40-7102

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Mr. Gary C. Comfort, Jr.
Licensing Section 2
Division of Fuel Cycle Safety and Safeguards, NMSS
U. S. Nuclear Regulatory Commission
Washington, D. C. 20555-0001

December 12, 1995

RE: Conceptual Decommissioning Plan for the Newfield Facility

Dear Mr. Comfort:

Enclosed herewith please find a revised submission of the Conceptual Decommissioning Plan for The Shieldalloy Metallurgical Corporation (SMC) Newfield facility. This conceptual plan is intended to replace the previous plan that was submitted in April 1993 and reflects changes that have taken place since that time. You will note that this conceptual plan takes into account the sale of the baghouse dust as well as the slags. As you are aware, the NRC has halted the preparation of the Environmental Impact Statement for this site as a result of the strong potential for sale of the slags. As you are also aware, we have had preliminary discussions with the NRC involving the regulatory status and future sale of the baghouse dust. Since, as a result of these developments, it seems very likely that both the slags and the baghouse dust will be sold as useful products in commerce in the future, release of the Newfield site for unrestricted use now appears achievable as is reflected in the enclosed Conceptual Decommissioning Plan.

Please let me know if you have any questions or if you need additional information.

Very Truly Yours,

R. Diane Kane for C. Scott Eves

C. Scott Eves

cc: MAF
HNS
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David Berz
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CONCEPTUAL DECOMMISSIONING PLAN FOR THE NEWFIELD, NEW JERSEY FACILITY

CONCEPTUAL DECOMMISSIONING PLAN FOR THE NEWFIELD, NEW JERSEY FACILITY

Submitted to:

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Report No. 94005/G-9118
December 8, 1995

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INTRODUCTION

Shieldalloy Metallurgical Corporation (Shieldalloy) operates a manufacturing facility located in Newfield, New Jersey. This facility manufactures or has manufactured specialty steel and super alloy additives, primary aluminum master alloys, metal carbides, powdered metals, and optical surfacing products. Raw materials in use at the facility include ores which contain oxides of columbium (niobium), vanadium, aluminum metal, titanium metal, strontium metal, zirconium metal, and fluoride (titanium and boron) salts. During the manufacturing process, the facility generates slag, dross, and bag house dust.

One of the materials received, used or stored by Shieldalloy contains radioactive material which is classified as "source material" pursuant to Title 10, Code of Federal Regulations, Part 40. This material is called pyrochlore, a concentrated ore containing columbium (niobium). Pyrochlore contains greater than 0.05% of natural uranium and natural thorium. Therefore, it is licensable by the U. S. Nuclear Regulatory Commission (USNRC).

Shieldalloy currently holds USNRC License No. SMB-743 which allows possession, use, and storage of source material.[1] The most recent renewal of SMB-743 was issued in July, 1980. Prior to its expiration in July, 1985, Shieldalloy submitted an application for renewal, thus extending SMB-743 until the USNRC acted upon the renewal application.

Pursuant to 10 CFR 40.36, applicants who submitted renewal applications prior to July 27, 1990 must submit a decommissioning funding plan (and provide financial assurance for decommissioning) by November 24, 1995. This report describes Shieldalloy's conceptual plan to decommission the Newfield facility after licensed activities have been terminated. The decommissioning efforts described herein are intended to ensure that short- and long-term radiation exposures to workers and members of the general population after license termination are as low as reasonably achievable, and that the volume of radioactive waste to be disposed of is minimized.

Included in this report is a description of the decommissioning objective for the Shieldalloy facility, the conceptual plan for decommissioning the site, and a conservative estimate of the cost

[1] Shieldalloy has also applied for a permit to export CANAL©, a by-product of ferrocolumbium operations. This product is used as a slag fluidizer in steel production.

of achieving the decommissioning objective. The decommissioning funding plan for Shieldalloy, submitted under separate cover, is based upon the conclusions of this report.

ITEMS TO BE DECOMMISSIONED

General Site Characteristics

The Shieldalloy plant is built on approximately 60 acres in the Borough of Newfield (Gloucester County), New Jersey.[2] The topography of the Newfield area is relatively flat, and the Shieldalloy property is located on a slight topographic high, with the ground surface generally sloping to the west-southwest, towards the Hudson's Branch. The Hudson's Branch, an intermittent, slow-moving tributary of Burnt Mill Branch in the Maurice River Basin, is the predominant surface water body in the vicinity of the plant. It borders the southern boundary of the property, where it flows from east to west.[3]

The plant is divided into four functional areas. These are the manufacturing area, the storage yard, the lagoon area, and other undeveloped plant property. The following is a brief description of each functional area:

- Manufacturing area - This area contains a number of operations facilities, offices, and loading docks. For the most part, the area is covered with buildings and asphalt or concrete pavement. Included are the Railroad Siding Area, Department 111 (ferrocolumbium operation), Department 107 (induction melting), Department 102 (aluminothermic reduction operation), Department 101 (metal grinding operations), Department 115 (aluminum master alloys), Department 116/118 (metal powder compaction operations), and Department 204 (maintenance operations).

- Storage Yard - This area is located on the eastern portion of the property, and is used to store materials generated during manufacturing operations.

- Lagoon area - This area consists of three lagoons located in the central portion of the property.

- Undeveloped plant property - This area is located along the southern plant property boundary, and includes all undeveloped and unused areas of the plant.

The plant area is surrounded by a seven-foot tall chain link fence, topped with barbed wire. There are 27 buildings on the property, and their construction is either steel frame or concrete block.

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[2] A small portion of the property lies in Cumberland County, New Jersey.

[3] The Hudson's Branch flows from northeast to southwest after it leaves the Shieldalloy property.

The licensed radioactive material inventory at the plant currently consists of the operating inventory of pyrochlore, the slag from the D111 production department, and the dust from the D111 bag house.[4] Greater than 99% of the radioactive species in the feed material for the smelting operation remains in the slag and, to a much lesser extent, in the baghouse dust.[5] Table 1 shows the physical quantities of these materials and their location at the plant.

Shieldalloy intends to package and sell CANAL©, produced from ferrocolumbium slag, to steel manufacturers in foreign countries. This product, which is used as a fluidizer for steel production, has significant financial value. In addition, Shieldalloy plans to package and sell its baghouse dust to a local cement manufacturer. Baghouse dust also has financial value as a source of calcium and silicon for cement production.

Licensed radioactive materials are located in specific areas within the Newfield facility. The following is a description of those areas, along with conservative estimates of the quantity of radioactive material that exists in each area as of the date of this report.[6]

D111 Production Department

The ferrocolumbium production department, D111, is the predominant location where source material is used. D111 is a 1,742 m^2 by 12 m tall building constructed of wood and metal. It is equipped with an operator control room, mechanical booms and heavy equipment handlers, storage containers, scales, a variety of melting pots, two furnaces, a dust collection system, and other miscellaneous items.

D111 is a "Restricted Area". For the purposes of this report, it is assumed that there will be no licensable materials, in the form of slag and pyrochlore, present in this location at the time of decommissioning. The radiation exposure rates in this area currently average approximately 75 microR per hour.

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[4] At the time of this report, the majority of the licensed material at the Newfield plant is in the form of slag.

[5] IT Corporation, "Assessment of Environmental Radiological Conditions at the Newfield Facility", IT Corporation Report No. IT/NS-92-106, April 1, 1992.

[6] The items listed herein are intended for planning purposes only. At the actual time of license termination, the list of items to be decommissioned will be determined from the results of a site-wide characterization.

The contamination levels in D111 (production areas) currently average about 1135 $\pm$ 600 disintegrations per minute (dpm) alpha (fixed plus removable) per 100 cm^2.[7] If it is conservatively assumed that all building surfaces in D111 are uniformly contaminated at this level, and that the building has a surface area of approximately 8,710 m^2,[8] there are approximately 4.45 x 10^{-4} curies each of residual thorium and uranium contamination currently in D111.

AAF Baghouse

The American Air Filter (AAF) system was installed in D111 in 1966. It is designed to draw 125,000 cfm of air through the system, and typically operates in concert with the Flex-Kleen system. Reverse air jets in the AAF baghouse remove the dust from the fabric. The dust is then conveyed via a series of screw conveyors and conveying ducts to a silo for temporary storage. The building is equipped with storage bins, filter bags, and other miscellaneous items.

The AAF Baghouse is a "Restricted Area". For the purposes of this report, it is assumed that there are 4.81 x 10^{-3} curies each of uranium and thorium in the form of baghouse dust present in this location. This estimate was determined by conservatively assuming that the contents of the AAF baghouse is at its maximum (approximately 48 cubic meters),[9] that the density of the baghouse dust is approximately two (2) grams per cubic centimeter, and that the uranium and thorium concentrations in the baghouse dust are 42 ppm and 261 ppm, respectively.[10] The radiation exposure rates in this area currently range from background to approximately 50 microR per hour.

The contamination levels in the AAF Baghouse currently average about 1,000 disintegrations per minute (dpm) per 100 cm^2.[11] If it is conservatively assumed that all building surfaces in the AAF Baghouse are uniformly contaminated at this level, and that the building has approximately 560

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[7] Safety and Ecology Consultants, Inc., "Shieldalloy Metallurgical Corporation, Third Quarter 1995 Radiological Surveillance Report", July 20, 1995.

[8] The building surface area is assumed to be equivalent five (5) times the floor dimensions (i.e., the floor plus four walls).

[9] Valenti, J., Shieldalloy Metallurgical Corporation, facsimile communication to C. D. Berger, Integrated Environmental Management, Inc., October 23, 1995.

[10] Berger, C. D., Integrated Environmental Management, Inc., written communication to C. S. Eves, Shieldalloy Metallurgical Corporation, September 11, 1995.

[11] Safety and Ecology Consultants, Inc., "Shieldalloy Metallurgical Corporation, Third Quarter 1995 Radiological Surveillance Report", July 20, 1995.

m^2 of surface area,[12] there are approximately 2.52x10 curies each of residual thorium and uranium contamination currently in this area.

Flex-Kleen Baghouse

The Flex-Kleen system was installed in D111 in 1987. It is designed to draw up to 200,000 cfm, but it typically operates in concert with the AAF system. Pulsed air jets in the Flex-Kleen baghouse remove the dust from the fabric. The dust is then conveyed via a series of screw conveyors and conveying ducts to a silo for temporary storage. The building is equipped with storage bins, filter bags, and other miscellaneous items.

The Flex-Kleen Baghouse is a "Restricted Area". As of the date of this report, there were 8.0 x 10^{-3} curies each of uranium and thorium in the form of baghouse dust present in this location. This estimate was determined by conservatively assuming that the contents of the Flex-Kleen baghouse is at its maximum (approximately 80 cubic meters),[13] that the density of the baghouse dust is approximately two (2) grams per cubic centimeter, and that the uranium and thorium concentrations in the baghouse dust are 42 ppm and 261 ppm, respectively.[14] The radiation exposure rates in this area currently range from background to about 50 microR per hour.

The contamination levels in the Flex-Kleen Baghouse currently average about 1,000 disintegrations per minute (dpm) per 100 cm^2.[15] If it is conservatively assumed that all building surfaces in the Flex-Kleen Baghouse are uniformly contaminated at this level, and that the building has a total of 375 m^2 of surface area,[16] there is approximately 1.69 x 10^{-5} curies each of residual thorium and uranium contamination currently in this area.

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[12] Valenti, J., Shieldalloy Metallurgical Corporation, facsimile communication to C. D. Berger, Integrated Environmental Management, Inc., October 23, 1995.

[13] Valenti, J., Shieldalloy Metallurgical Corporation, facsimile communication to C. D. Berger, Integrated Environmental Management, Inc., October 23, 1995.

[14] Berger, C. D., Integrated Environmental Management, Inc., written communication to C. S. Eves, Shieldalloy Metallurgical Corporation, October 6, 1994.

[15] Safety and Ecology Consultants, Inc., "Shieldalloy Metallurgical Corporation, Third Quarter 1995 Radiological Surveillance Report", July 20, 1995.

[16] Valenti, J., Shieldalloy Metallurgical Corporation, facsimile communication to C. D. Berger, Integrated Environmental Management, Inc., October 23, 1995.

D102 Production Department

The D102 Production Department houses the aluminothermic reduction operation and the stockpile for the CANAL© crushing/sizing/packaging operation. This building is equipped with a furnace, crushing equipment, scales, bagging equipment, and other miscellaneous items.

D102 is a "Restricted Area". For the purposes of this report, it is assumed that there will be no licensable materials (CANAL©) present in this location at the time of decommissioning. The radiation exposure rates in this area average about 30 microR per hour. However, when materials are stockpiled they average approximately 270 microR per hour.

The contamination levels in D102 currently average about 370 $\pm$ 280 disintegrations per minute (dpm) per 100 cm^2.[17] If it is conservatively assumed that all building surfaces in D102 are uniformly contaminated at this level, and that the building has approximately 7,950 m^2 of surface area,[18] there is approximately 4.72×10^{6} curies each of residual thorium and uranium activity currently in this area.

Storage Warehouses

Pyrochlore is received and temporarily stored in either Warehouse D203(A) or Warehouse D203(G) before being transferred to D111. The warehouses are also used to stage CANAL© prior to shipment.

The storage warehouses are "Restricted Areas". As of the date of this report, there is less than 0.1 curie of licensable materials in the form of pyrochlore, CANAL© or other ores, present in these locations. The radiation exposure rates in this area currently average approximately 10 microR per hour.

The contamination levels in the warehouses currently average about 10 $\pm$ 20 disintegrations per minute (dpm) per 100 cm^2.[19] If it is conservatively assumed that all building surfaces in D203(A) and D203(G) are uniformly contaminated at this level, and that the two buildings have a total of

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[17] Safety and Ecology Consultants, Inc., "Shieldalloy Metallurgical Corporation, Third Quarter 1995 Radiological Surveillance Report", July 20, 1995.

[18] Valenti, J., Shieldalloy Metallurgical Corporation, facsimile communication to C. D. Berger, Integrated Environmental Management, Inc., October 23, 1995.

[19] Safety and Ecology Consultants, Inc., "Shieldalloy Metallurgical Corporation, Third Quarter 1995 Radiological Surveillance Report", July 20, 1995.

9,300 m^2 of surface area,[20] there are approximately 1.55×10^{-7} curies each of residual thorium and uranium contamination currently in these buildings.

Storage Yard

Ferrocolumbium standard slag, ferrocolumbium high-ratio slag, and columbium nickel slag generated from the D111 and D102 smelting operations consist of solid, non-combustible material with the consistency of vitrified rock. All three slag types have been maintained separately from the others at their respective points of generation and are transported in trucks from D111 and D 102 to the Storage Yard. For the purposes of this report, it is conservatively assumed that there are approximately 20,000 cubic meters of ferrocolumbium slag (high ratio and standard) in the Storage Yard.[21]

In addition, baghouse dust is transported by truck to the Storage Yard. It is assumed that approximately 20,000 cubic meters of baghouse dust are currently in the Storage Yard.[22,23]

The Storage Yard is a "Restricted Area". As of the date of this report, there were 23 curies each of uranium and thorium in the form of slag and baghouse dust in this location. The radiation exposure rates in this area currently average about 100 microR per hour.[24]

The physical form of the slag in the Storage Yard slag (glass-like rock) does not permit the radioactive elements to leach out into the regional water supply or local wetlands. Leachability

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[20] Valenti, J., Shieldalloy Metallurgical Corporation, facsimile communication to C. D. Berger, Integrated Environmental Management, Inc., October 23, 1995.

[21] From the volumetric information obtained from an October, 1991 fly-over of the Newfield site, the slag yard contained 16,800 m^3 of standard slag and 1040 m^3 of high-ratio slag at that time, for a total of 17,840 m^3 (Shieldalloy Metallurgical Corporation, "Applicant's Environmental Report for the Newfield, New Jersey Facility", October 1, 1992).

[22] Historically, dusts generated from both ferrocolumbium production and un-recycled dusts from ferrovanadium production were not segregated. Currently, however, the ferrovanadium contribution to the collected dusts is negligible.

[23] From the volumetric information obtained from an October, 1991 fly-over of the Newfield site, the slag yard contained 15,100 m^3 of baghouse dust (Shieldalloy Metallurgical Corporation, "Applicant's Environmental Report for the Newfield, New Jersey Facility", October 1, 1992).

[24] As part of its environmental monitoring program, SMC places TLDs on the perimeter fence of the property. The mean measured doses from this effort for the first, second and third quarters of 1994 were 77.7 $\pm$ 110.6 millirem, 93.8 $\pm$ 119.8 millirem, and 71.4 $\pm$ 176.2 millirem, respectively.

studies performed on samples of the slag support this conclusion.[25] Also, the surface of the baghouse dust pile forms a "crust" when it encounters moisture, which serves to deter fugitive dust emissions. Furthermore, neither the groundwater nor the surface water collected from the vicinity of the Newfield site exhibit elevated (above background) radionuclide concentrations.[26] Therefore, once all residual slag and baghouse dust are removed from the Storage Yard the area can be released for unrestricted use.

Slag Used as Fill

In the past, ferrocolumbium slag may have been used on-site as fill material for certain construction projects within the plant site. Possible placement locations include the southwest fence line, in the vicinity of the T12 Tank Area, and under the Haul Road.[27]

Those areas where fill slag may exist are not designated "Restricted Areas". The ambient exposure rates in these areas currently range from background to a few tens of microR per hour.[28] The mass of fill slag is not well-known. Therefore, from the lateral extent of elevated surface exposure rates, it is estimated that there is 8,000 m^3 of fill slag on the property, for a total of 8.4 curies each of uranium and thorium.

Offsite Areas

Radiological surveys of the Newfield facility were conducted in 1988 and 1991 in order to characterize certain radiological constituents that were present both on the property and in designated off-site locations.[29,30] In those surveys, thorium and uranium concentrations in soil/sediment that are slightly in excess of background were noted outside of the Shieldalloy property boundary in the Hudson's Branch Watershed.

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[25] Teledyne Isotopes, "Report of Leachability Studies for Shieldalloy Metallurgical Corporation", Teledyne Isotopes, Westwood, New Jersey, 1992.

[26] TRC Environmental Consultants, Inc., "Remedial Investigation Technical Report", Project No. 7650-N51, Windsor Connecticut, April, 1992.

[27] SMC intends to excavate the fill slag, re-locate it to the Storage Yard. There it will be processed and sold as CANAL©.

[28] IT Corporation, "Assessment of Environmental Radiological Conditions at the Newfield Facility", IT Corporation Report No. IT/NS-92-106, April 1, 1992.

[29] IT Corporation, "Assessment of Environmental Radiological Conditions at the Newfield Facility", IT Corporation Report No. IT/NS-92-106, April 1, 1992.

[30] Oak Ridge Associated Universities, "Radiological Survey of the Shieldalloy Metallurgical Corporation, Newfield, New Jersey Facility", July, 1988.

Prior to evaluating the feasibility of various remedial actions for the radioactive materials contained in the Hudson's Branch, a baseline assessment of their radiological impact on the surrounding population was performed.[31] The results of this extremely conservative assessment indicated that the maximum risk of fatal cancer incurred by a hypothetical farm family resident in the Hudson's Branch is 1.8×10^{-6}. Therefore, no remedial actions are deemed necessary in order to release the outside areas for unrestricted use.

[31] IT Corporation, "Baseline Radiological Risk Assessment for the Hudson's Branch Watershed", IT Corporation Report No. IT/NS-91-116, 1992.

DECOMMISSIONING OBJECTIVE

A critical step in the decommissioning process is to determine the objective of the action. The objective typically refers to the maximum acceptable dose limit that will be incurred by members of the general public after all action is complete and the USNRC license is terminated.

There are a number of dose limits promulgated by standards groups and regulatory agencies that are considered to present negligible risk, any one of which would constitute an acceptable objective for decommissioning of the Newfield facility. The following are a few examples:

- The International Commission on Radiological Protection, in its guidance to regulatory and advisory agencies at national, regional, and international levels on the fundamental principles on which appropriate radiological protection can be based, also recommends a basic dose limit for members of the general public as a result of occupational practices of 100 millirem per year.[32] However, in special circumstances, the ICRP recommends that a higher value could be allowed in a single year, provided that the average over five (5) years does not exceed 100 millirem per year.

- The National Council on Radiation Protection and Measurements recommends a dose limit of 100 millirem per year from manmade sources for individual members of the public.[33] This limit is based on scientific recommendations developed through an impartial consensus process.

- The USNRC, in a 1991 Final Rule, adopted the recommendations of the NCRP as its basic dose limit applicable to any licensed facility.[34]

- The U. S. Environmental Protection Agency (USEPA) imposes a limit of 25 millirem per year to any member of the public from nuclear fuel cycle facilities.[35]

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[32] International Commission on Radiological Protection, "1990 Recommendations of the International Commission on Radiologial Protection", ICRP Pubication 60, Pergamon Press, November, 1990.

[33] National Council on Radiation Protection and Measurements, "Ionizing Radiation Exposure of the Population of the United States", NCRP Report No. 93, September, 1987.

[34] Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation", January 1, 1994.

[35] Title 40, Code of Federal Regulations, Part 190, "Environmental Radiation Protection Standards for Nuclear Power Operations", 1991.

- In 1994, the USNRC issued proposed radiological criteria for decommissioning.[36] The goal of these criteria, which are based upon a highly-restrictive dose objective of 15 millirem per year, is to ensure that residual radioactivity from decommissioned sites is "indistinguishable from background".

For the purposes of this report, a dose objective of 15 millirem is deemed applicable. The reason for selecting this objective is that it is consistent with the USNRC's current thinking on acceptable decommissioning. It is also the lowest of the values listed above, it demonstrates a desire to implement conservative radiological protection practices, and the intent is consistent with federal requirements that licensed radioactive materials be handled and released in a manner that ensures that exposures are as low as is reasonably achievable (ALARA) taking into account economic and societal factors.[37] Therefore, the goal of decommissioning the Newfield site is to ensure that members of the general population do not incur radiation doses in excess of 15 millirem per year after the license is terminated.

[36] Title 10, Code of Federal Regulations, Part 20, Proposed Rule, "Radiological Criteria for Decommissioning", FR 59, No. 161, 43220, August 22, 1994.

[37] Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation".

SELECTION OF PREFERRED DECOMMISSIONING METHODOLOGY

Decommissioning Alternatives

Once operations with licensed radioactive materials cease, the Newfield facility will be decommissioned. Typically, decommissioning means that the facility will be safely removed from service and all radioactive materials in excess of levels which would permit unrestricted use of the facility will be disposed of.

Several decommissioning alternatives potentially satisfy this general requirement. These are "No Action", DECON, SAFSTOR and ENTOMB.[38] The following are brief descriptions of each of these alternatives:

- No Action - This implies that Shieldalloy would simply abandon or leave the facility after ceasing operations.

- DECON - This option is to remove all radioactive materials such that residual levels permit the property to be released for unrestricted use. DECON will lead to termination of the facility license and facility re-use shortly after cessation of facility operations. Since DECON is generally completed within a few months or years following facility shutdown, personnel radiation exposures are generally higher than for options that spread the decommissioning work over longer time periods to take advantage of radioactive decay.[39]

- SAFSTOR - This alternative places and maintains the facility in a condition that ensures the risk to members of the general public is acceptable. In general, it requires that the radioactivity in the facility has a small enough half-life to substantially decay away during the safe storage period. It also requires that the facility can be safely stored, and that it can be subsequently decontaminated and released for unrestricted use (deferred decontamination). SAFSTOR consists of a short period of preparing the site for safe storage, and a variable safe storage period of continuing care consisting of security, surveillance, and maintenance.

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[38] Terms and definitions taken from NUREG-0568 (U. S. Nuclear Regulatory Commission, Office of Standards Development, "Draft Generic Environmental Impact Statement on Decommissioning of Nuclear Facilities", NUREG-0568, January, 1981).

[39] However, this advantage would not be realized at the SMC facility where only radionuclides with long half lives are present.

Depending upon the half-life of the radionuclides in question, there may also be a short period of deferred decontamination at the end of the continuing care period.[40]

- ENTOMB - This alternative requires the encasement of the facility in concrete to protect the public from radiation exposure until the radioactivity has decayed to levels permitting unrestricted use of the facility.

The "no action" alternative is clearly unacceptable to both Shieldalloy, regulatory agencies, and state/local officials. Given the relatively low volume of radioactivity that would be involved in final decommissioning (see Table 1), its physically stable form and the long radiological half-life of the residual radioactivity at the facility, SAFSTOR and ENTOMB are also not considered to be viable alternatives.[41] Therefore, only DECON is considered to be potentially applicable decommissioning alternatives for Shieldalloy.

Short-term Risks

DECON was evaluated with respect to its potential for increasing health and safety risks for members of the general public and workers involved in implementing the alternative. For this assessment, it is assumed that the general public will be protected from exposures by administrative and procedural controls. Therefore, the short-term impacts on this population group are considered to be negligible. It was also assumed that workers will follow ALARA procedures and all OSHA regulations, and that the intake of radioactive materials through inhalation or ingestion will thus be prevented.

For the DECON option, the goal will be to maintain radiation exposures to decommissioning workers to below regulatory limits. At Shieldalloy, the critical exposure time will be during material packaging and shipment, and the decontamination/removal/dismantling of the equipment, ventilation systems, and structures. For the work durations and exposure rates shown in Table 2, the total worker dose for the DECON alternative is estimated to be 0.4 person-rem.

Long-Term Risks

The primary long-term risk incurred by humans after decommissioning is complete is exposure to residual radioactive materials at the site. For the DECON option, the long-term risks to

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[40] In-situ disposal is a form of long-term or open-ended SAFSTOR. However, there is no "deferred decontamination" associated with the in-situ disposal option.

[41] Long-term SAFSTOR - or in-situ disposal - would be a viable option if the volume of residual radioactive materials was sufficiently large that an unacceptable ALARA (cost/benefit) analysis for DECON results.

members of the general public is considered to be negligible since the site will be released for unrestricted use pursuant to 10 CFR 40.42.[42]

Waste Disposal

Although it is assumed that all of the remaining ferrocolumbium slag (CANAL©) and baghouse dust present at the time of license termination will be sold, DECON will still entail disposal of some radioactive materials at an off-site disposal location. These materials will be in the form of contaminated soils, metals, building parts and other solids. For the purposes of this report, it is assumed that a total of 652 cubic meters (4.7×10^{-2} curies) will be disposed of as radioactive waste.[43]

Selection of Preferred Alternative

DECON, the traditional approach to facility decommissioning, is clearly approved by the USNRC for termination of operating licenses.[44] Its primary advantages are that it is relatively uncomplicated, eliminates the need for continued monitoring, and releases the facility for other uses within a relatively short time frame.[45] Activities performed under this option at the Newfield plant would generally include removal of contaminated equipment in all buildings/areas (furnaces, ventilation systems, packaged materials, other solids), decontamination of remaining room surfaces or soil areas to eliminate residual radioactive materials above the release criteria, and performance of a final release survey.

The licensable radioactivity at Shieldalloy consists primarily of residual materials generated from metallurgical operations. In their current state, the hazards to the general population from the licensable inventory are negligible. However, the long radiological half-life of the materials in question does not support consideration for delayed decommissioning in order to take advantage of radioactive decay.

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[42] An exception would be the members of the general public who live in the vicinity of the off-site disposal location after it undergoes closure.

[43] The radioactive waste subject to off-site disposal is assumed to consist of 384 m^3 of scrap metal and secondary waste (e.g., tyvek clothing) from decontamination of D111, 96 m^3 of secondary waste from D102, 96 m^3 of scrap metal from the AAF baghouse, and 65 m^3 of scrap metal from the Flex-Kleen baghouse. (The AAF baghouse is approximately 1.5 times the size of the Flex-Kleen baghouse.)

[44] Title 10, Code of Federal Regulations, Section 40.42.

[45] Other advantages of DECON include the availability of a work force that is highly knowledgeable about the facility, and elimination of the need for long-term security, maintenance and surveillance.

As required in 10 CFR 40.42, and consistent with the ALARA concept, DECON presents acceptable radiological risk over the short- and the long-term, results in a relatively small volume of solid waste to be disposed of (once the slag and baghouse dust is sold), and ensures that radiation exposures after decommissioning will be maintained as low as reasonably achievable with economic benefits taken into account. Therefore, DECON is the preferred decommissioning methodology for the Newfield facility.

CONCEPTUAL DECOMMISSIONING PLAN

Procedure Description

The Newfield facility will be decommissioned by the methodology of DECON by implementing the following general actions:

- Evaluate the adequacy of existing site characterization data, develop a plan for acquisition of additional data (as needed), and perform additional characterization.

- Generate and submit to USNRC a site-wide decommissioning plan that includes detailed work plan for the activities to be performed, a detailed description of and the justification for release criteria that will be adhered to during decontamination activities, a health and safety plan, a quality assurance plan, and the plan for performance of the final release survey.

- In D111, decontaminate equipment, building surfaces, and surrounding area; transfer remaining ferrocolumbium slag (CANAL©) to the Storage Yard for storage prior to sale; and dispose of materials (equipment, structures and decontamination residue) that do not meet the release criteria at an off-site disposal facility (licensed recycling facility or licensed low level waste burial ground).

- In D102, decontaminate equipment, building surfaces, and surrounding area; transfer remaining ferrocolumbium slag (CANAL©) to the Storage Yard for storage prior to sale; and dispose of materials (equipment, structures and decontamination residue) that do not meet the release criteria at an off-site disposal facility (licensed recycling facility or licensed low level waste burial ground).

- In the AAF and Flex-Kleen baghouses, decontaminate equipment, building surfaces, and surrounding area; transfer remaining baghouse dust to the Storage Yard for eventual sale; and dispose of materials (equipment, structures and decontamination residue) that do not meet the release criteria at an off-site disposal facility (licensed recycling facility or licensed low level waste burial ground).

- In the storage warehouses, decontaminate building surfaces, and surrounding area.

- For the fill slag, locate areas through surveys, sampling and/or review of historical information; extract slag and transport it to the Storage Yard for eventual sale.

- In the Storage Yard, sell all remaining ferrocolumbium slag (CANAL©) and baghouse dust.

- Backfill excavations with clean fill after completion of release surveys; sow new grass.

Final Report to the USNRC

A final release survey will be performed upon completion of remedial actions, and prior to any work area restoration. In general, the survey methodology will be designed in accordance with the recommendations of (draft) NUREG/CR-5849.[46] The objective of the survey will be to demonstrate that the radiological conditions at the Newfield site meet the decommissioning objectives, that surface radioactivity in buildings and structures are less than the site-specific release criteria, and that radiation doses to members of the general population will not exceed 15 millirem per year. These conditions will be demonstrated at a 95% confidence level. The survey data will also be used to calculate the total inventory of residual uranium and thorium at the Newfield site.

[46] Berger, J. D., "Manual for Conducting Radiological Surveys in Support of License Termination", Draft Report for Comment, NUREG/CR-5849, ORAU-92/C57, 1992.

DECOMMISSIONING COST ESTIMATE

Cost estimates for implementing the steps shown in Table 3 are based on a variety of cost-estimating data, including curves, generic unit costs, vendor information, conventional cost-estimating guides, and prior similar estimates as modified by site-specific information. Prior estimates, site-cost experience, and good engineering judgements were used to identify those items that will control the estimates. The following is a listing of assumptions used:

- Performance of Site characterization: Six week duration for a five man crew. The site characterization is conducted pursuant to (draft) NUREG-CR/5849.[47] The cost estimate includes charges for sampling equipment, sample analysis, and radiological survey instrumentation.

- Preparation of Decommissioning Plan: Level of effort is based on conduct of similar projects, and includes time for re-writes, regulatory negotiation, and other ancillary items.

- Building D111 Decontamination: Two month duration for 10 man crew, and a total of 384 m^3 of material to be disposed of off-site. The cost estimate includes charges for sample analysis, radiological survey instrumentation, decontamination equipment, waste packaging materials, and transportation/disposal charges.

- Building D102 Decontamination: One (1) month duration for 4 man crew, and a total of 96 m^3 of material to be disposed of off-site. The cost estimate includes charges for sample analysis, radiological survey instrumentation, decontamination equipment, waste packaging materials, and transportation/disposal charges.

- Flex-Kleen Baghouse Decontamination: Two (2) week duration for 3 man crew, and a total of 65 m^3 of material to be disposed of off-site. The cost estimate includes charges for sample analysis, radiological survey instrumentation, decontamination equipment, waste packaging materials, and transportation/disposal charges.

- AAF Baghouse Decontamination: Three (3) week duration for 4 man crew, and a total of 96 m^3 of material to be disposed of off-site. The cost estimate includes charges for sample analysis, radiological survey instrumentation, decontamination equipment, waste packaging materials, and transportation/disposal charges.

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[47] Berger, J. D., "Manual for Conducting Radiological Surveys in Support of License Termination", Draft Report for Comment, NUREG/CR-5849, ORAU-92/C57, 1992.

- Fill slag: Approximately 8,000 m^3 of slag is excavated and relocated to the Storage Yard. The cost estimate includes charges for excavating vehicles/equipment, sample analysis, radiological survey instruments, and labor for both locating and transporting the slag.

- Off-site waste disposal: Waste is disposed of at the Envirocare facility in Clive, Utah. The cost of disposal is $9.14 per cubic meter, exclusive of transportation, analytical, and materials preparation charges.

- Transportation Costs: The cost of transporting waste to Envirocare, assumed to be 2,200 miles from the Newfield site, is $2.65 per mile.

- Release Survey: Survey duration is seven weeks for a four-man crew. The Cost estimate includes charges for sampling equipment, sample analysis, and radiological survey instrumentation.

Both capital and operation and maintenance (O & M) costs were considered, where appropriate. Present-worth analysis was used for expenditures that may occur over different time periods.

The estimated cost of decommissioning the Newfield site pursuant to this conceptual decommissioning plan is $749,700. Table 3 contains a break down of costs with respect to the individual procedures.

REVIEW SCHEDULE

This conceptual decommissioning plan will be reviewed at least annually by the Shieldalloy Radiation Safety Officer (RSO) to determine if it requires revision due to any changes in the status of the Newfield facility. This review will also include a review of the Decommissioning Funding Plan if changes have taken place that might impact the cost estimates presented herein. This plan may be reviewed more frequently if significant events take place, such as a reduction in the inventory of source material at the facility, decontamination of an area specifically addressed in this plan, or an incident involving the spread of contamination to previously uncontaminated areas of the facility occurs.

Should events at the Shieldalloy facility warrant a revision to this plan or the Decommissioning Funding Plan, the RSO will present the proposed changes to the Radiation Safety Committee for their review and approval. Revised plans will then be submitted to the USNRC shortly thereafter.

TABLES

TABLE 1 - CURRENT INVENTORY OF LICENSED MATERIALS [48]

Area	Current Inventory of Solids (Ci)		Other Residual Activity (Ci)	
	Thorium	**Uranium**	**Thorium**	**Uranium**
Department D111	0.00e+00	0.00e+00	4.45e-04	4.45e-04
AAF Baghouse [49]	4.81e-03	4.81e-03	2.52e-05	2.52e-05
Flex-Kleen Baghouse [50]	8.00e-03	8.00e-03	1.69e-05	1.69e-05
Department D102	0.00e+00	0.00e+00	4.72e-06	4.72e-06
Storage Warehouses	0.00e+00	0.00e+00	1.55e-07	1.55e-07
Storage Yard	2.30e+01	2.30e+01	0.00e+00	0.00e+00
Fill slag	8.40e+00	8.40e+00	0.00e+00	0.00e+00
Outside Areas	0.00e+00	0.00e+00	0.00e+00	0.00e+00
Totals	**3.14e+01**	**3.14e+01**	**4.92e-04**	**4.92e-04**

[48] For the purposes of this report, it is conservatively assumed that all radioactive materials at the Newfield facility contain 350 pCi/g each of uranium (plus daughters) and thorium (plus daughters). Consequently, the inventory reflected in this table is somewhat higher than the true inventory. As of the date of this report, the inventory report maintained by Shieldalloy reflects a total of 295,210 kilograms of thorium and 39,812 kilograms of uranium on site.

[49] Assumes AAF baghouse is at capacity.

[50] Assumes Flex-Kleen baghouse is at capacity.

TABLE 2 - ESTIMATED COLLECTIVE DOSE

Action	Person-hours Required	Average Exposure Rate per Task (mr/hr)	Collective Dose (person-rem)
Site Characterization	1200	2e-2	0.024
Generate decommissioning plan	26	0	0
Decontaminate D111	3200	7.5e-2	0.24
Decontaminate D102	320	3e-2	0.0096
Extract and transfer fill slag to Storage Yard for sale as CANAL©	920	1e-1	0.092
Decontaminate AAF Baghouse	480	2.5e-2	0.012
Decontaminate Flex-Kleen Baghouse	320	2.5e-2	0.008
Decontaminate storage warehouses	80	1e-2	0.0008
Area restoration	112	1e-2	0.00112
Final release survey	1120	1e-2	0.0112
		Total	**0.40**

TABLE 3 - MANPOWER AND COST BREAKDOWN [51]

Action	Person-hours Required	Labor, Travel and Living ($)	Other Costs ($)	Total Cost ($)
Site Characterization	1200	60000	28200	88200
Generate decommissioning plan	16 (on-site) 108 (off-site)	15000	300	15300
Decontaminate D111	3200	229400	81000	310400
Decontaminate D102	320	26700	18000	44700
Extract and transfer fill slag to Storage Yard for sale as CANAL©	920	55600	16600	72200
Decontaminate AAF Baghouse	480	39800	19800	59600
Decontaminate Flex-Kleen Baghouse	320	26500	13000	39500
Decontaminate storage warehouses	80	5200	2300	7500
Area restoration	112	4500	35600	40100
Final release survey	1120	58800	13400	72200
			Total	**749700**

[51] Cost estimates for implementing the actions shown are based on a variety of cost-estimating data, including curves, generic unit costs, vendor information, conventional cost estimating guides, and prior similar estimates as modified by site-specific information. Both capital and operation and maintenance (O&M) costs were considered, where appropriate. Other costs associated with each action include analytical charges, waste disposal, personnel protective clothing, instrumentation, rented equipment, and similar charges.

This report was prepared under the direction of
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