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July 29, 2005

Kenneth L. Kalman
Decommissioning Branch
Division of Waste Management
Office of Nuclear Materials Safety and Safeguards
U. S. Nuclear Regulatory Commission
Washington, D.C. 20555

Re: Transmittal of Deliverable (License No. SMB-743, Control No. 132074)

Dear Mr. Kalman:

On February 23, 2005, Shieldalloy Metallurgical Corporation (SMC) submitted a schedule for completing three key components of our revised decommissioning plan as part of a phased approach.[1] Those deliverables are: (1) a Draft of Chapter 5 of the revised plan (entitled "Dose Modeling Evaluations") which was sent to the USNRC on April 14, 2005; (2) a draft environmental report which is due to the USNRC on May 27, 2005; and (3) a draft of Chapter 6 of the revised plan (entitled "ALARA Analysis") which is due now. This letter transmits the Chapter 6 draft (enclosed)

Please recall that these three deliverables are being sent to the USNRC for preliminary review to ensure their general contents and approach will meet your acceptability review when they are officially submitted as part of our decommissioning plan. As you will see during your review of the enclosure, it contains a number of placeholders and descriptive elements that are awaiting other information before they can be filled into this chapter. Nonetheless, we are hopeful that you will find we are on the right track with respect to the performance of an ALARA analysis of the various decommissioning options applicable to SMC's Newfield site, and that this chapter, when complete, will not cause our decommissioning plan to fail the USNRC's acceptability review. We also understand that technical review comments at this time, while they would be gratefully accepted, will not necessarily be forthcoming.

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[1] Shieldalloy Metallurgical Corporation, Report No. 94005/G-28247 (Rev. 1), "Decommissioning Plan for the Newfield Facility".

I look forward to your comments and suggestions on the enclosed draft. Your feedback will help SMC meet its goals of submitting a decommissioning plan that is accepted for technical review. This will allow the decommissioning of the Newfield site proceeds expeditiously and effectively. Please don't hesitate to call me at (856) 692-4201, extension 1-226 if you have any questions or need further information.

Sincerely,

David R. Smith,
Radiation Safety Officer

cc: Eric Jackson
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7 ALARA ANALYSIS

The proposed decommissioning action at SMC's Newfield facility is on-site stabilization and long-term control of the residual radioactivity at the site. In order to demonstrate that this approach is consistent with the ALARA (As Low As Reasonably Achievable) principle, a cost-benefit analysis that compares it to other alternatives was performed. As described in Chapter 6 of this Decommissioning Plan, the three alternatives are: (1) Partial restriction of the site under the long-term control license, with the remainder of the site released for unrestricted use; (2) Off-site disposal followed by release of the entire site for unrestricted use (i.e., the license termination alternative) and (3) no action alternative (i.e., the license continuation alternative). The following subsection contains a brief description of the three alternatives along with the results of the cost-benefit analysis.

7.1 Description of Decommissioning Options

7.1.1 On-Site Stabilization and Long Term Control (LTC) Alternative

For the proposed decommissioning action, residual radioactive materials above restricted release levels that are present at the Newfield site will be consolidated into a single capped pile within the Storage Yard, which will remain a radiologically-restricted area. Once the cap is installed over the seven (7) month construction period, a Final Status Survey of the plant in its entirety will be performed and documented as evidence that the restricted portion of the site meets the established dose criteria for restricted release (i.e., 25 millirem TEDE with all controls in place and 100 millirem if controls fail), and that the unrestricted portion of the site meets the dose criterion for unrestricted release (i.e., 25 millirem TEDE). At that point, License No. SMB-743 would be amended to a long term control (LTC) license, wherein license provisions that include access restrictions, maintenance, monitoring (visual inspections, radiation surveys and ground water and surface water monitoring) and specific legal restrictions against future residential construction, farming or business redevelopment on the restricted area would be attached. The remainder of the property will then be released for unrestricted use.

7.1.2 Off-site Disposal and License Termination (LT) Alternative

The LT alternative would require residual radioactivity present at the Newfield site to be processed and then transported to the Envirocare of Utah, Inc. facility near Clive, Utah for disposal as low-level radioactive waste. Once the two (2) year construction period is complete, a Final Status Survey of the plant in its entirety will be performed and documented as evidence that the site meets the established dose criteria for unrestricted release (i.e., 25 millirem TEDE). At that point, License No. SMB-743 would be terminated and the site released for unrestricted use.

7.1.3 License Continuation (LC) Alternative

If no action is taken at the Newfield site, the residual radioactivity present would retain its current amount and configuration, and the existing conditions of License No. SMB-743 would remain as they are as of the date of this report.[1] Assuming all provisions of the current license continue to be met, the annual radiation dose potential to workers at the site and to members of the general population would remain unchanged from their current measured values. Although this alternative does not offer an acceptable regulatory basis (i.e., the owner would be in violation of the timeliness requirements of 10 CFR 40.42), it is nonetheless included in the ALARA analysis for comparison purposes only.

7.2 Comparison of Risks

There are a variety of risks associated with each of the aforementioned options. These include physical risks associated with the implementation of the option (i.e., remedial action activities and transportation), as well as radiological risks present during implementation and after the option has been fully implemented. The following subsections describe and quantify these risks in compatible units so that the radiological ramifications of the three options may be fairly compared.

7.2.1 Radiological

Because radiation exposure, if high enough, is associated with an increased risk of cancer, the radiological risk of interest in the comparison of the three decommissioning options applicable to the Newfield site is the risk of incurring fatal cancer. Hypothetically, the risk of harm caused by radiation exposure increases as the exposure increases.[2] However, no effects have ever been observed at levels below 5,000 millirem delivered over a one year period.[3,4] In fact, the effects seen when humans are exposed to 100,000 millirem over a very short time period are temporary and

[1] As currently written, License No. SMB-743 authorizes possession of up to 303,050 kilograms of thorium in any chemical/physical form, and up to 45,000 kilograms of uranium in any chemical or physical form. As of July 29, 2005, SMC was at 96.8% of the thorium limit and 87.6% of the uranium limit.

[2] This linear relationship between dose and effect is clearly demonstrated in populations that have received large, acute exposures.

[3] Health Physics Society, "Radiation Risk in Perspective", Position Statement of the Health Physics Society, January, 1996 (revised August, 2004).

[4] Health Physics Society, "Compensation for Diseases that Might be Caused by Radiation Must Consider the Dose", Position Statement of the Health Physics Society, March, 2000 (Reaffirmed, March, 2001).

reversible. It takes a short-term dose on the order of 500,000 millirem (without medical intervention) to cause death.[5]

The radiation dose potential to even the maximally-exposed individual associated with the decommissioning of the Newfield site, regardless of which option is selected, is far too low to result in demonstrable health effects. Nonetheless, for the purpose of comparing the three options, the LNT, or "Linear No Threshold" hypothesis provides a useful risk assessment tool. In essence, this hypothesis states that since scientists have observed a linear relationship between radiation dose and effect at high doses and dose rates, and since a "radiation free" environment to test the theory at low doses (taken to be 20,000 millirem TEDE or less) does not exist, for radiation protection purposes it is reasonably conservative to assume that the relationship is indeed linear. While the LNT hypothesis leads to the obvious conclusion that any radiation dose, no matter how small, may be capable of causing some biological damage or detriment - a conclusion that is not supported with facts - it nonetheless offers a conservative risk coefficient that is useful for this assessment.

The coefficient that will be used to derive comparative risks associated with the three decommissioning options is that which gives the individual risk of fatal cancer per rem of dose equivalent, or approximately 5×10^{-4}.[6] The following subsections give the hypothetical risk associated with the option-specific dose for on-site workers and members of the public, and Table ___ gives a summary of findings.

7.2.1.1 On-site Workers

LC Alternative

For the LC alternative, radiological conditions at the site would remain as they are today. Since no operations involving source material would be permitted by the continued license, the only pathway for exposure of personnel present on the site would be external exposure associated with close proximity to the slag piles.

The ambient doses incurred by monitored workers during the production of ferrocolumbium, which required them to come in close proximity to both the feed stock and the slag in the operational areas

[5] International Commission on Radiological Protection, ICRP Publication 60, "1990 Recommendations of the International Commission", Pergamon Press, 1991.

[6] National Academy of Sciences, National Research Council, Committee on the Biological Effects of Ionizing Radiation, "Health Effects of Exposure to Low Levels of Ionizing Radiation (BEIR-V)", National Academy Press, Washington, D.C., 1990.

of the plant as well as the Storage Yard, were less than 40 millirem per calendar year.[7] Therefore, the dose potential for current on-site workers, who seldom frequent the Storage Yard and do not perform any other licensed operations, is conservatively assumed to be 50% of the maximum measured exposure for monitored workers, or 20 millirem TEDE. For a 30-year working lifetime, and applying the risk coefficient of 5×10^{-4} a hypothetical fatal cancer risk potential of 3×10^{-4} may be assumed for on-site workers.

LTC Alternative

For the LTC alternative, radiological conditions associated with the shaping of the residual radioactivity currently in the Storage Yard and installation of the engineered cover (cap) presents the potential for direct radiation exposure and inhalation of airborne radioactivity by on-site workers.[8] In addition, once the LTC license is in place, the dose potential for on-site workers, would be as shown for the Industrial Worker scenario in Chapter 5 of this decommissioning plan.

From the air modeling results shown in Section _____ of this decommissioning plan, the intake potential for the seven-month duration of these operations within the primary controlled area (i.e., the location of maximum airborne emissions) is 2.3×10^{11} micrograms of respirable particulates in an air volume of 4.3×10^{11} milliliters, for an airborne concentration of approximately 5.3×10^{-1} micrograms per milliliter.[9] Assuming a 60% deposition fraction, a 0.5% radiological fraction, a 50% distribution between thorium and uranium, and applying the isotopic concentration for each as shown in Table ____, the resulting airborne concentration in the Storage Yard for the 512-hour continuous work time duration for placement and configuration of the radiological constituents would be 9.7×10^{-14} microcuries of thorium and uranium per milliliter, respectively. When the Derived Air Concentrations (DACs) authorized for SMC are applied (i.e., 1.91×10^{-11} microcuries per milliliter for thorium and 8.4×10^{-11} microcuries per milliliter for uranium), the resulting internal dose potential to a hypothetical worker would be eight (8) millirem (CEDE).[10]

The ambient exposure rate measured around the circumference of the Storage Yard ranges from "background" to approximately 130 microR per hour, with an average measured rate of

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[7] See "Report of Radiation Safety Surveillance" for Quarters 1, 2 and 3 of 1996.

[8] Once the residual radioactivity is covered, there will be no measurable dose potential for on-site workers, thus no radiation dose of significance is associated with the performance of the final status survey.

[9] The air volume was determined for a work area footprint of 310687 square feet and a mixing height of 50 feet.

[10] Provision 12 of License No. SMB-743 authorizes the use of adjusted ALI and Derived Air Concentration (DAC) values for licensed materials.

approximately 30 microR per hour.[11] If a hypothetical remediation worker is present somewhere within the Storage Yard for the duration of remedial activities (i.e., 512 working hours), it is not unreasonable to assume his/her dose rate potential from external radiation would be equivalent to the average measured exposure rate, for a total dose potential of _____ millirem EDE.

Once the LTC license is issued, the dose potential for the Industrial Worker scenario (see Chapter 5, above) has a maximum value of ___ millirem TEDE. Over a 50-year working lifetime, that would be equivalent to a dose potential of____ millirem, TEDE.

Applying the risk coefficient of 5×10^{-4} to the total dose potential from all exposure pathways of___ millirem TEDE, and assuming a single hypothetical worker incurs the dose from all of these pathways and for all applicable time periods, the fatal cancer risk potential would be _____ $\times 10^{-5}$ for on-site workers.

LT Alternative

For the LT alternative, radiological conditions associated with processing (crushing) and packaging the residual radioactivity that is currently in the Storage Yard prior to shipment to the disposal site in Utah presents the potential for direct radiation exposure and inhalation of airborne radioactivity by on-site workers.[12] From the air modeling results shown in Section _____ of this decommissioning plan, the intake potential for the seven-month duration of these operations within outside of the primary restricted area (i.e., Area 2) is 4.0×10^{12} micrograms of respirable particulates in an air volume of 4.3×10^{11} milliliters, for an airborne concentration of approximately 9.3×10^{0} micrograms per milliliter.[13] Assuming a 60% deposition fraction, a 0.5% radiological fraction, a 50% distribution between thorium and uranium, and applying the isotopic concentration for each as shown in Table ____, the resulting airborne concentration in the Storage Yard for the 840-hour continuous work time duration would be 1.7×10^{-12} microcuries each of thorium and uranium per milliliter, respectively.[14] When the Derived Air Concentrations (DACs) authorized for SMC are

[11] Berger, C. D., "Quarter 4, 2004 Perimeter Monitoring Results", submitted to D. R. Smith, January 3, 2005.

[12] Once the residual radioactivity is covered, there will be no measurable dose potential for on-site workers, thus no radiation dose of significance is associated with the performance of the final status survey.

[13] The air volume was determined for a work area footprint of 310687 square feet and a mixing height of 50 feet.

[14] To ensure an element of conservatism in this analysis, no engineered or administrative controls over the work area and the working population and no standard radiation protection principles commonly associated with radiological work of this type were taken into account.

applied, the resulting internal dose potential to a hypothetical worker would be ____millirem (CEDE).[15]

The ambient exposure rate at the circumference of the Storage Yard ranges from "background" to approximately 130 microR per hour, with an average rate of approximately 30 microR per hour.[16] If a hypothetical remediation worker is present somewhere within the Storage Yard for the duration of remedial activities (i.e., 840 hours), his/her dose potential from external radiation would be 25.2 millirem EDE.

Applying the risk coefficient of 5×10^{-4} to the total dose potential from the internal and external exposure pathways of ___ millirem TEDE results in a fatal cancer risk potential of _____ $\times 10^{-5}$ for on-site workers.

7.2.1.2 Members of the Public

LC Alternative

For the LC alternative, radiological conditions at the site would remain as they are today. Since no operations involving source material would be permitted by the continued license, the only pathway for exposure of members of the general public would be external exposure associated with close proximity to the slag piles.

As a licensee, SMC is required by 10 CFR 20.1301 and 1302 to demonstrate that members of the general public do not incur a radiation dose in excess of 100 millirem TEDE in any calendar year. The maximum measured ambient exposure rate at the fence line around the Storage Yard is approximately 130 microR per hour with an average measured rate of approximately 30 microR per hour, and the nominal radon dose rate from baghouse dust emanation is approximately 8.2×10^{-3} microR per hour.[17] Monitoring records over the past five years demonstrate that no member of the public has incurred a radiation dose that even approaches the regulatory limit.

Nonetheless, to ensure an element of conservatism in this assessment, it is assumed that a hypothetical member of the general public is present somewhere around the perimeter of the Storage Yard constantly and continuously such that his/her annual radiation dose is equal to the regulatory limit of 100 millirem. Over a 70-year lifetime, that hypothetical member of the public would thus

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[15] Provision 12 of License No. SMB-743 authorizes the use of adjusted ALI and Derived Air Concentration (DAC) values for licensed materials.

[16] Berger, C. D., "Quarter 4, 2004 Perimeter Monitoring Results", submitted to D. R. Smith, January 3, 2005.

[17] Berger, C. D., "Quarter 4, 2004 Perimeter Monitoring Results", submitted to D. R. Smith, January 3, 2005.

incur a total dose of 7,000 millirem. Applying the risk coefficient of 5 x 10^{-4} to the lifetime dose potential from both pathways results in a hypothetical fatal cancer risk potential of _____ x 10^{-5} for members of the general public.[18]

LTC Alternative

For the LTC alternative, radiological conditions associated with the shaping of the residual radioactivity currently in the Storage Yard and installation of the engineered cover (cap) presents the potential for direct radiation exposure and inhalation of airborne radioactivity by members of the public.[19]

From the air modeling results shown in Section _____ of this decommissioning plan, the intake potential for the entirety of these operations at the nearest off-site location is _____ micrograms of material. Applying the specific activity for each of the radionuclides in the site source term (see Table ____), the resulting intake potential would be _____. When the dose conversion factors listed in Appendix B of 10 CFR 20 for each of the relevant radionuclides are applied, the resulting dose potential would be _____ millirem (CEDE).

The ambient exposure rate at the circumference of the Storage Yard ranges from "background" to approximately 130 microR per hour, with an average rate of approximately 30 microR per hour.[20] If a hypothetical member of the general public is present somewhere near the perimeter of the Storage Yard for four (4) hours per day for the duration of remedial activities (i.e., ___ work days as shown in Section ____), his/her dose potential from external radiation would be ___ millirem EDE.

Once the LTC license is issued, the dose potential for members of the public has a maximum value of ___ millirem TEDE based upon the _____ scenario as shown in Chapter 5. Over a 70-year lifetime, this is equivalent to a dose potential of____ millirem, TEDE. Applying the risk coefficient of 5 x 10^{-4} to the total dose potential from all exposure pathways of___ millirem TEDE results in a fatal cancer risk potential of_____ x 10^{-5} for members of the public.

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[18] A more realistic estimate of dose, based upon a scenario of _____, is ____ millirem, which is equivalent to a hypothetical risk potential of_____.

[19] Once the residual radioactivity is covered, there will be no measurable dose potential for on-site workers, thus no radiation dose of significance is associated with the performance of the final status survey.

[20] Berger, C. D., "Quarter 4, 2004 Perimeter Monitoring Results", submitted to D. R. Smith, January 3, 2005.

LT Alternative

For the LT alternative, radiological conditions associated with the processing and packaging the residual radioactivity currently in the Storage Yard for shipment to the disposal site in Utah presents the potential for direct radiation exposure and inhalation of airborne radioactivity by members of the public.[21] In addition, members of the public may incur direct exposure during the transportation of the residual radioactivity to the Utah disposal site. Furthermore, after the license is terminated, member of the public may incur a radiation dose of up to 25 millirem TEDE in any one year (see Subpart E of 10 CFR 20).[22]

From the air modeling results shown in Section _____ of this decommissioning plan, the intake potential for the entirety of the LT operations at the perimeter fence is _____ micrograms of material. Applying the specific activity for each of the radionuclides in the site source term (see Table ____), the resulting intake potential would be _____.

The ambient exposure rate at the circumference of the Storage Yard ranges from "background" to approximately 130 microR per hour, with an average rate of approximately 30 microR per hour.[23] If a hypothetical member of the general public is present somewhere at the perimeter of the Storage Yard for four (4) hours per day for the duration of remedial activities (i.e., ___ days as shown in Section ____), and assuming no reduction in dose as the volume of residual radioactivity is reduced over time, his/her dose potential from external radiation would be ____ millirem EDE.

Applying the risk coefficient of 5×10^{-4} to the total dose potential from all exposure pathways of ___ millirem TEDE, assuming that a single hypothetical individual incurs the dose from all of these pathways, results in a fatal cancer risk potential of _____ x 10^{-5} for members of the public.

7.2.2 Remedial Action Activities

When any remedial actions are performed, there is a risk for non-radiation-related injury or harm associated with those actions. From NUREG-1496, the workplace accident fatality rate may be assumed to be 4.2×10^{-8} per person-hour.[24] The following subsections give the hypothetical risk of

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[21] Once the residual radioactivity is covered, there will be no measurable dose potential for on-site workers, thus no radiation dose of significance is associated with the performance of the final status survey.

[22] A more realistic estimate of dose, based upon a scenario of _____, is ____ millirem, which is equivalent to a hypothetical risk potential of _____.

[23] Berger, C. D., "Quarter 4, 2004 Perimeter Monitoring Results", submitted to D. R. Smith, January 3, 2005.

[24] NUREG-1496, "Final Generic Environmental Impact Statement in Support of Rulemaking on Radiological Criteria for License Termination of NRC-Licensed Nuclear Facilities", Vol. 2, Appendix B, Table A.1, July, 1997.

fatality from the remedial actions associated with each option for both on-site workers and members of the public.

LC Alternative

For the LC alternative, it is assumed that there would be no remedial actions performed.[25] Therefore, there would be no potential for harm (fatality) if this option were implemented for either workers or members of the general public.

LTC Alternative

For the LTC alternative, workers incur some risk of fatality from accidents that may occur during the shaping of the residual radioactivity, the installation of the engineered cap, and during the performance of the final status survey. As shown in Section ____ of this decommissioning plan, the time duration of these activities is projected to be ____ months, which is equivalent to approximately ____ working days, for a total of ____ working hours. Applying the risk coefficient of 4.2×10^{-8} to this work duration results in a fatality risk potential of ____ x 10^{-5} for on-site workers. The fatality risk potential for members of the general public would be "zero".

LT Alternative

For the LT alternative, workers incur some risk of fatality from accidents that may occur during the processing and packaging of the residual radioactivity for transport to the Utah disposal site. As shown in Section ____ of this decommissioning plan, the time duration of these activities is projected to be two (2) years, which is equivalent to approximately ____ working days, for a total of ____ working hours. Applying the risk coefficient of 4.2×10^{-8} to this work duration results in a fatality risk potential of ___ x 10^{-4} for on-site workers. The fatality risk potential for members of the general public would be "zero".

7.2.3 Transportation

There are, of course, risks associated with transporting people and goods from place to place. The transport of residual radioactivity from the Newfield site presents no exception. From NUREG-1496, the transportation accident fatality rate may be assumed to be 6.6×10^{-7} per kilometer.[26] The following subsections give the hypothetical risk of fatality from transportation associated with each option for both on-site workers and members of the public.

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[25] This is an unrealistic assumption as it is likely that some sort of future remediation will be necessary. However, for the purposes of this assessment, the no-action option contains no provisions for future remedial actions.

[26] Federal Railroad Administration, Office of Safety Analysis, "Accident/Incident Overview, January to April, 2005", total accident incient rate with fatalities, July 27, 2005.

LC Alternative

For the LC alternative, there would be no remedial actions performed and no materials transported.[27] Therefore, there would be no potential for harm (fatality) if this option were implemented for either workers or members of the general public.

LTC Alternative

For the LTC alternative, people incur some risk of transportation fatality associated with the transport of borrow and construction materials to/from the site as part of engineered cap installation. As shown in Section ____ of this decommissioning plan, the projected travel distance for these activities is approximately ____ miles, or ____ kilometers. Applying the risk coefficient of 3.8 x 10^{-8} (for truck travel) to this distance results in a transportation fatality risk potential of _____ x 10^{-5} that is applicable to both workers and members of the public.[28]

LT Alternative

For the LT alternative, people incur some risk of fatality from transportation accidents that may occur during the transport of packaged residual radioactivity to the Utah disposal site. As shown in Section ____ of this decommissioning plan, the projected travel distance for these activities is approximately ____ miles, or ____ kilometers. Applying the risk coefficient of 3.8 x 10^{-8} to this distance results in a transportation fatality risk potential of _____ x 10^{-5} that is applicable to both workers and members of the public.

7.3 Comparison of Costs

Chapter ___ of this decommissioning plan gives a cost estimates for the preferred decommissioning option (i.e., the LTC alternative). This and the estimates for the LC and the LT alternatives were based on a variety of cost-estimating data sources, vendor information, conventional cost-estimating guides, inflation adjustment, and similar estimates as modified by prior site-specific project cost information. Prior estimates, site-cost experience, and good engineering judgements were used to identify those items that control the comparative estimates. In addition, a monetary discount rate of 0.07 per year for the first 100 years and 0.03 per year thereafter was assumed.[29] The following subsections give the costs associated with each of the decommissioning options.

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[27] This is an unrealistic assumption as it is likely that some sort of future remediation will be necessary. However, for the purposes of this assessment, the no-action option contains no provisions for future remedial actions.

[28] NUREG-1496, "Final Generic Environmental Impact Statement in Support of Rulemaking on Radiological Criteria for License Termiantion of NRC-Licensed Nuclear Facilities", Vol. 2, Appendix B, Table A.1, July, 1997.

[29] NUREG/BR-0058, Revision 2, "Regulatory Analysis Guidelies of the U. S. Nuclear Regulatory Commission", November, 1995.

7.3.1 Remedial Action Activities

LC Alternative

For the no-action option, on-going annual costs would be those associated with license compliance only. These would include the cost of radiological surveillance, record keeping, licensing fees, and regulatory interactions. During calendar year 2004, the total cost of these activities at the Newfield site was $_____. If extrapolated over a 1,000-year period, and taking into the account inflation and other monetary issues, the total cost would be $_____.

LTC Alternative

The cost of implementing the LTC alternative is described in detail in Chapter ___ of this decommissioning plan. That cost, which includes the cost of long-term surveillance and maintenance, as well as the cost of record keeping, licensing fees, and regulatory interactions over a 1,000-year period is $_____, adjusted for the escalating cost of money.

LT Alternative

For the LT alternative, the cost of material packaging and the associated cost to complete the final status survey and then terminate License No. SMB-743. The cost of transporting the packaged material to the disposal site is addressed in Section 7.3.2. Once the license is terminated and all applicable records transferred to the USNRC pursuant to Subpart L of 10 CFR 10, there would be no continuing cost. Therefore, the total cost of the alternative would be $_____.

7.3.2 Transportation of Waste

LC Alternative

For the no-action option, no waste would be shipped for disposal. Therefore, there would be no waste transportation cost associated with this alternative.

LTC Alternative

For the LTC alternative, no waste would be shipped for disposal. Therefore, there would be no waste transportation cost associated with this alternative.

LT Alternative

Before terminating License No. SMB-743, all packaged and staged radioactivity must be transported approximately ___ miles to the Envirocare of Utah facility. The cost of this action is $____.

7.3.3 Waste Disposal

LC Alternative

For the no-action option, no waste would be disposed of.[30] Therefore, there would be no waste disposal cost associated with this alternative.

LTC Alternative

For the LTC option, no waste would be disposed of. Therefore, there would be no waste disposal cost associated with this alternative.

LT Alternative

The cost of disposing of all packaged and shipped residual radioactivity from the Newfield site includes the cost of acceptance testing. This amount has been quoted to be $____.

7.3.4 Cost of Construction (Non-Radiological) Risks

LC Alternative

For the no-action option, no construction would be on-going.[31] Therefore, there are no construction risk costs associated with this alternative.

LTC Alternative

For the LTC option, there is a risk of construction-related injuries. As recommended in NUREG–1496, their cost may be evaluated as follows:

$$Cost_{TF} = \$3{,}000{,}000 \times F_W \times T_A$$

where $3,000,000 = the monetary value of a fatality equivalent to $2,000 per person rem; F_W = the workplace fatality rate in fatalities per hour worked; and T_A = the worker time required for remediation in units of worker-hours.

[30] This is an unrealistic assumption as it is likely that some sort of future remediation with associated waste disposal will be necessary. However, for the purposes of this assessment, the no-action option contains no provisions for disposal of waste.

[31] This is an unrealistic assumption as it is likely that some sort of future construction activities will be necessary. However, for the purposes of this assessment, the no-action option contains no provisions for on-site construction.

For the LTC alternative, the workplace fatality rate, as shown in Section ____, above, is ____ fatalities per hour. And, as shown in Section ____, the worker remediation time is ____ worker-hours. Therefore, the cost of construction risks for this alternative is:

$$Cost_{TF} = \$3{,}000{,}000 \times 1 \times 1 = \$1$$

LT Alternative

There is also a risk of construction-related injuries for the LT option. Using the same approach shown in Section 7.3.4, above, with a worker remediation time of ____ worker-hours and a workplace fatality rate of ____ fatalities per hour as input parameters, the cost of construction-related risks for this alternative is:

$$Cost_{TF} = \$3{,}000{,}000 \times 1 \times 1 = \$1$$

7.3.5 Cost of Transportation Risks

LC Alternative

For the no-action option, no transportation of residual radioactivity would occur.[32] Therefore, there are no transportation risk costs associated with this alternative.

LTC Alternative

For the LTC option, no transportation of residual radioactivity would occur. Therefore, there are no transportation risk costs associated with this alternative.

LT Alternative

For the LT option, there is a risk of transportation-related injuries in the shipment of residual radioactivity to the Envirocare of Utah site. As recommended in NUREG–1496, their cost may be evaluated as follows:

$$Cost_{TF} = \$3{,}000{,}000 \times \frac{V_A}{V_{SHIP}} \times F_T \times D_T$$

where \$3,000,000 = the monetary value of a fatality equivalent to \$2,000 per person rem; V_A = the volume of material in units of cubic meters, F_T = the fatality rate per vehicle-kilometer traveled in units of fatalities per vehicle-km; D_T = the distance traveled in km; and V_{SHIP} = the volume of a

[32] This is an unrealistic assumption as it is likely that some sort of future remediation that involves transportation of materials will be necessary. However, for the purposes of this assessment, the no-action option contains no provisions for transport.

vehicle shipment in cubic meters.[33] With a distance traveled of ___ kilometers and a nominal rail car shipment of ___ cubic meters, the cost of transportation risks for this alternative would be:

$$Cost_{TF} = \$3{,}000{,}000 \times \frac{1}{1} \times 1 \times 1 = \$1$$

7.3.6 Cost of Radiological Risks (Including Long-term Surveillance and Maintenance)

LC Alternative

NUREG-1496 recommends the use of a collective dose cost value of $2,000 per person rem. As shown in Table ___, the dose associated with the LC alternative, which has no construction phase, is ____ millirem.[34] For a ___-person worker population, the collective dose would be ____ person-rem. Therefore, the cost associated with the hypothetical radiological risks would be $_____.

LTC Alternative

As shown in Table ___, the dose associated with the LTC alternative, during construction is ____ millirem. For a ___-person worker population, the collective dose would be ____ person-rem.

For the 1,000-year period after the alternative has been implemented, the associated dose for the most limiting population (i.e., the industrial worker) is ____. Pursuant to NUREG-1496 recommendations, a population density of 0.09 persons per square meter may be assumed, meaning the anticipated population at the Newfield property would be ____ people, and the resulting collective dose would be ____ person-rem.

The total collective dose for both the construction and post-construction phase is thus ___ person-rem. This would then result in a cost for the hypothetical radiological risks incurred of $_____.

LT Alternative

As shown in Table ___, the dose associated with the LT alternative, during construction is ____ millirem. For a ___-person worker population, the collective dose would be ____ person-rem.

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[33] The NUREG-1496 equation requires input parametrs in units associated with transport by truck. However, it is anticipated that the residual radioactivity at the Newfield site would be transported by rail rather than truck, thus the reason for different units.

[34] This is an unrealistic assumption as it is likely that some sort of future remediation involving construction will be necessary. However, for the purposes of this assessment, the no-action option contains no provisions for construction activities.

For the 1,000-year period after the alternative has been implemented, the associated dose for the most limiting population (i.e., the industrial worker) is ____. Using the same population density assumption as for the LTC alternative, the anticipated population at the Newfield property would be ____ people, and the resulting collective dose would be ____ person-rem.

The total collective dose for both the construction and post-construction phase is thus ___ person-rem. This would then result in a cost for the hypothetical radiological risks incurred for this alternative of $_____.

7.3.7 Licensing

To be inserted

7.3.8 Change in Land Value

During the actual implementation of the alternatives listed below, no impacts on the economic use of the property are expected to result, as the actions associated with each alternative are basically limited to the Storage Yard and adjacent areas that are not currently industrially active. Therefore, this evaluation focuses on potential impacts on land value once the alternatives have been implemented.

Long-term potential changes in land value associated with the implementation of these alternatives are difficult to estimate, as they not only involve the normal variables associated with real estate cycles, but also such intangible factors as the potential stigma associated with a real or perceived environmental hazard, perceived risks, changes in science which may impact existing risk analyses, and potential future liability associated with regulatory changes. More practical but still intangible factors a potential developer faces also include problems associated with achieving financing for such a property or the general "trouble factor" of dealing with such a property. Since each of these variables can significantly impact future land values and are extremely difficult to predict, the evaluation presented below focuses on a qualitative evaluation of potential impacts on land value associated with each of the alternatives.

<u>LC Alternative</u>

For the no-action option, no changes in the existing nature of the site would occur. Therefore, there are no costs or benefits in terms of future land value associated with this alternative.

<u>LTC Alternative</u>

For the LTC option, engineering, institutional and regulatory controls would limit future use of the remaining restricted area (i.e., the area beneath the engineered cover or cap). Other existing restrictions associated with natural resource restoration requirements will prevent future use/redevelopment of much of the currently undeveloped area of the SMC facility. It is expected

that industrial operations will continue in the existing developed portions of the facility. Based on the industrial worker assessment presented in Section ___, no restrictions on future continued use of the existing industrial areas are anticipated. Therefore, no adverse impacts to existing land value are anticipated for these areas. With the aesthetic improvements associated with the capping of the existing Storage Yard materials as well as the improved aesthetics associated with the natural resource restoration program (i.e., reforestation of undeveloped portions of the site), an increase in future land use value could result, provided these benefits are not outweighed by any stigma associated with the continued presence of the capped materials at the facility.

LT Alternative

For the LT option, upon, the site would be released for unrestricted use completion of the removal of residual radioactivity. Existing restrictions associated with natural resource restoration requirements will prevent future use/redevelopment of much of the currently undeveloped area of the SMC facility. Similarly, soil contaminant levels will likely prevent any future residential use of the site. However, continued industrial use of the existing developed areas is likely. Because the implementation of the LT alternative requires the upgrading of an existing railroad spur along the northern border of the site to support the removal of materials off-site, the value of the facility as an industrial property is likely to increase following remediation. The removal of any stigma associated with the current presence of radiological material at the facility would only enhance the future property value. As the railroad spur borders the northern edge of the SMC facility, associated rail spur improvements also have the potential to increase the value of other adjacent properties for future industrial use (e.g., the former Newfield municipal landfill, located immediately to the north of the Storage Yard area).

7.3.9 Environmental Impacts

LC Alternative

For the no action option, the existing Storage Yard area remains a potential erosion source and, therefore, a potential source of impacts to surface water quality should storm water management controls not be maintained in the future. The Storage Yard area provides poor ecological habitat value and the exposed materials act as a potential a source of wind erosion.

LTC Alternative

For the LTC option, reshaping of existing Storage Yard materials (which will require handling of only a portion of the existing materials) and the placement of cover materials over the pile will result in emissions that ___*add description of modeled emissions relative to standards.* Costs associated with the control of these emissions include the costs of _____, which are included in the remedial action costs discussed in Section 7.3.1. No other environmental costs are expected to be associated with the implementation of the LTC alternative.

Long-term environmental benefits associated with the implementation of the LTC alternative include the reduction in potential erosion (both wind- and water-induced) of currently uncovered Storage Yard materials and the improved ecological habitat value of the capped area relative to existing conditions.

LT Alternative

For the LT option, the removal of residual radioactivity will result in greater emissions than those associated with the LTC alternative, as all of the residual radioactive materials will have to be removed and some will have to be crushed on site prior to loading in railcars for off-site disposal. The emissions associated with this alternative are estimated to be ____ *add description of modeled emissions relative to standards*. Costs associated with the control of these emissions include the costs of _____, which are included in the remedial action costs discussed in Section 7.3.1.

An environmental cost associated with the implementation of the LT option that is difficult to quantify is the cost of the loss of existing habitat associated with the upgrading of the existing railroad spur along the facility's northern property line. Since the spur was last used, the associated area has grown over with dense vegetation. It is estimated that nearly 2 acres of dense vegetation will require removal to support the rehabilitation and extension of the existing spur.

An indirect environmental cost associated with the implementation of the LT option that is difficult to quantify is the cost associated with the consumption of landfill space at the disposal facility. The permitting, design and construction of such facilities are extremely costly. While the costs of the development and maintenance of the Envirocare facility are reflected in their existing disposal costs, it is reasonable to expect that the development of new facilities in the future will be even costlier. By consuming currently permitted landfill airspace, a valuable commodity is being expended, guaranteeing increased costs for future projects where on-site stabilization is not an option.

Long-term environmental benefits associated with the implementation of the LT alternative include the permanent removal of residual radioactivity from acting as a source of future erosion (both wind- and water-induced) at this site. However, as the materials will not be destroyed but instead contained within another facility in Utah, the ultimate potential for future impacts due to wind- and water-induced erosion will be limited by the containment features of the disposal facility.

While removal of the radioactive materials will allow for the area in which they are currently stored to be planted with more habitat-friendly plants, the unrestricted use of the area will allow for its future development. Therefore, the long-term enhanced ecological value of the area is not guaranteed.

7.3.10 Cost Summary

Table ___ contains a summary of the costs associated with each alternative. For the LC alternative, the cost is $____. For the LTC alternative, the cost is $____. And for the LT alternative, the cost is $____.

7.4 Cost/Benefit Analysis

The following table shows the potential hazard, the risk estimate determined for that hazard, and the implementation cost for each of the decommissioning options evaluated in this Chapter:

Comparison of Risks and Costs

Population	Risk	Risks and Costs		
		LC Alternative	LTC Alternative	LT Alternative
Workers	Cancer Fatality			
	Remediation Activities Fatality			
	Transportation Fatality			
General Population	Cancer Fatality			
	Remediation Activities Fatality			
	Transportation Fatality			
	Total Fatality Risk			
	Total Cost			

This table shows that the ___ alternative presents the lowest overall risk of fatality and a lower cost. However, with respect to radiological impacts only, a simple cost-benefit analysis can be performed by evaluating the following:

$$X + \alpha S = Minimum$$

where X = the cost of achieving a given level of protection ($), S = the collective dose (person-rem), and α = a constant expressing the cost assigned to the collective dose.[35] The following is a summary of the cost-benefit analysis for the three options:

Option	X ($)	S (Person-Rem)	α ($ per Person-Rem)	Analysis Result
LC Alternative			2000	
LTC Alternative			2000	
LT Alternative			2000	

Consistent with the ALARA concept, the ____ alternative is clearly the most cost effective when radiation exposures only are taken into account.

7.6 Summary

Most decisions about human activities are based on an implicit form of balancing the costs and benefits leading to the conclusion that the conduct of a chosen practice is "worthwhile".[36] With respect to the use and control of radioactive materials, the decision-making process is typically based upon the following:

- No practice shall be adopted unless its introduction produces a positive net benefit;
- All exposures to ionizing radiation shall be kept as low as reasonably achievable, economic and societal factors being taken into account; and
- The dose equivalent to individuals shall not exceed applicable regulatory dose limits.

As part of the decommissioning planning process for SMC's facility in Newfield, three alternatives were compared in light of ALARA considerations. These were the LC (license continuation) alternative, the LTC (long-term control) alternative, and the LT (license termination) alternative.

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[35] A value of $2,000 is the value in dollars of a person-rem averted in NUREG/BR-0058, "Regulatory Analysis Guidelines of the U. S. Nuclear Regulatory Commission", Revision 2, November, 1995.

[36] International Commission on Radiological Protection, ICRP Publication 55, "Optimization and Decision-Making in Radiological Protection", Pergamon Press, 1989.

In the analysis, project costs, construction-related fatalities, transportation-related fatalities, and the risks of radiation exposure were compared for all options.

The results demonstrate that the ____ alternative is the most defensible decommissioning option for this site based upon ALARA considerations.