JAN 31 1994

Docket No. 040-07102 License No. SMB-743

Shieldalloy Metallurgical Corporation
ATTN: Robert L. Swenson
Senior Vice President
and General Manager
P.O. Box 768
West Boulevard
Newfield, New Jersey 08344

Dear Mr. Swenson:

SUBJECT: ROUTINE INSPECTION NO. 040-07102/93-001

On December 2 and 3, 1993, Duncan White of this office conducted a routine safety inspection at the above address of activities authorized by the above listed NRC license. The inspection was an examination of your licensed activities as they relate to radiation safety and to compliance with the Commission's regulations and the license conditions. The inspection consisted of observations by the inspector, interviews with personnel, and a selective examination of representative records. The findings of the inspection were discussed with Mary Higgins, Scott Eves, David Smith, Joseph Valenti and Brian Martin at the conclusion of the inspection.

A copy of the NRC inspection report is enclosed.

Based on the results of this inspection, it appears that your activities were not conducted in full compliance with NRC requirements. A Notice of Violation is enclosed as Appendix A and categorizes each violation by severity level in accordance with the "General Statement of Policy and Procedure for NRC Enforcement Actions," 10 CFR Part 2, Appendix C (Enforcement Policy). You are required to respond to this letter and in preparing your response, you should follow the instructions in Appendix A.

Please use the enclosed self-addressed green envelope when you submit your copy to the Regional Administrator, Region I. This will assist us in the timely processing of your response. In accordance with Section 2.790 of NRC's "Rules of Practice," Part 2, Title 10, Code of Federal Regulations, a copy of this letter, the enclosures and your reply will be placed in the Public Document Room. The responses directed by this letter and the accompanying Notice are not subject to the clearance procedures of the Office of Management and Budget as required by the Paperwork Reduction Act of 1980, PL 96-511.

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RETURN ORIGINAL TO REGION I

IE:07

Your cooperation with us is appreciated.

Sincerely,

Original Signed By:
John D. Kinneman

John D. Kinneman, Chief
Site Decommissioning Section
Facilities Radiological Safety and
Safeguards Branch

Enclosures:
1. Appendix A, Notice of Violation
2. NRC Region I Inspection Report No. 040-07102/93-001

cc (w/enclosures):
Public Document Room (PDR)
Nuclear Safety Information Center (NSIC)
State of New Jersey
Joseph Valenti, Assistant Radiation Safety Officer

bcc (w/enclosures):
Region I Docket Room (w/concurrences)
D. J. Holody, RI
G. Comfort, NMSS
C. Glenn, NMSS

DRSS:RI
White/gc
1/31/94

DRSS:RI
Kimeman
1/31/94

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APPENDIX A

NOTICE OF VIOLATION

Shieldalloy Metallurgical Corporation
Newfield, New Jersey 08344

Docket No. 040-07102
License No. SMB-743

During an NRC inspection conducted on December 2 and 3, 1993, violations of NRC requirements were identified. In accordance with the "General Statement of Policy and Procedure for NRC Enforcement Actions," 10 CFR Part 2, Appendix C, the violations are listed below:

A. Condition 10 of License No. SMB-743 requires that licensed material be possessed and used in accordance with statements, representations, and procedures contained in an application dated December 23, 1977.

Item 2 of Chapter IV and Item 1 of Chapter V of the application require that air surveys in the blending area and furnace area be performed monthly.

Contrary to the above, as of December 3, 1993, air surveys in the blending area and furnace area were performed two times in 1993, a frequency less than monthly.

This is a Severity Level IV violation. (Supplement VI)

B. 10 CFR 20.201(b) requires that each licensee make such surveys as may be necessary to comply with the requirements of Part 20 and which are reasonable under the circumstances to evaluate the extent of radiation hazards that may be present. As defined in 10 CFR 20.201(a), "survey" means an evaluation of the radiation hazards incident to the production, use, release, disposal, or presence of radioactive materials or other sources of radiation under a specific set of conditions.

Contrary to the above, as of December 3, 1993, the licensee did not make adequate surveys to assure compliance with 10 CFR 20.106, which limits the yearly average concentration of radioactive material in air discharged to unrestricted areas. Specifically, the licensee did not evaluate the impact on the radionuclide concentration in the effluent discharged to unrestricted areas as a result of the enclosure constructed around the electric arc furnace in Department 111, filter bag breakage in the baghouses, and the increase in uranium concentration in pyrochlore received from the Niobec Mine.

This is a Severity Level IV violation. (Supplement IV)

Pursuant to the provisions of 10 CFR 2.201, Shieldalloy Metallurgical Corporation is hereby required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, D.C. 20555, with a copy to the Regional Administrator, Region I, within 30 days of the date of the letter transmitting this Notice of Violation (Notice). This reply should be clearly marked as a "Reply to a Notice of Violation" and should include for each violation: (1) the reason for the violation, or, if contested, the basis for disputing the violation, (2) the corrective steps that have been taken and the results achieved, (3) the corrective steps that will be taken to avoid further violations, and (4) the date when full compliance will be achieved. If an adequate reply is not received within the time specified in this Notice, an order or a Demand for Information may be issued to show cause why the license should not be modified, suspended, or revoked, or why such other action as may be proper should not be taken. Where good cause is shown, consideration will be given to extending the response time.

U.S. NUCLEAR REGULATORY COMMISSION
REGION I

Report No. 040-07102/93-001

Docket No. 040-07102

License No. SMB-743

Licensee: Shieldalloy Metallurgical Corporation
West Boulevard
Newfield, New Jersey 08344

Facility Name: Shieldalloy Metallurgical Corporation

Inspection at: West Boulevard
Newfield, New Jersey 08344

Inspection Conducted: December 2 and 3, 1993

Inspector: Duncan White
Duncan White, Health Physicist — 1/27/94 date

Approved:
John D. Kinneman, Chief
Site Decommissioning Section — 1/28/94 date

Inspection Summary: Routine unannounced inspection conducted on December 2 and 3, 1993 (Inspection No. 040-07102/93-001).

Areas Inspected: Licensee action on previous violations, licensee event reports and NRC notices; organization and scope of activities; training and instruction of employees; radiation safety committee; observation of licensed activities; radiation protection program; contamination surveys and air sampling in restricted areas; personnel monitoring; inventory; waste storage; posting and labeling; environmental monitoring; instrumentation; effluent controls; and independent measurements.

Results: Two violations were identified: failure to perform air monitoring in restricted areas at required frequency (Section 8); and failure to adequately evaluate airborne effluent releases to unrestricted areas (Section 15).

DETAILS

1. Persons Contacted

* Joseph Valenti - Environmental Manager and Assistant Radiation Safety Officer
* David Smith - Director of Environmental Services
* Scott Eves - Vice President of Environmental Services
* Brian Martin - Production Manager, Alloy and Metal Division
* Mary Higgins - Vice President of Human Resources
Knud Clawson - Superintendent, Department 111
Bill Grabus - Safety, Training and Personnel Manager

Various administrative and production personnel

* indicate those present during exit interview

2. Licensee Action on Previous Violations, Licensee Event Reports and NRC Notices

a. (Closed) Violation, Inspection Report No. 040-07102/90-001

During an NRC inspection conducted on May 2 and 3, 1990, a violation was identified regarding the possession of licensed material in excess of the amount authorized by Condition 8 of License No. SMB-743. In a letter to the NRC dated May 22, 1990, the licensee requested that the license be amended to increase the possession limit. The NRC issued an amendment dated April 2, 1992 increasing the possession limit to 303,050 kilograms of thorium and 34,870 kilograms of thorium. During this inspection, the inspector determined that the licensee possessed 260,228 kilograms of thorium and 32,779 kilograms of uranium as of June 30, 1993.

No additional safety concerns were identified.

b. (Closed) Violation, Inspection Report No. 040-07102/90-001

During an NRC inspection conducted On May 2 and 3, 1990, a violation was identified regarding the failure of the licensee to calibrate radiation survey instruments every seven months as required by Condition 13 of License No. SMB-743. During this inspection, the inspector reviewed a selection of calibration records for radiation survey instruments and determined that calibrations were performed every six months. The inspector confirmed that the licensee's corrective actions outlined in a letter dated September 27, 1990 were achieved.

No additional safety concerns were identified.

c. (Closed) MLER-RI-92-32, Discovery of an Unlicensed Source and Device

In January 1993, licensee personnel identified the presence of a neutron transmission monitor containing 300 millicuries of americium 241 (Am-241) in their laboratory that was not licensed by the NRC. The monitor was used from 1973 until approximately 1982 for the analysis of boron levels in certain products. The console containing the monitor and source were not used and were stored in the laboratory for the past 10 years. The licensee contacted the NRC regarding the unlicensed source by telephone on January 29, 1993 and followed with a letter dated February 5, 1993. The licensee transferred the source to Troxler Electronics Laboratories on May 8, 1993. Based on a review of the results of neutron dosimeters place in the vicinity of the device, the results of the licensee's survey, and the location of the storage area compared to occupancy in the laboratory, the inspector concluded that the device probably did not produce radiation levels in any area exceeding those in 10 CFR 20.105.

No safety concerns were identified.

d. (Closed) MLER-RI-90-044 Chromium and Radioactive Contaminated Soil

On December 1, 1989, a spill occurred from the licensee's chromium ion-exchange tanks that contaminated a portion of a dirt roadway area known to contain licensed material in the form of radioactive slag. The chromium and radioactive contaminated soil were removed and stockpiled at the licensee's facility. The soil was screened for chromium contamination and it was determined that the level of chromium was below the State's action level of 100 parts per million requiring remediation. The licensee stated that this soil was then reused on the haul road. The licensee confirmed that none of the soil was removed from the site.

No safety concerns were identified.

3. Organization and Scope of Activities

Shieldalloy Metallurgical Corporation (SMC) has been processing raw ores for the production of metals and metal alloys since 1955. The ferro-columbium (FeCb) ores, or pyrochlore, contain licensable quantities of source material. SMC currently obtains pyrochlore from two sources, the Niobec Mine in Quebec and from Gfe/Leusche in Germany. Niobec pyrochlore, which makes up more than 90% of the ore used by the licensee, currently contains approximately 0.85% to 0.90% thorium by weight and approximately 0.11% uranium by weight. Some ferro-vanadium (FeV) ores formerly used at this facility also contained thorium and uranium, but in concentrations that do not meet the definition of source material. The licensee is

currently selling the FeV slag resulting from the use of these ores to steel companies in Indiana as an additive in the steel manufacturing process because of its high vanadium content (>40%). The FeV slag contains approximately 0.006% uranium by weight and approximately 0.02% thorium by weight and, therefore, is not source material.

Pyrochlore is processed in Department 111 (D111). Each shift performs three process runs or heats using a total of approximately 13,000 kilograms of pyrochlore. In addition to the pyrochlore, dolomite, lime, aluminum and steel are used in the process. Total weight of material used per shift, including the pyrochlore, is approximately 26,000 kilograms. The amount of product (FeCb alloy) produced per shift is approximately 8,500 kilograms. The balance of the material (approximately 17,500 kgs.) is waste in the form of slag and dust collected by the baghouses. Both the slag and the dust from the baghouse are removed from D111 and placed above ground in the northern end of the licensee's property (i.e. storage yard). Nearly all of the uranium and thorium present in the pyrochlore remain in the waste slag or baghouse dust. Currently, the licensee performs about 45 heats per month.

Seven individuals routinely work in D111; other employees may occasionally work in D111. The licensee's Environmental Services Department is responsible for compliance with applicable state and federal safety and environmental requirements, including radiation safety. The Radiation Safety Officer (RSO) named on the license left the company in August 1993. A representative of management stated that they are currently searching for a replacement and that they intend to fill the position. The licensee's assistant RSO is currently performing the RSO duties and is supported by other company personnel and consultants.

The licensee has been operating under the provisions of 10 CFR 40.43(b) since the license reached its expiration date on July 31, 1985. Since the licensee filed an appropriate application to renew the license, the license continues in force until final action by the NRC. The licensee does not meet a categorical exemption in 10 CFR 51.22(c) and has been providing information to support the preparation of an Environmental Assessment (EA) by NRC staff as part of the process to renew the license. In a letter dated April 7, 1993 to the NRC, the licensee submitted a conceptual decommissioning plan for the facility that requests NRC approval for the on-site disposal of all waste radioactive materials. The NRC determined that the approval of the licensee's request for on-site stabilization and disposal of the waste constitutes a major federal action as defined in 10 CFR 51.20(a)(1) and requires the preparation of an Environmental Impact Statement (EIS). The first stage of the EIS was a public scoping meeting held on December 16, 1993. The EIS process is scheduled to be completed in June 1995. The NRC has not yet made a decision whether to include the EA supporting the renewal of the license as part of the EIS.

The licensee's facility is currently listed on the Environmental Protection Agency's (EPA) National Priority List due to nonradioactive chromium contamination of the groundwater both on and off-site from the past practice of discharging processed waste water into an unlined lagoon on-site. The licensee is currently pumping the contaminated groundwater and treating it prior to discharge into local surface waters. The New Jersey Department of Environmental Protection and Energy (NJDEPE) is the lead agency with regard to Comprehensive Environmental Responsibility Cleanup Liability Act or Superfund activities. In addition, the licensee has entered into an Administrative Consent Order (ACO) with the NJDEPE under the State's Spill Act regarding site remediation. The State's Spill Act not only covers a number of non-radiological hazards, but includes uranium, thorium and radium and their progeny as hazardous substances. The ACO requires the licensee to post 8.0 million dollars for financial assurance for site remediation. In addition, the ACO includes another 8.2 million dollars in financial assurance for the closure of Resource Conservation and Recovery Act regulated units (surface impoundments).

The licensee also holds air and water discharge permits issued by the NJDEPE.

In September 1993, the licensee sought protection from creditors under Chapter 11 of federal bankruptcy laws. In a letter dated September 11, 1993 to the NRC, the licensee indicated they would continue operations. Representatives from management and environmental services told the inspector that the actions taken by the company regarding bankruptcy had not disrupted the availability of funds necessary for implementing the radiation safety program at the Newfield facility or complying with NRC requests for information related to the renewal of the license.

No safety concerns were identified.

4. Training and Instruction of Employees

The licensee provided general employee training to employees on December 1, 1993. The training included a description of the radioactive materials used on site, the potential hazards, rules for working in areas where radioactive materials are used and stored, and the licensee's administrative limits for occupational doses. Copies of NRC Regularly Guides 8.13, "Instruction Concerning Prenatal Radiation Exposure", and 8.29, "Instruction Concerning Risk from Occupational Radiation Exposure", were made available at the training class. The training was provided by the Assistant RSO and the Safety, Training, and Personnel Manager. Prior to the training, employees were required to read and sign a form describing those items mentioned above. The licensee told the inspector that additional training is planned for workers who work in D111. The inspector reviewed the materials provided to the employees, the attendance forms, and the outlined used by the instructors and determined that the level of training was commensurate with the potential radiological hazards in the restricted area as required by 10 CFR 19.12.

The licensee also provides specific training and fit testing for those individuals who use respiratory protection. Training is provided by the Safety, Training, and Personnel Manager and includes a video by 3M. Fit testing is also performed by the Safety, Training, and Personnel Manager. Adequate fit is determined by the use of saccharine released into the hood with the employee fitted with a half-face mask. The licensee does pulmonary testing through the services of a contractor. This test is part of a physical given to the employees. The use of respiratory protection equipment is approved by a medical doctor. The inspector reviewed selected records regarding respiratory protection training and pulmonary testing.

No safety concerns were identified.

5. Radiation Safety Committee

The licensee has a Radiation Safety Committee (RSC) that has met at least quarterly since August 1992. The committee membership includes the environmental services staff, safety, training and personnel staff, production supervisors for D111 and alloys and metals as well as management representatives. The licensee is currently not required by their license to have a RSC. The licensee submitted a revised radiation safety program to the NRC in a February 5, 1993 letter, but the NRC has not yet amended the license to incorporate the new program. The new program includes the RSC.

A major effort of the RSC has been the preparation, review and approval of nineteen standard operating procedures (SOPs). Fourteen of the procedures have been reviewed, in part, by members of the RSC. The inspector reviewed portions of the fourteen drafted and reviewed procedures. The inspector also reviewed a selection of RSC minutes. The topics discussed by the RSC included the cover for the baghouse dust pile, environmental monitoring, personnel monitoring, licensing including the environmental assessment, replacement for the RSO, and control of licensed material.

No safety concerns were identified.

6. Observation of Licensed Activities

On December 3, 1993, the inspector observed the third heat of the shift from the loading of the hoppers to the final pour in D111. The pyrochlore is received from the supplier in bags that were lifted by overhead crane and broken into the hopper by a metal spike mounted on the top of the hopper. Three bags of pyrochlore were used in the heat. Once the hoppers were loaded with pyrochlore and the other agents (dolomite, lime, aluminum and steel), each hopper was dumped into the furnace by the overhead crane. The electric arc furnace used to separate the FeCb is now inside an enclosure constructed in 1991. The front of the enclosure opens for loading by the

crane and the side opens for personnel access. The enclosure is open at the top, directly below the intake of the 325,000 cubic feet per minute (cfm) air handling system. The purpose of the enclosure is to increase the efficiency of the air handling system and decrease the amount of dust inside D111. Once the hoppers were loaded into the furnace, all doors to the enclosure were closed and the power to the three electrodes in the furnace was activated. Additional agents were added to the reaction vessel during reaction by the operator. The reaction and subsequent pour from the reaction vessel to the kettles took approximately 2 hours. The reaction was controlled by an operator who has a direct view of the furnace through a window.

Two workers load the pyrochlore into the hoppers on the ground floor of D111. The inspector noted that the dust generated from the loading operation lingered within six to eight feet of the floor and slowly migrated towards the air handling system by local drafts from the doors of the building. Licensee representatives stated they are pursuing the installation of an intake line in the area where the hoppers are loaded. The loading of raw materials into the furnace requires that one worker attach an air line and electrical supply to the hopper. Once attached the worker can then remotely unload the hopper into the furnace. The inspector noted that the connection of the electrical line to the hopper activated an alarm and warning light at the personnel entrances (side doors) of the enclosure. These signals are intended to warn individuals not to enter the enclosure because operations in the furnace are being performed. The unloading of the hopper created a great deal of dust, which was quickly drawn straight up into the ventilation system. The inspector stood at the door of the enclosure, approximately eight feet from the hopper, and did not notice any increase in dust in the air.

The reaction inside the furnace also generated a great deal of dust and sparks containing small amounts of molten material. Throughout the reaction, the enclosure was highly effective in channeling airborne material into the overhead ventilation system. The inspector noted that during the early stage of the reaction, the ventilation system easily maintained the airborne material directly over the furnace. During the later stages of the heat, when additional lime and other agents were added, the area throughout the inside of the enclosure became dusty. At no time during the reaction did the inspector notice dust escape from the enclosure. The enclosure also acts as a heat shield during the reaction.

Workers in D111 are required to wear personnel dosimeters and dust masks while working in the building. The inspector observed that workers wore personnel dosimeters and masks as required. The inspector interviewed a number of the workers and determined that they were knowledgeable about the hazards and operations. All workers are required to perform approximately two years of on-the-job training before they are allowed to perform particular jobs without direct supervision. The workers interviewed by the inspector have been in this Department for many years and have been trained to perform a variety of jobs in D111.

No safety concerns were identified.

7. Radiation Protection Program

The licensee has extensively revised their radiation protection program since the last inspection. As part of their renewal application, the licensee submitted to the NRC in a February 10, 1993 letter the revised radiation safety program. The licensee has implemented portions of the new radiation safety program. The licensee plans to implement additional portions of the revised program upon the review and approval of SOPs (see Section 5). The inspector reviewed the revised radiation safety program and concluded that it was more comprehensive and significantly better than the program contained in Condition 13 of the license.

No safety concerns were identified.

8. Contamination Surveys and Air Sampling in Restricted Areas

Until February 1992, the licensee performed monthly gamma radiation surveys using portable survey instruments in areas where licensed material was used or stored. These locations included the warehouses, D111, and the storage yard. Since February 1992 the licensee has continuously monitored approximately 45 locations at the facility with thermoluminescent dosimeters (TLDs). The TLDs are exchanged quarterly and analyzed by a vendor accredited by the National Voluntary Laboratory Accreditation Program (NVLAP). The inspector reviewed the licensee's radiation survey records from June 1990 through September 1993 and determined that the highest radiation levels in a restricted area were measured in D111 in the vicinity of unprocessed pyrochlore ore. The highest measurement over a three month period was 466.5 millirem or approximately 185 microrem per hour assuming continuous exposure of the TLD by the unprocessed ore.

The licensee performs periodic surveys for direct and removable contamination at several locations through the facility. The inspector reviewed the results of a contamination survey performed by the licensee in April 1992 and a survey by a contractor for the licensee in July 1993. During the 1992 survey, the highest direct measurement of gross alpha activity was 6,151 $\pm$ 495 disintegration per minute per 100 square centimeters (dpm/100 cm^2). For gross beta, the highest measurement was 46,864 $\pm$ 2,116 dpm/100 cm^2. Both of these measurements were taken with portable survey instruments on the first floor of D111. Removable contamination was significantly lower than direct contamination levels. The highest gross alpha measurement for removable activity was 78 $\pm$ 29 dpm/100 cm^2. Similar results were obtained during the 1993 survey which was more extensive than the earlier survey. The licensee representative stated that they are looking at alternatives to reduce surface contamination levels, especially in D111. The inspector noted that the licensee's administrative limit for surface contamination in restrictive areas is the

same limit used by the NRC for releasing equipment and building for unrestricted use. The licensee representative stated that they will consider revising their administrative limits for surface contamination to include administrative contamination levels for restricted areas.

The licensee performs periodic air sampling for airborne radioactivity in D111. Air samples are taken at three or four fixed locations throughout D111 in addition to lapel samplers wore by workers. The licensee representative showed the inspector the location of the air samplers when they are used. Based on the inspector's observations during operations involving licensed material and review of the air sampling results, it appears that the fixed samplers are placed in locations not frequented by workers. The inspector concluded that the lapel samplers are more representative of the workers exposure to airborne radioactivity.

The inspector reviewed the results of air sampling performed in 1992 and 1993. The results from fixed samples in D111 during September and October 1993 were typically in the E-12 microcuries per milliliter (uCi/ml) range for gross alpha activity. The maximum measurement noted by the inspector was 1.41 E-11 uCi/ml. For lapel samplers, most gross alpha measurements were 1 to 2 E-12 uCi/ml with a maximum of 5.06 E-12 uCi/ml. The most restrictive concentration for the isotopes present at the licensee's facility is thorium 230 (Th-230), with a Table 1, Appendix B of 10 CFR 20, maximum permissible concentration (MPC) of 2 E-12 uCi/ml. Although the highest concentration measured is higher than this MPC, the licensee is in compliance with 10 CFR 20.103 since all activity is not due to Th-230 and licensed material is used approximately 50% of the time workers are in D111. Airborne concentrations fall very quickly when licensed material is not in use.

The licensee's consultant evaluated sample results for 1992 and concluded that the intakes of uranium and thorium by workers in D111 were not significant. The consultant evaluated the workers' exposure using new Part 20 methodologies and concluded that the total derived air concentrations (DACs) hours that workers were exposed to in 1992 were less than those which require for monitoring under 10 CFR 20.1502. The consultant also evaluated the isotopic concentration of thorium 232 (Th-232) and uranium 238 (U-238) present in the samples, since these isotopes have the lowest DACs of the isotopes used at the licensee's facilities. U-238 and Th-232 each accounted for approximately 1% of the gross activity.

The licensee is required to perform monthly air sampling in restricted areas. During 1993, the licensee performed air sampling in restricted areas on only two occasions. Failure to perform monthly air sampling during 1993 is a violation of Condition 13 of License No. SMB-743.

9. Personnel Monitoring

Since April 1993, the licensee has issued whole body TLDs on a quarterly basis to individuals who frequently work in and around licensed material. Nearly all the individuals who are currently issued personnel monitors work in D111. Prior to April 1993, the licensee issued monthly film badges to a larger number of employees than those who work routinely with licensed materials. The reduction in the number of personnel monitors issued to employees was done after the licensee evaluated past personnel exposures. The licensee's decision was documented in a February 2, 1993 internal memorandum.

The inspector reviewed the personnel monitoring records from June 1990 to October 1993. The licensee used two different vendors during this period, both accredited by NVLAP. The maximum monthly dose received by an individual working with licensed material was 30 millirem (mrem). Most measurements were below the detection limit for the dosimeters. Higher doses were noted by the inspector, but these doses were received by individuals who operate x-ray fluorescence equipment used in the licensee's laboratory. This equipment is regulated by NJDEPE. The highest quarterly dose received by a laboratory worker was 1,010 mrem.

No safety concerns were identified.

10. Inventory

The licensee samples each lot of pyrochlore received from the supplier and composites a quarterly sample for analysis by an outside laboratory. The laboratory analyzes the raw ore using gamma spectroscopy to determine the concentration of uranium, thorium, and radium. The licensee uses the laboratory results along with the total amount of pyrochlore processed each month to determine the total amount of uranium and thorium present on site. The baseline for the volume and quantity of material in the storage is based on a 1990 aerial flyover of the storage piles and representative sampling. The pyrochlore supplier provides the licensee with their analysis of uranium oxide and thorium oxide present in each lot. Comparison of the supplier's results to the laboratory results for thorium and uranium indicate that the laboratory's results are lower than the supplier's.

The inspector reviewed the licensee's inventory records from June 1991 to June 1993. The total amount of uranium and thorium present on-site increases over time because all slag and baghouse dust are stored on-site. As of June 30, 1993, the licensee possessed 260,228 kilograms of thorium and 32,779 kilograms of uranium. The licensee is authorized to possess 303,050 kilograms of thorium and 34,870 kilograms of uranium. At the present rate of production, the licensee will probably reach their possession limit for uranium sometime in 1994. The licensee did not anticipate reaching their possession limit until 1996 or 1997. The cause for the more than

anticipated accumulation of uranium is due to the concentration of uranium doubling in the pyrochlore purchased from the Niobec Mine over the last two years.

No safety concerns were identified.

11. Waste Storage

The licensee stores slag containing licensed material and slag from other operations at the facility in several piles in the northern end of their property. The piles of slag are segregated according to the product extracted during processing. Nearly all of the slag containing licensed material is from FeCb processing. Dust from the baghouses used to filter airborne emissions from D111 is stored in an adjacent pile. The licensee recently constructed a earthen berm around the northern, eastern and southern side of the storage yard. The berm is constructed from soil recovered from the sorting of slag from the ferro-vanadium (FeV) process and varies in height from 3 to 6 feet. The berm is designed to serve as a physical barrier to delineate the slag piles as a restricted area and to reduce the erosion of radioactive material from the site. It was observed in previous inspections that water runoff from the site was carrying radioactive material from the restricted area into an unrestricted area owned by the licensee and subsequently into a nearby stream called Hudson Branch. This runoff was observed along the eastern fence line from the baghouse dust pile during previous inspections. The inspector observed pools of water from recent storms within the restricted area behind the berm, but noted that the berm appears to have mitigated the runoff of material from the site.

Subsequent to the previous NRC inspection, the licensee's consultants performed an assessment of environmental conditions at the Newfield facility. The assessment concluded that the storm water runoff from the lime pile was the likely source of licensed material identified in samples collected in unrestricted areas on the licensee's property. The assessment also identified elevated concentrations of uranium and thorium in soil and sediment samples in unrestricted areas outside the licensee's property boundaries. The licensee has proposed to remediate those off-site locations as part of the decommissioning of the facility.

Although the berm appears to have reduced the release of baghouse dust via surface runoff, the licensee's efforts to stabilize the baghouse pile with a cement-fiber based spray-on covering was not as successful. The inspector observed the cover broken up in numerous places including some holes from settling of the dust underneath the covering. The licensee representative stated that they are investigating the use of a longer lasting cover such as HDPE to cover this pile.

The baghouse dust is moved by covered dump truck from the baghouses near D111 to the storage yard. The dust is dry when removed from the baghouses. Between applications of the covering, the licensee representative stated that water is sprayed on

the freshly deposited dust to minimize windblown emissions. At the time of the inspection, the baghouse dust pile was wet from recent storms; therefore, the inspector was unable to confirm the licensee's assertion that insignificant amounts of dust containing licensed material were coming off the pile.

No safety concerns were identified.

12. Posting and Labeling

The entrances to D111 where the pyrochlore is stored and used were posted with the "Caution-Radioactive Materials" signs, as required by 10 CFR 20.203(e)(2). The storage yard where slag and baghouse dust containing licensed material are stored and other buildings and structures at the facility where licensed material is used or stored were also properly posted. One of these buildings, Warehouse G, is used by the licensee to unload and temporarily store incoming pyrochlore prior to moving it to D111.

The inspector observed that, while the licensee had sufficient posting of the documents required in 10 CFR 19.11, the break room in D111 has a bulletin board with various notices related to safety, but that none were related to licensed activities. The licensee representative agreed to post a NRC Form 3 in the D111 break room.

No safety concerns were identified.

13. Environmental Monitoring

The licensee continuously monitors external radiation levels at fifteen locations along the fence line around the facility using TLDs. The TLDs are exchanged quarterly. The inspector determined that the placement of the TLDs along the fence line were representative of external radiation levels emitted from the facility. The inspector reviewed the TLD results for 1992 and the first three quarters of 1993. The highest radiation levels were consistently measured across from the FeCb pile along the west fence line. The highest quarterly measurement at this location was 428 mrem. If an individual was continuously present at this location, the individual would receive an hourly dose of 0.21 mrem. This dose rate complies with 10 CFR 20.105(b) where the permissible external radiation level in an unrestricted areas is 2 mrem in any one hour and 100 mrem in any one week. The licensee representatives agreed to analyze the data to determine compliance with 10 CFR 20.1301.

Water samples from groundwater monitoring wells are taken by the licensee on a quarterly basis from five locations in the vicinity of the storage yard. The samples are analyzed then by a commercial radioanalytical laboratory. Local groundwater flow is towards the southwest. Four wells are located down gradient from the storage yard; one well is located up gradient in the northwest corner of the storage yard.

Initial measurements of the water samples are gross alpha and gross beta. If gross alpha results are than greater than 5 picocuries per liter (pCi/l) or gross beta results are greater than 50 pCi/l, then the sample is analyzed for isotopic thorium, uranium and radium by alpha spectroscopy.

The inspector reviewed the groundwater monitoring results from 1989 to third quarter 1992. A number of samples from the wells down gradient, particularly well location SC-13S, had elevated gross beta results compared to the results from the up gradient well. Elevated gross alpha results and elevated total dissolved solids (TDS) were associated with samples with elevated gross beta results. The presence of elevated TDS increased the minimum detectable activity (MDA) limit of detection for the gross alpha component. For example, the highest gross beta concentration in the second quarter of 1991 was 190 $\pm$ 60 pCi/l. The gross alpha concentration was reported as less than 70 pCi/l; the highest MDA reported for this parameter. The typical MDA reported for gross alpha results was 3 pCi/l. The licensee also performed a number of analyses with samples that were filtered and field filtered prior to analysis. Analysis of the filtered water samples showed very little soluble activity.

The concentration of thorium, uranium and radium from isotopic analyses were usually at the limit of detection. For radium, the limit of detection was 1 pCi/l and for thorium and uranium, the limit of detection was approximately 0.4 to 1 pCi/l. The highest uranium concentration was 7.3 $\pm$ 2.5 pCi/l for uranium 238 (U-238) and 6.2 $\pm$ 2.4 pCi/l for U-234. Thorium was not detected. Comparison of the isotopic concentrations in the monitoring wells are less than the limits specified in 10 CFR 20.106(a). Due to the absence of licensed material in the samples from the monitoring wells, the elevated gross beta measurements may be due to other naturally occurring radionuclides such as potassium 40 (K-40). The highest gross beta measurements were from SC 13S, the monitoring well closest to the baghouse dust pile. A significant component of the baghouse dust pile is lime, a naturally rich source of potassium and subsequently, K-40.

No safety concerns were identified.

14. Instrumentation

The licensee has a number of portable radiation survey instruments including Eberline SRM-100 meters coupled to AC-3-7, HP-210, and HP-260 probes, an Eberline ESP-1 ratemeter/scaler coupled to a SPA-3, a Bicron Analyst, Victoreen models 492, 450P, and 490, and a Reuter Stokes RSS-112 pressurized ionization chamber. In addition, the licensee possesses a number of regulated air samplers for monitoring of airborne radionuclides. Air filters and wipes taken for contamination could be counted on an Eberline SAC-4 scintillation counter. The licensee has an instrument storage and sample preparation room in Building 117.

The inspector reviewed a selection of instrument calibration records and determined that the licensee was calibrating radiation survey instruments at six month intervals as required by their license. Calibrations were traceable to NIST and are performed by outside commercial vendors licensed by the NRC. Air samplers are calibrated in-house every six months using a mass flowmeter manufactured by Teledyne Hastings-Raydist.

No safety concerns were identified.

15. Effluent Controls

Dusts produced during the blending and smelting are pulled into a baghouse filtration system. According to licensee representatives, approximately 44,000 kilograms of baghouse dust is removed from the baghouse and deposited in the storage yard each month. The dust consists mainly of lime contaminated with small amounts of licensed material. The concentrations of U-238 and Th-232 in the baghouse dust each range from approximately 16 to 140 pCi/g with an average around 50 pCi/g. The radium 226 (Ra-226) concentration is lower, ranging from approximately 8 to 43 pCi/g with an average around 25 pCi/g.

The baghouse filtration system consists of two units, the older one rated at 125,000 cfm and the newer system rated at 200,000 cfm, for a total of 325,000 cfm. Both baghouses operate during blending and smelting operations. The licensee told the inspector that the vendor states that the baghouses are 99% efficient; however, the licensee has not independently verified the efficiency. The stack for the larger volume baghouse is equipped with three dust sensors designed to send an alarm signal to the D111 control room, if the dust density in the effluent released to the atmosphere increases. Increases in dust in the effluent and the subsequent activation of the alarm is usually due to holes or tears in two or more of the 1,800 individual bags in the unit. The damaged bags are promptly replaced. According to the licensee, the average bag will last three to five years and the breakage is primarily due to wear and tear. The stack for the older baghouse does not have dust sensors but is periodically inspected to detect and replace damaged bags.

Neither stack is routinely monitored to measure the concentration of radionuclides in the effluent air. The concentrations of radioactive materials in the air discharged from the stacks were last monitored in 1988. The Oak Ridge Associated Universities' results from the 1988 sampling concluded that the licensee was in compliance with 10 CFR 20.106. While some individual sample results for Ra-226 and Ra-228 were in excess of the MPC in Table II of Appendix B to 10 CFR 20.1-20.602, the average was less than the required value.

The 1988 samples from the baghouses were taken under conditions that have changed. Since 1988, the licensee constructed an enclosure around the furnace (see Section 6) that increased the collection efficiency of dust generated during operations. The inspector discussed with the licensee representatives that the enclosure probably increased the amount of dust collected and may have changed the distribution of particle sizes filtered by the baghouse. The licensee did not know what effect the enclosure would have on the particle size in the effluent. Also, the 1988 analysis did not consider the impact of filter bag breakage in the baghouse on radionuclide concentrations in the effluent exiting the stack. Although the newer baghouse can detect an increase in dust in the effluent, the older baghouse does not have dust sensors. Finally, the concentration of uranium in the pyrochlore received from the Niobec Mine has increased since 1988. The concentration of uranium series isotopes (U-238, U-234, Th-230, and Ra-226) in effluent may have increased as a result.

As of January 1, 1994, the DACs in Table 2 of Appendix B to 10 CFR 20.1001-2402 for isotopes of uranium, radium and especially thorium significantly decreased compared to the maximum permissible concentrations in Table II of Appendix B to 10 CFR 20.1-20.602. Comparison of the 1988 results to the DACs indicate that individual results for U-238 and Th-228 are greater than the DACs. Some results from 1988 have detection limits for some radionuclides which are above the DACs.

For these reasons the 1988 samples and subsequent analysis do not represent an adequate evaluation of the effluent from the stack. The failure to adequately evaluate the airborne effluent releases into unrestricted areas containing licensed material from the baghouses since 1988 is a violation of 10 CFR 20.201(b).

16. Independent Measurements

The inspector took a number of independent measurements during the course of the inspection. Gamma radiation fields were measured with a Ludlum Model 19 micro-R meter (NRC Serial No. 033513) calibrated on October 1, 1993. Water samples were analyzed for Region I by the Oak Ridge Institute for Science and Education at their laboratory on a Tennelec Model LB5100 gas-flow proportional counter for gross alpha and gross beta activities.

A. Gamma Radiation

The following is a summary of gamma radiation measurements taken by the inspector. Background gamma radiation levels were measured at 6 to 10 microroentgens per hour (uR/hr).

1. D111 work areas; furnace level: 17 to 90 uR/hr
2. D111 work areas; ground level: 18 to 280 uR/hr
3. D111 pyrochlore ore storage; on contact: 1,800 to 2,000 uR/hr
4. Storage Yard; FeCb pile on contact: 600 to 2,500 uR/hr
5. Storage Yard; ferro-vanadium piles: 90 to 120 uR/hr
6. Storage Yard; baghouse dust: 120 uR/hr
7. Old Baghouse (AAF); exterior areas: 35 to 50 uR/hr
8. Old Baghouse (AAF); duct work from D111 to building: 30 to 60 uR/hr
9. New Baghouse (Flex-Clean); exterior areas: 30 to 150 uR/hr
10. New Baghouse (Flex-Clean); interior: 90 to 100 uR/hr
11. Fence line at one meter: background to 440 uR/hr
12. Southwest corner in unrestricted area at one meter: 150 uR/hr

B. Water Samples

The inspector took two surface water samples from the facility's permitted discharge points. One sample was taken at the discharge point for all plant processes, included processed groundwater contaminated with chromium. The second sample was taken from the storm water discharge point. Each sample contained 500 milliliters of water. The gross alpha and beta activities are reported in picocuries per liter of water at a counting uncertainty of two sigma. The following results were obtained:

Location	Gross Alpha Activity (pCi/l)	Gross Beta Activity (pCi/l)
Process Discharge	MDA ($\leq$ 3 pCi/l)	18.8 $\pm$ 1.9
Storm Water Discharge	MDA ($\leq$ 1.5 pCi/l)	3.9 $\pm$ 1.2

The gross beta activities in the two samples are less than the most restrictive MPCs in Table II of Appendix B to 10 CFR 20.1-20.602 of 3 E-8 uCi/ml (Ra-226 and Ra-228). The inspector concluded that the licensee's discharges into surface water were in compliance with 10 CFR 20.106.

No safety concerns were identified.

17. Exit Interview

The inspection findings were discussed with those licensee representatives identified in Section 1 of this report on December 3, 1993.