PARS
Environmental
Inc.

Suite A
6 South Gold Drive
Robbinsville, NJ 08691

Tel : 609-890-7277
Fax: 609-890-9116

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Final Status Survey Plan for the Remediated D111 and D102/112 Production Departments and Flex-Kleen Baghouse

Shieldalloy Metallurgical Corporation

Report No. 610-01

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Final Status Survey Plan
for the
Remediated
D111 and D102/D112
Production Departments
and
Flex-Kleen Baghouse

Submitted to:

Shieldalloy Metallurgical Corporation
12 West Boulevard
Newfield, NJ 08344
(609) 692-4200

Prepared by:

PARS Environmental Inc.
6 South Gold Drive, Suite A
Robbinsville, NJ 08691
(609) 890-7277

Project No. 610-01

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I.INTRODUCTION

Shieldalloy Metallurgical Corporation (SMC) operates a facility located in Newfield, NJ. 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 used at the facility had included beneficiated 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 a variety of by-products that have commercial application.

Some of the materials received, used or stored by SMC contain radioactive material, which is classified as "source material" pursuant to Title 10 CFR Part 40. The U.S. Nuclear Regulatory Commission has authorized SMC to ship, receive, possess, use, and store source material pursuant to License No SMB-743. The primary forms of source material currently present at the site include ores used as feed to metallurgical operations, byproduct slag used as a slag fluidizer, and baghouse dust. A schematic map of the site, showing the major site features of this plant, is presented on Figure 1 – Site Map.

In an effort to reduce the number of permanent restricted areas at the Newfield facility, SMC began the Decontamination and Dissassembly of the D111 and D102/112 Production Departments and Flex-Kleen Baghouse in May of 2002. The building structures that have been successfully decontaminated according to the site-specific release criteria as defined in RSP-009 Table 1, have been taken off-site for recycling or disposal. Materials that could not be decontaminated to meet the site-specific release criteria and volumetric material not approved for removal from the Newfield facility were taken to the Storage Yard.

1.1 Purpose

The purpose of this final status survey plan is to demonstrate that residual radioactivity in each survey unit of the land areas previously occupied by D111 and D102/112 Production Departments and the Flex-Kleen Baghouse will allow the areas to be removed from the list of permanent restricted areas that appears on the SMC License No. SMB-743.

This Plan describes the remediation and characterization of the land areas formerly occupied by D111 and D102/112 Production Departments and ultimately the final status survey plan. Additional information regarding the specific number and location of samples in each survey unit for the final status survey, which that are not known at this time, will be provided as an addendum to this Plan.

II. FACILITY INFORMATION

2.1 Building/Production Department Descriptions

A brief description of the former operation at each of the buildings included in this project, is provided in the following sections.

2.1.1 Production Department D111

Production Department D111, or the ferrocolumbium production department, was the predominant location where source material ore was smelted into ferroalloy. It was equipped with an operator room, mechanical booms, 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", but no licensable material, in the form of slag and pyrochlore, are present at this time.

The original building was purchased from the Federal Government and moved from Montana to Newfield, New Jersey in 1964. The original structure was 80 feet by 90 feet. An additional structure was added, also in 1964, that was 22 feet by 71 feet. In 1981, the D111 was expanded with the addition of another building, approximately 135 feet by 123 feet wide. The building was 70 feet tall at the peak.

2.1.2 Production Department D102

Production Department D102 produced pure metals and alloys by reducing metal oxides with aluminum powder, known as the aluminothermic process. D102 and the production of chromium metal began very early in the history of the SMC plant. In addition to the aluminothermic process, D102 also housed the stockpile of CANAL© crushing/sizing/packaging operation. The building had been equipped with a furnace, crushing equipment, scales, bagging equipment, and other miscellaneous items. D102 is a "Restricted Area", but no longer stores licensable material, in the form of CANAL©.

The former building was constructed in 1958. The overall building was 54 feet wide and 300 feet long. The aluminothermic department utilized 73% of the building with the balance utilized for the crushing and packaging department, as described in Department D112.

It the past, ferrocolumbium slag may have been used on-site as fill material for certain construction projects within the SMC plant. Should fill slag be encountered, through survey results or from disassembly operations, all slag shall be extracted and transported to the Storage Yard. Fill slag may be encountered in D102 and D111.

2.1.3 Production Department D112

Production Department D112 crushed all lump alloys smelted or melted at the SMC plant. D112 was capable of taking pieces as large as twenty-four inches in diameter. The lump alloy was then

crushed, sized, and packaged to a variety of forms. Metals and alloys could be sized from four inch to 8 mesh down through several different crushing systems. The sized alloy could be either delivered to another department for further processing or packaged in its final form for shipment to a customer.

D112 did not process source material, but was contained within the same structure as D102. D112 shares the 54 feet by 300 feet building with D102, and utilized approximately 27% of the building for its operations.

2.1.4 Flex-Kleen Baghouse

The Flex-Kleen Baghouse system was installed in 1987. It was designed to draw up to 200,000 cfm, and typically operated in concert with the former AAF Baghouse system. Pulsed air jets in the Flex-Kleen Baghouse removed the dust generated in the ferrocolumbium production department (D111). The dust was then conveyed via a series of screw conveyors through filter bags and collected into storage bins. When the storage bins were full, the dust was taken to the Storage Yard. The building was equipped with storage bins, filter bags, and other miscellaneous items.

2.2 Contaminants of Concern

SMC is licensed to possess uranium and thorium in any form suitable for transport under Department of Transportation regulations. Previous studies of radionuclide content of the materials typically found at SMC are indicative of a natural distribution of the radioactive progeny of these series radionuclides. The contaminants of concern at SMC and during this project include ^{232}Th plus progeny in equilibrium and ^{238}U plus progeny in equilibrium.

2.3 Background

During the Decontamination and Dissassembly of D111 and D102/112 Production Departments and the Flex-Kleen Baghouse, the area west of the Laboratory, Building D202, was used as a reference background area. The exposure rate in this area was 6.3 ● 0.4 μR/hr. Background exposure rate in the April 9, 1992 report "Assessment of Environmental Radiological Conditions at the Newfield Facility" prepared by IT Corporation/Nuclear Sciences was 6.6 ± 0.8 μR/hr.[1] The same report references background exposure rates of 6.5 ± 0.8 μR/hr that were taken by ENSR in 1991.[2]

Background soil concentrations utilized in the January 20, 2000 IEM report "Soil Sampling/Survey of the Storage Yard After Remediation" for ^{232}Th and ^{238}U was 0.97 ± 0.47 pCi/gram and 0.73 ± 0.41 pCi/gram, respectively.[3]

Background soil concentrations as reported in the "Assessment of Environmental Radiological Conditions at the Newfield Facility" for ^{232}Th and ^{238}U was 0.8 ± 0.6 pCi/gram and 0.8 ± 0.4 pCi/gram, respectively.[1]

For the purpose of this Project, it is reasonable to use either data set or both as a determination for background soil concentrations.

2.4 Release Criteria

SMC Radiation Safety Procedure No. RSP-009, "Contamination Control" contains the release criteria for the SMC Newfield facility. These criteria are shown in Table 1. The Derived Concentration Guideline Levels (DCGLs) is selected to be 1.1 pCi/g and 0.5 pCi/g for ^{232}Th plus progeny and ^{238}U plus progeny, respectively.

For the walk-over survey a screening level of 10 μR/hr above background, at a distance of one (1) meter from the soil surface will be used. At any location that exhibits an exposure rate in excess of this value will be subject to additional investigation and/or remediation.

2.5 Instrumentation and Detection Sensitivity

2.5.1 Surface (Alpha) Contamination

A Ludlum Measurements, Inc. (Ludlum) Model 43-1 Scintillator (Alpha detector) will be used to measure Total and Removeable surface contamination. The detection sensitivity on scaler and ratemeter mode of this instrument is 25 and 200 dpm (alpha)/100cm^2, respectively.

- The instrument will be calibrated according to Manufacturer specifications.
- The instrument will be source checked with ^{230}Th.
- Background measurements will be obtained in areas free of source material.
- Total contamination shall be conducted by scanning impermeable* surfaces (such as concrete, metal and drywall) with the detector held 1/8 inch off the surface being monitored.
  **Alternative procedures, i.e. offsite laboratory analysis, are to be followed for porous surfaces, such as wood, soil, water, etc.*
- The detector will be moved at a rate of one to two inches per second over the surface of the area.
- The measured data shall be recorded on the "Contamination Survey Form"
- This measurement value is the total surface contamination.

When total surface contamination measurements exceed the site-specific release criteria, removable surface contamination (wipe tests) shall be conducted in the following manner:

- A Smear cloth shall be wiped in an "S" shape using moderate pressure.
- The area covered will be approximately 100cm^2 (16in^2).
- The Ludlum Model 43-1 Scintillator shall be used to measure the activity on the smear cloth following the above-described procedure.
- The fixed contamination will be determined by subtracting the removable contamination value from the total surface contamination value.

2.5.2 Ambient Gamma Exposure

A Ludlum Model 19 MicroR Meter (Gamma Surveyor) will be used to measure Ambient Gamma Exposure. The detection sensitivity of this instrument is 175 cpm/micror/hr (*137Cs gamma*).

- The instrument will be calibrated according to Manufacturer specifications.
- The instrument will be source checked with ^{238}U or ^{239}Th.
- Background measurements will be obtained in areas free of source material.
- Ambient Gamma Exposure shall be monitored by holding the instrument detector approximately three feet (waist level) from the walking surface.
- The measured data shall be recorded on the "Ambient Gamma Exposure Form"

2.6 Conditions Prior to Land Area Remediation

After removal of the building structures and prior to the removal of concrete or soil, exposure rate surveys of the land areas of D111 and D102/112 Production Departments were conducted. An exposure rate survey was conducted of the land areas of the Flex-Kleen Baghouse prior to decontamination and disassembly of the building structure. The removal of the building, which sat on top of a concrete pad, is not expected to affect the exposure rates of this area.

Exposure rates measured at three (3) feet from the ground surface using a Ludlum Model 19 MicroR Meter in the D111 land area ranged from 9 to 130 μR/hr. Utilizing the same meter and measurement technique, the D102/112 land area ranged from 8 to 115 μR/hr and 7 to 40 μR/hr on the concrete pad and the surrounding 5 feet.

No soil concentration data that are representative of current conditions in D111 and D102/112 Production Departments or of the Flex-Kleen Baghouse are available at this time. After remediation, characterization soil samples from these areas will be taken, as described in Section 3.

2.7 Classification of Areas

Throughout the Newfield facility, not all areas of the site have the same potential for residual contamination, however since D111 and D102/112 Production Departments and the Flex-Kleen Baghouse have a potential for radioactive contamination or known contamination above the DCGL, they are all classified as Class 1 areas.[4]

III. REMEDIATION AND FINAL STATUS SURVEY PLAN

3.1 General Remediation, Measurement and Sampling Plan

The general procedure after the removal of the building structures is to conduct a gamma radiation survey of 100% the land areas formerly occupied by D111 and D102/112 Production Departments and the Flex-Kleen Baghouse. A direct frisk for surface contamination will be

conducted on concrete areas, such as the Flex-Kleen Baghouse pad. Areas that exceed the site-specific exposure and/or surface rate release criteria will be marked or flagged for further investigation and/or remediation. All materials suspected or confirmed to have radiological contamination will be removed and taken to the Storage Yard.

The remediated areas will be re-surveyed to determine if exposure and/or surface contamination levels have decreased to meet the site-specific release criteria. This process will be repeated, as necessary, until exposure and/or surface contamination measurements taken at each area are meet the site-specific release criteria.

After remediation, a set of soil samples will be taken to characterize the land areas. The mean, median and standard deviation for each land area soil sample set will be determined in order to determine the variables necessary to perform the final status survey. The procedure to be utilized is described in more detail in the following section.

3.2 Final Status Survey Sampling and Measurement Plan

In order to implement the characterization and final status surveys, the following procedure will be followed:

1. The surface soil will be removed from the areas until the exposure measurements subsequently taken at each area do not exceed the release criterion, 10 μR/hr above the natural background (using the MARSSIM protocols). This will require that 17 exposure measurements be taken in each area and in the background reference area; a total of 51 data points. The Wilcoxon Rank Sum (WRS) test will be used to test demonstrate that the statistical criterion has been met.

2. 10-15 soil samples will be taken from each survey area, the D102/D112 area and the D111 area to characterize the statistical parameters of the soil concentrations of ^{232}Th and ^{238}U. This characterization will be used to plan the sampling protocol for the final site survey, i.e. to determine the number of the samples needed to test the standard "Null Hypothesis" as stated by the MARSSIM guidance (Section 2.5):

   "The residual activity in the test area exceeds the release criteria."

Additional samples will be taken and subjected to the WRS test to test the Null Hypothesis.

Remedial action will be taken if the sample statistics indicate that the Null Hypothesis is accepted (the mean soil concentration is above the release limit).

The instrumentation and procedures used for the measurements are described in other sections of this document. The resultant data from the soil sampling and the exposure rate measurements will be subjected to the WRS test protocol to determine if the hypothesis is accepted or rejected.

The location of each sample will be determined by the random start systematic triangular pattern as described in the MARSSIM document. (Section 5.5.2.5).

The actual sample size will be adjusted in accordance with the result of the characterization studies and the MARSSIM guidance. We do not reject the possibility that the hypothesis for the final site survey will be changed to an alternative:

"The residual activity in the test area is not distinguishable from that in the reference background."

If this hypothesis is indeed chosen, the appropriate statistical tests of the data will be performed to test it (NUREG 1505).

The details of the calculations follow.

3.2.1 Determination of sample size for soil concentration of ^{238}U and ^{232}Th

The progeny of these two radionuclides will not be considered explicitly. The soil concentration limits for the release of these areas are given for ^{232}Th and ^{238}U. They are

^{232}Th 0.5 pCi/g
^{238}U 1.1 pCi/g

The derived concentration guideline level (DCGL) is 1 since the unity rule applies in this case: $[^{232}Th]/0.5 + [^{238}U]/1.1 = 1$ where the median concentrations are in pCi/g.

The relative shift (Δ/σ) is calculated using the values for the standard deviations from the background soil concentrations data set (σ_i) using the formula:

$$\sigma = [\Sigma(\sigma_i/DCGL_i)]^{1/2}$$

If one takes the acceptable probability of Type I and Type II errors to be 0.05 and the lower bound of the gray region (LBGR) to be 0.5 of the DCGL, then the shift, Δ = (DCGL-LBGR), is 0.5 and the relative shift (Δ/σ), is

$$\Delta/\sigma = (DCGL - LBGR)/\sigma$$

Using Table 5.1, MARSSIM, Pr is determined. Pr is the probability that a random measurement from the survey unit is greater than a random measurement from the background reference area by less than the DCGL when the survey unit median concentration is actually at the LBGR above background.

Using Table 5.2, MARSSIM, the decision error percentiles ($Z_{1-\alpha}$ and $Z_{1-\beta}$) are determined. The number of sample points required for each survey is N, calculated using the formula (MARSSIM equation 5-1):

$$N = (Z_{1-\alpha} + Z_{1-\beta})^2/[3(Pr-0.5)^2]$$

Increasing N by 20%, in accordance with the MARSSIM guidance, to obtain sufficient data points to attain the desired power level with the statistical tests and allow for possible lost or unusable data.

N is the total number of data points for each survey unit/reference area combination. Therefore, N/2 sample points will be obtained from each survey unit and N/2 sample points will be obtained from the reference area.

The survey area for D102/D112 is taken as 1505 square meters so L, the distance between survey points, based on the first set of background data, is calculated using (equation 5.7, MARSSIM):

$$L = \{A/0.866\ n)^{1/2}$$

For the area of D111 and Flex-Kleen Baghouse, the survey area is 2787 square meters.

3.2.2 Determination of sample size for exposure measurements

The release criterion for the exposure measurements is 10 μR/hr when measured at a distance of one meter from the local surface of the soil. Scoping measurements of the D102/D112 area, the D111 area, and the Flex-Kleen Baghouse, produced the following results:

D102(all points):	15.1 ± 5.5 μR/hr (1σ)
D102(without hot spots)	13.4 ± 3.3
D112 (all points):	9.1 ± 7.9
D112(without hot spots)	7.3 ± 3.4
D111 (without hot areas & spots)	9.1 ± 3.6
Baghouse area	9.2 ± 3.3
Reference background area:	6.3 ± 0.4
Background average[1]	6.6 ± 0.8
Background average[2]	6.5 ± 0.8

To determine the sample size for the final site survey for exposure rates at D102/112, a standard deviation of 3.3 μR/hr was chosen since it is the best approximation of the variation of the measurements after the contaminated soil is removed from the area. A LBGR of 5 μR/hr was chosen (0.5 of the DCGL). Thus the shift is:

$\Delta/\sigma = (10 - 5)/3.3 = 1.52$ which leads to a Pr = 0.865 (MARSSIM Table 5.1). The required number of samples N is determined as 28.5, Increasing this number by 20% gives a total of 34 samples which are divided equally between the reference background site and the survey area. The distance, L, between the measurements in a random start triangular pattern is 10.1 m.

D111 area has similar characteristics and will require a total of 38 samples equally divided between the survey area and background reference. The distance between data points will be 13.01 m.

3.3 Final Status Survey Report

At the conclusion of the remediation and subsequent sampling and measurement analysis, a comprehensive report will be prepared so that an independent re-creation and evaluation can be conducted in the future. To the extent practicable, the final status survey report will be a stand-alone document with minimal references. The report will be independently reviewed by a designated person who is capable of evaluating all aspects of the report prior to release, publication, or distribution. The report will include the following elements:

- Site Description
- Site Conditions
- Final Status Survey Objective
- Release Criteria/Derived Concentrations Guideline Levels (DCGLs)
- Instrumentation and Survey Technique
- Determination of Background
- Detection and Analytical Sensitivity
- Sample Collection and Analysis
- Data Interpretation

IV. PROJECT ORGANIZATION

All field work will be performed by **Mr. Ravi Jarecha, CET, Mr. Michael Moore, PG, and Ms. Kaiti Liao**. During the performance of the work described in this Plan, Mr. Jarecha will be the Field Supervisor. He will be the primary person responsible for implementing the procedures and plan outlined in this Work Plan. Mr. Moore and Ms. Liao will assist with the surveying and soil sampling during and after soil remediation.

Technical oversight for the entire project is the responsibility of **Dr. Edward A. Christman, CHP**. Dr. Christman has authored, reviewed and approved this Plan, will assist in the review of the data collected and the preparation of the Final Status Survey Report.

Dr. Harch S. Gill will ensure that work has been followed in accordance to this Plan and USNRC guidelines.

A brief narrative of each member of the PARS Project Team is included in Appendix A of this Plan.

Also, on the Project Team is Summit Compliance, a contractor to SMC, who will provide personnel, materials and equipment necessary for the remediation of the land areas included in this Plan. Summit will also provide a field supervisor, **Mr. Robert Bennet**, to oversee the crew of remediation personnel.

V. REFERENCES

1 "Assessment of Radiological Conditions at the Newfield Facility", IT Corporation/Nuclear Sciences Report No.IT/NS–92-106, April 1992.

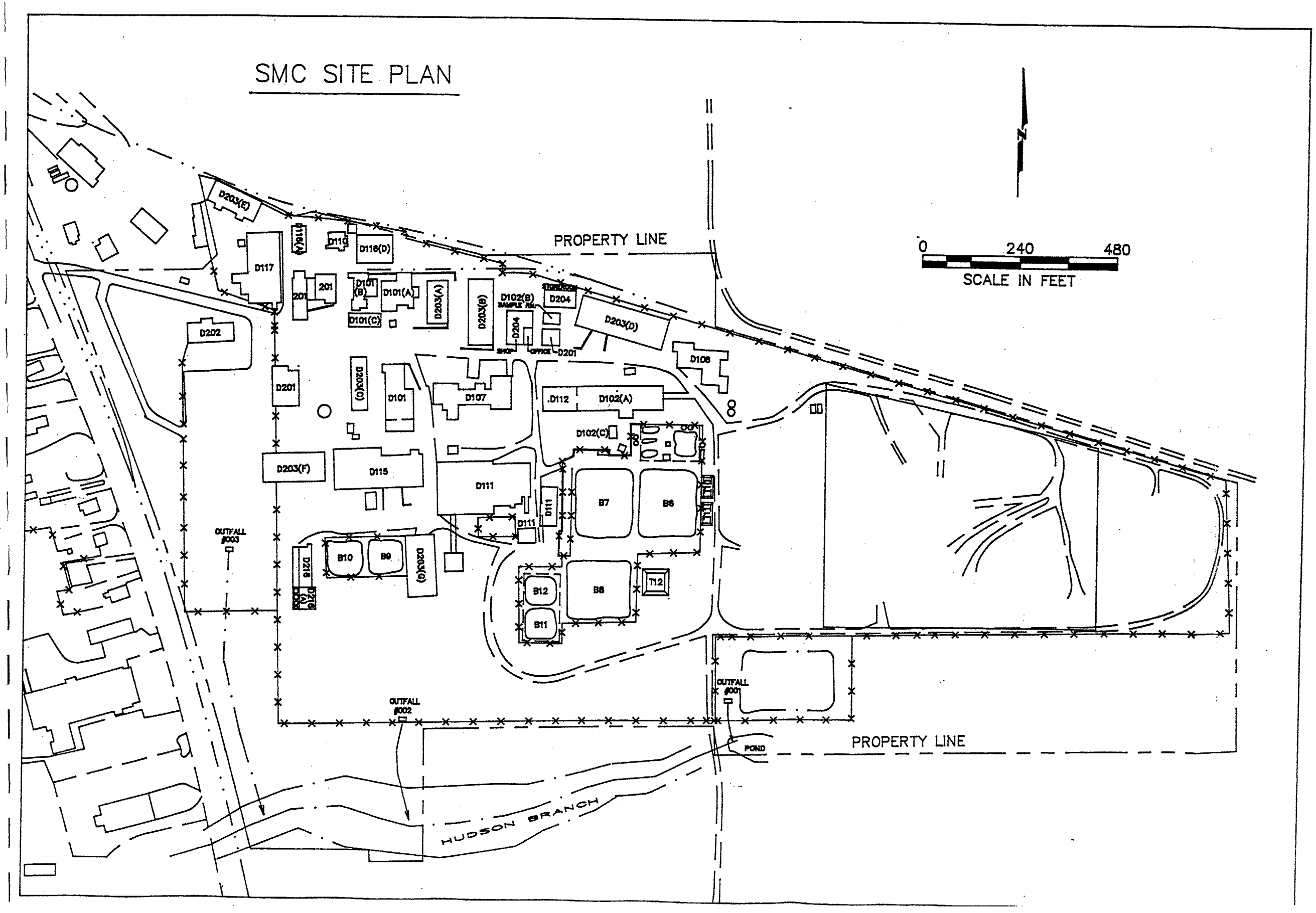
2 "Newfield Plant Radiological Pre-Survey", ENSR Document No. 59990-006-210, February 1991. and "Radiological Survey of the Shieldalloy Metallurgical Corporation, Newfield, New Jersey", Oak Ridge Associated Universities Report No. ORAU 88/G-79, July 1988 as referenced from Reference No. 1.

3 "Soil Sampling/Survey of Storage yard After Remediation", Integrated Environmental Management, Inc. Report No. 94005/G-18198, January 2000.

4 Decommissioning Plan for the Newfield Facility, Integrated Environmental Management, Inc. report No. 94005/G-28247, August 2002.

FIGURES

Figure 1: SMC Site Plan


SMC SITE PLAN
PROPERTY LINE
0
240
480
SCALE IN FEET
N
D203(E)
D116(A)
D110
D116(D)
D117
201
201
D101 (B)
D101(A)
D101(C)
D203(A)
D203(B)
D102(B)
SAMPLE RM.
D204
D204
D203(D)
D202
D201
D201
D203(C)
D101
D107
D112
D102(A)
D106
D102(C)
D203(F)
D115
D111
D111
D111
B7
B6
OUTFALL #003
D216
B10
B9
D203(G)
B12
B8
T12
B11
OUTFALL #001
OUTFALL #002
POND
PROPERTY LINE
HUDSON BRANCH

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TABLES

Table 1: SMC-specific Release Criteria

Table 1 - Site-specific Release Criteria

TYPE	NUCLIDE[1]	REMOVABLE[2,4]	TOTAL[2,3] (FIXED PLUS REMOVABLE)	CONCENTRATION[5,7]
Surface	U-nat, U-235, U-238 and associated decay products	1,000 dpm • /100 cm² above background	5,000 dpm • /100 cm² above background	--
Surface	Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	200 dpm/100 cm² above background	1,000 dpm • /100 cm² above background	--
Surface	Mixture of U-nat and Th-nat	--	600 dpm • /100 cm² by *direct frisk* above background[5]	--
SoilVolume	U-238 and U-234 with progeny in equilibrium	--	--	1.1 ~~2.5~~ pCi/g each above background, averaged over the volume of interest
SoilVolume	Th-232 and Th-228 with progeny in equilibrium	--	--	0.5 ~~2.5~~ pCi/g each above background averaged over the volume of interest
SoilVolume	Mixture of U-nat and Th-nat	--	--	15 microR per hour above background[8]

[1] Where surface contamination by both • and • gamma-emitting radionuclides exists, the limits established for • and • gamma-emitting radionuclides should apply independently.

[2] As used in this table, dpm (disintegrations per minute) means the rate of emission by radioactive material as determined by correcting the counts per minute observed by an appropriate detector for background, efficiency, and geometric factors associated with the instrumentation.

[3] The levels may be averaged over 1 m², provided the maximum surface activity in any area of 100 cm² is less than three times the guide values. For purposes of averaging, any square meter of surface shall be considered to be above the activity guide G if: (1) from measurements of a representative number (n) of sections it is determined that 1/n • S_i • G, where S_i is the dis/min-100 cm² determined from measurement of section i; or (2) it is determined that the sum of the activity of all isolated spots or particles in any 100 cm² area exceeds 3G.

[4] The amount of removable radioactive material per 100 cm² of surface area should be determined by wiping that area with dry filter or soft absorbent paper, applying moderate pressure, and assessing the amount of radioactive material on the wipe with an appropriate instrument of known efficiency. (Note - The use of dry material may not be appropriate for tritium.) When removable contamination on objects of surface area less than 100 cm² is determined, the activity per unit area should be based on the actual area and the entire surface should be wiped. Except for transuranics and Ra-226, Ra-228, Ac-227, Th-228, Th-230, and Pa-231 • emitters, it is not necessary to use wiping techniques to measure removable contamination levels if direct scan surveys indicate that the total residual surface contamination levels are within the limits for removable contamination.

[5] Assumes removable activity is the limiting value.

[6] Taken from (reference) BTP.

[7] Concentrations may be averaged over the soil volume of interest as described in (reference) FSTP.

[8] Assumes 2.5 pCi/g each of Th-232, Th-228, U-238, and U-234 (plus progeny in equilibrium) evenly distributed throughout the soil volume to a depth of 15 cm, with measurements made at a height of less than three (3) cm above the soil surface. Taken from (reference) IEM.

APPENDICES

Appendix A: PARS Project Team Description

APPENDIX A

Ravi Jarecha, CET (Project Director)

Ravi Jarecha, CET is the Director of Health & Safety Division at PARS Environmental, Inc. and is responsible for all day-to-day project activities, including the supervision of PARS field project personnel, for all Health & Safety projects. He is also responsible for coordinating all project activities, and he involves PARS senior level technical staff when appropriate and required to meet project objectives.

Mr. Jarecha is a graduate of Rutgers University where he majored in Environmental & Occupational Health. He is a Certified Environmental Trainer with over eight years of Health & Safety experience in diverse projects in the environmental field. During his career Mr. Jarecha has had a variety of roles on many environmental projects. His recent experience includes:

- Project Director and Supervising Health & Safety Officer during the environmental investigation conducted at a hazardous waste site that was contaminated with radioactive waste and volatile organic compounds in groundwater, where he also developed and implemented the Health and Safety Plan.

- Project Director of a personal air monitoring project for exposure to site contaminants at a hazardous waste site. The monitoring data was then compared to the OSHA Permissible Exposure Limit to determine if personnel wore adequate personal protective equipment.

- Project Director for air sampling at several asbestos abatement sites during removal and decontamination of asbestos containing building material.

Edward A. Christman, Ph.D., C.H.P. (Health Physics Planning)

Dr. Edward Christman has over 30 years experience in the field of Environmental Health and Safety, with specialized interest in Radiation Protection. He has served as the Assistant Clinical Professor at the Mailman School of Public Health in Columbia University, New York, and has taught a graduate level course in Health Physics offered jointly with the Department of Applied Physics and Applied Mathematics. He has also been an Associate Graduate Faculty Member at the Department of Environmental Sciences in Rutgers University.

Dr. Christman has been certified by the American Board of Health Physics in comprehensive Health Physics since 1983. He graduated with a Masters and a Doctorate in Radiation Science from Rutgers University in 1974 and 1977, respectively. His current specialized areas of expertise include Occupational Health and Safety, Radiation Protection, Radiation Physics and Chemistry, and Medical Physics.

APPENDIX A

From 1991 to 1999, he served as the Director of the Environmental Health and Safety Office at the Health Sciences Campus at Columbia University, where he initiated the program in the Health Sciences Division, and was responsible for all Environmental and Occupational Health and Safety Programs for the campus. Previously he had served as Associate Director for Program Development in the Department of Radiation and Environmental Health and Safety in Rutgers University, where he initiated and coordinated all Health and Safety programs at the university.

From 1977 to 1989, he was the Supervising Radiologist at the Department of Radiation and Environmental Health and Safety in Rutgers University, where his responsibilities included the supervision of the Radiation Safety Program for the University and Medical School. This included more than 300 radioisotope users, many analytic X-ray units, and other machine sources including a 20 MeV Tandem Van de Graff accelerator.

Dr. Christman has extensive experience in providing Radiation Protection to industry and is active in many professional activities. He is the founding member of the Executive Board at the U.S. EPA Eastern Region Radon Training Center at Rutgers University. He is also a Member of the New Jersey Department of Environmental Protection's (NJDEP) Radium/Radon Advisory Board, as well as being a member of several Health Physics honor societies and related professional organizations.

Michael Moore, P.G. (Site Investigation/Field Operations Manager)

Mr. Michael Moore is licensed Professional Geologist and Director of Environmental Services at PARS Environmental, Inc. He has over seven years of experience in soil and groundwater site remediation, regulatory compliance, and environmental management. Site remediation responsibilities have included project management of various phases of investigations including; preliminary assessments, site investigations, remedial investigations, and remedial actions at commercial, industrial, and agricultural properties.

He has also implemented and managed the following field operations; staff and contractor supervision, monitoring well installation, groundwater sampling, surface water sampling, sediment sampling, soil sampling, and field analysis of soil samples using the Ensys PCB Soil Test, Petroflag™ Hydrocarbon Test Kits, and Leadcheck® Test Kits.

APPENDIX A

Harch S. Gill, Ph.D. (Remedial Planning)

Dr. Harch Gill is the General Manager of PARS Environmental, Inc. and in that capacity he will be responsible for ensuring that all necessary resources are provided to the project in a timely manner.

Dr. Gill graduated from Cornell University in 1971 with a major in Civil Engineering and a minor in Environmental Engineering. He has worked with the Nuclear Regulatory Commission on several nuclear related projects since 1971. He has been the principal investigator and project manager for Preliminary Safety Analysis Reports (PSAR) and Environmental Reports (ER) for over twenty nuclear plants, primarily in the eastern United States. Clients that he has worked with include:

- Public Service Electric and Gas Company at the Salem and Hope Creek Nuclear Power Generating Stations
- Potomac Electric and Power Company at the Douglas Nuclear Power Generating Station
- Virginia Electric Power Company at the North Anna Nuclear Power Generating Station
- Niagara Mohawk Power company at the Nine-Mile Point Nuclear Power Generating Station
- Baltimore Gas and Electric Company at the Calvert Cliffs Nuclear Power Generating Station

He was the project manager for studies related to the disposal of low-level radioactive wastes for the "Southern Compact", a group of electric utility companies in the South-Eastern United States.

Dr. Gill has participated in the decommissioning of three facilities that were licensed with the United States Nuclear Regulatory Commission (USNRC) as Permanent Restricted Areas. In July 2000, Dr. Gill was part of the team that decommissioned several buildings at the Former Sylvania Products Incorporated facility in Hicksville, New York. The project was done for GTE Operations Support Incorporated (GTEOSI) in cooperation with New York State Department of Environmental Protection (NYSDEC) and USNRC. The decommissioning scope of work involved the excavation and disposal of over 2000 tons of soils at the site contaminated with low levels of Uranium, Thorium and trichloroethene. All work was performed in full compliance with NRC's Radiation Safety Procedures. The project involved the performance and documentation of a final status survey in accordance with NUREG-1575, "Multi-Agency Radiation Survey and Site Investigation Manual" (MARSSIM).