and waste disposal and shipment.

The decommissioning tasks proposed in Section 5.2 of the DCE are inconsistent with the costs provided in the appendices of the DCE. Specifically, the discussion in the text describes scabbling of the foundation, yet no decontamination costs have been included in the DCE for this building.

Given the Cs-137, Ra-226, Bi-214, Pb-214 and beta contamination in grids near this building, soil contamination is likely to exist below the top six inches of soil below the building foundation. Consequently, additional soil removal may be necessary. Additional soil removal will increase the overall cost estimate.

## 2.6 Above Ground Silo

The Monserco Survey found loose H-3 contamination greater than 1,000 dpm/$cm^2$ in sixteen grids. Fixed contamination greater than 5,000 dpm/$cm^2$ was found in five grids. Cs-137 and beta contamination were found in a sand sample collected in the vicinity of the silo.

Section 5 of the DCE proposes to:

- remove silo contents;
- decontaminate the foundation by scabbling or complete removal if necessary;
- demolish the building;
- survey the surface and subsurface soils; and
- excavate soils in excess of the DCGL.

The appendices of the DCE, which provide the detailed costs, include:

- disposal and shipping of 639 $ft^3$ waste;
- equipment removal;
- building demolition;
- scabbling one-quarter inch from the floor;
- foundation slab demolition;
- soil removal (6 inches deep); and
- labor for equipment removal, demolition activities, soil removal, building and soil survey, and waste disposal and shipment.

Given the Cs-137 and Bi-214 contamination in grids near this building, soil contamination is likely to exist below the top six inches of soil below the foundation. Consequently, additional soil removal may be necessary. Furthermore, given the fixed contamination found in five grids, it is uncertain whether scabbling of one-quarter inch from the foundation is adequate. Additional scabbling may be necessary to meet waste acceptance criteria. The silo reportedly contains H-3 contaminated equipment and scintillation fluids. A higher disposal cost may be applicable to these contents and would increase the overall cost estimate. Additional soil removal and decontamination will increase the overall cost estimate.

## 2.7 Main Building

The Monserco Survey found loose contamination greater than 1,000 dpm/$cm^2$ in one or more grids for thirteen rooms. Fixed contamination greater than 5,000 dpm/$cm^2$ was found in one or more grids for eighteen rooms. Hot spot contamination greater than 15,000 dpm/$cm^2$ was found in one or more grids for forty-two rooms. Ra-226, Bi-214, and Pb-214 contamination was found in a solid sample collected beneath the Office. Bi-214, Pb-214, and beta contamination was found in a solid sample collected from the floor space in Room 98.

Section 5 of the DCE proposes to:

- use temporary containment tents and ventilation systems to minimize the potential for airborne dust and radiological contaminants to affect occupied areas of the building;
- equipment removal;

- scabble of contaminated concrete floor surfaces; and
- decontamination of wall surfaces by surface cleaning or surface removal methods.

The appendices of the DCE, which provide the detailed costs, include:

- removal of contaminated duct work from the second floor;
- equipment removal from production rooms;
- scabbling walls and floors of specified rooms; and
- labor for building survey, equipment removal, and waste disposal and shipment.

The decommissioning tasks proposed in Section 5.2 of the DCE are inconsistent with the costs provided in the appendices of the DCE. Specifically, costs for temporary containment tents and ventilation systems planned for use during decontamination do not appear to be included in the cost estimate.

Given the loose, fixed, and hot spot contamination found in many rooms, the decontamination planned may be incomplete. Specifically, scabbling is not planned at all for rooms 105, 125S, 136, 201, 217, 302, and B3, all of which have loose, fixed, or hot spot contamination. Scabbling is also not planned for either the floors or walls of rooms 85, 92, 103, 113A, 113B, 127, 135, 202, 205, 211, 214, 215, 216, 301, and 301A, all of which have loose, fixed, or hot spot contamination. Decontamination costs for other surface cleaning methods do not appear to be included in the cost estimate. Additional scabbling or surface cleaning may be necessary to meet waste acceptance criteria.

Given the large number of rooms with hot spot contamination and the contaminated solid samples collected from the floor in this building, it is likely that contaminants have seeped below the foundation of the building into the soil. Furthermore, Cs-137, Ra-226, Bi-214, Pb-214, and beta contamination was found in grids adjacent to this building. Consequently, additional soil sampling, building demolition, foundation removal, and soil removal may be necessary. Given the large number of rooms and size of this building, additional sampling, demolition, and removal activities will increase the overall cost estimate considerably. The additional waste materials generated by such activities will also have a significant impact on cost.

## 2.8 Personnel Office Building

The Monserco Survey revealed loose beta contamination greater than 1,000 dpm/cm$^2$ in only one grid. Fixed contamination greater than 5,000 dpm/cm$^2$ was found on top of the well in the basement. Actual fixed contamination at this location was 20,272,016 dpm/cm$^2$.

Section 5 of the DCE proposes to:

- remove building contents;
- demolish the building;

- characterize the dry well and excavate as needed;
- survey the surface and subsurface soils; and
- excavate soils in excess of the DCGL.

The appendices of the DCE, which provide the detailed costs, include:

- equipment removal;
- building demolition;
- dry well excavation (10 feet deep);
- scabbling one-quarter inch from the floor; and
- labor for building survey, building demolition, equipment removal, dry well excavation, and waste disposal and shipment.

The decommissioning tasks proposed in Section 5.2 of the DCE are inconsistent with the costs provided in the appendices of the DCE. Specifically, no labor costs have been included for dry well characterization and for soil removal.

Given the hot spot contamination found in only one grid, the limited decontamination activities planned are probably sufficient. However, the DCE does not include the costs of soil removal for this building other than dry well excavation. Soil sampling was not conducted in grids adjacent to this building. Soil samples adjacent to these grids are contaminated with Bi-214 and Pb-214. In addition, records indicate that the dry well may have been used for disposal of material surplus. Consequently, soil contamination is likely to exist below the top six inches of soil and additional soil removal may be necessary. Additional soil removal will increase the overall cost estimate.

## 2.9 Lacquer Storage Building

The Monserco Survey found hot spot contamination greater than 15,000 dpm/cm$^2$ in one grid.

Section 5 of the DCE proposes to:

- demolish the building following a release survey;
- survey the surface and subsurface soils; and
- excavate soils in excess of the DCGL.

The appendices of the DCE, which provide the detailed costs, include:

- equipment removal;
- building demolition;
- slab demolition;

- soil removal (6 inches deep); and
- labor for equipment removal, demolition activities, soil removal, building and soil survey, and waste disposal and shipment.

Given the hot spot contamination found in one grid, a limited amount of decontamination is necessary. Scabbling or surface cleaning may be necessary to meet waste acceptance criteria.

Given the Cs-137, Ra-226, Bi-214, Pb-214, and beta contamination in grids near this building, soil contamination is likely to exist below the top six inches of soil below the building foundation. Consequently, additional soil removal may be necessary. Additional soil removal and decontamination will increase the overall cost estimate.

## 2.10 Multi-Metals Waste Treatment Plant

According to the DCE, the main portion of this building, including the Boiler Room, the Waste Room, and the Compressor Room, were not used for operations involving radioactive materials. However, the Monserco Survey identified fixed contamination greater than 5,000 dpm/cm$^2$ in one grid of the Boiler Room. Hot spot contamination greater than 15,000 dpm/cm$^2$ was found in two grids of the Boiler Room and five grids of the Compressor Room. The actual values of the hot spots in the Boiler Room were 268,424 dpm/cm$^2$ and 865,063 dpm/cm$^2$.

The Carpenter Shop in the rear of the building was used for operations involving radioactive materials. The Monserco Survey found fixed contamination greater than 5,000 dpm/cm$^2$ in five grids. Hot spot contamination greater than 15,000 dpm/cm$^2$ was found in eight grids. The actual values of fixed and hot spot contamination in grid 10 were 267,141 dpm/cm$^2$ and 11,904,820 dpm/cm$^2$ respectively. Loose alpha, beta, and H-3 contamination greater than 1,000 dpm/cm$^2$, fixed contamination greater than 5,000 dpm/cm$^2$, and hot spot contamination greater than 15,000 dpm/cm$^2$ were all found during additional survey of grid 10. Fixed contamination greater than 5,000 dpm/cm$^2$ was also found on a light fixture and a vacuum cleaner within grid 10. Ra-226, Bi-214, and Pb-214 contamination was found in a concrete sample collected from the HS East Wall.

Section 5 of the DCE proposes to:

- remove equipment;
- decontaminate the Carpenter Shop by scabbling or surface cleaning;
- scabble contaminated concrete floor surfaces of the remaining building; and
- decontaminate wall surfaces by surface cleaning or surface removal methods.

The appendices of the DCE, which provide the detailed costs, include:

- scabbling one-quarter inch from the floor and one-eighth inch from the walls; and
- labor for building survey and for waste disposal and shipment.

The decommissioning tasks proposed in Section 5.2 of the DCE are inconsistent with the costs provided in the appendices of the DCE. Specifically, equipment removal costs have not been included. It is unclear whether the DCE covers appropriate levels of equipment. This building includes a large volume of equipment including treatment tanks, control panels, epoxy coated tanks, overflow tanks, compressors, an electrical panel, a generator, pipes, a metal storage cabinet, and twenty 55 gallon drums.

Given the high levels of fixed contamination and hot spots found in the building, it is uncertain whether scabbling of one-quarter inch from the floor and one-eighth inch from the walls is adequate. Additional scabbling may be necessary to meet waste acceptance criteria.

Furthermore, given the Bi-214, Pb-214, and beta contamination in grids near this building and the sumps located in the floor, soil contamination is likely to exist below the top six inches of soil below the building foundation. Consequently, building demolition and soil removal may be necessary. Equipment removal, building demolition activities, soil removal, and decontamination will increase the overall cost estimate. The additional waste materials generated by such activities will also have a significant impact on cost.

## 2.11 Well House

The Monserco Survey found hot spot contamination greater than 15,000 dpm/cm$^2$ in one grid and on a bottom shelf fixture. Surveys for fixed contamination were not conducted for the floor. Ra-226, Bi-214, Pb-214, and beta contamination was found in a solid sample collected from the floor.

Section 5 of the DCE proposes to:

- remove equipment;
- decontaminate the building;
- demolish the building;
- grout the well;
- survey the surface and subsurface soils; and
- excavate soils in excess of the DCGL.

The appendices of the DCE, which provide the detailed costs, include:

- equipment removal;
- building demolition;
- soil removal (6 inches deep); and
- labor for equipment removal, building demolition, building survey, and waste disposal and shipment.

The decommissioning tasks proposed in Section 5.2 of the DCE are inconsistent with the costs provided in the appendices of the DCE. Specifically, there are no costs included for grouting the well or decontaminating the building.

The DCE indicates that the old water supply well is probably contaminated with Ra-226. The known radiological contamination combined with the potential chemical contamination in the soil warrants excavation of the well. Also, given the single hot spot found in the building, decontamination costs for a limited amount of surface cleaning or scabbling is necessary. Furthermore, decontamination of the building floor may be warranted given the contamination in solid samples collected from the floor and the Sr-90 spill that is suspected to have taken place in this building. Additional scabbling may be necessary to meet waste acceptance criteria.

Given the Bi-214 and Pb-214 contamination in grids near this building and, soil contamination is likely to exist below the top six inches of soil below the building foundation. An oil spill is known to have contaminated soil in the vicinity of this building. In addition, an underground acetone storage tank is suspected to be housed under this building and an oil storage tank is in the ground next to the building. Further investigation and tank excavation may be required following building demolition. Additional soil removal, tank excavation, and decontamination will increase the overall cost estimate. The presence of the oil spill and acetone storage tank present the potential for soil contaminated with both radiological constituents and chemical constituents. Disposal costs will be higher for this mixed waste.

## 2.12 Pipe Shop

The Monserco Survey identified loose H-3 contamination greater than 1,000 dpm/cm$^2$ on two pieces of equipment. Fixed contamination greater than 5,000 dpm/cm$^2$ was found on three pieces of equipment or fixtures. Hot spot contamination greater than 15,000 dpm/cm$^2$ was found in one grid. The actual value of this hot spot was 22,967 dpm/cm$^2$.

Section 5 of the DCE proposes to:

- remove the building contents;
- demolish the building;
- survey the surface and subsurface soils; and
- excavate soils in excess of the DCGL.

The appendices of the DCE, which provide the detailed costs, include:

- equipment removal;
- building demolition;
- slab demolition;

- soil removal (6 inches deep); and
- labor for equipment removal, demolition activities, soil removal, building survey, and waste disposal and shipment.

Given the hot spot found in the building, a limited amount of decontamination is necessary. Given the Bi-214 and Pb-214 contamination in grids near this building and the high radon concentrations in this building, soil contamination is likely to exist below the top six inches of soil below the building foundation. Furthermore, the building was constructed over a portion of the old canal that was used for disposal of Ra-226 contaminated ductwork. Additional soil removal may be necessary. Additional soil removal and decontamination will increase the overall cost estimate.

### 2.13 Old House

The Monserco Survey found loose H-3 contamination greater than 1,000 dpm/cm$^2$ in two grids and on two pieces of equipment or fixtures. Fixed contamination greater than 5,000 dpm/cm$^2$ was found in two grids and hot spot contamination greater than 15,000 dpm/cm$^2$ was found in two grids and on five pieces of equipment or fixtures.

Section 5 of the DCE proposes to:

- remove the building contents;
- demolish the building;
- survey the surface and subsurface soils; and
- excavate soils in excess of the DCGL.

The appendices of the DCE, which provide the detailed costs, include:

- equipment removal;
- building demolition;
- soil removal (depth not legible, 2 inches or 2 feet); and
- labor for equipment removal, building demolition, soil removal, building survey, and waste disposal and shipment.

Given the Bi-214 and Pb-214 contamination in grids near this building, soil contamination is likely to exist below the top six inches of soil below the building foundation. Consequently, additional soil removal may be necessary. Because of the wooden structure, decontamination of this building may not be practical. However, given the given the fixed contamination greater than 5,000 dpm/cm$^2$ found in two grids and hot spot contamination greater than 15,000 dpm/cm$^2$ found in two grids, decontamination should be addressed in the discussion. If decontamination is not practical, the cost estimate should reflect the cost for disposal of these contaminated materials. Additional soil removal and decontamination will increase the overall cost estimate.

## 2.14 Sr-90 Source Vault

The Monserco Survey revealed fixed contamination greater than 5,000 dpm/cm$^2$ in seven grids and on boxes in the room. Hot spot contamination greater than 15,000 dpm/cm$^2$ was found in eight grids. The actual value of hot spot contamination in grid 13 was 1,217,430 dpm/cm$^2$.

Section 5 of the DCE proposes to:

- remove the vault contents;
- demolish the building;
- survey the surface and subsurface soils; and
- excavate soils in excess of the DCGL.

The appendices of the DCE, which provide the detailed costs, include:

- equipment removal;
- scabbling one-quarter inch from the floor;
- building demolition;
- soil removal (no depth specified); and
- labor for equipment removal, building demolition, soil removal, building survey, and for waste disposal and shipment.

Given the Cs-137, Bi-214, and beta contamination in grids near this building, soil contamination is likely to exist below the top six inches of soil below the building foundation. Additional soil removal may be necessary. Given the number of grids with fixed or hot spot contamination, it is uncertain whether scabbling of one-quarter inch from the floor is adequate. Additional soil removal and decontamination will increase the overall cost estimate.

## 2.15 Drain Lines

Surface soils and waters from drainage ditches or outfalls were sampled during early investigations, but do not appear to have been characterized during the Monserco Survey. An electromagnetic survey and a ground penetrating radar (GPR) survey identified buried pipes across the site.

Section 5 of the DCE proposes to:

- survey and remove the cement trough behind the Main Building;
- locate other drain lines via excavation or other means;
- survey drain lines; and
- remove drain lines, if contaminated.

The appendices of the DCE, which provide the detailed costs, include:

- excavating and removing buried drain pipe;
- removing imbedded drain pipe;
- excavating and removing sewer pipe;
- removing imbedded sewer pipe;
- removing manholes and catch basins;
- labor for survey of the grate behind the Main Building; and
- labor for excavation and removal activities as well as waste disposal and shipment.

Numerous drain lines have been identified in facility documents that are not acknowledged in the DCE. A drain known to be contaminated with Ra-226 lies under the floor of the maintenance wire enclosure area of the Etching Building. The back of the Main Building has a drain conveyance (cement trough/sewer grate) which transferred process water from the Main Building to the East Lagoon. An 8 or 10 inch diameter outfall drains into the East Lagoon. Drain lines from a sink in the cesium laboratory portion of the Main Building are routed to the Cesium Ion Exchange Building and then join a drain line from the parking lot and flow to a 10 foot sump that was found underground near the north side of the Lacquer Storage Building. The outfall from current USR Metals operations at the Multi-Metals Waste Treatment Plant is located south of the East Plant Dump and behind the fencing. In addition, apparent discharge lines or discharge ditches have been observed from the Liquid Waste Building to the river and from the Multi-Metals Waste Treatment Plant to the river. It is difficult to assess the adequacy of the demolition costs because the specific drain systems were not described. Given the number of drain lines to be removed and the soil contamination across the site, soil contamination in the vicinity of some drains is likely to exist. Soil removal may be necessary. Costs for both soil removal and soil disposal will increase the overall cost estimate.

## 2.16 Employee Parking Area/Sidewalk Areas/Site Paved Roads

During the Monserco Survey, samples were collected from gridded areas that include the Employee Parking Area. Ra-226, Bi-214, Pb-214, and beta contamination was found in these grids. Generally, sidewalk areas and site paved roads were not characterized. However, soils adjacent to these areas were characterized and contaminated with Cs-137, Ra-226, Bi-214, Pb-214, and beta.

Section 5 of the DCE proposes to:

- survey the surface and subsurface soils in the gravel employee parking area; and
- excavate soils in excess of the DCGL limits.

The appendices of the DCE, which provide the detailed costs include:

- removal of contaminated soil from the employee parking area;
- labor for excavation and survey of employee parking area as well as disposal and shipment of contaminated soils; and
- labor for survey of the employee parking area, the main entrance road, the visitor parking lot, the eastern north-south road, the western north-south road, the east-west road, the sidewalk in front of the Main Building, the sidewalk around the Nuclear Building, and the slab north of the Nuclear Building.

Although discussed in the DP, the DCE does not address remediation of sidewalk areas and site paved roads. The appendices of the DCE, however, do incorporate costs for survey of these areas, suggesting that have been assumed to be uncontaminated.

Given the contamination in soils adjacent to the sidewalk areas and paved roads, it is likely that the soil beneath these surfaces is contaminated. Sampling, demolition, soil removal, and soil disposal may be necessary. Disposal of asphalt and cement that may be removed from impacted areas may also be necessary. Additional costs for sampling, demolition, soil removal, and waste disposal will increase the overall cost estimate.

## 2.17 Soils and Other Land Inside Fenced Area

During the Monserco Survey, 504 surface soils samples were collected from the 307 gridded areas used to describe sampling locations. Monserco reported the following results.

- 181 positive Cs-137 results with 61 above NRC guideline values;
- 154 positive Bi-214 results with 112 above NRC guideline values;
- 94 positive Pb-214 results with 94 above NRC guideline values;
- 21 positive Ra-226 results with 21 above NRC guideline values; and
- 8 positive Am-241 results were reported with 3 above NRC guideline values.

Drawings are included in the *ICF Review and Evaluation of Characterization Data* to show the specific grids that were above the reference values. Beta contamination was also identified and is described in the same document. In addition, four samples were collected in the vicinity of the Underground Silo Area, the Old Loading Dock, and Well M7. These samples were analyzed for volatile organics but did not have results above the EPA health-based levels (HBLs). One soil sample collected behind the Lacquer Storage Building gave a result of 461 µg/g Total Hydrocarbons. Four samples were collected in the vicinity of grid 223, Well M7, the Underground Silo Area, and the Old Loading Dock and were analyzed for metals analysis. Beryllium and cadmium were detected above HBLs.

The Monserco Survey also included a limited characterization of sub-surface soils. Thirteen boreholes were drilled in the areas south of the Main Building. Cs-137, Ra-226, Bi-214, Pb-214 and beta were all detected above reference values at depths as shallow as 0.61 meters (2 feet) and as deep as 5.49 meters (18 feet). An electromagnetic survey identified areas of elevated soil conductivity (indicative of inorganic contamination) and anomalies associated with buried metallic objects in the vicinity of the two lagoons. Anomalies indicative of large metallic objects were identified south of the Etching Building and to the east of the Well House. A GPR survey conducted during the Monserco investigation revealed GPR reflections characteristic of metallic objects/drums in the vicinity of the West Dump and in soils adjacent to the Liquid Waste Building.

Section 5 of the DCE proposes to:

- survey the surface and subsurface soils for the soil north of Well 5, the soil under the Old Loading Dock, and the soil around the Machine Shop during the first phase of decommissioning;
- survey the surface and subsurface soils surrounding the Underground Silo Area, Abandoned Canal Area, East and West Lagoon Area, East Plant Dump, West Plant Dump, soil by Old Berwick Road, soil from Vance/Walton property, soil north of Lacquer Storage Building, and all other land inside the fenced area; and
- excavate soils in excess of the DCGL limits.

The appendices of the DCE, which provide the detailed costs include:

- disposal and shipping of 7,683 $ft^3$ of waste from soils north of Well 5;
- disposal and shipping of 143 $ft^3$ of waste from soil under the Old Loading Dock;
- disposal and shipping of 6,023 $ft^3$ of waste from soil around the Machine Shop;
- disposal and shipping of 95,343 $ft^3$ of waste from remediation of remaining site soils;
- soil removal for the area north of Well 5 (7,679 $ft^3$);
- soil removal for the Old Loading Dock (143 $ft^3$);
- soil removal for the area north of the Machine Shop (6,021 $ft^3$);
- soil removal for the East Lagoon (volume unspecified);
- soil removal for the West Lagoon (volume unspecified);
- soil removal for the soil near Old Berwick Road (volume unspecified);
- soil removal for the soil from the Vance/Walton property (volume unspecified);
- soil removal for the soil north of the Lacquer Storage Building (volume unspecified);
- excavation of the West Dump;
- excavation of the East Dump;
- excavation of surface soils at the unpaved area north of the fence;
- excavation of surface soils at the Abandoned Canal Area;
- excavation of sub-surface soils at the Abandoned Canal Area;
- excavation of other surface soils around Safety Light Buildings;
- excavation of surface soil in area between fence and river;

- drainage of lagoons;
- backfill for all excavated areas; and
- labor for soil removal and excavation activities, survey of all soil areas addressed, and waste disposal and shipment of contaminated soils.

Given the vast contamination of surface soils across the site and in areas not specifically described by the DCE, and the lack of characterization of sub-surface soils, it is likely that the DCE underestimates the volume of soil that will require removal. Depths are given in the appendices for soil removal and excavation but are not completely legible. Six feet (1.87 meters) appears to be the greatest depth of excavation. Radiological contamination is known to exist as deep as 5.49 meters (18 feet). Consequently, additional soil will require excavation and disposal. Also, the electromagnetic and GPR surveys revealed metallic objects that will require excavation and disposal. The DCE indicates that the lagoons will be drained and lagoon waters will be released to the river. Given, the lack of characterization data for these waters, should not be assumed to be uncontaminated.

The presence of metal and organic contaminants in the surface soil raises the possibility that the soil may be considered mixed waste. Disposal costs will be higher for this mixed waste. Finally, the stated unit cost of $62.10/ft$^3$ provided in the DCE is noted to apply to DAW. Costs for soil disposal may be different, but are not necessarily higher. Additional soil excavation, water treatment, and soil disposal will increase the overall cost estimate.

## 3.0 TASKS NOT COVERED BY THE DCE

The most significant gap in the DCE for the 37-00030-02 license is the failure to address groundwater remediation. Radiological contaminants, organic contaminants, and inorganic contaminants were detected during both the Monserco investigation and the more recent PADEP investigation. Results of these monitoring events combined with previous investigations indicate that the underlying groundwater is contaminated. Remediation of the groundwater should be included in the DCE and will have a significant impact on cost.

Two water tanks are located on the site and also have not been addressed by the DCE. The Emergency Water Tank is located east of the Machine Shop adjacent to the property line and the Water Tower is located just west of the Main Building. These structures were not evaluated during the Monserco Survey and are not expected to be contaminated. However, soils in the grids adjacent to the Emergency Water Tank were sampled and are contaminated with Cs-137, Pb-214, and beta. Based on these results, the Emergency Water Tank may need to be removed to allow excavation and disposal of soils. Gamma spectrometry was not performed in grids immediately adjacent to the Water Tower; however, gross beta was detected in an adjacent grid. Given the lack of characterization data, these soils should not be assumed to be uncontaminated. The Water Tower may need to be removed to allow excavation and disposal of soils.

The following bullets identify additional tasks that should be required for individual buildings and areas.

- Etching Building - The DCE should be revised to account for scabbling or surface cleaning in all affected rooms.

- Main Building - The DCE should be revised to account for scabbling or surface cleaning in all affected rooms.

- Lacquer Storage Building - The DCE should be revised to account for decontamination.

- Well House - The DCE should be revised to account for well excavation and decontamination of the floor.

- Pipe House - The DCE should be revised to account for decontamination.

- Soils and Other Land Inside Fenced Area - The DCE should be revised to address excavation of subsurface soils and management and treatment of lagoon waters should they fail to meet the criteria for release into the river.

ICF
CONSULTING

August 17, 2001

To: Eric Pogue, U.S. Nuclear Regulatory Commission

From: Jen Mayer, Ivy Porpotage, Craig Dean, John Collier, and Howard Finkel, ICF Consulting

Subject: Review of Safety Light Corporation Decommissioning Cost Estimate, Bloomsburg, Pennsylvania

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Safety Light Corporation (SLC) submitted a decommissioning funding plan (DFP) for a portion of its facility in Bloomsburg, Pennsylvania, which is covered by 10 CFR Part 40 license 37-00030-08.[1] The DFP includes a decommissioning cost estimate (DCE) for unrestricted release in the amount of $5,621,360. ICF's review of this cost estimate is presented below, and is divided into three sections. Section 1 reviews the overlying assumptions listed in the beginning of the licensee's DCE. Section 2 evaluates the costs estimated for the decommissioning tasks that are identified in the DCE. Section 3 identifies decommissioning tasks that are not covered by the DCE.

## 1.0 REVIEW OF OVERLYING ASSUMPTIONS

Page 1-2 of the DCE lists eight assumptions used to develop the cost estimate. While most of these assumptions seem generally reasonable, five of them may not in fact provide a reasonable basis for the DCE. These assumptions are discussed below.

### 1.1 Buildings

The DCE assumes that the Nuclear Building will remain in place after decommissioning. No sampling of this building has been performed. The operations involving tritium have been ongoing since 1969 and will continue until decommissioning, and the building is located on a part of the site that may require decontamination. Given these circumstances and the documented contamination of groundwater and subsurface soils on-site, it may not be feasible for the building to remain in place after decommissioning.

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[1] ICF has reviewed the decommissioning cost estimate for the remaining portions of the facility covered by license 37-00030-02 and has presented its findings under separate cover.

## 1.2 Equipment

The DCE assumes a no-cost scenario for disposition of uncontaminated equipment and an at-cost disposal scenario for disposition of contaminated equipment. However, the DCE does not include a list identifying which equipment is assumed to be uncontaminated along with the basis for its inclusion. Furthermore, the DCE does not include a complete inventory of equipment for each building. Consequently, it is not possible to evaluate whether the costs of equipment disposal are reasonable. In addition, the DCE provides no guidance or criteria for determining which disposition scenario will be selected for contaminated equipment.

## 1.3 Disposal Site

The DCE notes that radioactive waste not suitable for disposal at Envirocare of Utah can be sent to the Barnwell, South Carolina disposal site, but then states that all waste does qualify for disposal at Envirocare under the current license and waste acceptance criteria. The basis for this statement is unclear, given the incomplete characterization of the site (particularly with respect to mixed waste and subsurface soil contamination) and the difficulty the site is having with disposal of the silo remediation wastes. The DCE includes costs for shipping one cask of waste to Barnwell, which further suggests that not all the waste would qualify for Envirocare.

## 1.4 Labor

The DCE assumes that local decontamination technicians and supervisors will be used to staff this project. It is unclear whether a sufficient number of local qualified personnel will be available at the time of decommissioning. If local personnel are not available, additional funding may be required to cover lodging and meals.

## 1.5 Disposal

The DCE assumes a radioactive waste disposal rate based on shipping to Envirocare of Utah and negotiating a "favorable rate" with Envirocare based on a large waste volume and low levels of activity. It is unclear why the licensee would be able to obtain a "favorable" rate from Envirocare. The disposal cost of $62.10/ft^3$ appears to be in the low end of the range for disposal costs. The unit cost used in calculating the total waste disposal cost in the DCE appears to be closer to $77/ft^3$. However, this unit cost is still on the low end of the range for disposal of other wastes. An independent assessment of disposal costs by ICF revealed a range of $50 - $675/ft^3$ for soil and $75 - $315/ft^3$ for other wastes. Because the most significant portion of the overall decommissioning cost is disposal costs, small changes in the unit cost for disposal could cause significant increases in the overall cost estimate. For example, a 10 percent increase in the unit disposal cost would increase the total waste disposal cost by approximately $280,000.

## 2.0 COST ESTIMATE EVALUATION

The DCE for license 37-00030-08 encompasses the following buildings and areas :

(1) Nuclear Building
(2) Machine Shop
(3) Solid Waste Building
(4) Liquid Waste Building
(5) Restricted Area Soils

Several significant components of decommissioning costs were not addressed by the DCE, however. Specifically, the DCE does not account for the costs of restoration, site stabilization, and long-term surveillance of the facility, if necessary. Also, the DCE does not describe a mechanism for adjusting the cost estimates and associated funding levels over the life of the facility.

Review of the DCE also revealed a number of minor gaps and/or discrepancies. However, the potential impact of these gaps on the overall cost is considered insignificant and, consequently, these issues are not documented in this review. The major gaps or issues for each building are described in Sections 2.1 through 2.5 of this memorandum, however, several general concerns apply to the estimated costs for all or most of these buildings:

- First, in most cases, the derivation of labor hour estimates or cost estimates provided in Table 4-1 is unclear, and we have been unable to reproduce them. For example, according to Table 4-1, which lists the overall costs of decommissioning, it will take 5,042 labor hours to decontaminate the Nuclear Building. No detail is provided explaining the breakdown of labor hours by labor category or how many hours are needed for each specific task involved. Thus, in many cases it is impossible to evaluate the appropriateness of the estimated cost without creating an independent cost estimate (which we will undertake in Subtask 3 of this task order).

- Second, due to an insufficient level of detail, it is difficult to ascertain whether the DCE covers appropriate levels of equipment removal and decontamination, such as for hot spots, drains, ducting, and fans.

- It was difficult to assess the quantity of decontamination waste to be generated as the DCE indicated that this quantity was estimated as a function of labor.

- Lastly, the waste disposal cost used in the cost estimate calculations appears to be higher than the stated unit cost of $62.10/ft$^3$ listed in three different places in the DCE (in section 4.3, Table 4-8, and Appendix A-3).

The following fives subsections discuss the characterization data available for each building, describe the proposed decommissioning tasks, list the costs included in the DCE, and identify any inconsistencies between the proposed tasks and the included costs.

## 2.1 Nuclear Building

This building was built in 1969 and has only been used to process H-3 as work with the other radionuclides ended by 1968. Hence, it may be reasonable to assume that the building has significant H-3 contamination, but that other radionuclides are unlikely to be present. No sampling of this building was performed during the 1995 Monserco Survey because this building was still in use (and could therefore become contaminated after sampling).

Section 5.2 of the DCE proposes to:

- decontaminate the Nuclear Building by removing equipment, removing floor tile/linoleum as needed;
- scabble contaminated concrete floor surfaces as needed; and
- decontaminate the wall surfaces by surface cleaning or surface removal methods;[2]

The DCE indicated that this building will not be demolished. The appendices of the DCE, which provide the detailed costs, include:

- disposal of equipment such as hoods, storage boxes, various ducts, ceiling and floor tiles, sewer piping, vacuum pumps, and other miscellaneous equipment;
- scabbling one-quarter inch from 25 percent of the floor and one-eighth inch from 25 percent of the walls;
- labor for general cleanup, removing buried and imbedded sewer pipe, and removing equipment; and
- labor hours for surveying both the outside and inside of the building.

Although no sampling of this building has been performed, the operations involving tritium have been ongoing since 1969. This building is located on a part of the site that may require decontamination, and operations are expected to continue until decommissioning. Consequently, for purposes of the cost estimate the Nuclear Building should be assumed to require decontamination.

In addition, given the Bi-214 contamination in one grid adjacent to this building and the lack of sampling of other grids adjacent to this building, soil beneath the building should not be assumed to be uncontaminated. Additional soil sampling, building demolition, foundation removal, and

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[2] The outer walls of this building are made of corrugated metal. The DCE did not provide any information on the composition of interior walls.

soil removal may be necessary. These tasks will increase the overall cost estimate. Demolition and waste disposal costs for this building will significantly increase in the overall cost estimate.

## 2.2 Machine Shop

The Monserco Survey found fixed contamination greater than 5,000 dpm/cm$^2$ in one grid and on the sink in the bathroom.

Section 5.2 of the DCE proposes to:

- remove equipment and remove floor tile/linoleum as needed;
- scabble contaminated concrete floor surfaces as needed;
- decontaminate wall surfaces by surface cleaning or surface removal methods;
- demolish the building;
- survey the surface and subsurface soils; and
- excavate soils in excess of the DCGL.

The appendices of the DCE, which provide the detailed costs, include:

- removal and disposal of 24 tons (768 ft$^3$) of equipment;
- removal and disposal of the walls and cement slab floor;
- removal of approximately 428 ft$^3$ of soil under the Machine Shop (to a maximum depth of 6 inches);
- labor for general cleanup, equipment removal, machine shop demolition, slab removal, and soil removal; and
- labor for surveying both the outside and inside of the building

The decommissioning tasks proposed in Section 5.2 of the DCE are inconsistent with the costs provided in the appendices of the DCE. Specifically, the discussion in the text describes scabbling of floors and decontamination of walls, yet no decontamination costs have been included in the DCE for this building.

Given the Ra-226, Pb-214, and Bi-214 contamination in grids near this building, soil contamination is likely to exist below the top six inches of soil. Additional soil removal may be necessary and would increase the overall cost estimate.

## 2.3 Solid Waste Building

The Monserco Survey found fixed contamination greater than 5,000 dpm/cm$^2$ in four grids and on a cabinet. Loose H-3 contamination greater than 1,000 dpm/cm$^2$ was found in seven grids, as well as on two fixtures and two pieces of equipment. In one grid the loose H-3 contamination measured 99,840 dpm/cm$^2$. Hot spot contamination greater than 15,000 dpm/cm$^2$ was found in two grids and on seven pieces of furniture.

Section 5.2 of the DCE proposes to:

- remove equipment;
- scabble contaminated concrete floor surfaces as needed;
- decontaminate wall surfaces by surface cleaning or surface removal methods;
- demolish the building;
- survey the surface and subsurface soils; and
- excavate soils in excess of the DCGL.

The appendices of the DCE, which provide the detailed costs, include:

- removal and disposal of equipment and waste including tritium foil and target waste, scrubber column cans, sign waste, paper bag waste, stub can waste, liquid scintillation waste, and waste in drums;
- scabbling one-quarter inch from 25 percent of the floor and one-eighth inch from 25 percent of the walls;
- removal and disposal of the walls and cement slab floor;
- removal of approximately 285 $ft^3$ of soil under the Solid Waste Building (to a maximum depth of 6 inches);
- labor for general cleanup, equipment removal, machine shop demolition, slab removal, and soil removal;
- labor for surveying both the outside and inside of the building; and
- disposal of one cask containing 8 $ft^3$ of tritium foil and target waste at Barnwell.

There appears to be some discrepancy between equipment being disposed, as listed in Appendix 13 of the DCE and summarized above, and the types of waste and fixtures observed during the site visit. For example, ICF observed two old glove boxes, a compactor, ladders, a cabinet, a wall fan (previously used to vent the building), a gas line for a heater, and a heater. It is unclear whether this additional equipment was assumed to be uncontaminated, stored in the solid waste building after the DCE was prepared, accidentally omitted from the DCE, or incorporated into one of the more general line items, such as solid waste building demolition.

Given the Cs-137, Pb-214, and Bi-214 contamination in grids near this building, soil contamination is likely to exist below the top six inches of soil. Additional soil removal may be necessary and would increase the overall cost estimate.

## 2.4 Liquid Waste Building

The Monserco Survey revealed loose H-3 contamination greater than 1,000 dpm/$cm^2$ in one grid. Hot spot contamination greater than 15,000 dpm/$cm^2$ was found on three fixtures. Liquid in the sump had a H-3 concentration of over 1 million pCi/L.

Section 5.2 of the DCE proposes to:

- remove equipment;
- scabble contaminated concrete floor surfaces as needed;
- decontaminate wall surfaces by surface cleaning or surface removal methods;
- demolish the building;
- survey the surface and subsurface soils; and
- excavate soils in excess of the DCGL.

The appendices of the DCE, which provide the detailed costs, include:

- removal and disposal of 49 tons (1,536 $ft^3$) of equipment;
- removal and disposal of the walls, cement slab floor, and sump;
- removal of approximately 17,100 $ft^3$ of soil under the Liquid Waste Building (to a maximum depth of 10 feet);
- labor for general cleanup, equipment removal, building demolition, slab removal, sump removal, and soil removal; and
- labor for surveying both the outside and inside of the building.

The decommissioning tasks proposed in Section 5.2 of the DCE are inconsistent with the costs provided in the appendices of the DCE. Specifically, the discussion in the text describes scabbling of floors and decontamination of walls, yet no decontamination costs have been included in the DCE for this building.

It is unclear whether the DCE covers appropriate levels of equipment observed during the site visit, including removal and decontamination, such as the four large metal tanks (each having a 2,400 gallon capacity) that are used to treat tritium-contaminated wastewater, four tables/work benches, pallets, a lawn tractor (i.e., riding mower), a sink, ladders, gardening tools, a jig saw, a hand truck, empty metal 55-gallon drums, an empty overpack, an empty plastic drum, several boxes of returned signs, several pairs of boots, an old oven, and lockers.

According to the Monserco report, before 1960, the building at this location contained below ground vaults used to dilute low level radioactive waste water, prior to discharge to the river. After the 1972 flood, the below ground area was backfilled and the current Liquid Waste Building was constructed over this backfill. As a result, soil contamination may exist below the top 10 feet of soil and additional soil removal may be necessary. This tasks will increase the overall cost estimate.

## 2.5 Restricted Area Soils

With the exception of soils below the Machine Shop, Solid Waste Building, and Liquid Waste Building, no soil removal was included in the DCE for the 37-00030-08. The DCE indicated other soils in the Restricted Area fencing were addressed in the DCE for the 37-00030-02. Our

evaluation of the disposal costs for additional soils within the restricted area fencing is included in our review of the 37-00030-02 license.

## 3.0 TASKS NOT COVERED BY THE DCE

The most significant gap in the DCE for the 37-00030-08 license is the failure to address groundwater remediation. Radiological contaminants, organic contaminants, and inorganic contaminants were detected during both the Monserco investigation and the more recent PADEP investigation. Results of these monitoring events combined with previous investigations indicate that the underlying groundwater is contaminated. Remediation of the groundwater should be included in the DCE and will have a significant impact on cost.

The following bullets identify additional tasks that should required for individual buildings.

- Nuclear Building - The DCE should be revised to account for decontamination of the main stack, disposal of the plastic tubing used to vent the solid waste building to the main stack on the nuclear building, and decontamination costs for the floor underneath the tile (given possibility that tritium might have seeped under tiles).

- Liquid Waste Building - The DCE should be revised to account for removal of soil from under the building below 10 feet deep, and disposal of drain lines and contaminated soil.