40-7102
040-07102

SHIELDALLOY METALLURGICAL CORPORATION

WEST BOULEVARD
P.O. BOX 768
NEWFIELD, NJ 08344
TELEPHONE (609) 692-4200
TWX (510) 687-8918
FAX (609) 697-9025

C. SCOTT EVES
VICE PRESIDENT – ENVIRONMENTAL SERVICES

December 22, 1994

Mr. Gary Comfort
U.S. Nuclear Regulatory Commission
Mail Stop T-8D16
Washington, D.C. 20555

RE: Request for Additional Information
Application dated June 2, 1992
Shieldalloy Metallurgical Corporation, Docket #40-7102

Dear Mr. Comfort:

Enclosed herewith, please find SMC's response to the above referenced request. We believe that this information, while not exhaustive, will address the majority of the NRC's information needs. If this is not the case, or if you have questions or additional requirements, please do not hesitate to let us know.

Cordially,

Lidia M. Stasiuk for:
C. Scott Eves, RSO
V.P., Environmental Services

CSE:lms

300010

NF01
1/1

RESPONSE TO NRC REQUEST FOR ADDITIONAL INFORMATION FOR APPLICATION DATED JUNE 2, 1992

1. **Provide the name and location of the providers of the pyrochlore ore used in the production of FeCb. List transportation methods and the monthly average of shipments to ship the ore from the provider to the SMC facility.**

   The names and locations of the providers are as follows:

   Cambior, Inc
   3400 Ch. Du Columbium
   St. Honore Cte. Dubuc
   GOV 1LO

   Luesche, Inc.
   c/o Gesellschaft für Elektrmetallurgie mbH
   Postfach 2844
   90013 Nürnberg 80
   Germany

   The transportation method used is truck.

   The total number of shipments of ore to SMC at Newfield averaged 14.09 sh[redacted] the first 11 months of 1994.

2. **List the type of records and reports that are maintaine[redacted] of radioactive materials associated with the FeCb proc[redacted] type of record.**

   The following records are maintained with regards to the [redacted]

   Receiving documents covering the number of packages, gr[redacted] received, etc. Monthly reports containing this information [redacted]

   Monthly inventory records are maintained showing the amount of material in stock at the beginning of the month, the amount received, the amount used in production, and the amount left in stock at the end of the month. Monthly reports containing this information are distributed.

   Quarterly reports covering the quantity of uranium and thorium that have been added to the on site inventory are generated based on the amount of uranium and thorium contained in the received material and assuming that 100% of these elements have remained on site after processing.

3. **Provide an aerial photograph of the SMC facility that may also be used to assist in surrounding land use discussions.**

   The enclosed photograph is one that was selected by the NRC specifically for this purpose.

4. **Provide a copy of contingency plans that may be used in responding to any emergency conditions which could be triggered by upset conditions from the FeCb process.**

   Enclosed as part of this package is a copy of a Standard Operating Procedure "Emergency Response and Notifications" which should respond to this request.

5. **Provide general information on other types (non-FeCb) of processing that occur at the Newfield facility for a general background discussion.**

   Attached is a copy of such a general description. If the NRC needs a more detailed explanation for this purpose, please let us know.

6. **Provide average energy and utility consumption for the SMC facility, as related to the FeCb process (estimates are acceptable).**

   The significant majority of energy used in FeCb production is electrical, and the use for October 1994 was 659,536 Kw.

7. **Provide an updated map of the slag storage yard showing current locations of FeCb slag and baghouse dust, as well as other segregated piles in the storage. Include designations of berms currently in place.**

   A map showing the requested information is being prepared and will be submitted to the NRC by the end of January 1995.

8. **Provide copies of Standard Operating Procedures (SOP's) for the radiation protection program. It is NRC's understanding that there are approximately 19 SOP's which are or will be in place.**

   Enclosed are copies of the 18 Draft SOP's that have been prepared to cover the operations involving pyrochlore and FeCb production. These SOP's are in draft form and may change before being implemented as final.

9. **Assuming operation until the end of year 2000, provide possession limit requirements for uranium and thorium. What is the estimated volume and footprint of materials expected to be stored in the slag storage yard at this point (an estimate using an updated figure from question 7 is acceptable)?**

   The estimated maximum volume of materials that can be stored on site is 342,491m^3 on a footprint of 47014m^2. At current production rates, this volume of materials will be reached sometime after the year 2100.

10. **Provide references (or location in documents which have been previously provided to NRC) that contains the latest sampling and/or monitoring results for radiological concentrations (including location and results of maximum off site results, if any) of soil, air surface water, and ground water and the maximum external gamma exposure rates at the fence line and on contact with the slag piles. In particular, include soil and water measurement data of radionuclide contamination along the Hudson's Branch to Weymouth Rd. If the reference data is dated, provide descriptions of any changes at the site which may alter interpretations of the data (e.g., a new chimney has been placed in D-111 since 1988 ORAU air effluent measurements, any further cleanup since a data set was provided, etc.) or provide new sampling data.**

Enclosed are copies of the following documents which respond to the above request. Although SMC has made every effort to locate all the applicable documents, this list may not be exhaustive. We will consider this an open request and will submit additional information as it is available.

a. Applicants Environmental Report for the Newfield, New Jersey Facility, Report No. IT/NS-92-118, October 28, 1992

b. Baseline Radiological Risk Assessment for the Hudson's Branch Watershed, Report No. IT/NS-92-116.

c. Data from the 4th quarter Radiological Survey for the SMC Newfield Facility.

d. Most recent data from environmental monitoring for gamma radiation at fence line of facility.

e. Routine Inspection Report #040-07102/93-001

11. **It is NRC's understanding that radon monitoring is to begin in December 1994. Please provide results of this testing as soon as it becomes available, particularly for the slag and dust piles and at the site perimeter.**

SMC will provide this data as soon as it is available.

12. **Provide the following information regarding the D-111 baghouses:**

A) The number of bags in each baghouse.

The American Air Filter (AAF) baghouse has 540 bags.
The FlexKleen (FK) baghouse has 1800 bags.

B) Dust capacity (in kg) of each baghouse and storage silo.

The AAF baghouse has capacity for approximately 4,000 kg of dust.

The FK baghouse has capacity for approximately 14,000 kg of dust.
The silo has capacity for 1700 ft^3 kg of dust.

C) **Average number of trips each month made to empty the baghouse.**

There are an average of 8 trips made each month to empty both baghouses and the storage silo.

D) **Capacity of truck transporting baghouse dust to slag storage yard.**

The truck used for this purpose has a capacity of 12 yd^3 but is not filled to capacity to avoid spillage.

E) **Typical failure mode for each baghouse.**

A typical failure mode for either of the baghouses is a hole or tear in one or more of the bags.

F) **Average and expected number of bags that may fail over a given period of time.**

The average number of bags that may fail is 96 per year.

G) **Describe how failures are detected.**

On the FK baghouse, there is an opacity detector. This detector sounds and audible alarm whenever the opacity of the effluent exceed the set point. The AAF baghouse is monitored visually by the operators.

H) **How much time passes between bag failure and it's replacement?**

Any broken bags detected are replaced before the next heat of material is run through the furnace.

I) **Estimate the amount of throughput of dust during a failure (both average and expected maximum).**

To develop this information (even in the form of an estimate) would require significant effort on the part of SMC and would involve the dynamic flow patterns within the baghouse, the relative resistance of the remaining bags as compared to the failed one, the dust loading at th time of the failure since it changes during the different stages of production, how many bags had failed and what type of failure was involved (catastrophic, gradual bypass because of wear, a tear or hole on the side of the bag) etc. Instead SMC suggests that this question be addressed as part of the stack effluent monitoring that is being proposed as a response to the most recent inspection report. SMC has agreed to have performed stack monitoring on both baghouses to confirm that the amount of material being released is less than that permitted under the regulations, and these two studies would dovetail nicely, saving the licensee significant resources.

13. **Review and provide any changes or updates to your renewal application since its last submittance.**

There have been changes that need to be included as part of this renewal application. However, SMC wishes to be sure that none of the changes are overlooked and so will provide a written copy of the necessary changes under separate cover. This additional submittal will be provided to the NRC by the end of January, 1995.

TELEDYNE BROWN ENGINEERING ENVIRONMENTAL SERVICES

ENVIRONMENTAL TLD EXPOSURE REPORT

SM99 SHIELDALLOY METALURGICAL

THE RESULTS INDICATED BELOW HAVE BEEN OBTAINED USING THE TELEDYNE ISOTOPES READOUT SYSTEM AND DOSIMETERS. THE ORIGINAL DATA ARE RETAINED ON FILE.

NET EXPOSURES IN MR AND MR/STD. QUARTER

IDENT.	BEGINNING MM/DD/YY	HR	ENDING MM/DD/YY	HR	DAYS	TLD	AREA 1	AREA 2	AREA 3	AREA 4	AVERAGE	STD. DEV.	PER STANDARD QUARTER AVERAGE	2 STD. DEV.
STA-02	04/11/94	15	07/20/94	10	99.8	3-2531	9.3	8.8	8.9	10.2	9.3	0.6	8.5	1.2
STA-03	04/11/94	15	07/20/94	10	99.8	3-2584	210.0	202.1	195.4	222.5	207.5	11.6	189.9	21.3
STA-04	04/11/94	15	07/20/94	10	99.8	3-2602	77.7	74.4	61.6	74.7	72.1	7.2	66.0	13.1
STA-05	04/11/94	15	07/20/94	11	99.8	3-2633	234.4	223.3	207.1	224.3	222.3	11.3	203.3	20.6
STA-06	04/11/94	15	07/20/94	11	99.8	3-2635	502.2	500.6	441.4	451.0	473.8	32.1	433.3	58.7
STA-07	04/11/94	15	07/20/94	11	99.8	3-2379	24.1	23.9	19.8	20.6	22.1	2.2	20.2	4.1
STA-08	04/11/94	15	07/20/94	11	99.8	3-2643	46.0	45.1	38.7	39.9	42.4	3.7	38.8	6.7
STA-09	04/11/94	15	07/20/94	11	99.8	3-2401	94.4	92.4	78.7	74.0	84.9	10.0	77.6	18.4
STA-10	04/11/94	15	07/20/94	11	99.8	3-2421	53.4	50.1	40.4	41.9	46.4	6.3	42.5	11.5
STA-11	04/11/94	15	07/20/94	11	99.8	3-2614	66.4	63.8	50.9	57.3	59.6	6.9	54.5	12.7
STA-12	04/11/94	15	07/20/94	11	99.8	3-2638	72.1	70.6	65.3	72.6	70.1	3.3	64.1	6.1
STA-13	04/11/94	15	07/20/94	11	99.8	3-2670	10.5	9.4	8.3	8.9	9.3	0.9	8.5	1.7
STA-14	04/11/94	15	07/20/94	11	99.8	3-2654	13.5	13.6	12.3	12.6	13.0	0.7	11.9	1.2
STA-16	04/11/94	18	07/21/94	22	101.2	3-0030	6.0	5.6	5.0	5.4	5.5	0.4	5.0	0.7
STA-17	04/12/94	07	07/22/94	10	101.1	3-2540	6.6	6.5	6.0	6.1	6.3	0.3	5.7	0.6
STA-18	04/11/94	16	07/20/94	12	99.8	3-2650	295.7	280.1	245.2	302.8	280.9	25.6	256.9	46.9
STA-19	04/11/94	16	07/20/94	12	99.8	3-2393	49.7	50.0	42.4	44.9	46.7	3.7	42.8	6.8
STA-20	04/11/94	16	07/20/94	12	99.8	3-2389	71.7	67.9	63.9	67.1	67.6	3.2	61.9	5.9

CONTINUED
NEXT PAGE

IDENT.	BEGINNING MM/DD/YY	HR	ENDING MM/DD/YY	HR	DAYS	TLD	AREA 1	AREA 2	AREA 3	AREA 4	AVERAGE	STD. DEV.	PER STANDARD QUARTER AVERAGE	2 STD. DEV.
STA-21	04/11/94	16	07/20/94	12	99.8	3-2386	35.5	33.6	30.4	32.1	32.9	2.2	30.1	4.0
STA-22	04/11/94	16	07/20/94	12	99.8	3-2359	100.9	98.8	90.1	95.4	96.3	4.7	88.1	8.6
STA-23	04/11/94	16	07/20/94	12	99.8	3-2512	25.8	25.6	22.7	23.4	24.4	1.6	22.3	2.8
STA-24	04/11/94	16	07/20/94	12	99.8	3-2484	95.3	95.2	91.1	96.3	94.5	2.3	86.4	4.3
STA-25	04/11/94	16	07/20/94	12	99.8	3-2413	104.3	104.7	92.8	89.6	97.9	7.8	89.5	14.2
STA-26	04/11/94	16	07/20/94	12	99.8	3-2480	273.6	276.7	236.1	250.7	259.3	19.3	237.1	35.3
STA-27	04/11/94	16	07/20/94	12	99.8	3-2411	885.5	899.3	967.9	1059.5	953.1	79.6	871.6	145.6
STA-28	04/11/94	16	07/20/94	12	99.8	3-2358	87.3	82.2	65.4	61.0	74.0	12.7	67.6	23.3
STA-29	04/11/94	16	07/20/94	12	99.8	3-2615	93.8	93.1	84.2	83.7	88.7	5.5	81.1	10.0
STA-30	04/11/94	16	07/20/94	12	99.8	3-2363	32.4	31.3	29.2	31.3	31.1	1.3	28.4	2.5
STA-31	04/11/94	16	07/20/94	12	99.8	3-2644	31.1	30.2	27.1	24.7	28.3	2.9	25.8	5.4
STA-32	04/11/94	16	07/20/94	12	99.8	3-2641	84.2	81.3	81.4	85.3	83.1	2.0	76.8	3.7
STA-33	04/11/94	16	07/20/94	12	99.8	3-2612	16.8	15.3	13.2	13.9	14.8	1.6	13.5	2.9
STA-34	04/11/94	16	07/20/94	12	99.8	3-2566	17.7	17.3	15.5	15.7	16.6	1.1	15.1	2.0
STA-35	04/11/94	16	07/20/94	12	99.8	3-2404	16.1	15.8	13.7	14.3	15.0	1.2	13.7	2.1
STA-36	04/11/94	16	07/20/94	12	99.8	3-2444	11.3	11.7	8.6	8.1	9.9	1.8	9.1	3.4
STA-37	04/11/94	16	07/20/94	12	99.8	3-2570	10.3	10.1	9.0	9.2	9.6	0.6	8.8	1.1
STA-38	04/11/94	16	07/20/94	12	99.8	3-2675	14.2	14.1	15.2	16.4	15.0	1.1	13.7	2.0
STA-39	04/11/94	16	07/20/94	12	99.8	3-0011	14.8	17.4	12.7	12.6	14.4	2.3	13.1	4.1
STA-40	04/11/94	16	07/20/94	12	99.8	3-2821	12.5	12.1	10.7	10.8	11.5	0.9	10.5	1.7
STA-41	04/11/94	16	07/20/94	12	99.8	3-2825	11.4	10.9	10.2	10.5	10.7	0.5	9.8	0.9

CONTINUED
NEXT PAGE

IDENT.	BEGINNING MM/DD/YY	HR	ENDING MM/DD/YY	HR	DAYS	TLD	AREA 1	AREA 2	AREA 3	AREA 4	AVERAGE	STD. DEV.	PER STANDARD QUARTER AVERAGE	2 STD. DEV.
STA-42	04/11/94	16	07/20/94	12	99.8	2-3822	11.2	11.5	9.9	10.5	10.8	0.7	9.8	1.3
STA-43	04/11/94	16	07/20/94	12	99.8	3-2824	16.2	15.4	14.0	14.3	15.0	1.0	13.7	1.8
STA-45	04/11/94	16	07/20/94	12	99.8	3-2581	13.6	13.6	12.4	12.4	13.0	0.7	11.9	1.2
STA-46	04/11/94	16	07/20/94	12	99.8	3-2589	8.8	8.7	8.1	8.2	8.5	0.4	7.7	0.7
STA-47	04/11/94	12	07/20/94	12	100.0	3-2559	8.3	8.9	7.8	8.0	8.2	0.5	7.5	0.9
STA-48	04/11/94	12	07/20/94	12	100.0	3-2629	8.8	8.8	8.2	7.9	8.4	0.4	7.7	0.8
STA-49	04/11/94	12	07/20/94	12	100.0	3-2430	16.1	15.9	13.7	14.3	15.0	1.2	13.7	2.2
STA-50	04/11/94	12	07/20/94	12	100.0	3-2367	9.9	10.9	7.3	5.6	8.4	2.4	7.7	4.4
STA-51	04/11/94	12	07/20/94	12	100.0	3-7919	10.2	9.8	9.2	9.5	9.7	0.4	8.8	0.8
STA-52	04/11/94	12	07/20/94	12	100.0	3-7918	8.3	8.7	12.3	8.6	9.5	1.9	8.6	3.4
SITEZERO	04/11/94	15	07/20/94	10	99.8	3-2640	8.8	9.1	8.2	7.9	8.5	0.6	7.8	1.0
TELEZERO	03/17/94	12	07/27/94	12	132.0	3-7917	0.1	-0.1	-0.5	-0.4	-0.2	0.3	-0.1	0.3

THESE NET EXPOSURE VALUES RESULTED AFTER SUBTRACTING AN AVERAGE CONTROL READING OF 8.7 MR, DERIVED FROM THE FOLLOWING CONTROL DOSIMETERS:

CONTROL TR	00/00/00	00	00/00/00	00		CALCUL	8.7	8.7	8.7	8.7	8.7	0.0		

APPROVED jmlatin

DATE 8-31-94

SMC (formerly Shieldalloy Corporation) has been operating at the Newfield, NJ facility since 1955. Past production processes include: chromium oxide and chromium metal production, ferrovanadium production, ferrocolumbium and columbium nickel production. A titanium metal degreasing operation was operated from 1965 to 1967. The principal production processes currently employed by SMC include aluminothermic and reduction smelting of ores, which produce purified metal, slags, and various other by-products, co-products, or other materials. Current products include aluminum master alloys, ferroalloys, crushing/grinding metal powders, and pressed metal powder briquettes. Raw materials currently used and stored at the facility include pyrochlore, columbium (niobium), ferroboron, aluminum oxide, titanium oxide, strontium oxide, zirconium oxide, dolomite lime, steel slag, lead, nickel, ferromanganese, silicon, fluoride salts, and oxides of vanadium. The raw materials are distributed to appropriate warehouse or departments upon arrival. In the past, some raw materials may have been stored throughout the plant. As a result of these current and past manufacturing processes, the facility has generated slag, dross, baghouse dust, and wastewaters.

CC: MAF
2/8/94
lms

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PENNSYLVANIA 19406-1415

DATE 2/7/94
TO HNS, MAH, KRP Bu
FROM: CSE

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.

9402220088 2pp.

Your cooperation with us is appreciated.

Sincerely,

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

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
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.

	TRAINING IN RADIATION PROTECTION	Procedure: ENV-R-002
		Page: 1 of 10
		Revision No. 000
		Date: 03/10/94
		Approved by (Director):
		Approved by (RSO):
		Approved by (QAO):
		Approved by (RSC Chair):

TABLE OF CONTENTS

CONTROLLED COPY NO. : _____

1 PURPOSE

1.1 This procedure describes the requirements of the radiation protection training program which trains individuals commensurate with the hazards to which they are exposed and complies with 10 CFR 19 and 10 CFR 20.

1.2 Responsibilities:

1.2.1 The Director shall be responsible for implementation of this program.

1.2.2 The Radiation Safety Officer (RSO) shall be responsible for oversight and technical content of this program.

1.2.3 Shieldalloy management and Authorized Users shall be responsible for ensuring their workers are trained prior to exposure to radiological hazards.

2 SCOPE

2.1 The training program applies to all Shieldalloy employees, visitors and contractors who have access to the Controlled Areas at Shieldalloy.

3 REFERENCES

3.1 Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation"

3.2 Title 10, Code of Federal Regualtions, Part 19, "Notices, Instructions and Reports to Workers: Inspections,"

3.3 U. S. Nuclear Regulatory Commission License No. SMB-743.

3.4 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-001, "Radiation Protection Program Plan".

3.5 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-011, "Radiation Protection Records".

4 DEFINITIONS

4.1 Approval - An act of endorsing or adding positive authorization or both.

4.2 Authorized User - Employees who supervise the use of source material and who supervise individuals who work with source material. Authorized users are qualified, by training and experience, to assure

source material is used for its intended purpose in a manner that protects health and minimizes danger to life or property.

4.3 Controlled Area - Any area to which access is controlled in order to protect individuals from exposure to radiation and radioactive materials. (The controlled area at Shieldalloy consists of the entire area within the fence line.)

4.4 Director - Designated senior manager of Shieldalloy Metallurgical Corporation with the authority to commit Shieldalloy resources for radiation protection purposes.

4.5 May - The word *may* is used to denote permission.

4.6 Radiation Safety Officer (RSO) - An individual who, by virtue of qualifications and experience, has been given the authority to implement the Shieldalloy Radiation Protection Program Plan. The RSO is qualified to use source material for its intended purpose in a manner that protects health and minimizes danger to life or property. The RSO is responsible for recognizing potential radiological hazards, developing a radiation safety program to protect against these hazards, training workers in safe work practices, and supervising day-to-day safety operations.

4.7 Radiation Worker - An occupational worker who may enter radiological areas and/or who has the potential to receive greater than 0.1 rem per year.

4.8 Restricted Area - An area within the controlled area to which access is limited for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials. Restricted areas at Shieldalloy include D.203(A), D.102, D.111, and other areas so designated by the RSO.

4.9 Shall - The word *shall* is to be understood as a requirement.

4.10 Should - The word *should* is to be understood as a recommendation.

4.11 Thermoluminescent Dosimeter - The thermoluminescence phosphor(s) used for determining external radiation exposure to beta, gamma, x-rays, and neutrons. The words TLD and dosimeter are used interchangeably throughout this procedure.

4.12 Unrestricted Area - Areas that include but are not limited to, laboratory floors, benches, equipment, and materials released from potentially contaminated areas for unrestricted use.

4.13 Visitor - An individual who is not assigned to the job site or fixed facility and who does not perform physical work activities (e.g., inspectors, auditors, supervisors, vendors), for Shieldalloy.

5 PROCEDURE

5.1 Requirements

5.1.1 All Shieldalloy employees, subcontractors, and visitors who access a job site with radiological hazards shall be trained in regard to radiological hazards.

5.1.2 The level of training shall be commensurate with the level of hazard to which they will be exposed.

5.2 Radiation Protection Training Programs

5.2.1 The Shieldalloy training program is designed to accommodate three groups of personnel:

- Visitors
- Non-radiation workers
- Radiation workers

5.2.2 Visitors shall be trained by reading and signing a briefing form. This form is shown in Attachment 1.

5.2.3 Non-radiation workers shall receive the General Employees Training (GET) program. This program shall address the topics outlined in Attachment 2 and may take from one to two hours to complete.

5.2.4 Radiation workers shall receive the Radiation Worker Training (RWT) program. This program shall address the topics outlined in Attachment 3 and may take from eight to twelve hours to complete.

5.2.5 Special Briefings shall be made available on a case-by-case basis to provide comprehensive and in-depth knowledge of certain radiation protection topics (e.g., respiratory protection devices, containments, engineering controls). The need for Special Briefings shall be determined and arranged by the RSO.

5.3 When Training is Required

5.3.1 Visitors shall sign a "Visitor Briefing Form" at the start of each week that they access the job site.

5.3.2 Non-radiation workers shall receive GET within one week of assignment at Shieldalloy. As long as the worker is at or has potential to work at a job site covered by this procedure

retraining shall be required annually thereafter by the end of the same quarter it was originally completed.

5.3.3 Radiation workers shall receive Radiation Worker Training prior to entering any restricted area. To maintain active radiation worker status, retraining shall be completed annually thereafter by the end of the same quarter in which it was originally completed.

NOTE: **Shieldalloy shall not issue a TLD to any Shieldalloy employee, subcontractor, or visitor prior to them receiving radiation protection training.**

5.4 Conduct of Training

5.4.1 Visitors may be briefed by any individual who has received GET or Radiation Worker Training.

5.4.2 GET and Radiation Worker Training shall be conducted by appropriately trained and qualified individuals, as approved by the RSO.

5.5 Testing

Testing to demonstrate proficiency shall be required for radiation workers. The test shall address all of the required topics shown in Attachment 3.

5.6 Credit for Non-Shieldalloy Training Courses

5.6.1 To receive credit for previous training shall require the following:

- Evidence of satisfactory completion of training (i.e., certificate, test results).
- List of subjects covered in the training.
- Test score.

5.6.2 The RSO shall review the training received and make a determination of equivalency.

5.6.3 The RSO's evaluation shall be documented.

5.7 Waivers

5.7.1 A waiver of GET shall require the approval of the RSO.

5.7.2 A waiver of Radiation Worker Training shall require the approval of the RSO and the Director.

5.7.3 Waivers shall be documented on the "Waiver of Training" form (Attachment 4).

5.7.4 All individuals who have training waived shall be escorted by individuals who are currently trained.

6 DOCUMENTATION

6.1 All records pertinent to this procedure shall be maintained pursuant to ENV-R-011.

6.2 The following training records shall be maintained:

6.2.1 Copies of all course lesson plans.

6.2.2 Test results.

6.2.3 Copies of tests.

6.2.4 Training attendance rosters.

6.2.5 Equivalency determinations.

6.2.6 Waivers of Training (Attachment 4).

6.3 Shieldalloy employees shall have training records incorporated in their personnel file.

7 ATTACHMENTS

7.1 Attachment 1: Visitor Radiation Protection Briefing

7.2 Attachment 2 - General Employee Training

7.3 Attachment 3 - Radiation Worker Training

7.4 Attachment 4 - Waiver of Training

ATTACHMENT 1

VISITOR RADIATION PROTECTION TRAINING

The following guidelines shall be read and acknowledged by signing the bottom of this form.

1. Visitors shall not enter any Controlled Area or any area posted with radiological warnings or cautions unless a Waiver of Training form has been completed and the visitor is properly escorted.

2. Visitors who do enter Radiological Areas shall have their dose estimated by the RSO or be issued a thermoluminescent dosimeter (TLD).

3. During emergencies the visitor shall remain in the custody of their escort and follow the escort's instructions.

Visitor's signature: _____ Date: _____

Visitor's printed name: _____

Escort agreement:

I understand that as the escort for the above mentioned visitor, I am responsible for their radiation protection.

Escort's signature: _____ Date: _____

Individual administering briefing
Signature: _____ Date: _____

Distribution
Original: RSO
cc: Visitor
Escort

ATTACHMENT 2

GENERAL EMPLOYEE TRAINING

1. General Employee Training (GET) is administered to workers who do not enter restricted areas, i.e., non-radiation workers.

2. GET addresses the following topics:

   a. The risk of low level occupational radiation exposure.
   b. The risk of pre-natal radiation exposure.
   c. Basic radiation protection concepts.
   d. NRC and/or DOE, and Shieldalloy radiation protection policies and procedures.
   e. Employee and management responsibilities for radiation safety.
   f. Identification of radiation postings and barriers.
   g. Emergency procedures.

3. GET consists of classroom lecture, hand-out materials, and a question/answer period.

4. Although not required by regulation, Shieldalloy may test individuals in GET to ensure proficiency. A score of 80% is required to successfully complete the course. Employees failing an exam shall review the incorrectly answered questions with the RSO. Following the review a second test shall be taken and a score of 80% is required for passing. Any employee failing the second test shall be required to attend another GET session.

ATTACHMENT 3

RADIATION WORKER TRAINING

1. Radiation Worker Training (RWT) shall be administered to radiation workers.

2. Radiation Worker Training shall address the following topics:
   a. Radioactivity and radioactive decay.
   b. Characteristics of ionizing radiation.
   c. Man-made radiation sources.
   d. Acute effects of exposure to radiation.
   e. Risks associated with occupational radiation exposures.
   f. Special considerations in the exposure of women of reproductive age.
   g. Dose-equivalent limits.
   h. Mode of exposure - internal and external.
   i. Dose-equivalent determinations.
   j. Basic protective measures - time, distance, shielding.
   k. Specific procedures for maintaining exposures as low as reasonably achievable.
   l. Radiation survey instrumentation - calibration and limitations.
   m. Radiation monitoring programs and procedures.
   n. Contamination control, including protective clothing, equipment and work place design.
   o. Personnel decontamination.
   p. Emergency procedures.
   q. Warning signs, labels, and alarms.
   r. Responsibilities of employees and management.
   s. Interaction with radiation protection staff.
   t. Operational procedures associated with specific job assignments (e.g., handling pyrochlore ore, transport of baghouse dust).

3. RWT shall consist of classroom lecture and a demonstration of practical abilities. The practical exercise requires that the workers correctly dress-out in protective clothing, demonstrate the correct removal of protective clothing, and frisk for contamination.

4. RWT requires demonstration of proficiency by testing. Each part of the training shall be evaluated and a passing score of 80% is required for each part.

5. Review of incorrectly answered questions with the RSO followed by retesting or repeating the course are options available to supervisors of "failed" employees through arrangements with the RSO.

6. Workers shall be given the opportunity to review their tests and have incorrect responses reviewed for the correct response.

7. Workers with appropriate training and experience may elect to take examinations without benefit of the instruction if previously arranged with the RSO.

ATTACHMENT 4

WAIVER OF TRAINING

WAIVER OF TRAINING

Individual's Name (Print): _____

Individual's Signature: _____

Training course being waived:

___ General Employee Training

___ Radiation Worker Training

___ Classroom Training

___ Practical Demonstrations

Escort's Name (Print): _____

Escort's Signature: _____

APPROVALS:

RSO: _____
Signature Date

Director: _____
Signature Date

Distribution:
Original: RSO
cc: Individual
Escort

	ALARA PROGRAM	Procedure: ENV-R-004
		Page: 1 of 10
		Revision No. 000
		Date: 03/11/94
		Approved by (Director):
		Approved by (RSO):
		Approved by (QAO):
		Approved by (RSC Chair):

TABLE OF CONTENTS

CONTROLLED COPY NO. : _____

1 PURPOSE

1.1 This procedure describes the Shieldalloy ALARA (as low as reasonably achievable) program regarding exposures to ionizing radiation and radioactive material. This procedure is applicable to all Shieldalloy operations, activities, and personnel.

1.2 Responsibilities:

1.2.1 The Director shall:

1.2.1.1 Ensure that plant personnel are aware and supportive of management's commitment to keep occupational radiation exposures ALARA.

1.2.1.2 Review radiation protection program audit findings in order to determine how exposures might be reduced.

1.2.1.3 Ensure that workers are trained in radiation protection practices.

1.2.1.4 Ensure that revisions to operating and maintenance procedures, and modifications to plant equipment and facilities are made if they will substantially reduce exposures at a reasonable cost.

1.2.1.5 Ensure that the authority for providing procedures designed to meet ALARA goals is properly delegated.

1.2.1.6 Ensure that the resources needed to achieve ALARA goals are made available to the RSO and the RSC.

1.2.2 The Radiation Safety Officer (RSO) shall:

1.2.2.1 Perform radiological surveys in order to provide comprehensive and current information on the radiological status of Shieldalloy facilities and equipment.

1.2.2.2 Ensure that posting and labeling is appropriate and commensurate with the hazards.

1.2.2.3 Provide appropriate radiation protection information on Radiation Work Permits.

1.2.2.4 Ensure radiation monitoring and surveillance instruments are functional, calibrated, and available in adequate quantities to perform both routine and emergency tasks.

1.2.2.5 Provide the listing of ALARA goals to the Radiation Safety Committee for consideration.

1.2.3 The Radiation Safety Committee (RSC) shall review, recommend, and approve ALARA goals at a frequency of not less than once per calendar year.

1.2.4 Shieldalloy personnel shall:

1.2.4.1 Plan work in controlled and restricted areas in order to minimize exposures.

1.2.4.2 Follow the basic radiation protection principles of "time", "distance" and "shielding" whenever possible.

1.2.4.3 Comply with the instructions contained on Radiation Work Permits or given by the RSO.

1.2.4.4 Obtain special briefings pursuant to ENV-R-002, "Training in Radiation Protection", when advised by the RSO.

1.2.4.5 Comply with the listing of individual worker responsibility for ALARA as contained in Attachment 1.

2 SCOPE

2.1 This procedure applies to all Shieldalloy employees, visitors, and contractors.

3 REFERENCES

3.1 Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation"

3.2 U. S. Nuclear Regulatory Commission License No. SMB-743.

3.3 Shieldalloy Metallurgical Corporation Radiation Protection Procedure No. ENV-R-001, "Radiation Protection Program Plan".

3.4 Shieldalloy Metallurgical Corporation Radiation Protection Procedure No. ENV-R-002, "Training in Radiation Protection".

3.5 Shieldalloy Metallurgical Corporation Radiation Protection Procedure No. ENV-R-011, "Radiation Protection Records".

3.6 USNRC Regulatory Guide 8.8, "Information Relevant to Ensuring that Occupational Radiation Exposures at Nuclear Power Stations will be As Low As Reasonably Achievable," June 1978.

4 DEFINITIONS

4.1 ALARA - Acronym for "As Low As Reasonably Achievable", a basic concept of radiation protection that specifies that radiation exposures should be maintained as low as is reasonably achievable taking into account technological, economical, and societal considerations.

4.2 Approval - An act of endorsing or adding positive authorization or both.

4.3 Authorized User - Employees who supervise the use of radioactive material and who supervise individuals who work with radioactive materials. Authorized users are qualified, by training and experience, to ensure radioactive materials are used for their intended purpose and in a manner that protects health and minimizes danger to life or property.

4.4 Contamination Area - Any area accessible to personnel where there exists fixed and/or removable source material contamination in excess of the limits established for unrestricted access.

4.5 Controlled Area - Any area to which access is controlled in order to protect individuals from exposure to radiation and radioactive materials. (The controlled area at Shieldalloy consists of the entire area within the fence line.)

4.6 Director - Designated senior manager of Shieldalloy Metallurgical Corporation with the authority to commit Shieldalloy resources for radiation protection purposes.

4.7 May - The word *may* is used to denote permission.

4.8 Pocket Ionization Chambers (PIC) - A self-indicating, dose integrating device which is considered to be a "secondary" dosimetry device. A PIC shall not be worn without a primary dosimetry device (TLD).

4.9 Radiation Safety Officer (RSO) - An individual who, by virtue of qualifications and experience, has been given the authority to implement the Shieldalloy Radiation Protection Program Plan. The RSO is qualified to use source material for its intended purpose in a manner that protects health and minimizes danger to life or property. The RSO is responsible for recognizing potential radiological hazards, developing a radiation safety program to protect against these hazards, training workers in safe work practices, and supervising day-to-day radiation safety operations.

4.10 Restricted Area - An area within the controlled area to which access is limited for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials.

Restricted areas at Shieldalloy include D.203(A), D.102, D.111, and other areas so designated by the RSO.

4.11 Shall - The word *shall* is to be understood as a requirement.

4.12 Should - The word *should* is to be understood as a recommendation.

4.13 Thermoluminescent Dosimeters (TLD) - The thermoluminescence phosphor(s) used for determining external radiation exposure to beta, gamma, x-rays, and neutrons. The words TLD and dosimeter are used interchangeably throughout this procedure.

5 PROCEDURE

5.1 ALARA Objectives

5.1.1 To establish a program for maintaining occupational radiation doses ALARA;

5.1.2 To design facilities and select equipment using ALARA concepts;

5.1.3 To establish radiation controls in the program, plans, and procedures, and;

5.1.4 To make available supporting equipment, instrumentation, and facilities.

5.2 Program for Maintaining Personnel Radiation Doses ALARA

5.2.1 A formal management policy and commitment to ALARA shall be established.

5.2.2 Responsibility and authority for the programs shall be clearly delegated by the Director.

5.2.3 A training program in the fundamentals of radiation protection and ALARA procedures shall be established. (Shieldalloy has established an effective program which addresses these topics. The program is described in ENV-R-002.)

5.3 Designing Facilities and Selecting Equipment Using ALARA Concepts

5.3.1 Whenever applicable, the design of facilities and selection of equipment shall be based on ALARA concepts.

5.3.2 These reviews shall be conducted by the RSC.

5.3.3 Reviews shall be based upon the work using the guidance of Regulatory Guide 8.8, Section 2.

5.4 Establishing Radiation Controls

5.4.1 Radiation controls shall be established for work operations to ensure radiation exposures are ALARA, and should be included in:

5.4.1.1 Work planning and preparation,

5.4.1.2 Actual work operations, and

5.4.1.3 Post operation reviews.

5.4.2 The specific requirements for implementing radiation controls shall be described in job-specific procedures and/or work plans.

5.5 Supporting Equipment, Instrumentation, and Facilities

5.5.1 Appropriate support equipment, instrumentation, and facilities shall be provided for all Shieldalloy work involving ionizing radiation.

5.5.2 Support may include:

A. A radiation counting area

B. Radiation survey instrumentation (portable and nonportable)

C. Personnel monitoring devices

D. Protective clothing

E. Respiratory protection

F. Decontamination areas for personnel and equipment

G. Change rooms

H. Communication equipment

I. Office space and equipment

5.6 ALARA Goals

5.6.1 The RSC shall establish radiological goals to direct all levels of management and workers at Shieldalloy toward improvement in radiological performance.

5.6.2 ALARA goals shall be established, reviewed, and documented at a frequency of no greater than once per calendar year.

5.6.3 Typical quantitative goals may include, as applicable:

5.6.3.1 Maximum individual dose to an on-site and off-site individual.

5.6.3.2 Number of individuals with confirmed intakes of radioactive material.

5.6.3.3 Number of individuals that become externally contaminated.

5.6.3.4 Number of contamination incidents.

5.6.3.5 Square footage of contaminated areas.

5.6.3.6 Number of radiological incident reports.

5.6.4 The following steps for establishing an ALARA goal shall be included in the goal-setting process:

5.6.4.1 The RSC, with input from the RSO, shall determine which areas need improvement.

5.6.4.2 The RSC shall evaluate the existing condition(s), root cause(s), and corrective action(s).

5.6.4.3 The RSC shall determine the improvement needed and propose the goal.

5.6.4.4 The RSC shall present the goal to the Director for approval and shall assign and implement actions plans.

5.6.4.5 The RSC shall periodically review performance in achieving the goal and modify the action plan, if necessary.

5.6.4.6 The RSO shall document radiological goals, their status, and performance, and shall present them to the RSC at planned and periodic meetings.

6 DOCUMENTATION

6.1 All records pertinent to this procedure shall be maintained pursuant to ENV-R-011.

6.2 The minutes of the RSC meetings shall reflect RSC action in establishing and monitoring ALARA goals.

7 ATTACHMENTS

7.1 Attachment 1: Individual Worker's Responsibilities for ALARA

ATTACHMENT 1

INDIVIDUAL WORKER'S RESPONSIBILITIES FOR ALARA

1. Obey promptly "stop work" and "evacuate" instructions of RSO.
2. Follow all procedures and instructions.
3. Wear TLDs and pocket ionization chambers (PICs) as required by procedures and instructions, signs, or the RSO.
4. Keep track of your own radiation dose status and avoid exceeding dose control levels and limits.
5. Remain in as low a radiation area as practical to accomplish work.
6. Leave radiation areas or airborne radioactivity areas when not working, and use "wait areas" when designated.
7. **DO NOT** smoke, eat, drink, or chew in radiologically controlled areas, or bring smoking, eating, drinking, or chewing materials into such areas.
8. Wear protective clothing and respirators properly and whenever required by signs, RWPs, the RSO, procedures and instructions.
9. Remove protective clothing and respirators properly to minimize spread of contamination.
10. Frisk yourself or be frisked for contamination as directed when leaving contamination zones and radiologically controlled areas.
11. Minimize the spread of a known or possible radioactive spill and notify radiation protection personnel promptly.
12. Avoid unnecessary contact with contaminated surfaces, including your clothing, tools and other equipment.

13. Place contaminated tools, equipment, and solid waste on disposable surfaces (e.g., sheet plastic) when not in use, and inside plastic bags when work is finished.

14. Control the amount of materials brought into radiologically controlled areas.

15. Limit the amount of waste that has to be decontaminated or disposed of as radioactive waste.

16. Report the presence of treated or open wounds to the RSO before work in areas where radioactive contamination exists; and exit promptly if a wound occurs while in such an area.

17. Report promptly unsafe or noncompliance situations to the RSO or Authorized User.

18. Report prior or concurrent occupational radiation exposure to the RSO.

19. Report pregnancy in accordance with Shieldalloy procedures and instructions.

	CONTROL OF RADIOLOGICAL WORK	Procedure: ENV-R-005
		Page: 1 of 8
		Revision No. 000
		Date: 03/11/94
		Approved by (Director):
		Approved by (RSO):
		Approved by (QAO):
		Approved by (RSC Chair):

TABLE OF CONTENTS

CONTROLLED COPY NO. : _____

1 PURPOSE

1.1 This procedure establishes the method to be followed in obtaining a Radiation Work Permit (RWP).

1.2 Responsibilities:

1.2.1 The Radiation Safety Officer (RSO) shall:

1.2.1.1 Maintain a supply of Radiation Work Permit (RWP) Forms (Attachment 1)

1.2.1.2 Insure that all work performed inside a Shieldalloy restricted area is covered by a current RWP.

1.2.1.3 Provide RWPs to Authorized Users upon request.

1.2.1.4 Review the RWP submittal from the Job Supervisor and complete and issue the RWP

1.2.1.5 Perform periodic surveillance to determine compliance with this procedure.

1.2.1.6 Maintain copies of completed RWP's as part of the Radiation Protection Program records.

1.2.2 Authorized Users shall:

1.2.2.1 Initiate RWP's for <u>all</u> work in a restricted area or when directed by the RSO by completing Part A of the RWP form.

1.2.2.2 Obtain RSO review and approval of the RWP.

1.2.2.3 Post completed RWP's at the work location or maintain at the work site.

1.2.2.4 Ensure that RWP requirements are followed by all personnel that enter the area.

1.2.3 Shieldalloy Radiation Protection Personnel shall:

1.2.3.1 Review completed RWP's with an Authorized User or the RSO, who will provide additional instructions if required.

1.2.3.2 Read the RWP and sign the RWP to indicate knowledge of requirements.

1.2.3.3 Perform the work in accordance with the requirements specified in the RWP.

2 SCOPE

2.1 This procedure applies to all work within a restricted area at Shieldalloy that is not covered by Standard Operating Procedures, or for work in unrestricted areas for which a RWP is deemed necessary by the RSO.

3 REFERENCES

3.1 Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation"

3.2 U. S. Nuclear Regulatory Commission License No. SMB-743.

3.3 Shieldalloy Metallurgical Corporation Radiation Protection Procedure No. ENV-R-001, "Radiation Protection Program Plan".

3.4 Shieldalloy Metallurgical Corporation Radiation Protection Procedure No. ENV-R-011, "Radiation Protection Records".

3.5 Shieldalloy Metallurgical Corporation Radiation Protection Procedure No. ENV-R-020, "Internal Radiation Exposure Control".

4 DEFINITIONS

4.1 Approval - An act of endorsing or adding positive authorization or both.

4.2 ALARA - Acronym for "As Low As Reasonably Achievable", a basic concept of radiation protection that specifies that radiation exposures should be maintained as low as is reasonably achievable taking into account technological, economical, and societal considerations.

4.3 Authorized User - Employees who supervise the use of source material and who supervise individuals who work with source material. Authorized users are qualified, by training and experience, to assure source material is used for its intended purpose in a manner that protects health and minimizes danger to life or property.

4.4 Controlled Area - Any area to which access is controlled in order to protect individuals from exposure to radiation and radioactive materials. (The controlled area at Shieldalloy consists of the entire area within the fence line.)

4.5 May - The word *may* is used to denote permission.

4.6 Radiation Safety Officer (RSO) - Personnel who perform radiation protection functions such as release surveys, personnel dosimeter distribution, radiation protection records maintenance, and quality assurance activities as they pertain to radiation protection. The term radiation protection personnel includes the RSO and the ARSO or qualified contractor. Training and qualifications of radiation protection personnel is contained in ENV-R-017, "Training and Qualifications of Radiation Protection Personnel".

4.7 Radiation Work Permit (RWP) - An authorizing document that establishes the radiological requirements for working with known or potential radiological hazards. Its purpose is to instruct personnel how to work safely around radioactive materials and to define controls to prevent the spread of contamination.

4.8 Release Limits - A limit on the amount of radioactive contamination that may be present on people or equipment leaving a controlled or restricted area.

4.9 Restricted Area - An area within the controlled area to which access is limited for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials. Restricted areas at Shieldalloy include D.203(A), D.102, D.111, and other areas so designated by the RSO.

4.10 Shall - The word *shall* is to be understood as a requirement.

4.11 Should - The word *should* is to be understood as a recommendation.

4.12 Thermoluminescent Dosimeters (TLD) - The thermoluminescence phosphor(s) used for determining external radiation exposure to beta, gamma, x-rays, and neutrons. The words TLD and dosimeter are used interchangeably throughout this procedure.

4.13 Unrestricted Area - Areas that include but are not limited to, laboratory floors, benches, equipment, and materials released from potentially contaminated areas for unrestricted use.

5 *PROCEDURE*

5.1 Equipment and Materials

5.1.1 Portable radiation survey meter, capable of detecting the radiation likely to be emitted from the samples being analyzed.

5.1.2 Container suitable for collecting contaminated waste and trash.

5.1.3 Warning signs and banners capable of restricting the radiation control zone.

5.2 Initiating the RWP

5.2.1 Upon determination that construction, demolition or maintenance work activities are scheduled within a restricted area, the Authorized User shall notify the RSO and shall initiate the RWP process.

5.2.2 The Authorized User shall enter the following information in Part A of the RWP form:

5.2.2.1 Location of the proposed work, including the department and the work area.

5.2.2.2 The start and finish dates anticipated for the proposed work.

5.2.2.3 The names of all individuals who are expected to enter the restricted area. If contractors are involved, the name of the company should be provided.

5.2.2.4 A brief description of the proposed work including the type of tools and equipment that will be brought into the work area.

5.2.2.5 The name, title, and signature of the individual requesting authorization.

5.2.2.6 The date of the application.

5.3 Completing the RWP

5.3.1 Upon receipt of the RWP form, the RSO shall review it for completeness and establish the requirements for the RWP.

5.3.2 The RSO shall complete Part B of the RWP form and establish the following provisions:

5.3.2.1 RWP number. This number shall be the month and year that the RWP is issued, plus a sequential number at the end (ex., 0394-01). This information shall be entered into a log maintained by the RSO.

5.3.2.2 Protective requirements specified on the RWP form.

5.3.2.3 Special instructions specified on the RWP form.

5.3.2.4 Approval signature.

5.4 General Requirements

5.4.1 The RWP shall be posted at the boundary of the restricted area, near the entrance if practical.

5.4.1.1 All employees performing the job shall sign the RWP.

5.4.1.2 This signature shall demonstrate the employee's understanding of all requirements.

5.4.2 If job requirements on a RWP change or any unusual/unexpected events occur:

5.4.2.1 The RSO shall be notified as soon as possible

5.4.2.2 A new RWP shall be issued or changes shall be made to the existing RWP.

5.4.3 The RSO shall investigate any suspected personnel contamination incidents pursuant to ENV-R-010, "Emergency Response and Notification".

5.5 Personnel Requirements

5.5.1 Personnel working inside the restricted area without an escort shall:

5.5.1.1 Complete the radiation safety training courses required by ENV-R-002;

5.5.1.2 Wear a TLD; and

5.5.1.3 Participate in the routine bioassay program, as required in ENV-R-020.

5.5.2 Personnel who have not completed the requirements specified above, may enter the restricted area zone if approved by the RSO, and shall be escorted by a person designated by the RSO.

5.5.2.1 The visitors shall comply with all elements of the RWP.

5.5.2.2 The escort shall confirm that all visitors have properly surveyed their personal clothing before leaving the zone.

5.5.2.3 The visitor shall NOT handle or in any way, work directly with radioactive material.

5.5.3 Persons exiting the restricted area shall frisk their clothing and shoes before leaving as required in ENV-R-013, "Contamination Control".

5.6 Terminating the RWP

5.6.1 A RWP shall be valid for seven (7) consecutive days, unless otherwise noted.

5.6.2 If an activity covered by a RWP exceeds seven (7) days, an extension may be granted by the RSO.

5.6.3 The Authorized User shall notify the RSO when the work with the radioactive material is completed.

5.6.4 The RSO shall:

5.6.4.1 Confirm that all materials requiring a RWP have been removed from the area or transferred to a different controlled zone.

5.6.4.2 Confirm that all waste and contaminated trash has been removed from the area and is properly stored.

5.6.4.3 Perform a direct survey of the floors and surfaces likely to come in contact with the radioactive material.

5.6.4.4 Perform a wipe test survey of the floors and surfaces likely to come in contact with the radioactive material.

5.6.5 The RSO shall remove the RWP and other restrictions from the area after the results of the surveys are complete.

6 DOCUMENTATION

6.1 All Records pertinent to this procedure shall be maintained pursuant to ENV-R-011.

6.2 RWPs shall be maintained by the RSO as quality assurance records.

7 ATTACHMENTS

7.1 Attachment 1: "Radiation Work Permit"

ATTACHMENT 1

RADIATION WORK PERMIT

	QUALITY ASSURANCE IN RADIOLOGICAL PROTECTION	Procedure: ENV-R-006
		Page: 1 of 11
		Revision No. 000
		Date: 03/11/94
		Approved by (Director):
		Approved by (RSO):
		Approved by (QAO):
		Approved by (RSC Chair):

TABLE OF CONTENTS

CONTROLLED COPY NO. : _____

1 PURPOSE

1.1 This procedure provides instructions for reporting conditions adverse to quality and items, services, or activities that do not meet Shieldalloy requirements. It also provides requirements for the selection and completion of corrective actions.

1.2 Responsibilities:

1.2.1 The Director shall:

1.2.1.1 Assure that all Shieldalloy personnel and contractors follow this procedure in reporting conditions adverse to quality, selecting proper corrective actions, and completing those actions in a timely manner.

1.2.1.2 Review the proposed corrective actions, the start and completion dates, and the responsible personnel prior to initiating the corrective actions.

1.2.1.3 Supply adequate resources to ensure compliance with this procedure.

1.2.2 The Radiation Safety Officer (RSO) shall:

1.2.2.1 Complete Conditions Adverse to Quality Report (CAQR) and Nonconformance Report (NCR) as necessary.

1.2.2.2 Determine corrective actions for all CAQRs and NCRs.

1.2.3 The Quality Assurance Officer (QAO) shall:

1.2.3.1 Review all CAQRs.

1.2.3.2 Determine and report conditions that are nonconformances.

1.2.3.3 Track all conditions adverse to quality to assure the appropriate corrective actions are taken.

1.2.3.4 Assure that all documentation required in this procedure is completed.

1.2.3.5 Maintain all forms/logs generated by this procedure in the QA files.

1.2.3.6 Verify compliance with this procedure during planned and periodic audits of the Radiation Protection Program.

1.2.4 Shieldalloy personnel shall:

1.2.4.1 Follow the requirements of this procedure for reporting conditions adverse to quality.

1.2.4.2 Perform corrective actions within the time allotted, as applicable.

2 SCOPE

2.1 This procedure applies to all Shieldalloy radiation protection activities performed by Shieldalloy employees, visitors or contractors.

3 REFERENCES

3.1 Shieldalloy Metallurgical Corporation, Standard Operating Procedure for Radiation Safety for Radiation Safety No. ENV-R-011, "Radiation Protection Records"

4 DEFINITIONS

4.1 Acceptance Criteria - Specified limits placed on characteristics of an item, process, or service defined in codes, standards, or other required documents.

4.2 Approval - An act of endorsing or adding positive authorization or both.

4.3 Condition Adverse to Quality (CAQ) - An all-inclusive term used in reference to any of the following: failures, malfunctions, deficiencies, defective items, and nonconformances. A significant condition adverse to quality is one which, if uncorrected, could have a serious effect on safety or operability.

4.4 Corrective Action - Measures taken to rectify conditions adverse to quality and, where necessary, to preclude repetition.

4.5 Director - Designated senior manager of Shieldalloy Metallurgical Corporation with the authority to commit Shieldalloy resources for radiation protection purposes.

4.6 May - The word *may* is used to denote permission.

4.7 Nonconformance - A deficiency in characteristic, documentation, or procedure that renders the quality of an item or activity unacceptable or indeterminate.

4.8 Radiation Safety Officer (RSO) - An individual who, by virtue of qualifications and experience, has been given the authority to implement the Shieldalloy Radiation Protection Program Plan. The RSO is qualified to use source material for its intended purpose in a manner that protects health and

minimizes danger to life or property. The RSO is responsible for recognizing potential radiological hazards, developing a radiation safety program to protect against these hazards, training workers in safe work practices, and supervising day-to-day radiation safety operations.

4.9 Quality Assurance Officer (QAO) - An individual who, by virtue of qualifications and experience, has been given the authority to manage the quality of items and/or activities affecting quality.

4.10 Shall - The word *shall* is to be understood as a requirement.

4.11 Should - The word *should* is to be understood as a recommendation.

5 PROCEDURE

5.1 General Requirements

5.1.1 All activities conducted as part of the Shieldalloy radiation protection program shall be subject to quality assurance requirements.

5.1.2 The quality assurance provisions for radiation protection shall ensure consistency/accuracy of results and documentation/verification of the effectiveness of the radiation protection program. These provisions shall include the following:

5.1.2.1 Compliance with Standard Operating Procedures for Radiation Safety (SOPRS) developed to implement the Shieldalloy Radiation Protection Program Plan. Audits/assessments shall be conducted to determine compliance to these procedures.

5.1.2.2 Periodically, analytical and survey measurements shall be verified through processes such as split sample measurements, duplicate or replicate measurements, and inter-facility intercomparisons.

5.1.3 Suspected or known violations of these provisions shall require further documentation.

5.2 Reporting Conditions Adverse to Quality and Nonconformances

5.2.1 Any individual who identifies or creates any condition adverse to quality (CAQ) shall notify the RSO.

5.2.2 The RSO shall complete a CAQR (Attachment 1).

5.2.3 The QAO shall evaluate the information and determine if a nonconformance has occurred. This determination shall be made by comparing the known characteristics or written

documentation of the items, services, and activities to written acceptance criteria. A nonconformance shall be declared when acceptance criteria have not been met.

5.2.4 When a nonconformance is determined, the QAO shall initiate a Nonconformance Report (NCR) (Attachment 2) and obtain the RSO's signature to verify that the transcribed details are correct.

5.2.5 After assigning appropriate tracking numbers as described in this procedure, the QAO shall provide a copy of each report to the person who identified the CAQ, the RSO and the Director, and maintain the original in the QA files.

5.3 Corrective Actions

5.3.1 The RSO shall review each CAQR and decide if rework is necessary and what corrective actions should be taken to avoid recurrence of the problem. The RSO shall complete Section 2 of each form defining the actions to be taken, providing dates for the initiation and completion of those actions and the name of the person(s) who will perform the activities.

5.3.2 The RSO shall then submit the CAQR to the Director for approval of the proposed corrective actions, the start and completion dates, and the responsible personnel.

5.3.3 The Director shall review the report, sign Section 3 when details of the correction plans are acceptable, and forward the report to the QAO.

5.3.4 The QAO shall review the proposed corrective actions and dates and sign Section 3 of the CAQR if they are deemed acceptable. If they are found unacceptable, the QAO shall return the report to the RSO for revision of the actions or dates.

5.3.5 The previous steps in this subsection shall be repeated until the QAO concurs with the corrective actions and associated dates.

5.3.6 Upon completion of corrective actions, the personnel assigned to perform the tasks shall notify the RSO who shall notify the QAO of the completed tasks.

5.3.7 If a completion date for a corrective action cannot be met, the RSO shall notify the QAO on or before such date and provide a revised date. Revised dates shall be approved by the QAO. Dates may not be revised more than once without written approval from the Director.

5.3.8 The QAO shall verify the satisfactory completion of each corrective action prior to closing out a report.

5.4 Tracking

5.4.1 The QAO shall establish a CAQ Log (Attachment 3) and numbering system that shall include the last two digits of the current year, the code "CAQ" and a sequential number that begins at "01" at the beginning of each calendar year.

EXAMPLE: 93CAQ01

5.4.2 The QAO, using this system, shall assign a number to each CAQR as it is received and shall record the receipt of the report in the CAQ Log.

5.4.3 The QAO shall establish an NCR Log (Attachment 4) and numbering system similar to the CAQ system but replacing the letter code with "NCR" to clearly distinguish NCRs from CAQs.

EXAMPLE: 93NCR01

5.4.4 If the CAQ is determined to be a nonconformance, the QAO shall indicate such on the original report, assign an NCR number, and cross reference the numbers on both report forms.

5.4.5 The QAO shall record the NCR on the associated log at the time the number is assigned.

5.4.6 The QAO shall track each corrective action by assigning the associated report number followed by a dash and a sequential letter for each corrective action required by the report.

EXAMPLE: 93CAQ01-a
93CAQ01-b

6 DOCUMENTATION

6.1 The following records shall be maintained by the QAO:

6.1.1 CAQR

6.1.2 NCR

6.1.3 CAQ Log

6.1.4 NCR Log

6.2 All other records generated as part of this procedure shall be maintained as described in Radiation Protection Records.

7 ATTACHMENTS

7.1 Attachment 1: Condition Adverse to Quality Report

7.2 Attachment 2: Nonconformance Report

7.3 Attachment 3: CAQ Log

7.4 Attachment 4: NCR Log

ATTACHMENT 1

CONDITION ADVERSE TO QUALITY REPORT

CAQR NO. _____

Job Location: _____ Page ____ of ____

Job Description: _____ Date: _____

1. Description of Condition Adverse to Quality

   Identified By: _____ Date: _____

2. (To be completed by QAO)

   Is this CAQ a nonconformance to requirements? If so, provide NCR No. _____

3. Proposed Corrective Action (including initiation and completion dates)

   To Be Performed By: _____

4. Approval for Proposed Corrective Action

   Director _____ Date: _____

   Quality Assurance Officer _____ Date: _____

5. Corrective Action Complete

   Performed By: _____ Date: _____

   Verified By: _____ Date: _____

cc: Person that identified the CAQ
Radiation Safety Officer
Quality Assurance Officer
Director
Other _____

ATTACHMENT 2

NONCONFORMANCE REPORT

NCR No._____

Job Location: _____ Page ____ of _____

Job Description: _____ Date: _____

1. Nonconformance Description

   Identified By: _____ Date: _____

2. Proposed Corrective Action, Including Initiation and Completion Dates

   To Be Performed By: _____

3. Approval for Proposed Corrective Action

   Director: _____ Date: _____

   Quality Assurance Officer: _____ Date: _____

4. Corrective Action Taken (if different from that proposed)

5. Corrective Action Complete

   Performed By: _____ Date: _____

   Verified By: _____ Date: _____

cc: Person that identified the CAQ
Radiation Safety Officer
Quality Assurance Officer
Director
Other _____

ATTACHMENT 3

CONDITION ADVERSE TO QUALITY LOG

CAQR Number	Job Location	Job Description	Date Issued	Corrective Action Target Date	Verified Date/Initials

ATTACHMENT 4

NONCONFORMANCE REPORT LOG

NCR Number	Job Location	Job Description	Date Issued	Corrective Action Target Date	Verified Date/Initials

	CONTROL OF STANDARD OPERATING PROCEDURES FOR RADIATION SAFETY	Procedure: ENV-R-007
		Page: 1 of 12
		Revision No. 000
		Date: 03/10/94
		Approved by (Director):
		Approved by (RSO):
		Approved by (QAO):
		Approved by (RSC Chair):

TABLE OF CONTENTS

CONTROLLED COPY NO. : _____

1 PURPOSE

1.1 This procedure provides instructions for the issuance and revision of Standard Operating Procedures for Radiation Safety (SOPRSs) in a manner designed to assure that persons performing radiological activities are provided the most current approved procedures, and to assure that all provision of Shieldalloy's USNRC license are met.

1.2 Responsibilities:

1.2.1 The Director shall:

1.2.1.1 Review and approve all SOPRSs.

1.2.1.2 Assure that the instructions contained in SOPRSs are followed.

1.2.1.3 Assure that the SOPRSs are adequate for their intended use.

1.2.1.4 Assure that the SOPRSs are consistent with USNRC regulations and license requirements.

1.2.2 The Radiation Safety Officer (RSO) shall:

1.2.2.1 Develop and administer SOPRSs.

1.2.2.2 Review and approve SOPRSs to assure compliance with USNRC regulations and license requirements.

1.2.2.3 Train personnel on SOPRSs requirements.

1.2.3 The Radiation Safety Committee (RSC) shall review and approve all SOPRSs to ensure compliance with corporate safety and operational requirements as well as with the Shieldalloy Radiation Protection Program Plan.

1.2.4 The Quality Assurance Officer (QAO) shall:

1.2.4.1 Maintain historical procedure files for SOPRSs.

1.2.4.2 Review and approve SOPRSs for compliance with corporate and quality assurance requirements.

1.2.4.3 Approve minor changes to SOPRSs.

1.2.5 Shieldalloy personnel shall:

1.2.5.1 Comply with all applicable SOPRSs.

1.2.5.2 Notify appropriate management if a SOPRSs is found to be inaccurate or lacking sufficient detail for the activity.

2 SCOPE

2.1 This procedure applies to all Shieldalloy SOPRSs.

3 REFERENCES

3.1 Shieldalloy Metallurgical Corporation, Standard Operating Procedure No. QQQ-L-204, "Procedure Writing".

3.2 Title 10, Code of Federal Regulations, Part 50, "Domestic Licensing of Production and Utilization Facilities"

3.3 Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation"

3.4 U. S. Nuclear Regulatory Commission License No. SMB-743.

3.5 U. S. Nuclear Regulatory Commission Guide 4.15, "Quality Assurance for Radiological Monitoring Programs (Normal Operations) -- Effluent Streams and the Environment", 1979.

3.6 ANSI/ASME N45-2, "Quality Assurance Program Requirements for Nuclear Facilities", 1978.

3.7 ASME NQA-1-1989, "Quality Assurance Program Requirements for Nuclear Facilities", September, 1989.

4 DEFINITIONS

4.1 Approval - An act of endorsing or adding positive authorization or both.

4.2 Director - Designated senior manager of Shieldalloy Metallurgical Corporation with the authority to commit Shieldalloy resources for radiation protection purposes.

4.3 May - The word *may* is used to denote permission.

4.4 Procedure - A document that specifies or describes how an activity is to be performed. It may include methods to be employed, equipment or materials to be used and sequence of operations.

4.5 Procedure Change Notice (PCN) - A form used to make a change to a SOPRS prior to reissue of the revised document.

4.6 Radiation Safety Officers (RSO) - An individual who, by virtue of qualifications and experience, has been given the authority to implement the Shieldalloy Radiation Protection Program Plan. The RSO is qualified to use source material for its intended purpose in a manner that protects health and minimizes danger to life or property. The RSO is responsible for recognizing potential radiological hazards, developing a radiation safety program to protect against these hazards, training workers in safe work practices, and supervising day-to-day radiation safety operations.

4.7 Quality Assurance Record - A completed document that furnishes evidence of the quality of items and/or activities affecting quality.

4.8 Shall - The word *shall* is to be understood as a requirement.

4.9 Should - The word *should* is to be understood as a recommendation.

5 PROCEDURE

5.1 Procedure Format

5.1.1 Each page of each SOPRS shall utilize the header format as shown on this page.

5.1.1.1 This header shall specify the title of the procedure.

5.1.1.2 The procedure number and page designation shall be specified in the header.

5.1.1.3 The page designation shall specify both the specific page and the total number of pages of the SOPRSs.

5.1.2 The format for all SOPRSs shall include six major sections: Purpose; Scope; References; Definitions; Procedure; and Documentation.

5.1.2.1 The Purpose Section shall include two subsections:

5.1.2.1.1 The Purpose subsection shall specify the reason for the SOPRS and if appropriate, shall denote why the activity is to be performed.

5.1.2.1.2 The Responsibilities subsection shall identify those individuals who have responsibilities under the SOPRS. Responsibilities shall identify all groups and/or levels of individuals that are involved in any phase of any procedure. This includes execution of the SOPRS through management review of the completed task.

5.1.2.2 The Scope section shall specify the range of activities covered by the SOPRS and any limitations on the use of the SOPRS.

5.1.2.3 The References Section shall include Regulatory References and Technical References.

5.1.2.3.1 Regulatory References should include regulatory documents used during the preparation of the SOPRS.

5.1.2.3.2 Technical References should include all technical standards, related in-house procedures, and regulatory guides used in the preparation of the SOPRS or identified in the SOPRS.

5.1.2.4 The Definitions section shall include the definitions of terms that are used in the body of the document that may not be commonly understood.

5.1.2.5 The Procedures Section shall contain all of the information necessary for the successful execution of the task being described by the SOPRS.

5.1.2.5.1 Each statement describing an action to be performed should be direct and to the point.

5.1.2.5.2 All instructions should be written in a manner that is clear and avoids ambiguity.

5.1.2.6 The Documentation Section shall specify the records that will be maintained and the length of time records shall be retained.

5.2 Listing of SOPRSs to be Maintained

5.2.1 Radiation Protection Program Plan

5.2.2 Radiation Protection Organization and Administration

5.2.3 Stop Work Authority

5.2.4 Training in Radiation Protection

5.2.5 Training and Qualifications of Radiation Protection Personnel

5.2.6 Radiation Exposure Control

5.2.7 ALARA Program

5.2.8 Contamination Control

5.2.9 Instrumentation and Surveillance

5.2.10 Environmental Surveillance

5.2.11 Radiological Areas and Posting

5.2.12 Control of Radiological Work

5.2.13 Receipt, Handling, and Identification of Radioactive Materials

5.2.14 Packaging and Transportation of Radioactive Materials

5.2.15 Control of Radioactive Waste

5.2.16 Radiation Protection Records

5.2.17 Control of Standard Operating Procedures for Radiation Protection

5.2.18 Emergency Response and Notifications

5.2.19 Quality Assurance in Radiological Protection

5.3 Review of Procedures

5.3.1 Prior to submittal for approval, each SOPRS shall receive editorial and technical reviews.

5.3.2 An editorial review shall be performed by someone other than the author of the and should address clarity, grammar, punctuation, spelling, and consistency in abbreviations.

5.3.3 SOPRSs shall be reviewed for technical adequacy by a technically competent individual who is not directly responsible for the generation of the SOPRS.

5.4 Approval of Procedures

5.4.1 All SOPRSs shall be approved by the RSO, the QAO, the RSC, and the Director.

5.4.2 Approval signatures shall signify that the SOPRS is adequate for its intended use, that it meets the requirements of the Shieldalloy Radiation Protection Program Plan, and that all provisions of Shieldalloy's USNRC license are met.

5.5 Revision of Procedures

5.5.1 SOPRSs shall be revised by making needed changes and resubmitting the revised SOPRS for the same review and approval as the original SOPRS.

5.5.2 Signed approvals for the revised SOPRS shall be obtained prior to implementing any changes.

5.5.3 The following SOPRSs shall not be revised without amendment of USNRC License No. SMB-743:

5.5.3.1 Radiation Protection Program Plan

5.5.3.2 Control of Standard Operating Procedures for Radiation Protection.

5.6 Procedure Change Notices

5.6.1 When the need for a procedural change is identified and it is of such nature that an immediate change is required, a Procedure Change Notice (PCN) may be used to implement the change until the standard SOPRS can be revised and reissued.

5.6.2 The originator of the PCN shall perform the following:

5.6.2.1 Enter onto the standard PCN form (see Attachment 1) the needed changes, referencing by number the paragraph to be changed. Entries may be hand written or typed.

5.6.2.2 Submit the PCN to the appropriate individuals for review and approval.

5.6.2.3 Submit the signed form to the RSO for reproduction and distribution of SOPRSs.

5.6.3 The RSO shall assign a number to each PCN for a given SOPRS number sequentially as each is submitted for production and distribution.

5.6.4 Copies of PCNs shall be distributed to all holders of controlled copies within one week of approval.

5.6.5 Temporary SOPRS changes shall be noted as such on the PCN, along with effective dates.

5.6.6 Revised SOPRSs with permanent changes shall be issued within six months of the procedure change approval.

5.7 Minor Changes

5.7.1 Minor changes in SOPRSs that do not substantively effect required actions may be made by the RSO.

5.7.2 Minor changes shall be written by hand on the affected page.

5.7.3 The Minor Change Number, date, and originator shall be noted at the top of the affected page.

5.7.4 Copies of the affected page shall be distributed to all holders of controlled copies within one week of approval by the RSO.

5.8 Procedure Manual Issuance and Control

5.8.1 All SOPRSs shall be maintained under a controlled distribution system.

5.8.2 All SOPRSs shall be maintained in a standardized procedure manual.

5.8.3 The VP shall determine who is to be issued manuals to assure that all individuals needing the SOPRSs will have access to them in the area in which the work is to be performed. This information should be submitted to the QAO or designated distribution system coordinator.

5.8.4 Each procedure manual issued shall have a unique number assigned, and each SOPRS within the manual shall carry that assigned number (e.g., copy number).

5.8.5 A master list of procedure manuals issued shall be maintained by the RSO, including:

5.8.5.1 The name of the individual to which the manual is assigned.

5.8.5.2 The manual control number.

5.8.5.3 The dates each manual is issued and recalled.

5.8.6 Standard transmittal forms for controlled distribution documents shall be distributed with each manual issued and each additional or revised SOPRS (see Attachments 2 and 3). These forms shall serve as a record that each manual holder has received all documents.

5.9 Procedure Cancellation

5.9.1 If it becomes necessary to cancel a SOPRS, a revision shall be issued consisting of only a PCN that states that the revision cancels the SOPRS.

5.9.2 The following SOPRSs shall not be canceled without amendment of USNRC License No. SMB-743:

5.9.2.1 Radiation Protection Program Plan

5.9.2.2 Control of Standard Operating Procedures for Radiation Protection.

6 DOCUMENTATION

6.1 A historical procedure file shall be maintained for each SOPRS.

6.2 The historical file shall consist of the following:

6.2.1 The signed original of the SOPRS and each revision.

6.2.2 A copy of all Procedure Change Notices associated with the SOPRS.

6.2.3 The signed original of each Minor Change.

7 ATTACHMENTS

7.1 Attachment 1: "Procedure Change Notice"

7.2 Attachment 2: "Procedure Manual Transmittal Form"

7.3 Attachment 3: "Procedure Transmittal Form"

ATTACHMENT 1: PROCEDURE CHANGE NOTICE

Procedure Change Notice Number: _____

Modification to existing procedure ( ) or Supplement to exiting procedure ( )

Procedure Number: _____

Procedure Title: _____

Time Period from _____ to _____

Specific Activities affected: _____

Description of changes including pages and paragraphs affected (attach additional sheets as needed):

_____

_____

_____

_____

_____

_____

Justification for changes:

_____

_____

Approved by: _____
Radiation Safety Officer

Approved by: _____
Quality Assurance Officer

Approved by: _____
Director

Approved by: _____
Chairman, Radiation Safety Committee

ATTACHMENT 2: PROCEDURE MANUAL TRANSMITTAL FORM

To: Date:

From:

Subject: Standard Operating Procedure for Radiation Safety Manual Issuance

Enclosed for your use is Controlled Copy No. _____ of the Standard Operating Procedure Manual for Radiation Safety. Please note that as a controlled-copy holder, you will be issued all revisions to the enclosed procedures. If you feel you do not need this manual, now or in the future, or if you leave the employment of Shieldalloy, please return this manual to the Radiation Safety Officer (RSO).

Upon receipt of this document, please sign and date this form and return it to the RSO within five working days.

I verify by my signature that I have received the controlled manual numbered as indicated above.

_____ / _____

Name/Date

ATTACHMENT 3: PROCEDURE TRANSMITTAL FORM

To: Date:

From:

Subject: Standard Operating Procedure for Radiation Safety Transmittal

Attached is a new or revised copy of the procedure(s) listed below for incorporation into your Standard Operating Procedure for Radiation Safety Manual. Within ten working days, please place the attached document(s) into your manual and remove and discard all superseded documents. Procedure Change Notices should be placed at the front of the existing procedure and all pages retained. When you have updated your manual, please sign and date this form and return it to the Radiation Safety Officer (RSO).

Revision Number	Date	Pages Affected	Description of Change

I verify by my signature that the above item(s) have been placed in my controlled manual and superseded procedures/PCNs removed and discarded.

_____/_____

Name/Date

	RECEIPT, HANDLING AND IDENTIFICATION OF RADIOACTIVE MATERIALS	Procedure: ENV-R-008
		Page: 1 of 9
		Revision No. 000
		Date: 03/10/94
		Approved by (Director):
		Approved by (RSO):
		Approved by (QAO):
		Approved by (RSC Chair):

TABLE OF CONTENTS

CONTROLLED COPY NO. : _____

1 PURPOSE

1.1 This procedure provides the guidance for receiving, handling, and identifying incoming shipments that are known or suspected to be radioactive or containing radioactivity.

1.2 Responsibilities:

1.2.1 The Director shall:

1.2.1.1 Review and approve the requirements of this procedure.

1.2.1.2 Supply adequate resources to ensure compliance with this procedure.

1.2.2 The Radiation Safety Officer (RSO) shall:

1.2.2.1 Verify that only radiation protection personnel conduct receiving surveys.

1.2.2.2 Verify that radiation surveys are completed on incoming shipments known or suspected to be radioactive.

1.2.2.3 Perform the initial radiation survey upon receipt of radioactive material that meets the 10 CFR 40 definition of source material.

1.2.2.4 Evaluate radiation survey results from incoming shipments.

1.2.2.5 Assure that all radiation protection personnel are properly trained in the provisions of this procedure.

1.2.2.6 Provide direction in any remediation of receiving incidents involving radioactive materials.

1.2.2.7 Assure that the requirements of this procedure are met.

1.2.2.8 The Radiation Safety Committee (RSC) shall approve the procurement of all licensable radioactive materials and radiation - producing machines.

1.2.3 The Quality Assurance Officer (QAO) shall:

1.2.3.1 Review and approve this procedure.

1.2.3.2 Verify compliance with this procedure during planned and periodic audits of the Radiation Protection Program.

1.2.4 Shieldalloy personnel shall:

1.2.4.1 Comply with all applicable requirements of this procedure.

1.2.4.2 Periodically review the contents of this procedure, as required.

2 SCOPE

2.1 This procedure applies to all functions carried out by Shieldalloy and contract personnel pertaining to receipt, handling, and identification of incoming shipments known or suspected to be radioactive.

3 REFERENCES

3.1 Nuclear Regulatory Commission, Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation".

3.2 Nuclear Regulatory Commission, Title 10, Code of Federal Regulations, Part 40, "Domestic Licensing of Source Material".

3.3 Shieldalloy Metallurgical Corporation, Standard Operating Procedure for Radiation Safety No. ENV-R-013, "Contamination Control".

3.4 Shieldalloy Metallurgical Corporation, Standard Operating Procedure for Radiation Safety No. ENV-R-012, "Instrumentation and Surveillance".

3.5 Shieldalloy Metallurgical Corporation, Standard Operating Procedure for Radiation Safety No. ENV-R-011, "Radiation Protection Records".

4 DEFINITIONS

4.1 Approval - An act of endorsing or adding positive authorization or both.

4.2 Background Radiation - The ambient radiation field to which we are exposed daily, originating from cosmic rays, naturally-occurring radionuclides (^{40}K, etc.) and human endeavors (fallout, fuel cycle, etc.). This radiation field is variable, and causes a survey meter to respond in the absence of radioactive materials.

4.3 Contamination Area - Any area accessible to personnel where there exists fixed and/or removable source material contamination in excess of the limits established for unrestricted access.

4.4 Director - Designated senior manager of Shieldalloy Metallurgical Corporation with the authority to commit Shieldalloy resources for radiation protection purposes.

4.5 Millirad per hour (mR/hr) - A unit of gamma exposure rate. One mR/hr shall be equivalent to 1000 μR/hr.

4.6 May - The word *may* is used to denote permission.

4.7 Radiation Protection Personnel - Personnel who perform radiation protection functions such as release surveys, personnel dosimeter distribution, radiation protection records maintenance, and quality assurance activities as they pertain to radiation protection. The term radiation protection personnel includes the RSO and the ARSO or qualified contractor. Training and qualifications of radiation protection personnel is contained in ENV-R-017, "Training and Qualifications of Radiation Protection Personnel".

4.8 Radiation Safety Officer (RSO) - An individual who, by virtue of qualifications and experience, has been given the authority to implement the Shieldalloy Radiation Protection Program Plan. The RSO is qualified to use source material for its intended purpose in a manner that protects health and minimizes danger to life or property. The RSO is responsible for recognizing potential radiological hazards, developing a radiation safety program to protect against these hazards, training workers in safe work practices, and supervising day-to-day radiation safety operations.

4.9 Radioactive Shipping Labels - A label applied to two sides of a shipping package bearing the radiation symbol and the isotope and quantity contained in the package. The label shall be indicative of the external radiation levels measured on the surface of the package. Specifically:

4.9.1 White Bar I - gamma radiation levels on the surface of the package are less than 0.5 mR/hr.

4.9.2 Yellow Bar II - gamma radiation levels on the surface of the package are less than 50 mR/hr.

4.9.3 Yellow Barr III - gamma radiation levels on the surface of the package are less than 200 mR/hr.

4.10 Radiation Survey Instrument - A hand-held radiation survey instrument capable of detecting ionizing radiation.

4.11 Shall - The word *shall* is to be understood as a requirement.

4.12 Should - The word *should* is to be understood as a recommendation.

4.13 Source Material (as defined by 10 CFR 40) - (1) Uranium or thorium, or any combination thereof, in any physical or chemical form or (2) ores which contain by weight one-twentieth of one percent (0.05%) or more of: (i) Uranium, (ii) thorium or (iii) any combination thereof. Source material does not include special nuclear material.

5 PROCEDURE

5.1 General Information

5.1.1 Supersacks of ore shipped to Shieldalloy contain radioactivity and as a result, shall be surveyed before they are handled by Shieldalloy or contractor personnel.

5.1.2 Prior to handling radioactive material, all personnel shall be familiar with accompanying paperwork. This information can be critical to planning the safe handling of contaminated material.

5.1.3 While it is anticipated that all shipments will be clearly marked concerning the type and quantities of radioactive material, it is possible for packages containing radioactivity to arrive unmarked and unannounced.

5.1.4 This survey procedure is useful only for detecting ionizing radiation that can penetrate the ore sacks and other radioactive packages (i.e., gamma radiation) or radioactive contamination (i.e., alpha, beta, and/or gamma radiation) on the outside of the shipment.

5.1.5 All applicable safety and compliance guidelines set forth by Shieldalloy, and by federal, state, and local regulations shall be followed during performance of this procedure.

5.1.6 Work shall be stopped in the event of a known or potential compromise to the health or safety of any Shieldalloy or contractor personnel and shall be reported immediately to the RSO.

5.2 Purchase of Radioactive Materials

5.2.1 The individual requesting acquisition of radioactive material shall inform the RSO of the quantity and form needed, and the intended use for the material.

5.2.2 The RSO shall review and approve the planned acquisition based upon safety considerations and existing inventory.

5.2.3 Upon approval by the RSO, the requisition shall be submitted to the purchasing agent to complete the purchase order.

5.2.4 The RSO shall maintain a file of approved acquisitions pending their addition to the inventory.

5.2.5 When the inventory is updated following receipt of the materials, the approved forms shall be transferred to the inventory file.

5.2.6 When the materials are received, the materials shall be added to the inventory log.

5.3 Receiving Radioactive Materials

5.3.1 All papers, forms, radioactive shipping labels, etc., accompanying the shipment shall be inspected. These contain information which may help determine the level of protection and instrumentation required.

5.3.1.1 If the information on these forms is unclear or incomplete:

5.3.1.1.1 Work shall be stopped.

5.3.1.1.2 Clarification shall be obtained from the RSO.

5.3.1.1.3 The RSO shall be consulted before proceeding.

5.3.2 Special attention should be paid to preventing the spread of contamination by using protective clothing, such as gloves, lab coat, vinyl gloves, and safety glasses.

5.3.3 There shall be no eating, drinking, smoking, or chewing in any area where radioactive materials are handled.

5.3.4 Sacks of ore and other incoming packages shall be inspected for visible defects, and all package defects shall be noted on the Chain of Custody (COC) form or receiving papers.

5.3.5 Radiological survey instruments shall be selected and operationally checked in accordance with ENV-R-012, "Instrumentation and Surveillance" prior to use. If any of the following items fail the check, the instrument shall be removed from service and the RSO shall be notified.

5.3.5.1 Instruments shall have been calibrated within the last six months.

5.3.5.1.1 This shall be verified by reviewing the calibration sticker on the instrument.

5.3.5.1.2 The RSO shall be notified if an instrument is out of calibration.

5.3.5.2 The instrument shall be checked against a radiation source of known activity and an instrument check form completed on the day of use pursuant to ENV-R-012, "Instrumentation and Surveillance".

5.3.5.3 The batteries should be checked prior to use.

5.3.5.4 Instrument parts shall be inspected for damage or broken connections. Confirm that cables are not frayed or bent.

5.3.5.5 Background radiation levels shall be confirmed to be within the ranges specified in ENV-R-012, "Instrumentation and Surveillance".

5.4 Radiation surveys of items known or suspected to be radioactive that do not meet the 10 CFR 40 definition of source material

5.4.1 Exposure rate surveys shall be performed on contact and at a distance of approximately 1 meter from the outside of the shipment.

5.4.1.1 A gamma dose rate instrument shall be used to perform the surveys.

5.4.1.2 If readings exceed 1 mR/hr, a label shall be placed on the shipment indicating "INTERNAL CONTAMINATION".

5.4.1.3 The RSO shall be notified.

5.4.2 Fixed contamination surveys shall be performed at a distance of approximately one centimeter from the surface of the package.

5.4.2.1 The appropriate meter and probe shall be used.

5.4.2.2 The shipment shall be scanned slowly to find the location that exhibits the highest radiation level.

5.4.2.3 If a shipment exceeds Shieldalloy total contamination limits as specified in ENV-R-013, "Contamination Control", the RSO shall be notified.

5.4.2.4 Place a label indicating "RADIOACTIVE MATERIAL" on the material.

5.4.2.5 Under the supervision of the RSO, the material shall be transported to a designated Contamination Area. (Precautions should be taken not to spread contamination during transport.)

5.4.3 Removable contamination surveys shall be performed for the outside of the shipping package.

5.4.3.1 Smear the outside of the shipment in the areas that exhibit the highest radiation levels from the fixed and removable contamination survey pursuant to ENV-R-013, "Contamination Control".

5.4.3.2 The appropriate detector/scaler shall be used for counting smears.

5.4.3.3 If a shipment exceeds Shieldalloy removable contamination limits as specified in Standard Operating Procedure for Radiation Safety No. ENV-R-013, "Contamination Control", the RSO shall be notified.

5.4.3.4 A label shall be placed on the material indicating "LOOSE CONTAMINATION".

5.4.3.5 Under the direct supervision of the RSO, the material shall be transported to a designated Contamination Area taking precautions not to spread the contamination during transport.

5.5 Radiation surveys of shipments that do meet the 10 CFR 40 definition of source material

5.5.1 Shipments shall be surveyed within three (3) hours of arrival for exposure rate, total contamination, and removable contamination.

5.5.2 If the package is received after normal business hours, the RSO shall be notified and the survey shall be performed no later than three (3) hours after the beginning of the next working day.

5.5.3 The RSO shall review the documentation accompanying the shipment and radioactive shipping labels in order to obtain information regarding the activity of its contents.

5.5.4 The RSO shall confirm that the shipment is marked and labeled as containing radioactive material and that it has no physical evidence of possible contamination (e.g., crushed, wet, or damaged).

5.5.5 Materials shall be entered onto an inventory log maintained by the RSO and shall be updated at least quarterly to reflect usage and new acquisitions.

6 DOCUMENTATION

6.1 All Records pertinent to this procedure shall be maintained pursuant to ENV-R-011, "Radiation Protection Records".

6.2 The RSO shall maintain the records pertaining to the inventory of licensable radioactive material.

6.3 The RSO shall submit a copy of the current USNRC license as requested by the vendor supplying the radioactive material.

6.4 All personnel opening packages containing radioactivity shall forward all pertinent information to the RSO.

7 ATTACHMENTS

None

	RADIOLOGICAL AREAS AND POSTING	Procedure: ENV-R-009
		Page: 1 of 6
		Revision No. 000
		Date: 03/10/94
		Approved by (Director):
		Approved by (RSO):
		Approved by (QAO):
		Approved by (RSC Chair):

TABLE OF CONTENTS

CONTROLLED COPY NO. : _____

1 PURPOSE

1.1 This procedure describes the radiological areas and posting requirements for Shieldalloy Metallurgical Corporation.

1.2 Responsibilities:

1.2.1 The Director shall ensure that all employees are trained and understand the meaning of each type of posting and label.

1.2.2 The Radiation Safety Officer (RSO) shall:

1.2.2.1 Establish restricted areas based upon radiological conditions.

1.2.2.2 Approve all work in Contamination Areas prior to the beginning of work.

1.2.2.3 Ensure that all employees understand the appropriate labeling of radiological areas.

1.2.2.4 Remove radiation hazard identification postings when the conditions requiring their use no longer exists.

1.2.3 The Quality Assurance Officer (QAO) shall periodically observe radiological areas to ensure that the requirements of this procedure are being met.

1.2.4 Shieldalloy personnel shall:

1.2.4.1 Observe and obey radiological areas and postings.

1.2.4.2 Periodically review this procedure.

2 SCOPE

2.1 This procedure applies to all radiologically-controlled and restricted areas at Shieldalloy.

3 REFERENCES

3.1 Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation"

3.2 U. S. Nuclear Regulatory Commission License No. SMB-743.

3.3 Regulatory Guide 1.86, "Termination of Operating Licenses for Nuclear Reactors."

4 DEFINITIONS

4.1 Airborne Radioactivity Area - Any area where airborne radioactive concentrations exceed 25% of the Derived Air Concentrations (DAC).

4.2 Approval - An act of endorsing or adding positive authorization or both.

4.3 Contamination Area - Any area accessible to personnel where there exists fixed and/or removable source material contamination in excess of the limits established for unrestricted access.

4.4 Controlled Area - Any area to which access is controlled in order to protect individuals from exposure to radiation and radioactive materials. (The controlled area at Shieldalloy consists of the entire area within the fence line.)

4.5 Derived Air Concentration (DAC) - The concentration of a given radionuclide in air which, if breathed by Reference Man for a working year of 2,000 hours under conditions of light work (inhalation rate of 1.2 m^3 per hour) results in an intake of one Annual Limit on Intake (ALI). DAC values are given in Table 1, Column 3 of Appendix B, 10CFR 20.1001-2401.

4.6 Director - Designated senior manager of Shieldalloy Metallurgical Corporation with the authority to commit Shieldalloy resources for radiation protection purposes.

4.7 High Radiation Area - Any area where an individual may receive an effective dose equivalent from external sources of 100 mrem or greater but less than five rem in one hour at a distance of 30 cm from the radiation source or from any surface through which the radiation penetrates.

4.8 May - The word *may* is used to denote permission.

4.9 Radiation Area - Any area accessible to personnel, where radiation levels exist such that a major portion of the body may receive an effective dose equivalent from external sources of greater than five mrem but less than 100 mrem in one hour at a distance of 30 cm from the radiation source or from any surface through which the radiation penetrates.

4.10 Radiation Safety Officer (RSO) - An individual who, by virtue of qualifications and experience, has been given the authority to implement the Shieldalloy Radiation Protection Program Plan. The RSO is qualified to use source material for its intended purpose in a manner that protects health and minimizes danger to life or property. The RSO is responsible for recognizing potential radiological hazards, developing a radiation safety program to protect against these hazards, training workers in safe work practices, and supervising day-to-day radiation safety operations.

4.11 Radioactive Material Storage Area - An area where radioactive materials are stored or handled and where working conditions in the general area are normally such that radiation and contamination levels are maintained below those for which posting is required.

4.12 Radiologically-controlled Areas - An airborne radioactivity area, radiation area, high radiation area, very high radiation area, or contamination area.

4.13 Shall - The word *shall* is to be understood as a requirement.

4.14 Should - The word *should* is to be understood as a recommendation.

4.15 TLD-Required Area - Any area within a controlled area where an individual may receive:

- 100 mrem annual effective dose equivalent to the whole body (i.e., 0.05 mrem/hr for 2000 hours)
- 5000 mrem annual dose equivalent to the skin or extremity (i.e., 2.5 mrem/hr for 2000 hours)
- 1500 mrem annual dose equivalent to the lens of the eye (i.e., 0.75 mrem/hr for 2000 hours)

4.16 Very High Radiation Area - Any area where an individual may receive an effective dose equivalent from external sources of five rem or greater in one hour at a distance of 30 cm from the radiation source or from any surface through which the radiation penetrates.

5 PROCEDURE

5.1 Areas to be Posted

5.1.1 Radiological area posting/labeling requirements throughout Shieldalloy facilities shall be as described in 10 CFR 20, Subpart J.

5.1.2 The following areas shall be established by the RSO:

- Radiologically Controlled Areas
- Radiation Areas
- High Radiation Areas
- Very High Radiation Areas
- Airborne Radioactivity Area
- Contamination Area
- TLD - Required Area

5.1.3 Each area, building, or room in which licensed radioactive materials are stored in quantities that exceed 10 times the quantity of such materials shown in 10 CFR Appendix C of

20.1001-2401 shall be posted with the magenta and yellow symbol and the words "CAUTION - RADIOACTIVE MATERIAL(S)" at each entrance point.

5.1.4 Caution signs may not be necessary in areas/rooms containing source materials for a period of less than eight (8) hours, provided that the materials are attended throughout the temporary storage period by an individual who has been trained in the precautions for radiation exposure of personnel.

5.2 Posting Requirements

5.2.1 The yellow and magenta trefoil (three-blade) radiation symbol shall be used to signify the actual or potential presence of ionizing radiation and to identify objects, devices, materials, or combinations of materials which emit ionizing radiation.

5.2.2 The symbols and color combination of yellow and magenta are not to be used for purposes other than to warn of the actual or potential presence of a radiation or contamination hazard.

5.2.3 Each sign, tag, or label shall be displayed prominently and must be recognizable from a safe distance. The signs and symbols shall conform to ANSI N12.1-1971 and ANSI N2.1-1971.

5.2.4 Each posted area shall be defined and clearly marked with appropriate signs and may include a portion or all of a room, building, area, or vehicle. Areas without clearly defined existing boundaries should be defined by the use of radiation tape, ribbon, or rope.

5.2.5 Supplementary notices specifying the requirements for entry to and exit from areas and other special precautions that are to be exercised shall be posted in conjunction with radiation warning signs and tags to provide personnel with any required additional instructions or information not given by the signs and tags.

5.2.6 The information signs, tags, labels, and notices shall be kept current, reflecting any changes in radiological conditions.

5.2.7 Warning signs, tags, labels, notices and other radiation hazard identification markings shall be removed when the RSO determines that conditions requiring their use no longer exist.

5.2.8 Warning signs, tags, labels, notices and other radiation hazard identification markings shall be removed only by the RSO.

5.2.9 Form NRC-3, "Notice to Employees" shall be posted in prominent locations within the Shieldalloy Controlled Area, such as employee break rooms and bulletin boards.

5.2.10 Radiation Work Permits shall be posted at the entrance to restricted areas or radiation areas where work is being performed under a Radiation Work Permit.

5.3 Training

All personnel permitted unescorted access to the Controlled Area at Shieldalloy shall be trained in recognition of posting/labeling.

6 DOCUMENTATION

6.1 All records pertinent to this procedure shall be maintained pursuant to ENV-R-011.

7 ATTACHMENTS

7.1 None

	EMERGENCY RESPONSE AND NOTIFICATIONS	Procedure: ENV-R-010
		Page: 1 of 19
		Revision No. 000
		Date: 03/10/94
		Approved by (Director):
		Approved by (RSO):
		Approved by (QAO):
		Approved by (RSC Chair):

TABLE OF CONTENTS

CONTROLLED COPY NO. : _____

1 PURPOSE

1.1 This procedure contains the general policies and actions to be implemented during incidents or emergencies where radioactive materials or radiation sources are handled or stored at Shieldalloy. It establishes the responsibilities and methods by which incident/events are to be reported, documented, reviewed, distributed, and the root cause(s) determined in order to develop corrective action to minimize or prevent the same or similar occurrences.

1.2 Responsibilities:

1.2.1 The Director shall:

1.2.1.1 Review and approve the requirements of this procedure.

1.2.1.2 Supply adequate resources to ensure compliance with this procedure.

1.2.2 The Radiation Safety Officer (RSO) shall:

1.2.2.1 Assure that all personnel working in a radiologically-controlled area are instructed in the procedures for responding to an incident or emergency involving radioactive material.

1.2.2.2 Check the status of emergency equipment on a planned and periodic basis.

1.2.2.3 Supervise decontamination efforts.

1.2.2.4 Provide consultation to fire fighting or other emergency personnel by direct involvement.

1.2.2.5 Submit a report to the Director within four working days detailing the circumstances, corrective actions, materials involved, exposures, etc., for each incident or emergency which involved a radiological hazard.

1.2.2.6 Notify the USNRC Regional office of any incident involving licensed material pursuant to the reporting requirements contained in Title 10, Code of Federal Regulations, Part 20.

1.2.2.7 The Radiation Safety Committee (RSC) shall review unusual incidents involving radioactivity or radiation-producing machines and provide recommendations to the Director on how their reoccurrence shall be prevented.

1.2.3 The Quality Assurance Officer (QAO) shall:

1.2.3.1 Review and approve the requirements of this procedure.

1.2.3.2 Verify compliance with this procedure during planned and periodic audits of the radiation protection program.

1.2.4 Shieldalloy personnel shall

1.2.4.1 Comply with the requirements of this procedure, as applicable.

1.2.4.2 Be aware of the location of emergency exits, eyewash stations, safety showers and fire alarms.

1.2.4.3 Immediately notify the RSO of any known or suspected incident or emergency.

1.2.4.4 Periodically review this procedure, as required.

2 SCOPE

2.1 This procedure applies to all Shieldalloy and contractor personnel working with or in the vicinity of radioactive material or radiation sources at Shieldalloy facilities.

3 REFERENCES

3.1 Nuclear Regulatory Commission, Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation."

3.2 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-014, "Stop Work Authority"

3.3 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-016, "Radiation Exposure Control"

3.4 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-011, "Radiation Protection Records"

3.5 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-012, "Instrumentation and Surveillance"

3.6 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-009, "Radiological Areas and Posting"

4 DEFINITIONS

4.1 Approval - An act of endorsing or adding positive authorization or both.

4.2 Corrective Action - Measures taken to rectify conditions adverse to quality and, where necessary, to preclude repetition.

4.3 Critique - A meeting of management and involved/concerned personnel to analyze an event to determine what happened, why it happened, and how to minimize or prevent recurrence.

4.4 Director - Designated senior manager of Shieldalloy Metallurgical Corporation with the authority to commit Shieldalloy resources for radiation protection purposes.

4.5 Incident/Event - Potential conditions or real occurrences which are described in the appendices to this procedure. Incidents may include power failures, minor spills of radioactive materials, or radioactive contamination that present no significant hazard to personnel, etc. Emergency situations may include fires, acute illness or personnel injuries involving a contamination hazard, major spills, accidents resulting in personnel exposure to radioactive dusts, mists, fumes, organic vapors or gases.

4.6 May - The word *may* is used to denote permission.

4.7 Radiation Safety Officer (RSO) - An individual who, by virtue of qualifications and experience, has been given the authority to implement the Shieldalloy Radiation Protection Program Plan. The RSO is qualified to use source material for its intended purpose in a manner that protects health and minimizes danger to life or property. The RSO is responsible for recognizing potential radiological hazards, developing a radiation safety program to protect against these hazards, training workers in safe work practices, and supervising day-to-day radiation safety operations.

4.8 Shall - The word *shall* is to be understood as a requirement.

4.9 Should - The word *should* is to be understood as a recommendation.

4.10 Root Cause - The most basic, fundamental cause, which, if corrected will prevent recurrence. There may be more than one root cause of an incident or event

5 PROCEDURE

5.1 General Requirements

5.1.1 The basic initiatives and actions for responding to incidents or emergencies at Shieldalloy are contained in the Shieldalloy Emergency Plan.

5.1.2 All applicable safety and compliance guidelines set forth by Shieldalloy and federal, state, and local regulations shall be followed during performance of this procedure.

5.1.3 Work shall be stopped in the event of a known or potential compromise to the health or safety of any Shieldalloy or contractor personnel and shall be reported immediately to the RSO.

5.1.4 Following a radiological incident or emergency, the RSO shall determine the need to collect personnel dosimeters for immediate processing.

5.1.5 If it is known or suspected that radioactive material has been taken into the body, the RSO shall evaluate the amount of material ingested/inhaled and the resulting exposure. This investigation may include air sampling and analysis, bioassays, or whole body counting, as needed.

5.2 Emergency Response

5.2.1 When an individual identifies and incident/event (I/E) that meets (or may potentially meet) the criteria shown in Attachment 1, they shall perform the following:

5.2.1.1 Ensure the situation is in a stable, safe condition, taking all required immediate corrective action;

5.2.1.2 Notify the appropriate personnel responsible for the area or activity; and,

5.2.1.3 Notify the RSO.

5.2.2 After notification, the RSO shall then perform the following:

5.2.2.1 Make a determination if an I/E as described in Attachment 1 has occurred or may have occurred.

5.2.2.2 Ensure required notifications are made.

5.2.2.3 Ensure an I/E Report (Attachment 2) is initiated and recorded in the Incident/Event Report Log (Attachment 3) for tracking purposes.

5.2.2.4 Ensure that a critique is conducted in accordance with Attachment 4 and the critique package (Attachments 5-7) is assembled and attached to the I/E Report.

5.2.3 Upon completion of the critique and other initial review activities, the RSO shall determine whether the I/E should be reviewed or completed by other organizations such

as the QAO or independent, third-parties. If so, this course of action should be entered as immediate corrective action.

5.2.4 The remainder of the report shall then be completed and all accompanying information attached.

5.2.4.1 Root cause analysis may be required for certain events. If the RSO determines root cause analysis is required, he shall assign an individual who has been formally trained or has previous experience to complete this. The analysis shall be attached to the I/E Report.

5.2.4.2 Long-term corrective action shall be specified, assigned, and a response due date entered. If more than two items are required, add another page 2 of the report and denote accordingly.

5.2.4.3 Each organization/individual assigned long-term corrective action shall indicate their concurrence with these assignments by signature (use additional forms if more than two are assigned action).

5.2.4.4 Approval of the I/E Report by the Director is mandatory.

5.2.5 After completion, the I/E Report shall be distributed as indicated on the report.

NOTE: The original shall be maintained by the RSO.

5.2.6 Verification of corrective action completion shall be periodically conducted by the RSO. Reports of findings shall be addressed to the QAO and copied to the VP.

5.3 Lost or Damaged Dosimeters

5.3.1 Employees shall promptly notify the RSO if a dosimeter is lost or damaged.

5.3.2 The RSO shall issue the employee a new dosimeter for that monitoring period.

5.3.3 The RSO shall evaluate/estimate the radiation exposure incurred from the beginning of the monitoring period until the time of loss or damage, and record all pertinent information in the employee's dosimetry records. (It may be necessary to limit additional exposure of the individual involved until this investigation is completed.)

5.4 Electrical Power Failure

5.4.1 The RSO shall determine whether a radiological hazard exists and take appropriate action to control or contain the hazard.

5.4.2 The operations manager shall determine the cause of a local power failure and, if possible, take corrective action to restore electrical power.

5.4.3 In the event of a general power failure, radiological activities shall cease until power is restored.

5.5 Minor Spills or Releases

5.5.1 All other persons in the area shall be notified at once.

5.5.2 The spill should be confined immediately.

5.5.3 The RSO shall be notified as soon as possible.

5.5.4 The RSO shall establish a contamination zone in the area of the spill by erecting barriers and or posting signs, as necessary.

5.5.5 The RSO shall restrict access of unnecessary personnel to the spill area.

5.5.6 The RSO shall supervise decontamination efforts.

5.5.7 For liquid spills

5.5.7.1 Don protective gloves

5.5.7.2 Drop absorbent paper on spill

5.5.7.3 Notify the RSO.

5.5.8 For dry spills:

5.5.8.1 Don protective gloves

5.5.8.2 Dampen the material thoroughly, taking care not to spread the contamination.

5.5.8.3 Notify the RSO.

5.5.8.4 Work in the area may resume after radiation surveys confirm that levels of radioactive contamination are below the action levels established in ENV-R-013, "Contamination Control".

5.6 Major Spills or Releases

5.6.1 All persons in the area shall be alerted and the area shall be cleared of unnecessary personnel.

5.6.2 Individuals shall be surveyed for radioactive contamination upon leaving radiological hazard areas by radiation protection personnel.

5.6.3 The RSO shall be notified as soon as possible.

5.6.4 The RSO shall ascertain that all doors given access to the room are closed, and post conspicuous warnings or guards to prevent accidental entry.

5.6.5 If the spill is liquid, and the hands are protected, the container shall be placed in an upright position.

5.6.6 If skin contamination is suspected, the area shall be flushed thoroughly with lukewarm water.

5.6.7 If the spill is on the clothing, outer or protective clothing shall be removed at once, segregating it from other personal articles of clothing.

5.6.8 The RSO shall close the door securely upon exit after confirming that the area has been evacuated.

5.6.9 The individual(s) involved in the incident should remain as close to the area as possible while awaiting the arrival of the RSO in order to minimize the spread of contamination.

5.6.10 All persons who evacuated the area shall be monitored (frisked) by radiation protection personnel.

5.7 Injuries to Personnel Involving Contamination

5.7.1 Minor wounds shall be flushed immediately with lukewarm water while spreading the edges of the wound.

5.7.2 Radiological accidents (wounds, overexposure, ingestion, inhalation) shall be reported promptly to the RSO.

5.7.3 No person involved in a contaminating injury shall be allowed to return to work without the approval of the RSO and/or the attending physician.

5.8 Fires or other major emergencies

5.8.1 All other persons in the area shall be alerted and the building shall be evacuated.

5.8.2 All personnel not involved with the emergency shall walk to the nearest unencumbered exit, and proceed to a safe distance from the building.

5.8.3 The RSO shall be notified.

5.8.4 Fire Department/Medical Assistance shall be enlisted from nearby facilities.

5.8.5 Employees shall only attempt to put out fires if a radiological hazard is not immediately apparent and if the fire is small enough to be completely smothered with an available fire extinguisher.

5.8.6 If ingestion or inhalation of radioactivity is possible, sand shall be used instead of fire extinguisher to smother the fire.

5.8.7 The RSO shall provide consultation to fire fighting or other emergency personnel by direct involvement.

5.8.8 Following the emergency, monitoring and decontamination, as needed, shall be directed by the RSO.

5.9 Prevention measures

5.9.1 Do not use any defective electrical equipment.

5.9.2 Report any defective electrical equipment to your supervisor or to the RSO.

5.9.3 Place combustible trash in appropriate containers.

5.9.4 Do not allow trash to accumulate.

5.9.5 Report the use of any fire extinguisher to the RSO.

5.9.6 Do not change the location of any fire extinguisher without the approval of the Shieldalloy Safety Officer.

5.9.7 Use properly marked safety cans for storage of flammable liquids.

5.9.8 Cover or cap containers of flammable liquids when not in use.

5.9.9 Do not store containers, materials, equipment in front of electrical panels. Free access to electrical panels should be maintained.

5.10 Notifications

5.10.1 The RSO and/or Director shall notify the USNRC Regional Office of any incident involving licensed material pursuant to the reporting requirements contained in Title 10, Code of Federal Regulations, Part 20.

5.10.2 Failure to comply with these guidelines may result in violation of the USNRC license and could result in the suspension of the license.

5.10.3 The RSO shall submit a report to the Director within four working days detailing the circumstances, corrective actions, materials involved, exposures, etc., for each incident or emergency which involved a radiological hazard.

6 DOCUMENTATION

6.1 All Records pertinent to this procedure shall be maintained pursuant to ENV-R-011.

6.2 The following documents shall be retained by the RSO:

6.2.1 Personnel Decontamination Records;

6.2.2 Area/Equipment Decontamination Records; and

6.2.3 RSO contingency or emergency reports.

6.2.4 Incident/Event Reports

6.2.5 Incident/Event Logs

6.2.6 Critique Attendance Forms

6.2.7 Statements by Involved Personnel

6.2.8 Critique Reports

7 ATTACHMENTS

7.1 Attachment 1 - Radiological Incidents/Events Listing

8.2 Attachment 2 - Incident/Event Report Forms

8.3 Attachment 3 - Incident/Event Report Log Form

8.4 Attachment 4 - Critique Requirements

8.5 Attachment 5 - Critique Attendance Form

8.6 Attachment 6 - Involved Personnel Statement Form

8.7 Attachment 7 - Critique Report Form

ATTACHMENT 1

RADIOLOGICAL INCIDENTS/EVENTS LISTING

The following items require an I/E Report

1. External radiation exposures equal to or greater than:

   - 1000 mrem to the whole body/quarter without a dose extension
   - 5000 mrem to the skin/quarter
   - 10,000 mrem to the forearms/quarter
   - 25,000 mrem to the hands or feet/quarter

2. Skin contaminations that result in greater than 100 mrem skin dose.

3. Internal exposure of 10 Derived Air Concentration-hours in a day, or 40 in a week.

4. Radioactive contamination exceeding the levels of 5000 dpm/100 cm^2 beta-gamma and 1000 dpm/100 cm^2 alpha in areas outside of posted Radiological Areas.

The following items will also require a critique.

5. Radiation exposures exceeding the limits of 10 CFR 20.

6. Unplanned releases of radioactive materials to the environment (e.g., spills).

7. Any loss of integrity of a radioactive material shipment.

ATTACHMENT 2

SHIELDALLOY
METALLURGICAL
CORPORATION

INCIDENT/EVENT REPORT

Page ___ of ___

INCIDENT/EVENT REPORT NUMBER: _____
OCCURRENCE TIME/DATE: _____
REPORT INITIATED TIME/DATE: _____

EVENT DESCRIPTION: _____

NOTIFICATIONS:

EVENT CATEGORY/CRITERIA: _____
(FROM ATTACHMENT 4)

CRITIQUE HELD: YES _____ NO _____ IF YES, TIME/DATE: _____

APPARENT CAUSE: _____

ROOT CAUSE ANALYSIS REQUIRED: YES _____ NO _____ IF YES, ATTACH ANALYSIS

IMMEDIATE CORRECTIVE ACTION: _____

ATTACHMENT 2

SHIELDALLOY METALLURGICAL CORPORATION

INCIDENT/EVENT REPORT
(Continued)

Page ___ of ___

INCIDENT/EVENT REPORT NUMBER: _____

LONG TERM CORRECTIVE ACTION PLAN:

1. ACTION REQUIRED: _____
_____
_____
RESPONSIBLE ORGANIZATION/INDIVIDUAL: _____
RESPONSE DUE DATES: _____

2. ACTION REQUIRED: _____
_____
_____
RESPONSIBLE ORGANIZATION/INDIVIDUAL: _____
RESPONSE DUE DATES: _____

REPORT PREPARED BY: _____/_____
Radiation Safety Officer Date

CONCURRENCE WITH LONG TERM CORRECTIVE ACTION PLAN:

1. _____/_____
Signature Title Date

2. _____/_____
Signature Title Date

APPROVED BY: _____/_____
Date

DISTRIBUTION:
Original: RSO
cc: Long Term Corrective Action Responsible Organization/Individual
Quality Assurance Officer

ATTACHMENT 3

INCIDENT/EVENT REPORT LOG SHEET

SHIELDALLOY
METALLURGICAL
CORPORATION

INCIDENT/EVENT REPORT LOG

Page ___ of ___

I/E NUMBER YY-XXX	DESCRIPTION	DATE OF OCCURRENCE	DATE REPORT INITIATED	DATE REPORT COMPLETED

ATTACHMENT 4

CRITIQUE REQUIREMENTS

Requirements:

1) Whenever a critique is required by the criteria in Attachment 4, the RSO shall initiate the critique activities.

2) The RSO shall be designated as the critique chairman unless a third party chairman is required.

3) The chairman shall gather all involved or concerned personnel. Attendance at critiques is mandatory.

NOTE: The QA Officer or designee shall be invited to attend all critiques.

4) Attendance at critiques shall be documented on the Critique Attendance form.

5) Statements of all appropriate personnel shall be obtained and documented on the Statements by Involved Personnel form.

NOTE: Consideration should be given to obtaining statements and conducting individual interviews prior to the critique.

6) The chairman shall ensure that minutes are taken at the critique and documented on the Critique Report form.

7) The critique should attempt to determine the following, as appropriate;

- An accurate chronology of events
- Actual and expected responses of personnel and equipment
- Adequacy of procedures
- Factors affecting personnel performance (e.g., training, qualifications, mental/physical state)
- Adequacy of immediate corrective action
- Comparison with other similar events

8) After the critique, the critique package (i.e., Critique Attendance forms, Statements by Involved Personnel forms, and Critique Report forms) shall be assembled and incorporated as part of the Incident/Event Report.

ATTACHMENT 5

CRITIQUE ATTENDANCE FORM

SHIELDALLOY
METALLURGICAL
CORPORATION

CRITIQUE ATTENDANCE FORM

Page ___ of ___

INCIDENT/EVENT REPORT NUMBER: _____

NAME	TITLE/DEPARTMENT	TELEPHONE NUMBER/EXT.

ATTACHMENT 6

SHIELDALLOY
METALLURGICAL
CORPORATION

STATEMENTS BY INVOLVED PERSONNEL

Page ___ of ___

INCIDENT/EVENT REPORT NUMBER: _____

Describe the event from your perspective. Include all pertinent information such as times, dates, job conditions, sequence of events, action taken, and any other related information.

Name: _____ _____ _____
PRINT SIGNATURE DATE

ATTACHMENT 7

SHIELDALLOY
METALLURGICAL
CORPORATION

CRITIQUE REPORT

Page ___ of ___

INCIDENT/EVENT REPORT NUMBER: _____

Critique Minutes:

Recorded by: _____ _____
SIGNATURE DATE

	RADIATION PROTECTION RECORDS	Procedure: ENV-R-011
		Page: 1 of 12
		Revision No. 000
		Date: 03/10/94
		Approved by (Director):
		Approved by (RSO):
		Approved by (QAO):
		Approved by (RSC Chair):

TABLE OF CONTENTS

CONTROLLED COPY NO. : _____

1 PURPOSE

This procedure describes the records necessary to document implementation of the Shieldalloy Radiation Protection Program Plan and Standard Operating Procedures for Radiation Safety (SOPRS's), and to demonstrate compliance with USNRC license requirements.

1.1 Responsibilities:

1.1.1 The Director shall oversee the radiation protection program (RPP) and implementation of this RPP.

1.1.2 The Radiation Safety Officer (RSO) shall maintain the records generated during implementation of the radiation protection program and SOPRSs.

1.1.3 The Quality Assurance Officer (QAO) shall:

1.1.3.1 Periodically review the radiation protection records to ensure compliance with the requirements of this procedure and the Shieldalloy Quality Assurance Program.

1.1.3.2 Maintain backup copies of radiation protection records.

1.1.4 Shieldalloy employees, contractors and visitors that provide radiation protection services shall:

1.1.4.1 Submit records generated during implementation of the Radiation Protection Program and SOPRSs to the RSO.

1.1.4.2 Periodically review this procedure.

2 SCOPE

2.1 This procedure applies to the maintenance of records generated during implementation of the Radiation Protection Program and SOPRSs.

2.2 The scope includes but is not limited to the following:

2.2.1 Training records;

2.2.2 Contamination Control records;

2.2.3 Radiation exposure records;

2.2.4 Source material inventory records;

2.2.5 Site monitoring records; and

2.2.6 Waste disposal records.

3 REFERENCES

3.1 U. S. Nuclear Regulatory Commission License No. SMB-743.

3.2 Title 10, Code of Federal Regulations, Part 19, "Notices, Instructions, and Reports to Workers, Inspections."

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

3.4 USNRC Regulatory Guide 8.7, "Occupational Radiation Exposure Records System".

3.5 USNRC Regulatory Guide 10.5, "Application for Type A Licenses of Broad Scope."

3.6 Shieldalloy Metallurgical Corporation Procedure ENV-R-005, "Control of Work".

3.7 Shieldalloy Metallurgical Corporation Radiation Protection Procedure No. ENV-R-011, "Radiation Protection Records".

3.8 Shieldalloy Metallurgical Corporation Radiation Protection Procedure No. ENV-R-017, "Training and Qualifications of Radiation Protection Personnel"

4 DEFINITIONS

4.1 Approval - An act of endorsing or adding positive authorization or both.

4.2 Director - Designated senior manager of Shieldalloy Metallurgical Corporation with the authority to commit Shieldalloy resources for radiation protection purposes.

4.3 May - The word *may* is used to denote permission.

4.4 Monitored Employee or Personnel - An individual who performs work within a radiologically controlled area and has the potential to receive greater than 100 millirem total effective dose equivalent in one calendar year.

4.5 Radiation Protection Personnel - Personnel who perform radiation protection functions such as release surveys, personnel dosimeter distribution, radiation protection records maintenance, and quality assurance activities as they pertain to radiation protection. The term radiation protection

personnel includes the RSO and the ARSO or qualified contractor. Training and qualifications of radiation protection personnel is contained in ENV-R-017, "Training and Qualifications of Radiation Protection Personnel".

4.6 Radiation Safety Officer (RSO) - An individual who, by virtue of qualifications and experience, has been given the authority to implement the Shieldalloy Radiation Protection Program Plan. The RSO is qualified to use source material for its intended purpose in a manner that protects health and minimizes danger to life or property. The RSO is responsible for recognizing potential radiological hazards, developing a radiation safety program to protect against these hazards, training workers in safe work practices, and supervising day-to-day radiation safety operations.

4.7 Radiation Work Permit (RWP) - An authorizing document that establishes the radiological requirements for working with known or potential radiological hazards. Its purpose is to instruct personnel how to work safely around radioactive materials and to define controls to prevent the spread of contamination.

4.8 Shall - The word *shall* is to be understood as a requirement.

4.9 Should - The word *should* is to be understood as a recommendation.

4.10 Survey (Radiation or Contamination) - Evaluation of the radiation conditions incident to the production, use, release, disposal, or presence of sources of ionizing radiation. When appropriate, such evaluation includes a physical survey of materials and equipment and levels of radiation or concentrations of radioactive material present.

4.11 USNRC - Acronym for "United States Nuclear Regulatory Commission," a federal regulatory agency.

5 PROCEDURE

5.1 Records of Purchased Services

5.1.1 If Shieldalloy personnel or the RSO purchases radiation protection services[1] from another firm, records clearly delineating responsibilities both during and subsequent to the performance of the services shall be specified on the Request for Purchase Order.

5.1.2 The RSO should be assured that pertinent records requirements are being met.

5.1.3 Records requirements should include:

[1] Common examples of purchased services are TLD personnel dosimetry services, bioassay analyses, health physics technician support, and calibration of radiation instrumentation.

5.1.3.1 Retention of written information of sufficient scope to define the procedure and method of evaluation; and

5.1.3.2 Data and computed dose results.

5.2 Records Related to an Individual

5.2.1 The purpose of individual records is to enable the RSO to provide an accurate, quantitative description of the occupational radiation exposure received by Shieldalloy employees, visitors, or contractors.

5.2.2 Examples of individual records are:

5.2.2.1 External radiation monitoring results;

5.2.2.2 Internal radiation monitoring results;

5.2.2.3 Supplementary information on individual exposures (e.g., radiation incident investigation reports); and

5.2.2.4 Documentation of proficiency in radiological training and qualification requirements.

5.2.3 Identification of the individual:

5.2.3.1 Positive identification of the individual employee, visitor, or contractor is required.

5.2.3.2 Due to such factors as multiple employment, duplication of common names, and legal changes of names, the Social Security number shall be used for individual identification.

5.2.3.3 For those cases where Social Security numbers are not available (e.g., foreign nationals), the birth date and sex of the individual shall accompany the individual's Employee number on all records.

5.2.4 Radiation exposure received during prior employment:

5.2.4.1 A summary of the occupational radiation exposure received by a monitored worker during previous employment shall be obtained.

5.2.4.2 The RSO shall secure and record the following information when radiation exposure is indicated for previous employment:

- Period(s) of employment and identification of employer.
- The nature and magnitude of prior occupational exposure, both internal and external, for the periods in question.

5.2.5 Exposure Received by Individuals at Other Installations or Facilities During Employment by Shieldalloy:

5.2.5.1 The RSO shall record the radiation exposure received by the individual at facilities other than Shieldalloy.

5.2.5.2 When necessary in order to maintain continuity in exposure data, it may be necessary for the RSO to provide dosimetry devices to employees during official visits to other facilities.

5.2.5.3 The RSO shall encourage employees to report when radiation exposure is being incurred at other facilities.

5.2.6 Records of External Exposure

5.2.6.1 The following information shall be available directly or indirectly from the TLD records:

- Identification of the wearer of the dosimeter;
- Period of exposure or deployment;
- Type(s) of phosphor, lot number, or processing batch identifiers;
- Control dosimeter readings and confidence limits;
- Personnel dosimeter readings and confidence limits;
- Notation of abnormalities; and
- Identification of individual processing the dosimeter.

5.2.6.2 From processing of personnel dosimeters, the radiation dose for each individual shall be computed and recorded, and the following data should be included in the record:

- Identification of the individual;

- Period of exposure or deployment of the dosimeter;
- Cross reference to control and calibration data;
- Computed dose for each type of radiation for the specified period;
- Appropriate summation to facilitate comparison with permissible limits; and
- Identification of the individual performing the dose computations.

5.2.6.3 When the dosimeter is the primary means of dose measurement, the records should be continuous for the period in question.

5.2.6.4 If no valid measurement result can be obtained from the personnel dosimeter, an estimate of the radiation exposure shall be recorded after performance of an investigation. The record of investigation should include:

- Identification of the individual;
- Dates involved;
- Nature of the abnormality (e.g., contaminated dosimeter, lost dosimeter);
- Location and tasks to which the individual was assigned;
- Readings from other dosimeters worn by the individual;
- Dose received by others working under similar conditions;
- Results of time-and-motion studies;
- Conclusions as to magnitude and type of occupational exposure actually incurred;
- Signature of the individual; and
- Signature of the RSO.

5.2.7 Records of Internal Exposure

5.2.7.1 When bioassay analyses are performed the record should include:

- Identification of the individual;

- Purpose of the sample and, if applicable, date of suspected intake;
- Collection period for the sample and the date submitted for analysis;
- Type of sample and size of aliquot;
- Type of radioactivity (e.g., alpha, beta);
- Gross and net activity observed, and the counting time;
- Identity of all radionuclides detected;
- Cross reference to calibration and control data and confidence limits; and
- Identification of the laboratory technicians performing the analysis.

5.2.7.2 Records of bioassay interpretation shall include the following:

- A listing of the bioassay data used in the interpretation and the identity of the radionuclide;
- Reference to the method of interpretation;
- Assumptions used in arriving at the conclusion including the known or assumed date of intake;
- Conclusion as to the magnitude and location of the body burden, expressed in units of activity (i.e., curies or becquerels); and
- Identification of the individual making the conclusion.

5.2.7.3 When whole body counting is performed, the record should include:

- Identification of the individual
- Date, time, and purpose of the examination and, if applicable, date and time of suspected intake.
- Quantitative output counting data (e.g., length and type of count, counts per channel, keV per channel, energy range over which counts are made)
- Cross reference to procedure, calibration factors, periodic background and resolution checks, and confidence levels

- Description of calculation procedure or reference to calculation procedure
- Qualitative and quantitative calculations
- Identity and location of all radionuclides detected and the magnitude of the body (organ) burden.
- Identification of the individual making the conclusion.

5.3 Other Individual Exposure Records

5.3.1 Completed Form NRC-5

5.3.2 Completed Form NRC-4

5.3.3 Accident Reports

5.3.4 Personnel Decontamination Records

5.3.5 Radiation Work Permits

5.3.6 Dose estimates and justifications for those estimates

5.4 Radiation Safety Training Records

5.4.1 The V.P. of Human Resources should maintain the date, number, and subject matter of general employee training in radiation protection, radiation worker training, authorized user training, and special briefings.

5.4.2 The occupational radiation exposure record file for the individual should include reference to their participation in these activities.

5.4.3 Specific training records should include:

5.4.3.1 Outline or course lesson plan indicating the name of the instructor, the company that provided the training, the date and time the training was conducted, the name or number of the test used for the class, and employee test results.

5.4.3.2 Training Attendance Records

5.4.3.3 Performance Verification Sheets for all radiation protection personnel completed pursuant to ENV-R-017, "Training and Qualifications of Radiation Protection Personnel".

5.5 Medical Services Provided to the Individual

5.5.1 In certain cases, medical services (i.e., periodic chest x-rays, examinations following occupational injuries, medical qualification for respiratory usage, etc) may be provided to Shieldalloy employees.

5.5.2 These records shall be forwarded to the Human Resources Department.

5.6 Records to be Maintained by the RSO

5.6.1 Program Administration

5.6.1.1 Records Index

5.6.1.2 Minutes of the Radiation Protection Committee Meetings

5.6.1.3 Statement of RSO Qualifications

5.6.2 Radioactive Material License

5.6.2.1 Application

5.6.2.2 License and Amendments

5.6.2.3 Inspections by the USNRC

5.6.2.4 Correspondence with the USNRC

5.6.3 Nuclear Regulatory Commission

5.6.3.1 Title 10, Code of Federal Regulations

5.6.3.2 Referenced USNRC Regulatory Guides

5.6.3.3 Information Notices from the USNRC

5.6.4 Standard Operating Procedures for Radiation Safety and Document Control Records

5.7 Contamination Control Records

5.7.1 Radiation Work Permits

5.7.2 Contamination Survey Records

5.7.3 Blank Floor Plans

5.7.4 Equipment/Area Decontamination Records

5.8 Source Material Inventory Records

5.8.1 Inventory records for sealed sources

5.8.2 Inventory records for pyrochlore and other licensable raw materials

5.8.3 Inventory records for slag, baghouse dust, and other licensable materials in the Storage Yard.

5.8.4 Inventory records for other unsealed sources of licensable radioactive materials.

5.9 Site Monitoring Records

5.9.1 Radiological survey results including ambient surveys, contamination surveys, airborne radioactivity surveys, environmental monitoring surveys, etc.

5.9.2 Inventory list of radiological instruments used to perform surveys

5.9.3 Calibration and maintenance records for radiological survey equipment

5.9.4 Radiological survey instrument user manuals

5.10 Waste Disposal Records

5.10.1 Names, quantity, and release survey results of the radioactive material deemed waste

5.10.2 Location, method and date of disposal

5.10.3 Shipping records

5.11 Retention and Storage of Records

5.11.1 Occupational radiation exposure records shall be kept confidential, and the following controls shall be in place:

5.11.1.1 Records shall be kept in a locked cabinet (or equivalent) except when in use.

5.11.1.2 There shall be a primary and backup custodian for the records.

- The primary custodian shall be the V.P. Human Resources
- The backup custodian shall be the QAO.

5.11.2 Employee exposure records shall be preserved and maintained for at least 30 years.

5.11.3 Each analysis using employee exposure records shall be preserved and maintained for at least 30 years.

5.11.4 The contents of occupational radiation exposure records shall be maintained intact.

5.11.5 At the termination of employment, occupational radiation exposure records may be microfilmed and retained pursuant to 29 CFR 1910.

5.11.6 Records relating to the radiation protection program shall be maintained for 30 years.

5.11.7 When the USNRC license is no longer in force, the RSO shall contact the USNRC for permission to dispose of radiation protection records other than personnel exposure records.

6 DOCUMENTATION

None

7 ATTACHMENTS

None

	INSTRUMENTATION AND SURVEILLANCE	Procedure: ENV-R-012
		Page: 1 of 18
		Revision No. 000
		Date: 03/11/94
		Approved by (Director):
		Approved by (RSO):
		Approved by (QAO):
		Approved by (RSC Chair):

TABLE OF CONTENTS

CONTROLLED COPY NO. : _____

1 PURPOSE

1.1 This procedure describes the requirements for calibration and use of radiation survey instruments, and the methodology for performing radiation surveys.

1.2 Responsibilities:

1.2.1 The Director shall:

1.2.1.1 Review and approve the requirements of this procedure.

1.2.1.2 Supply adequate resources to ensure compliance with this procedure.

1.2.2 The Radiation Safety Officer (RSO) shall:

1.2.2.1 Assure the adequacy of the radiation survey and instrumentation program.

1.2.2.2 Obtain and maintain calibration of all radiological instruments in the active inventory.

1.2.2.3 Maintain instrument calibration certificates on file for all radiological instruments in the active inventory.

1.2.2.4 Assure that all radiological surveillance is performed pursuant to this procedure.

1.2.2.5 Assure that all radiation protection personnel are properly trained in the provisions of this procedure.

1.2.3 The Quality Assurance Officer (QAO) shall:

1.2.3.1 Review and approve this procedure.

1.2.3.2 Verify compliance with this procedure during planned and periodic audits of the Radiation Protection Program.

1.2.4 Radiation Protection Personnel shall:

1.2.4.1 Verify that only calibrated radiological instruments are used.

1.2.4.2 Follow this procedure when using radiological instruments.

1.2.4.3 Periodically review this procedure, as applicable.

2 SCOPE

2.1 This procedure applies to all radiological instrumentation and radiological surveys conducted by Shieldalloy employees, visitors and contractors at Shieldalloy facilities.

3 REFERENCES

3.1 American National Standard Institute, "Radiation Protection Instrumentation Test and Calibration," N323-1978m, 1977.

3.2 INPO 88-010, "Guidelines for Radiological Protection at Nuclear Power Stations," 1988.

3.3 Instrument Instruction Manuals Published by the Instrument Manufacturers.

3.4 U.S. NRC Regulatory Guide 8.10, "Operating Philosophy for Maintaining Occupational Radiation Exposures As Low As is Reasonably Achievable".

3.5 U.S. NRC Regulatory Guide 8.21, "Health Physics Surveys for Byproduct Material at NRC-Licensed Processing and Manufacturing Plants," 1979.

3.6 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety for Radiation Safety No. ENV-R-013, "Contamination Control".

3.7 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-009, "Radiological Areas and Posting".

3.8 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-016-E, "External Radiation Exposure Control".

3.9 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-017, "Training and Qualification of Radiation Protection Personnel"

3.10 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-011, "Radiation Protection Records"

4 DEFINITIONS

4.1 Approval - An act of endorsing or adding positive authorization or both.

4.2 Contamination Area - Any area accessible to personnel where there exists fixed and/or removable source material contamination in excess of the limits established for unrestricted access.

4.3 Controlled Area - Any area to which access is controlled in order to protect individuals from exposure to radiation and radioactive materials. (The controlled area at Shieldalloy consists of the entire area within the fence line.)

4.4 Fixed Contamination - Radioactive contamination that is fixed to a surface and not likely to be removed by simple brushing or detergent solutions.

4.5 Loose Contamination - Radioactive contamination that is likely to be transferred to any surface that touches the contaminated area.

4.6 May - The word may is used to denote permission.

4.7 Radiation Protection Personnel - Personnel who perform radiation protection functions such as release surveys, personnel dosimeter distribution, radiation protection records maintenance, and quality assurance activities as they pertain to radiation protection. The term radiation protection personnel includes the RSO and the ARSO or qualified contractor. Training and qualifications of radiation protection personnel is contained in ENV-R-017, "Training and Qualifications of Radiation Protection Personnel".

4.8 Radiation Safety Officer (RSO) - An individual who, by virtue of qualifications and experience, has been given the authority to implement the Shieldalloy Radiation Protection Program Plan. The RSO is qualified to use source material for its intended purpose in a manner that protects health and minimizes danger to life or property. The RSO is responsible for recognizing potential radiological hazards, developing a radiation safety program to protect against these hazards, training workers in safe work practices, and supervising day-to-day radiation safety operations.

4.9 Shall - The word shall is to be understood as a requirement.

4.10 Should - The word should is to be understood as a recommendation.

4.11 Temporary Control Zone - An area where access is restricted in order to reduce the likelihood of exposure to radiation or radioactive contamination.

4.12 Unrestricted Areas - Areas that include but are not limited to, laboratory floors, benches, equipment, and materials released from potentially contaminated areas for unrestricted use.

5 PROCEDURE

5.1 Radiation Survey Instruments

5.1.1 Instrumentation used by radiation protection personnel shall be of sufficient sensitivity and accuracy to assess the radiation exposure levels which may be found

at Shieldalloy facilities; detect the presence of contamination on tools, equipment, clothing, and personnel at all levels which may be found at Shieldalloy; and of sufficient quantity to support on-going or planned operations.

5.1.2 The basis for selection of instruments for use shall include:

5.1.2.1 Type of radiation to be monitored.

5.1.2.2 Sensitivity required.

5.1.2.3 Purpose of the survey.

5.1.3 Training in the use of the radiation survey instruments shall be conducted by the RSO in accordance with ENV-R-002.

5.1.4 Instruments to be purchased for inclusion in the active inventory shall be evaluated and tested, as applicable, for:

5.1.4.1 physical construction

5.1.4.2 effect of shock, sound, vibration, electric transients, RF energy, magnetic fields and high humidity

5.1.4.3 extent of switching transients, capacitance effects, geotropism and static charge effects

5.1.4.4 power supply, including stability and battery life

5.1.4.5 range, sensitivity, linearity, detection limit, and response to overload conditions

5.1.4.6 accuracy and reproducibility precision

5.1.4.7 energy dependence

5.1.4.8 angular dependence

5.1.4.9 response to ionizing radiation other than those being measured

5.1.4.10 temperature and pressure dependence on measurements

Note: These tests are normally performed by the manufacturer and credit may be taken for the manufacturer's evaluation and testing.

5.1.5 Reference Source Response

5.1.5.1 The response of each instrument to a reference source placed in a repeatable geometry shall be determined and recorded on the calibration label before the instrument is placed into the active inventory and after each calibration.

5.1.5.2 With the instrument response switch in the "slow" position, place the reference source and detector in the reference geometry and allow the instrument to stabilize.

5.1.5.3 Multiply the instrument reading by 0.80 and record that number on the calibration label as the "lower limit" (-20%).

5.1.5.4 Multiply the instrument reading by 1.20 and record that number on the calibration label as the "upper limit" (+20%).

5.1.6 Prior to each use or daily when kept in use, each instrument shall have the following conducted (as applicable), and results recorded on the appropriate Radiation Survey Form (Attachment 1).

5.1.6.1 Daily Source Check

5.1.6.1.1 With the instrument response switch in the "slow" position, place the reference source and detector in the reference geometry and allow the instrument to stabilize.

5.1.6.1.2 Verify that the reading is between the "upper limit" and "lower limit" noted on the calibration label of the instrument.

5.1.6.1.3 Record the results of the daily source check on the appropriate Radiation Survey Form.

5.1.6.2 Battery Check

5.1.6.2.1 Move the scale selector switch to the "BAT" position.

5.1.6.2.2 The needle should move to the right of the battery test level indicated on the scale of the rate meter.

5.1.6.2.3 Replace the batteries if the needle does not move to the right of the battery test level.

5.1.6.3 Test of the Reset Button

5.1.6.4 Test of the Audible Response

5.1.6.4.1 Move the Audio "AUD" toggle switch to the "on" position to turn the speaker on.

5.1.6.4.2 With the instrument and the reference source in the reference geometry, verify that the instrument response is audible.

5.1.6.5 Examination for physical damage

5.1.6.6 Verification that the calibration sticker is on the instrument and the instrument is "in calibration".

5.1.6.6.1 Do not use an instrument that is out of calibration.

5.1.6.6.2 Notify the RSO if an instrument is out of calibration.

5.1.7 Fixed laboratory instrumentation used for analysis of samples shall be checked for satisfactory performance pursuant to vendor instruction manuals.

Acceptable performance of fixed laboratory instrumentation shall be demonstrated by measurement of background counting rates and by the response of the instruments to an appropriate calibration source and/or check source.

5.1.8 Portable or fixed instruments failing any pre-operational check shall be taken out of service, segregated from other instruments, tagged as "out of service", and repaired prior to use.

5.1.9 Each instrument shall be labeled with a unique identifier to enable traceability to surveys and records (e.g., serial number of instrument).

5.2 Calibration

5.2.1 Instrumentation shall be calibrated every 6 months or following repairs to the rate meter and/or detector.

5.2.2 The instrument shall be calibrated according to the guidelines of ANSI-N323.

5.2.3 Each rate meter shall be calibrated with a specific detector, designated by the detector serial number. Use of a rate meter with a different probe constitutes the use of an uncalibrated meter.

5.2.4 Survey instruments shall be calibrated before being put into service.

5.2.4.1 A contractor shall provide the calibration program, using radiation sources which are traceable to the National Institute of Standards and Technology (NIST).

5.2.4.2 The contractor shall be the manufacturer of the instrument or a qualified individual/firm approved in advance by the RSO.

5.2.4.3 Calibration schedules shall be staggered to maintain some instruments at the facility at all times. At a minimum, one calibrated beta/gamma radiation contamination survey meter and one gamma exposure rate instrument shall be available at Shieldalloy at all times.

5.3 Radiation Surveys

5.3.1 Radiation surveys shall be performed as necessary to evaluate:

5.3.1.1 External exposure to personnel.

5.3.1.2 Concentrations of airborne radioactive materials.

5.3.1.3 Surface contamination (fixed + removable contamination).

5.3.1.4 Extent of contamination on tools or equipment.

5.3.2 Radiation surveys shall be performed periodically to confirm that levels of radiation and radioactive contamination are within acceptable limits as specified in ENV-R-004.

5.3.3 Surveys shall be performed under the following conditions:

5.3.3.1 Prior to initiation of a Radiation Work Permit

5.3.3.2 When radioactive shipments are received

5.3.3.3 When radioactive material is spilled

5.3.3.4 When an employee discovers radioactive contamination when frisking with a portable survey instrument.

5.3.4 Periodic surveys of x-ray machines shall be performed as required by applicable State regulations (e.g., New Jersey Administrative Code 7:28-21.6(4)).

5.3.5 Radioactive contamination surveys shall be performed to assess the potential for personnel exposures as described in ENV-R-004.

5.3.5.1 At a minimum, wipe tests for removable contamination shall be collected at the frequency specified in ENV-R-004, or when designated by the RSO.

5.3.5.2 Wipe tests for removable and fixed contamination shall be collected in each temporary radiation control zone before the barriers and signs are removed.

5.3.5.3 Wipe tests for removable and fixed contamination shall be collected whenever a radioactive sample is spilled or in the event of an incident involving exposure of personnel to radioactive materials.

5.3.6 Area radiation surveys shall be conducted by radiation protection personnel in the restricted and unrestricted areas shown in Attachment 2, with consideration given for the following:

5.3.6.1 Storage areas and laboratory areas where radioactive materials are used or stored routinely; and

5.3.6.2 Any area where the potential for personnel whole body exposures in excess of 0.5 mR/hr exist.

5.3.7 Radiation surveys for official purposes shall be performed by radiation protection personnel who are qualified in accordance with ENV-R-002.

5.3.8 All radiation surveys shall be documented on the Radiological Survey Form (Attachment 1).

5.3.9 Radiation surveys shall be reviewed by the RSO for completeness. The RSO shall evaluate trends in area conditions.

5.4 Survey Methods for Removable Radioactive Contamination

5.4.1 On the Radiological Survey Form, produce a map of the area to be surveyed.

5.4.2 Loose contamination shall be measured with dry disc smears wiped over a suspect surface area of at least 100 cm^2 and counted in a gas counter or equivalent device.

5.4.3 The smear locations in the areas specified in Attachment 3, with consideration for the following:

5.4.3.1 Doorways

5.4.3.2 Floor areas in front of sinks, hoods, and benches used for radioactive work

5.4.3.3 Common walkways

5.4.3.4 Hood doors, hood utility controls, and internal hood work surfaces

5.4.3.5 Inside of sinks, and faucet handles

5.4.3.6 Lab bench tops and lab stool seats

5.4.3.7 Tops and sides of radwaste collection containers

5.4.3.8 Doors, handles, and interior shelves of source cabinet

5.4.3.9 Floor in waste storage area

5.4.3.10 Random sample containers and floor area in sample storage area

5.4.3.11 Door knobs

5.4.3.12 Telephones

5.4.4 Record the approximate location of the smear test and the sample number.

5.4.5 Place a filter paper disc on the surface to be sampled.

5.4.6 Move the disc over an "S"-shaped area using moderate pressure, covering approximately 100 cm^2 (6 in^2), or about 20 inches in length, or the entire surface, if it is less than 100 cm^2 in area.

5.4.7 Place the disc smear in a sample holder such that individual smears are separated from each other to prevent cross contamination (e.g., smear booklet or envelope).

5.4.8 Count each smear for alpha and beta activity in the counter/scaler for at least two minutes, along with two blank (or background) smears per survey.

5.4.9 Vendor instruction manuals shall be followed for operation of the counter/scaler.

5.4.10 When low energy beta contamination is suspected, use Poly-Foam smears or equivalent type that dissolves in scintillation cocktail.

5.4.10.1 Count the Poly-Foam smears in a liquid scintillation counter (LSC) pursuant to the vendor instruction manuals for operation of the LSC.

5.4.10.2 Dissolve each Poly-Foam smear in LSC cocktail and count for 10 minutes in a LSC.

5.4.10.3 Count two blank or background smears and a known quantity of the isotope of interest.

5.4.11 Complete the Radiological Survey Log (Attachment 4) as the smears are collected.

5.4.12 Record all results on the appropriate Radiological Survey Form (Attachment 1).

5.5 Survey Methods for Fixed Radioactive Contamination

5.5.1 On the Radiological Survey Form, produce a map of the area to be surveyed.

5.5.1.1 Record the approximate location of the survey.

5.5.1.2 The survey should represent any areas where a potential exists for contamination, including but not limited to floors, table tops, ventilation hoods, and equipment used in the area.

5.5.2 Fixed contamination shall be measured by direct survey with portable radiation survey instruments sensitive to beta/gamma radiation or alpha radiation.

5.5.3 Record the instrument manufacturer name, model number, and serial number on the Radiological Survey Form.

5.5.4 Select the lowest scale setting on the rate meter.

5.5.5 Confirm that the background count rate is less than 50 cpm using the beta/gamma detector, and less than 10 cpm using the alpha detector. Contact the RSO if the background reading is outside of this range.

5.5.6 Perform daily checks.

5.5.7 Survey the area being monitored by moving the detector slowly (approximately 2 inches per second) at a distance of 1/4 inch from the surface being monitored.

5.5.8 An increase in the audible response or in the needle movement may indicate the presence of radioactive material.

5.5.9 Hold the probe stationary over the areas where the increased response was noted.

5.5.10 If the needle "pegs" the meter face, switch to the next highest scale, press the reset button and repeat the measurement.

5.5.11 If the needle remains offscale, secure the area or item and contact the RSO.

5.5.12 On the map, identify the area where the highest activity is detected and record this reading on the Radiological Survey Form (Attachment 1).

5.5.13 Repeat the survey until the entire area has been surveyed.

5.6 Surveys Methods for Whole Body Exposures to Gamma Radiation

5.6.1 Ambient radiation measurements of exposure rate shall be performed in those work areas where licensed materials are stored or are being used.

5.6.2 Inspect the exterior of the instrument for damage.

5.6.3 The bottom scale (0 to 25) shall be read when the range selector switch is in the 25 or 250 position. The top scale (0 to 50) shall be read when the range selector switch is in the 50, 500, or 5000 position.

5.6.3.1 A reading of 20 (on the top scale) with the range selector switch in the 50 position is equal to 20 μR/hr.

5.6.3.2 A reading of 20 (on the top scale) with the range selector in the 500 position is equal to 200 μR/hr.

5.6.4 Select the 25 range setting on the instrument.

5.6.5 Confirm that the background count rate is less than 20 μR/hr. Contact the RSO if the response is outside of this range.

5.6.6 Area surveys shall be conducted by walking slowly through the area with the detector at a height of one meter above the ground (waist high).

5.6.7 Gamma exposure rate measurements for items or equipment (e.g., contact exposure rate measurements on waste drums) shall be made by holding the instrument stationary with the detector end of the instrument closest to the item being monitored. The detector end is indicated by a dimple in the case.

5.6.8 An increase in the audible response or in the needle movement may indicate the presence of radioactive material.

5.6.9 Hold the instrument stationary in the areas where the increased response is noted.

5.6.10 If the needle moves past 25 on the meter face, switch to the next highest scale (50), press the reset button and repeat the measurement.

5.6.11 If the needle remains offscale, secure the area or item and contact the RSO immediately.

5.6.12 Record survey locations and results on the Radiological Survey Form.

5.6.13 "Radiation Area" signs shall be posted in areas where whole body exposures are found to be in excess of 2.0 mR/hr.

5.7 Ambient Gamma Radiation Levels

5.7.1 Ambient gamma radiation levels shall be determined over extended time period in areas where radioactive materials are used routinely pursuant to ENV-R-016.

5.7.2 Ambient gamma radiation levels shall be determined using TLDs. TLDs shall be assigned, exchanged, and results reviewed and recorded pursuant to ENV-R-016.

6 DOCUMENTATION

6.1 All Records pertinent to this procedure shall be maintained pursuant to ENV-R-011, "Radiation Protection Records".

6.2 The following records shall be maintained:

6.2.1 Instrument calibration and maintenance records.

6.2.2 Manufacturer instruction manuals for each type of rate meter and detector.

6.2.3 Radiological Survey Forms and Radiological Survey Logs.

7 ATTACHMENTS

7.1 Attachment 1 - Radiological Survey Form

7.2 Attachment 2 - Ambient Surveillance Program

7.3 Attachment 3 - Contamination Surveillance Program

7.4 Attachment 3 - Radiological Survey Log Sheet

ATTACHMENT 1

RADIOLOGICAL SURVEY FORM

ATTACHMENT 2

AMBIENT SURVEILLANCE PROGRAM

Area	Department/Building	Frequency
Restricted	D111	Monthly
Restricted	D111	Monthly
Restricted	D111	Monthly
Restricted	D102	Monthly
Restricted	D102	Monthly
Restricted	Raw Material Storage Facilities	Monthly
Unrestricted	203	Quarterly
Unrestricted	D117	Quarterly

ATTACHMENT 3

CONTAMINATION SURVEILLANCE PROGRAM

Area	Department/Building	Location	Frequency
Restricted	D111	Control Room	Monthly
Restricted	D111	Break Room	Monthly
Restricted	D111	Entrance(s)	Monthly
Restricted	D102	Entrance(s)	Monthly
Restricted	D102	Break Room	Monthly
Restricted	Raw Material Storage Facilities	Entrance(s)	Monthly
Unrestricted	203	Radiation Safety Office	Quarterly
Unrestricted	D117	Workbench(s)	Quarterly

ATTACHMENT 4

RADIOLOGICAL SURVEY LOG

Survey Number	Survey Date	Survey By	Description

	CONTAMINATION CONTROL	Procedure: ENV-R-013
		Page: 1 of 15
		Revision No. 000
		Date: 03/11/94
		Approved by (Director):
		Approved by (RSO):
		Approved by (QAO):
		Approved by (RSC Chair):

TABLE OF CONTENTS

CONTROLLED COPY NO. : _____

1 PURPOSE

1.1 This procedure provides requirements and guidelines for controlling radioactive contamination at Shieldalloy Metallurgical Corporation. Loose and fixed contamination limits for monitoring work areas are addressed as well as frisking limits for monitoring of personnel.

1.2 Responsibilities:

1.2.1 The Director shall:

1.2.1.1 Review and approve the requirements of this procedure.

1.2.1.2 Supply adequate resources to ensure compliance with this procedure.

1.2.2 The Radiation Safety Officer (RSO) shall:

1.2.2.1 Assure that the requirements of this procedure are met.

1.2.2.2 Assure that all radiation protection personnel are properly trained in the provisions of this procedure.

1.2.3 The Quality Assurance Officer (QAO) shall:

1.2.3.1 Review and approve this procedure.

1.2.3.2 Verify compliance with this procedure during planned and periodic audits of the Radiation Protection Program.

1.2.3.3 The Radiation Safety Committee shall review unusual incidents involving contamination pursuant to ENV-R-010, "Emergency Response Notifications".

1.2.4 Shieldalloy personnel shall

1.2.4.1 Comply with applicable requirements of this procedure, if applicable.

1.2.4.2 Report any unusual findings to the RSO.

1.2.4.3 Periodically review the contents of this procedure.

2 SCOPE

2.1 This procedure applies to all areas at Shieldalloy, and to all Shieldalloy employees, contractors and visitors that perform work in radiologically controlled areas at Shieldalloy.

3 REFERENCES

3.1 Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation"

3.2 U. S. Nuclear Regulatory Commission License No. SMB-743.

3.3 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-001, "Radiation Protection Program Plan".

3.4 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-011, "Radiation Protection Records".

3.5 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-016, "External Radiation Exposure Control".

3.6 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-020, "Internal Radiation Exposure Control".

4 DEFINITIONS

4.1 Approval - An act of endorsing or adding positive authorization or both.

4.2 Contamination - The deposition of unwanted radioactive material on the surfaces of structures, areas, objects, or personnel. During personnel monitoring, contamination is normally identified with a survey meter when a count rate exceeds 100 counts per minute (cpm) above background with a beta/gamma survey meter or 3 cpm above background with an alpha survey meter.

4.3 Contamination Zone - Specific locations within Restricted Areas which have limited access due to the presence of loose contamination in excess of Surface Radioactivity Guides (Attachment 1).

4.4 Controlled Area - Any area to which access is controlled in order to protect individuals from exposure to radiation and radioactive materials. (The controlled area at Shieldalloy consists of the entire area within the fence line.)

4.5 Decontamination - The removal of radioactive material from an affected area. Use of soap and water is the normal decontamination method used for skin contamination. Clothing and equipment decontamination methods are more varied.

4.6 Director - Designated senior manager of Shieldalloy Metallurgical Corporation with the authority to commit Shieldalloy resources for radiation protection purposes.

4.7 Dosimeter - The thermoluminescence phosphor(s) used for determining external radiation exposure to beta, gamma, x-rays, and neutrons. The words dosimeter and TLD are used interchangeably throughout this procedure.

4.8 May - The word *may* is used to denote permission.

4.9 Radiation Protection Personnel - Personnel who perform radiation protection functions such as release surveys, personnel dosimeter distribution, radiation protection records maintenance, and quality assurance activities as they pertain to radiation protection. The term radiation protection personnel includes the RSO and the ARSO or qualified contractor. Training and qualifications of radiation protection personnel is contained in ENV-R-017, "Training and Qualifications of Radiation Protection Personnel".

4.10 Radiation Safety Officer (RSO) - An individual who, by virtue of qualifications and experience, has been given the authority to implement the Shieldalloy Radiation Protection Program Plan. The RSO is qualified to use source material for its intended purpose in a manner that protects health and minimizes danger to life or property. The RSO is responsible for recognizing potential radiological hazards, developing a radiation safety program to protect against these hazards, training workers in safe work practices, and supervising day-to-day radiation safety operations.

4.11 Restricted Area - An area within the controlled area to which access is limited for the purpose of protecting individuals against undue risks from exposure to radiation and radioactive materials. Restricted areas at Shieldalloy include D.203(A), D.102, D.111, and other areas so designated by the RSO.

4.12 Shall - The word *shall* is to be understood as a requirement.

4.13 Should - The word *should* is to be understood as a recommendation.

4.14 Unrestricted Areas - Areas that include but are not limited to, laboratory floors, benches, equipment and materials released from potentially contaminated areas for unrestricted use.

5 PROCEDURE

5.1 Contamination Limits

5.1.1 Personnel and equipment are considered contaminated if the surface being surveyed (fixed plus removable contamination) exceeds 100 cpm above background with a beta/gamma survey meter or 3 cpm above background with an alpha survey meter.

5.1.2 At Shieldalloy facilities, loose contamination limits for unrestricted areas is 200 dpm (alpha activity) per 100 cm^2 above background. Loose contamination limits for Contamination

Zones within Restricted Areas is greater than 200 dpm (alpha activity) per 100 cm^2 above background.

5.1.3 At Shieldalloy facilities, fixed contamination limits for unrestricted areas is 1,000 dpm per 100 cm^2 detected by a direct survey. Fixed contamination limits for Contamination Zones within Restricted Areas is greater than 1,000 dpm per 100 cm^2 above background.

5.2 Tagging and Posting

5.2.1 Contaminated areas shall be posted in accordance with ENV-R-009, "Radiological Areas and Posting".

5.2.2 All contaminated items that are not in a posted Contamination Zone shall be tagged. The tag shall contain information on extent and type of contamination. An example is shown in Attachment 2.

5.2.3 In addition to the tagging and posting requirements, contaminated areas shall be identified through association with the colors yellow and magenta.

5.2.4 Contaminated equipment should be bagged or wrapped in materials that are yellow.

5.3 Protection of Equipment

5.3.1 Equipment that is to enter a Contamination Zone shall be protected to the maximum extent possible, by such actions as bagging or taping.

5.3.2 Equipment that cannot be protected from becoming contaminated shall be treated in a manner to facilitate decontamination whenever possible by such actions as painting, strip coating, or polishing.

5.3.3 Any equipment outside of a Contamination Zone that has removable or fixed contamination in excess of the Surface Radioactivity Guides (Attachment 1) shall be tagged, bagged, wrapped, taped, etc. with yellow and magenta materials to minimize the spread of contamination.

5.3.4 Contaminated equipment shall be stored in storage areas designated by the RSO.

5.4 Protection of Areas

5.4.1 The extent of Contamination Zones shall be clearly defined by the RSO and may include, but are not limited to, source material storage areas, certain process areas, or hood areas.

5.4.2 Contamination Zones shall be located within restricted areas.

5.4.3 Temporary contamination zones may be established by the RSO in order to minimize the spread of contamination.

5.4.4 Areas shall be protected to prevent them from becoming contaminated by such actions as the use of floor coverings or other physical barriers.

5.4.5 Areas shall be treated to the maximum extent practicable to ease decontamination by such actions as painting or sealing concrete.

5.5 Protection of Personnel

5.5.1 All unescorted personnel entering a Contamination Zone shall have a thermoluminescent dosimeter (TLD) for monitoring their exposure to ionizing radiation if required by ENV-R-016, "External Radiation Exposure Control". In addition to TLDs, personnel may be required to wear personal protective equipment (PPE) in contaminated areas. PPE may include shoe covers, boots, coveralls, hood, gloves, or faceshields.

5.5.2 PPE shall be specified in a Radiation Work Permit or by the RSO.

5.5.3 Guidelines for donning and removal of PPE (e.g. full set) are contained in Attachment 3.

5.5.4 Whole body frisks upon exiting Contamination Zones may be required by the RSO and/or specified on a Radiation Work Permit.

5.6 Whole Body Frisk Procedure at a Frisker Monitoring Station

NOTE: This section applies to the use of any portable frisker with an alpha or G-M pancake probe. Background fluctuations do occur but generally the background should be between 20-50 counts per minute (cpm) for beta or gamma radiation and 5 cpm for alpha radiation. If the background is outside of these limits, the RSO shall be notified.

5.6.1 Workers shall verify that the instrument is set on the most sensitive scale (x 0.1 or x 1) as appropriate and that the response is in the slow response position.

5.6.2 Before picking up the probe, workers shall place hands within 1/4 to 1/2 inch of the probe and hold for approximately 3 seconds. If the count rate does not exceed 100 cpm above background for beta/gamma radiation or exceed 3 cpm above background for alpha radiation, or an alarm does not sound, workers should pick up the probe to perform the whole body frisk.

NOTE: If hands are contaminated, notify the RSO immediately.

5.6.3 Workers shall hold the probe within 1/4 to 1/2 inch of the body surface being monitored and move the probe over the surface at a rate of approximately 2 inches per second.

5.6.4 Workers shall frisk the head, trunk, seat, arms, legs, and feet. Pay particular attention to pant cuffs and the bottoms of shoes.

5.6.5 If no contamination is found (< 100 cpm above background for beta/gamma or < 3 cpm above background for alpha), workers shall replace the probe in its allotted place and leave the area. If contamination is found (i.e., counts exceed 100 cpm over background for beta/gamma or exceeds 3 cpm over background for alpha), workers shall contact the RSO.

5.6.6 All personnel contamination events shall be reported to the RSO.

5.7 Taking a smear

5.7.1 When taking a smear, the area covered should be as close to 100 cm^2 as possible.

5.7.2 The smear should be held with the thumb and first two fingers and while applying moderate pressure, should be moved in an "S" pattern approximately 16 inches in length, (100 cm^2 ~ 4" x 4" square).

5.7.3 It may be necessary to estimate the surface area of irregular surfaces and areas which are less than 100 cm^2.

5.7.4 Smears may be counted on a frisker for field analysis. When more accurate quantitative analysis is needed, smears shall be sent to a low background laboratory or counting facility.

5.8 Taking a Large Area Wipe

5.8.1 Wipes may be used when a quick qualitative indication of contamination is needed.

5.8.2 For large flat surfaces such as floor areas, a muslin mop may be used. Areas greater than 10 ft^2 require that multiple wipes be used to prevent build up and self absorption on the muslin.

5.8.3 100 cm^2 smears should be taken of the area to provide a more representative contamination levels.

5.9 Ingress/Egress of Contaminated Zones

5.9.1 Contamination Zones shall be demarcated such that ingress/egress are through a designated access point.

5.9.2 Where possible, one-way traffic flow in Contamination Zones should be encouraged.

5.9.3 Ingress/egress points should be located in low contamination areas.

5.9.4 Workers shall remove all PPE except inner gloves and shoe covers in the Contamination Zone before leaving. PPE shall be placed in designated receptacles at the egress point.

5.9.5 Egress points should have a step-off pad or sticky pad between the clean area and the contaminated area. Gloves and shoe covers should be removed at this point prior to entry into the clean area.

5.9.6 Personnel shall frisk themselves and personal items for contamination prior to leaving a Contamination Zone if required by the RSO.

5.9.7 Friskers shall be located as close to egress points as background radiation levels allow. In the event that the background count rate with the pancake G-M detector exceeds 300 cpm, smears shall be taken by radiation protection personnel on the surface of concern and screened in a low-background area (< 300 cpm). If smear counts exceed 100 cpm, the effected areas will be decontaminated as described below.

5.9.8 Items, other than personal items, shall be surveyed for release only by radiation protection personnel when leaving the contaminated area.

5.10 Decontamination of Personnel

5.10.1 Decontamination procedures should involve removing the contamination with the least possible insult to the individual. Decontamination procedures (arranged in a progressive order) may include:

A. Wash contaminated area with hand soap and water

B. Wash contaminated area with laundry detergent and water

C. Wrap contaminated area with plastic to cause sweating

D. Other measures taken only under the direction of the Project RSO.

5.10.2 Decontamination procedures shall never result in reddening or abrasion of the skin.

5.10.3 Decontamination procedures shall never involve cutting or shaving of hair unless specifically authorized by the Project RSO.

5.10.4 Decontamination of the eyes shall be restricted to flushing with water and shall only be done under medical supervision.

5.10.5 Decontamination of the nasal passages shall be restricted to nose blowing and nasal swabs.

5.10.6 Decontamination procedures may be conducted in the field using decontamination kits, in showers at a changehouse, or at other facilities with a monitored release point.

5.10.7 Decontamination shall only be conducted under the supervision of the RSO.

5.11 Documentation and Reporting of a Personnel Skin Contamination

5.11.1 The RSO shall document all personnel skin contaminations.

5.11.2 The Director shall be notified prior to permitting any individual to leave the restricted area with contaminated skin.

5.12 Surveillance

5.12.1 A surveillance program shall be initiated by the RSO and performed by radiation protection personnel.

5.12.2 The surveillance program shall include the restricted and unrestricted areas shown in Attachment 4.

5.12.3 Loose contamination shall be measured with dry disc smears wiped over a suspect surface area of at least 100 cm^2 and counted in an appropriate counting device.

5.12.4 Fixed contamination shall be measured by direct surveys with portable radiation survey instruments sensitive to the applicable radiation types.

5.12.5 The frequency of surveillance shall be as shown in Attachment 4.

5.12.6 Results shall be reported on a Contamination Survey Report (Attachment 5).

6 DOCUMENTATION

6.1 Contamination Survey Reports (See Attachment 5) shall be maintained by the RSO.

6.2 All records pertinent to this procedure shall be maintained pursuant to ENV-R-011.

7 ATTACHMENTS

7.1 Attachment 1: Surface Radioactivity Guides

7.2 Attachment 2: Sample Contamination Tag

7.3 Attachment 3: Guidelines for Donning and Removing Personal Protective Equipment

7.4 Attachment 4: Contamination Surveillance Program

7.5 Attachment 5: Contamination Survey Report

ATTACHMENT 1
SURFACE RADIOACTIVITY GUIDES

NUCLIDE[1]	REMOVABLE[2,4]	TOTAL[2,3] (FIXED PLUS REMOVABLE)
U-nat, U-235, U-238 and associated decay products	1,000 dpm α/100 cm^2	5,000 dpm α/100 cm^2
Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133	200 dpm/100 cm^2	1,000 dpm/100 cm^2

[1] Where surface contamination by both α and β-gamma-emitting radionuclides exists, the limits established for α and β-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 m^2, provided the maximum surface activity in any area of 100 cm^2 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 $1/n \, \Sigma_n \, S_i \geq G$, where S_i is the dis/min-100 cm^2 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 cm^2 area exceeds 3G.

[4] The amount of removable radioactive material per 100 cm^2 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 cm^2 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 α 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.

ATTACHMENT 2

SAMPLE CONTAMINATION TAG

ATTACHMENT 3

GUIDELINES FOR DONNING AND REMOVING PERSONAL PROTECTIVE EQUIPMENT

1. Donning of Protective Clothing

   A. Review Radiation Worker Permit (RWP) and/or Safety Work Release for proper personal protective equipment to be used for the current job.

   B. Inspect all protective clothing for rips, tears, holes, etc. If a defect is found, dispose of the item.

   C. To don protective clothing:
      1) don plastic shoe covers over work shoes
      2) don coveralls
      3) don rubber overshoes
      4) place dosimetry in coveralls
      5) tape joints and seams
      6) don surgeon cap and hood
      7) don cotton liners
      8) don neoprene (surgeon's) gloves
      9) don rubber gloves
      10) tape outer gloves to sleeves

2. Doffing of Protective Clothing
   A. Remove hood
   B. Remove overshoes
   C. Remove all tape
   D. Remove rubber gloves
   E. Remove dosimeter
   F. Remove surgeon cap
   G. Remove coveralls
   H. Remove plastic booties
   I. Remove inner gloves

3. Self-Monitoring
   A. Proceed to nearest frisker.
   B. Follow frisking procedure stated in ENV-R-013, "Contamination Control".

ATTACHMENT 4

CONTAMINATION SURVEILLANCE PROGRAM

Area	Department/Building	Location	Frequency
Restricted	D111	Control Room	Monthly
Restricted	D111	Break Room	Monthly
Restricted	D111	Entrance(s)	Monthly
Restricted	D102	Entrance(s)	Monthly
Restricted	D102	Break Room	Monthly
Restricted	Raw Material Storage Facilities	Entrance(s)	Monthly
Unrestricted	203	Radiation Safety Office	Quarterly
Unrestricted	D117	Workbench(s)	Quarterly

ATTACHMENT 5

CONTAMINATION SURVEY REPORT

	STOP WORK AUTHORITY	Procedure: ENV-R-014
		Page: 1 of 6
		Revision No. 000
		Date: 03/11/94
		Approved by (Director):
		Approved by (RSO):
		Approved by (QAO):
		Approved by (RSC Chair):

TABLE OF CONTENTS

CONTROLLED COPY NO. : _____

1 PURPOSE

1.1 This procedure describes situations that may require a Stop-Work order to be initiated and assigns responsibilities associated with the Stop-Work order.

1.2 Responsibilities:

1.2.1 The Director shall:

1.2.1.1 Review and approve the requirements of this procedure.

1.2.1.2 Supply adequate resources to ensure compliance with this procedure.

1.2.1.3 Review working conditions and authorize approval prior to lifting a Stop-Work order.

1.2.2 The Radiation Safety Officer (RSO) shall:

1.2.2.1 Train radiation protection personnel in the proper use of their stop-work authority.

1.2.2.2 Shut-down or prevent job from starting if the job may violate regulatory or Shieldalloy requirements for radiological protection.

1.2.2.3 Specify actions necessary to continue work and lift the Stop-Work order.

1.2.2.4 Maintain corrective actions on file upon completion.

1.2.2.5 Assure that safe work conditions are in place before lifting the Stop-Work order.

1.2.2.6 Assure that the requirements of this procedure are met.

1.2.3 The Quality Assurance Officer (QAO) shall:

1.2.3.1 Review and approve this procedure.

1.2.3.2 Verify compliance with this procedure during planned and periodic audits of the Radiation Protection Program.

1.2.4 Shieldalloy personnel shall:

1.2.4.1 Notify the RSO of any known or suspected unsafe work conditions.

1.2.4.2 Comply with the requirements of this procedure, as applicable.

1.2.4.3 Periodically review the contents of this procedure, as applicable.

2 SCOPE

2.1 This procedure applies to work situations that do or may violate regulatory or Shieldalloy requirements for radiological protection. It pertains to all Shieldalloy personnel and contractors.

3 REFERENCES

3.1 Institute of Nuclear Power Operations, "Guidelines for Radiological Protection at Nuclear Power Stations", Preliminary Draft, INPO-85-004, February, 1985.

3.2 International Commission on Radiological Protection, Internal Dosimetry, "Dose Limitation Methodology", Chapter 9, ICRP 2.

3.3 U. S. Nuclear Regulatory Commission, Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation".

3.4 Shieldalloy Metallurgical Corporation, Standard Operating Procedure for Radiation Safety No. ENV-R-017, "Training and Qualifications of Radiation Protection Personnel"

3.5 Shieldalloy Metallurgical Corporation, Standard Operating Procedure for Radiation Safety No. ENV-R-011, "Radiation Protection Records"

4 DEFINITIONS

4.1 Annual Limit on Intake - The derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year by Reference Man that would result in a committed effective dose equivalent of 5,000 millirems or a committed dose equivalent of 50,000 rems to any individual organ or tissue. ALI values are given in Table 1, Columns 1 and 2 of Appendix B, 10 CFR 20.1001-2401.

4.2 Approval - An act of endorsing or adding positive authorization or both.

4.3 Derived Air Concentration (DAC) - The concentration of a given radionuclide in air which, if breathed by Reference Man for a working year of 2,000 hours under conditions of light work (inhalation rate of 1.2 m^3 per hour) results in an intake of one Annual Limit on Intake (ALI). DAC values are given in Table 1, Column 3 of Appendix B, 10 CFR 20.1001-2401.

4.4 Director - Designated senior manager of Shieldalloy Metallurgical Corporation with the authority to commit Shieldalloy resources for radiation protection purposes.

4.5 Extremities - Hand, elbow, arm below the elbow, foot, knee, and leg below the knee.

4.6 May - The word *may* is used to denote permission.

4.7 Radiation Protection Personnel - Personnel who perform radiation protection functions such as release surveys, personnel dosimeter distribution, radiation protection records maintenance, and quality assurance activities as they pertain to radiation protection. The term radiation protection personnel includes the RSO and the ARSO or qualified contractor. Training and qualifications of radiation protection personnel is contained in ENV-R-017, "Training and Qualifications of Radiation Protection Personnel".

4.8 Radiation Safety Officer (RSO) - An individual who, by virtue of qualifications and experience, has been given the authority to implement the Shieldalloy Radiation Protection Program Plan. The RSO is qualified to use source material for its intended purpose in a manner that protects health and minimizes danger to life or property. The RSO is responsible for recognizing potential radiological hazards, developing a radiation safety program to protect against these hazards, training workers in safe work practices, and supervising day-to-day radiation safety operations.

4.9 Radiological Protection Hold Points - Checklist or procedures generated following a Stop-Work order that must be addressed before work can resume or continue past the holding point.

4.10 Rem - Special unit of any of the quantities expressed as dose equivalent. Absorbed dose in rad multiplied by the quality factor is the dose equivalent in rem.

4.11 Shall - The word *shall* is to be understood as a requirement.

4.12 Should - The word *should* is to be understood as a recommendation.

4.13 Whole-body - The head, lens of the eye, trunk, gonads, arms above the elbow, and legs above the knees. The remaining parts of the body are considered to be individual extremities.

5 PROCEDURE

5.1 Notifications

5.1.1 Shieldalloy personnel and contractors shall notify the RSO of any known or suspected unsafe working conditions that may violate regulatory requirements or Shieldalloy radiological procedural requirements.

5.1.2 The RSO shall assesses the situation and has the responsibility and authority for issuing a Stop-Work order if unsafe working conditions are evident.

5.1.3 If a Stop-Work order is issued, work shall be suspended and the RSO shall immediately notify the Director.

5.2 Issuance of a Stop-Work Order

5.2.1 All radiation protection personnel have the responsibility and authority to initiate a Stop-Work order if they have been trained in this action pursuant to ENV-R-017, "Training and Qualifications of Radiation Protection Personnel".

5.2.2 The following example situations may require a Stop-Work order to be initiated.[1]

5.2.2.1 Shieldalloy personnel or contractors could be exposed to a whole-body dose rate greater than 3 rem per hour, a skin dose rate greater than 7 rad per hour, or an extremity dose rate greater than 18 rad per hour.

5.2.2.2 Shieldalloy personnel or contractors could be exposed to airborne radioactivity greater than 0.25 DAC without engineered controls or protective equipment.

5.2.2.3 Shieldalloy personnel or contractors could enter an area known or suspected to contain the following:

5.2.2.3.1 Airborne radioactivity greater than 1 DAC; or

5.2.2.3.2 Removable surface contamination greater than 50,000 disintegrations per minute (dpm)/100 cm^2.

5.2.2.4 Shieldalloy personnel or contractors could receive greater than 1 rem whole-body, 2 rem skin, or 6 rem extremity while performing the task.

5.2.3 Specific work activities shall be permitted to proceed to a safe condition after issuance of the Stop-Work order.

5.2.4 Radiation protection personnel shall supervise specific work activities as they proceed to a safe shut down.

5.3 Radiological Protection Hold Points

---

[1] This list is <u>not</u> all inclusive.

5.3.1 Radiological protection hold points shall specify the actions necessary to remove the Stop-Work order and for work to proceed past the specific hold point.

5.3.2 The RSO shall signify the completion of the actions by signing or initialing the procedure.

5.3.3 Completed radiological protection hold points shall be maintained by the RSO.

5.4 Removal of a Stop-Work Order

5.4.1 Stop-Work orders shall be lifted by the RSO after initiating conditions have been alleviated.

5.4.2 The RSO shall monitor operations after removing the Stop-Work order to ensure safe conditions are present.

6 DOCUMENTATION

6.1 Radiological protection hold points shall be documented and maintained by the RSO.

6.2 All other records that are pertinent to this procedures shall be maintained as described in ENV-R-011.

7 ATTACHMENTS

None

	CONTROL OF RADIOACTIVE WASTE	Procedure: ENV-R-015
		Page: 1 of 10
		Revision No. 000
		Date: 03/10/94
		Approved by (Director):
		Approved by (RSO):
		Approved by (QAO):
		Approved by (RSC Chair):

TABLE OF CONTENTS

CONTROLLED COPY NO. : _____

1 PURPOSE

1.1 This procedure describes the methods for the control, segregation, analysis, and disposal of radioactive waste materials generated at Shieldalloy Metallurgical Corporation.

1.2 Responsibilities:

1.2.1 The Director shall:

1.2.1.1 Review and approve the requirements of this procedure.

1.2.1.2 Ensure that the radiological status of potentially-contaminated waste materials is determined as described in this procedure.

1.2.1.3 Supply adequate resources to ensure compliance with this procedure.

1.2.2 The Radiation Safety Officer (RSO) shall:

1.2.2.1 Train radiation protection personnel on the requirements of this procedure, as applicable.

1.2.2.2 Identify waste collection points and supervise the storage of radioactive wastes at these locations.

1.2.2.3 Make final waste disposal arrangements with vendors if necessary.

1.2.2.4 Maintain an inventory of disposed materials.

1.2.2.5 Maintain waste screening and survey records in the radiation safety files.

1.2.2.6 Assure that the requirements of this procedure are met.

1.2.3 The Quality Assurance Officer (QAO) shall:

1.2.3.1 Review and approve this procedure.

1.2.3.2 Verify compliance with this procedure during planned and periodic audits of the Radiation Protection Program.

1.2.4 Contaminated Waste Generators shall be responsible for:

1.2.4.1 Wearing minimum protective clothing when packaging contaminated or potentially-contaminated waste.

1.2.4.2 Ensuring that only clear, thick-wall (6 mil) plastic bags are used for collection of contaminated or potentially-contaminated waste (normally these are 55-gallon drum liners).

1.2.4.3 Sealing and transporting contaminated or potentially-contaminated waste bags to collection points identified by the RSO.

1.2.4.4 Notifying the RSO of any circumstance which could have resulted in an intake of radioactive materials by inhalation, ingestion, or absorption.

1.2.5 Other Shieldalloy personnel shall:

1.2.5.1 Handle waste in a manner that prevents the spread of contamination.

1.2.5.2 Segregate wastes in appropriate containers.

1.2.5.3 Comply with applicable requirements of this procedure.

1.2.5.4 Periodically review the requirements of this procedure, as applicable.

2 SCOPE

2.1 This procedure applies to waste materials that have the potential to be contaminated with licensable quantities of radioactive material. This procedure is applicable to all work performed by Shieldalloy employees, visitors and contractors.

3 REFERENCES

3.1 Nuclear Regulatory Commission, Title 10, Code of Federal Regulations, Part 19, "Notices, Instructions, and Reports to Workers, Inspections."

3.2 Nuclear Regulatory Commission, Title 10, Code of Federal Regulations, Part 240 through 281, "Resource Conservation and Recovery Act."

3.3 Environmental Protection Agency, Title 40, Code of Federal Regulations, Part 240 through 281, "Resource Conservation and Recovery Act".

3.4 Department of Transportation, Title 49, Code of Federal Regulations, Subchapter C, Part 171 through 177, "Hazardous Materials Regulations."

3.5 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-013, "Contamination Control".

3.6 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-012, "Instrumentation and Surveillance".

3.7 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-011, "Radiation Protection Records".

4 DEFINITIONS

4.1 Approval - An act of endorsing or adding positive authorization or both.

4.2 Bag-House Bags - Combustible dry solids which may contain licensable quantities of radioactive materials.

4.3 Bag-House Dusts - Dry solids which may contain licensable quantities of radioactive materials.

4.4 Contaminated Waste - Any waste generated which is contaminated by licensable radioactive materials.

4.5 Controlled Area - Any area to which access is controlled in order to protect individuals from exposure to radiation and radioactive materials. (The controlled area at Shieldalloy consists of the entire area within the fence line.)

4.6 Contaminated Waste Generator - Any person who creates contaminated waste.

4.7 Director - Designated senior manager of Shieldalloy Metallurgical Corporation with the authority to commit Shieldalloy resources for radiation protection purposes.

4.8 Ferrocolumbium Slag - Dry solids known to contain licensable quantities of radioactive materials.

4.9 May - The word *may* is used to denote permission.

4.10 Minimum Protective Clothing - Protective gloves (leather-palm or nitrile-latex) and safety glasses with side shields.

4.11 Pyrochlore Super-sacks - Combustible dry solids used to contain pyrochlore ores which may be contaminated with licensable quantities of radioactive materials.

4.12 Radioactive Dry Combustible Waste - Combustible, dry solids including plastic bags, absorbent paper and protective equipment used to prevent the spread of contamination.

4.13 Radiation Safety Officer (RSO) - An individual who, by virtue of qualifications and experience, has been given the authority to implement the Shieldalloy Radiation Protection Program Plan. The RSO is qualified to use source material for its intended purpose in a manner that protects health and

minimizes danger to life or property. The RSO is responsible for recognizing potential radiological hazards, developing a radiation safety program to protect against these hazards, training workers in safe work practices, and supervising day-to-day radiation safety operations.

4.14 Shall - The word *shall* is to be understood as a requirement.

4.15 Should - The word *should* is to be understood as a recommendation.

4.16 Spent Refractory - Dry solids which may contain licensable quantities of radioactive materials.

5 PROCEDURE

5.1 Control of Waste

5.1.1 Control of radioactive waste materials shall be accomplished by the following:

5.1.1.1 Preventing materials from becoming unnecessarily and/or excessively contaminated;

5.1.1.2 Decontaminating and reusing radioactive materials such as tools and equipment;

5.1.1.3 Identifying, controlling, and promptly repairing leaks from radioactive systems;

5.1.1.4 Using waste volume reduction techniques when practical; and

5.1.1.5 Monitoring materials for radioactivity and removing non-radioactive materials prior to disposal.

5.1.2 Radioactive waste streams generated at Shieldalloy may include dry solid wastes such as bag-house dusts, bag-house bags, pyrochlore super-sacks, ferrocolumbium slag, spent refractor, and radioactive dry combustible waste.

5.2 Collection of Waste

5.2.1 Each radiologically controlled area shall have designated waste disposal areas located adjacent to monitoring areas and other areas as deemed necessary by the RSO.

5.2.2 Waste disposal areas shall be in prominent locations and clearly labeled.

5.2.3 Precautions to prevent mixing of various hazardous substances when organizing the waste disposal area should be instituted.

5.2.4 If a bag tears during transport, notify the RSO for and repackage.

5.2.5 If the RSO does not have first hand or direct knowledge of the source of the waste, a specialized detector will be used to determine the presence of organics and a beta-gamma frisker will be used to determine the presence of radioactive contamination.

5.2.6 Minimum protective clothing is to be worn to minimize skin or eye contact any time waste is handled. First-hand or direct knowledge of the waste can be used to determine the need for additional protective clothing. Monitoring results will be used to determine the need for additional clothing (TYVEK or respirators) when direct knowledge is not available. Additional clothing will be worn if the waste bag contains dry, dusty material.

5.3 Screening and Segregation

5.3.1 Radiological screening/analysis should be performed on all potentially-contaminated waste materials generated at Shieldalloy. The purpose of screening is to determine the radiological status of waste materials for shipping and disposal purposes.

5.3.2 The following steps shall be taken to sample drummed waste:

5.3.2.1 Don lab coat (or coveralls), safety glasses and gloves prior to opening the waste drum.

5.3.2.2 Inspect the drum before sampling. If the drum is leaking, off-gassing, or bulging, do not open the drum. Notify the RSO immediately.

5.3.2.3 Keep the drum sealed until you are ready to sample and reseal promptly after sampling. Open only one drum at a time.

5.3.2.4 Label an appropriate sample container with the drum identification, known hazards, sample date, and sampler's initials.

5.3.2.5 Slowly loosen the bung and listen for pressure venting. Allow the drum pressure to come to equilibrium before proceeding.

5.3.2.6 Open the drum and slowly insert a sample collection device the full length of the drum.

5.3.2.7 Slowly withdraw the sampling device and empty contents into a tray or pan for compositing.

5.3.2.8 Obtain 1 to 3 more samples of the material.

5.3.2.9 Mix the samples in the tray or pan by stirring with a spatula or spoon.

5.3.2.10 Place a representative of this sample into the appropriately labeled container.

5.3.2.11 Clean the sampling equipment by rinsing with water and drying.

5.3.2.12 Complete the top two sections of the Waste Screening Form (Attachment 1).

5.3.2.13 Sign and date the "HOLD" tag and affix it to the drum (Attachment 2).

5.3.3 For liquid waste materials, samples shall be placed on a planchet, dried under a heat lamp or on a hot plate, brought to constant weight at room temperature, and counted for gross alpha and gross beta activity as described in ENV-R-012, "Instrumentation and Surveillance".

5.3.4 For solid homogenous waste materials, samples shall be placed on a planchet and counted for gross alpha and gross beta activity as described in ENV-R-012, "Instrumentation and Surveillance".

5.3.5 For nonhomogeneous solid waste materials (e.g., protective clothing, containers, lab trash, paper, etc.), the materials shall be frisked with portable survey instruments that are sensitive to alpha, beta and gamma radiation as described in ENV-R-012, "Instrumentation and Surveillance".

5.3.6 Waste materials that exceed the release criteria of ENV-R-013 shall be stored and disposed of as radioactive waste, or decontaminated to levels below the release criteria.

5.3.7 Potentially-contaminated items or equipment (i.e., coolers, analytical instruments, drums, etc.) designated for disposal shall be direct surveyed for fixed contamination and smear surveyed for removable contamination as described in ENV-R-013, "Contamination Control".

5.4 Waste Disposal

5.4.1 In general, radioactive waste generated by Shieldalloy shall be stored on site, however alternative means of disposal, such as the following, may be implemented:

5.4.1.1 Transfer to a waste disposal service which is licensed to receive such waste in accordance with 10 CFR 20.2001;

5.4.1.2 Transfer to the original supplier which is properly licensed to receive radioactive materials;

5.4.1.3 Other means specifically approved in advance by the USNRC pursuant to 10 CFR 20.2002.

5.4.2 If required, the RSO shall dispose of radioactive waste materials by:

5.4.2.1 Contracting an independent licensed vendor to seal, survey, pick up and transport filled drums to a final disposal facility, or

5.4.2.2 By arranging transfer and disposal of sealed, surveyed, and manifested drums to a disposal facility, either on-site or off-site.

5.4.2.3 The RSO, in conjunction with the disposal vendor, shall confirm that each container is sealed, and surveyed for radioactive contamination before the containers leave the waste area.

5.4.2.4 The RSO shall provide the disposal vendor with the inventory of radioactive materials contained in the waste drums.

5.4.3 The RSO shall determine when the capacity of the radioactive waste collection area dictates a radioactive waste shipment to a commercial disposal facility or waste broker.

6 *DOCUMENTATION*

All records generated in implementing this procedure shall be maintained as described in ENV-R-011, "Radiation Protection Records".

7 *ATTACHMENTS*

7.1 Attachment 1: Waste Screening Form

7.2 Attachment 2: "Hold" Tag for Waste Materials

ATTACHMENT 1

WASTE SCREENING FORM

Waste Drum Number:	Waste Sample Identification Number:
Date/Time Collected:	Sample Collected By:
Sample Matrix: Liquid Solid Sludge	Sample Appearance:

KNOWN OR POTENTIAL HAZARDS	
FLAMMABLE	CORROSIVE
TOXIC	RADIOACTIVE
Other:	

SAMPLE PREPARATION	
Aliquot vol. (liquids) or mass (solids) in ml/g:	Dry weight (solids/sludge) in grams:
Planchet tare weight in grams:	Planchet final weight in grams:
Sample weight (final-tare) in grams:	Prepared By/Date:

SAMPLE COUNTING		
ANALYSIS	GROSS ALPHA	GROSS BETA
Count Date		
Instrument		
Efficiency		
Total Counts/Count Time		
Background Counts/Count Time		
Self-absorption Factor		
Assay Results		
Counted By/Date		

ATTACHMENT 2
"HOLD" TAG FOR WASTE MATERIALS

HOLD

Awaiting Radiological Analysis

Drum #: _____

Sampled by: _____

Date: _____

	EXTERNAL RADIATION EXPOSURE CONTROL	Procedure: ENV-R-016
		Page: 1 of 18
		Revision No. 000
		Date: 03/11/94
		Approved by (Director):
		Approved by (RSO):
		Approved by (QAO):
		Approved by (RSC Chair):

TABLE OF CONTENTS

CONTROLLED COPY NO. : _____

1 PURPOSE

1.1 This procedure describes the external radiation exposure control and monitoring system for Shieldalloy employees, visitors and contractors. The purpose of the program is to ensure that external radiation exposures are minimized by establishing dose limits, administrative dose control points, and monitoring criteria.

1.2 Responsibilities:

1.2.1 The Director shall:

1.2.1.1 Provide administrative review and control of personnel external radiation exposure levels.

1.2.1.2 Establish administrative dose limits and administrative dose control levels.

1.2.1.3 Approve all planned exposures in excess of regulatory or administrative limits, and for planned exposures as a result of emergency or recovery operations.

1.2.1.4 In conjunction with the RSO, assign personnel to the appropriate monitoring program.

1.2.2 The Radiation Safety Officer (RSO) shall:

1.2.2.1 Assign personnel to the appropriate external radiation monitoring program (e.g., monthly or quarterly TLD exchange frequency, beta/gamma or beta/gamma/neutron dosimeter usage).

1.2.2.2 Secure accredited National Voluntary Laboratory Accreditation Program (NVLAP) or personnel dosimetry services from a pre-qualified vendor.

1.2.2.3 Review the results of personnel dosimeter processing and take appropriate corrective actions when necessary (e.g., work restriction) to assure that external dose limits are not exceeded, and that radiation exposures are maintained as low as reasonably achievable.

1.2.2.4 Estimate doses to individuals when dosimeters have been lost or damaged.

1.2.2.5 Provide reports to Shieldalloy employees and contractors on their radiation exposure history upon request.

1.2.2.6 Approve all planned exposures in excess of administrative limits.

1.2.2.7 Assign area dosimeters for purposes of characterizing the ambient radiological environment.

1.2.2.8 Review results of the area dosimeters.

1.2.2.9 The Radiation Safety Committee (RSC) shall review unusual exposure incidents pursuant to ENV-R-010, "Emergency Response and Notifications".

1.2.3 The Quality Assurance Officer (QAO) shall:

1.2.3.1 Periodically review employee exposure history files to ensure they are complete and in compliance with this procedure.

1.2.3.2 Through planned and periodic audits, verify that the requirements of this procedure are met.

1.2.4 Shieldalloy personnel shall:

1.2.4.1 Provide past exposure history for the employee exposure history files if designated a participant in the monitoring program.

1.2.4.2 Wear the appropriate monitoring device as directed by the RSO.

1.2.4.3 Comply with the requirements of this procedure.

1.2.4.4 Periodically review this procedure, if applicable.

2 *SCOPE*

2.1 This procedure pertains to all work activities in the vicinity of radiation sources or radiation-producing machines. It applies to all Shieldalloy employees, visitors and contractors performing work in radiologically-controlled areas.

3 *REFERENCES*

3.1 Title 10, Code of Federal Regulations, Part 19, "Notices, Instructions and Reports to Workers; Inspections".

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

3.3 Institute of Nuclear Power Operations, Report No. INPO 88-010, "Guidelines for Radiological Protection at Nuclear Power Stations".

3.4 National Bureau of Standards, "NVLAP Dosimetry LAP Handbook - Operational and Technical Requirements of the Laboratory Accreditation Program for Personnel Dosimetry Processors", NBS 85-3170, May, 1985.

3.5 American National Standards Institute, ANSI N322-1975, "Inspection and Test Specifications for Direct and Indirect Reading Quartz Fiber Pocket Dosimeters".

3.6 American National Standards Institute, "Personnel Dosimetry Performance - Criteria for Testing", ANSI N13.11, 1983.

3.7 American National Standards Institute, "Radiation Protection Instrumentation Test and Calibration", ANSI N323, 1978.

3.8 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-011, "Radiation Protection Records".

3.9 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-010, "Emergency Response and Notifications"

3.10 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-012, "Instrumentation and Surveillance"

4 DEFINITIONS

4.1 ALARA - Acronym for "As Low As Reasonably Achievable", a basic concept of radiation protection that specifies that radiation exposures should be maintained as low as is reasonably achievable taking into account technological, economical, and societal considerations.

4.2 Approval - An act of endorsing or adding positive authorization or both.

4.3 Director - Designated senior manager of Shieldalloy Metallurgical Corporation with the authority to commit Shieldalloy resources for radiation protection purposes.

4.4 Dosimeter - The thermoluminescence phosphor(s) used for determining external radiation exposure to beta, gamma, x-rays, and neutrons. The words dosimeter and TLD are used interchangeably throughout this procedure.

4.5 Employee(s) - The word employee(s) is to be understood to be Shieldalloy employees, visitors or contractors.

4.6 Extremity - Hand, elbow, arm below the elbow, foot, knee, and leg below the knee.

4.7 High Radiation Area - Any area where an individual may receive an effective dose equivalent from external sources of 100 mrem or greater but less than five rem in one hour at a distance of 30 cm from the radiation source or from any surface through which the radiation penetrates.

4.8 May - The word may is used to denote permission.

4.9 Monitored Employee or Personnel - An individual who performs work within a radiologically controlled area and has the potential to receive greater than 100 millirem total effective dose equivalent in one calendar year.

4.10 Pocket Ionization Chamber (PIC) - A self-indicating, dose integrating device which is considered to be a "secondary" dosimetry device. A PIC shall not be worn without a primary dosimetry device (TLD).

4.11 Radiation Area - An area, accessible to personnel, where radiation levels exist such that a major portion of the body may receive an effective dose equivalent from external sources of greater than five mrem but less than 100 mrem in one hour at a distance of 30 cm from the radiation source or from any surface through which the radiation penetrates.

4.12 Radiation Protection Personnel - Personnel who perform radiation protection functions such as release surveys, personnel dosimeter distribution, radiation protection records maintenance, and quality assurance activities as they pertain to radiation protection. Training and qualifications or radiation protection personnel is contained in ENV-R-017. The term radiation protection personnel includes the RSO and the Assistant RSO.

4.13 Radiation Safety Officer (RSO) - An individual who, by virtue of qualifications and experience, has been given the authority to implement the Shieldalloy Radiation Protection Program Plan. The RSO is qualified to use source material for its intended purpose in a manner that protects health and minimizes danger to life or property. The RSO is responsible for recognizing potential radiological hazards, developing a radiation safety program to protect against these hazards, training workers in safe work practices, and supervising day-to-day radiation safety operations.

4.14 Shall - The word shall is to be understood as a requirement.

4.15 Should - The word should is to be understood as a recommendation.

4.16 Thermoluminescent Dosimeter (TLD) - The thermoluminescence phosphor(s) used for determining external radiation exposure to beta, gamma, x-rays, and neutrons. The words TLD and dosimeter are used interchangeably throughout this procedure.

4.4 Whole Body - The head, lens of the eye, trunk, gonads, arms above the elbow, and legs above the knees. The remaining parts of the body are considered to be individual extremities.

5 PROCEDURE

5.1 External Dose Control

5.1.1 The Director, the RSO, and other radiation protection personnel, shall be responsible fo identifying and controlling external exposures from sources of radiation.

5.1.2 Work involving radioactive materials shall be planned and performed in order to minimiz the external radiation exposures received.

5.1.3 The Director shall establish administrative dose limits and administrative dose control level for Shieldalloy personnel, contractors and visitors.

5.1.4 The RSO shall monitor personnel for external radiation exposure and track the exposure received.

5.1.5 Area dosimeters shall be deployed for purposes of characterizing the ambient radiologic environment.

5.2 Administrative Dose Limits

5.2.1 Individual doses for monitored personnel shall not exceed 500 millirem per calendar yea excluding medical radiation exposures.

5.2.2 Approval by the Director is required for any employee to exceed this limit.

5.2.3 The Director or the RSO shall inform the appropriate regulatory agency of any instance which an individual receives more than 500 millirem in a calendar year.

5.2.4 Individual doses for non-monitored personnel shall not exceed 100 millirem per calend year, excluding medical radiation exposures.

5.2.5 Total radiation dose to the unborn child shall not exceed 500 millirem.

A. Female employees, visitors, and contractors shall inform the RSO and the Hum Resources Director of a pregnancy.

B. All employees (e.g., male and female) who may perform work in a facility using radiation sources or radiation-producing machines shall be instructed in the effects of radiation exposure on the unborn child.

C. Employees may request a transfer to a different job assignment during pregnancy pursuant to Shieldalloy Employee Guidelines.

5.3 Dose Limits for Emergency Conditions

5.3.1 The Director may authorize planned personnel exposures to emergency workers in excess of administrative and regulatory limits, should this extremely unlikely situation become necessary.

5.3.2 Exposures shall be limited to volunteers who have given informed consent.

5.3.3 The one-time personnel exposure guideline limit to save a life shall not exceed 100 rad to the whole body.

5.3.4 The one-time personnel exposure limit to save vital equipment/facilities or to terminate/mitigate a serious accident shall not exceed 25 rad to the whole body.

5.3.5 Doses in excess of these guideline limits shall not be permitted for any planned emergency activities.

5.4 Administrative Dose Control for Monitored Personnel

5.4.1 Each individual is responsible for controlling their exposure to radiation hazards such that their annual dose remains below the administrative limits.

5.4.2 The RSO shall ensure that personnel do not receive occupational radiation exposure in excess of the administrative limit unless the following are instituted:

A. Approval by the Director is obtained; and

B. Stay-times are determined and used to limit the amount of time that the person is permitted to remain in a radiation area so that no more than one-half (50%) of his remaining administrative dose limit shall be incurred on an entry.

5.4.3 The RSO shall verify that the need exists for an individual to exceed an administrative dose limit. Justification may include:

A. Other qualified individuals with lower accumulated exposures are not available.

B. The unique ability or experience of the individual will minimize collective exposure.

5.4.4 The RSO shall investigate instances in which administrative dose limits are exceeded without authorization pursuant to ENV-R-010, "Emergency Response and Notifications".

5.5 Monitoring Requirements

5.5.1 The RSO shall provide monitored personnel with a primary dosimetry device capable of measuring the individual's whole body exposure.

5.5.2 All individuals permitted unescorted access to radiologically-controlled areas at Shieldalloy and with the potential to receive greater than 10% of the limits specified in 10 CFR 20.1201 shall be assigned a personnel dosimeter to wear while on site.

5.5.3 Operators of x-ray-producing machines at the Newfield, New Jersey site shall wear extremity dosimeters while operating these machines.

5.5.4 Other Shieldalloy employees or contractors may be issued a primary dosimetry device at the discretion of the RSO.

5.6 Previous Exposure History

5.6.1 Monitored personnel shall complete a Nuclear Regulatory Commission Form-4, "Occupational External Radiation Exposure History" (See Attachment 1).

5.6.2 The RSO shall obtain previous exposure histories from an individual's former employer(s) whenever possible. Requests for exposure histories shall be initiated by completing a "Request for Occupational Exposure History" form (See Attachment 2).

5.6.3 No employee, visitor or contractor shall be permitted to exceed 100 millirem of whole body occupational exposure without a known or estimated exposure history on file.

5.7 Secondary Dosimetry Devices

5.7.1 Radiation protection personnel shall provide each individual who may enter a "radiation area" or "high radiation area" as part of their work a self-indicating, dose integrating device such as a Pocket Ionization Chamber (PIC), which is considered to be a "secondary" dosimetry device.

5.7.2 The individual shall place the primary dosimetry device and the PIC within a hand's width of each other on the part of the whole body that is expected to receive the highest exposure.

5.7.3 The individual should read their PICs periodically when in radiation areas and frequently in high radiation areas to ensure doses received are consistent with expectations.

5.7.4 The RSO shall identify individuals whose PIC totals indicate they are at or near administrative dose levels, process their primary dosimetry device, and exclude them from further exposure until primary dosimeter results are available and evaluated.

5.7.5 Individuals shall not wear a PIC without a primary dosimetry device.

5.8 Placement of Monitoring Devices

5.8.1 Monitored personnel shall place the primary dosimetry device on the part of the whole body that is likely to receive the highest exposure.

5.8.2 If the highest exposure location on the whole body is not known, monitored personnel may wear additional primary dosimetry devices on those parts of the whole body that might receive the highest exposure.

5.8.3 Monitored personnel shall place extremity dosimetry such that they are as close as possible to the radiation source during work operations without restricting the use of the extremity.

5.9 Monitoring for Neutron Exposures

5.9.1 Each individual who handles a neutron source, enters a neutron radiation area, or is expected to receive greater than 30 millirem of neutron dose equivalent in a calendar year shall be monitored for neutron radiation exposure.

A. If less than 100 millirem of neutron dose equivalent is expected in a calendar year, then neutron exposures may be estimated from a calculated neutron dose equivalent based upon stay-time and known neutron dose rate, or from known neutron-to-gamma dose ratios.

B. If more than 100 millirem of neutron dose equivalent is expected in a calendar year, an appropriate neutron dosimeter shall be issued and worn.

5.10 Monitoring for Extremity Exposures

5.10.1 For work situations in which extremity exposures are expected to be significantly greater than whole body exposures, or if extremity exposures are expected to exceed 1000 millirem per calendar quarter, or if specified by license requirements, the RSO shall specify additional dosimetry devices to be placed on the extremities to measure and control extremity dose.

5.10.2 Each extremity shall be provided with a dosimetry device if the extremity is to be placed into a radiation field (including both penetrating and non-penetrating radiation) in which the extremity could receive 1000 millirem or more than twice the expected whole body dose.

5.11 Monitoring for Skin Exposure

5.11.1 Due to the complexity of assessing skin dose, the RSO shall control skin dose rates by shielding and decontamination.

5.11.2 The non-penetrating radiation energies and dose rates encountered in the work place should be determined to ensure that sufficient protective clothing is used to prevent skin doses.

5.11.3 Dose to the skin of the extremities shall be considered extremity dose rather than dose to the skin of the whole body.

5.11.4 The RSO shall calculate the skin dose if a worker may have received greater than 100 millirad from skin contamination or if detectable skin contamination cannot be removed by decontamination.

5.12 Ambient Radiation Monitoring

5.12.1 Area dosimeters may be deployed, at the discretion of the RSO, for purposes of characterizing ambient radiological hazards.

5.12.2 Area dosimeters shall be exchanged on a planned and periodic basis, and results shall be reviewed by the RSO.

5.12.3 At the discretion of the RSO, the results of the area dosimetry program may be used for assignment of external dose equivalent in place of, or in addition to personnel dosimeters.

5.13 Equipment and Facilities Specifications

5.13.1 Primary dosimetry services for routine use and for area monitoring, including dosimeters and processing equipment, shall be accredited by the National Voluntary Laboratory Accreditation Program (NVLAP) in all radiation categories except neutron.

5.13.2 Supplementary neutron dosimeters, if issued, shall be accredited by NVLAP in the neutron categories.

5.13.3 The RSO shall ensure that dosimeter issuance, retrieval, handling, storage, and processing practices; personnel training and qualifications; quality assurance; documentation; calibration; and record keeping practices meet the minimum conditions for accreditation by NVLAP, and the requirements of ANSI N13.11, "Criteria for Testing Personnel Dosimetry Performance".

5.14 Calibration of Dosimetry Devices

5.14.1 The RSO shall ensure that primary dosimetry devices are calibrated by the vendor to measure dose equivalent directly or indirectly through calibration factors.

5.14.2 The RSO shall ensure that primary dosimetry processing systems are calibrated at least quarterly using NIST-traceable standards.

5.14.3 Beta and neutron sensitive dosimeters shall be calibrated using sources that represent the energies of the radiations encountered at Shieldalloy.

5.14.4 Radiation protection personnel shall use radiation survey results to assign or control worker exposures in accordance with ENV-R-005, "Control of Work".

5.14.5 The RSO shall ensure that secondary dosimetry devices (e.g., PICs) are calibrated at least annually or any time results indicate that a device is potentially defective. ANSI N322 guidance should be used in performing these checks.

5.15 Quality Control

5.15.1 The RSO shall perform quality control checks periodically to ensure proper operation of the vendor-supplied personnel and area dosimetry processing system.

5.15.2 These checks should include the following:

A. Vendor processing of dosimeters irradiated to a known quantity of gamma radiation during each processing run or batch to detect reader malfunction or excessive system

bias. (These dosimeters should also include non-penetrating and neutron radiation if the primary dosimeters are used to monitor for these types of radiation.)

B. At least quarterly, a set of blind standards, or spiked dosimeters, should be processed.

1. The vendor should not be aware of the spiked dosimeters or the doses to which they have been irradiated.

2. The RSO should review the results of these spiked dosimeters and analyze the results to estimate the relative bias and precision errors.

3. If the performance index exceeds 20%, the cause shall be investigated.

4. If the performance index exceeds 50%, the quality of the dosimeters should be assessed prior to assigning individual dosimeter results.

5.16 Deployment, Storage, and Retrieval of Primary and Area Dosimeters

5.16.1 Radiation protection personnel shall retrieve and process primary dosimetry devices issued to employees and area dosimeters at least quarterly.

5.16.2 Radiation protection personnel shall retrieve and process primary dosimetry devices of personnel who enter high radiation areas at least monthly.

5.16.3 Primary dosimetry devices of personnel who enter radiation areas may be processed monthly, at the discretion of the RSO.

5.16.4 If an individual is known or suspected to have reached or exceeded an administrative exposure control level, the RSO shall process the primary dosimetry device prior to the individual being allowed to receive additional external radiation exposure.

5.17 Assessment of External Dose

5.17.1 A dose assessment to determine an accurate estimate of external radiation dose received by monitored individuals, should include the following:

A. Reading of the individual's undamaged dosimetry device(s);

B. Testing of damaged or possibly damaged dosimetry devices in order to ensure the device is operational prior to returning it to service or to determine why the device failed;

C. Confirming undamaged dosimetry results or exposure estimates by determining the exposure received by co-workers or workers doing similar work and by calculating an exposure based on the time spent and the dose rates in the work area;

D. Reading the applicable area dosimeter(s) and confirming that the reading is consistent with the individual's primary dosimeter reading.

E. If multiple whole body dosimetry is used, assigning the worker the highest dose measured on the whole body over the monitoring period.

5.17.2 The RSO shall perform an assessment of a worker's dose under the following conditions:

A. If a worker does not wear or does not wear in the correct location a primary dosimetry device,

B. If a worker loses or damages a dosimetry device,

C. If a secondary dosimetry device alarms, indicates an off-scale condition, or is damaged,

D. Any time multiple whole-body dosimeters are worn,

E. If a comparison of primary and secondary devices for the same time period and body location shows a difference of greater than 25% in measured exposure and the exposure of either device exceeds 100 millirem.

5.17.3 Dose assessments shall be reviewed and approved by the RSO and Director prior to entering it into the dose of record unless measured by primary dosimetry device.

5.17.4 The worker should sign the dose assessment to verify that the information provided to the RSO by the worker is accurate and to indicate that the information on the assessment has been explained to the worker.

5.17.5 The results of the dose assessment shall be entered in the individual's radiation dose totals (USNRC Form 5), and a copy of the dose assessment shall be placed in the individual's dosimetry record file (See Attachment 3).

5.18 Trend Analysis of External Dosimetry Results

5.18.1 Trend analysis of personnel dosimetry and dose assessment results shall be performed as part of the ALARA program.

5.18.2 The RSO should analyze the following parameters for trends on a monthly or quarterly basis:

A. Mean individual and collective external radiation exposure for Shieldalloy personnel and contractors;

B. Mean individual and collective external radiation exposure by job classification;

C. Mean individual and collective external radiation exposure by a particular task; and

D. Frequency of personnel external exposure incidents.

5.18.3 Trend analyses shall be submitted to the Radiation Safety Committee for review.

6 DOCUMENTATION

6.1 All Records pertinent to this procedure shall be maintained pursuant to ENV-R-011, "Radiation Protection Records".

6.2 The following Individual Exposure Records shall be maintained:

6.2.1 Name and Social Security number (if available) of the individual.

6.2.2 Radiation exposure received during prior employment (See Attachment 2)

6.2.3 Exposure received by individuals at other work locations during current employment by Shieldalloy (See Attachment 1).

6.2.4 Individually-worn dosimeter measurements.

6.2.5 Radiation dose estimates from special studies.

6.2.6 Records of unusual exposures.

6.3 The following Monitoring Program Records shall be maintained:

6.3.1 Investigation reports for instances in which significant external radiation exposures occur.

6.3.2 Reports that summarize trends in external radiation exposures in workers.

6.3.3 Procedures and records associated with the vendor-supplied personnel dosimetry program, including set-up, testing, calibration, and quality control records.

6.3.4 External dose assessments, including the bases for the dose assessment.

6.3.5 Area dosimeter results.

7 ATTACHMENTS

7.1 Attachment 1 - USNRC Form 4

7.2 Attachment 2 - Request for Occupational Exposure History

7.3 Attachment 3 - USNRC Form 5

ATTACHMENT 1

USNRC FORM 4
OCCUPATIONAL EXTERNAL RADIATION EXPOSURE HISTORY

ATTACHMENT 2

REQUEST FOR DOSIMETRY RECORDS

Date

Name of Former Employer
Address of Former Employer

Re: Request for Occupational Exposure History

Gentlemen:

So that we may compile radiation exposure histories for new employees, we request your cooperation in providing us with the history of exposure to radioactive materials, including both internal and external exposures, for the following individual, who was formerly employed at your facility.

Name:

Social Security No:

Dates of Employment:

Signature Authorizing Release: _____

Your assistance is appreciated. Should you have any questions, please telephone me at (609) 692-4200. Please mail your response to the attention of the Radiation Safety Officer, Shieldalloy Metallurgical Corporation.

Sincerely,

_____
Radiation Safety Officer
Shieldalloy Metallurgical Corporation

ATTACHMENT 3

USNRC FORM 5
CURRENT OCCUPATIONAL EXTERNAL RADIATION EXPOSURE

	TRAINING AND QUALIFICATIONS OF RADIATION PROTECTION PERSONNEL	Procedure: ENV-R-017
		Page: 1 of 10
		Revision No. 000
		Date: 03/11/94
		Approved by (Director):
		Approved by (RSO):
		Approved by (QAO):
		Approved by (RSC Chair):

TABLE OF CONTENTS

CONTROLLED COPY NO. : _____

1 PURPOSE

1.1 This procedure details the knowledge, skills, abilities, and training that are necessary to ensure that radiation protection personnel are able to provide effective services.

1.2 Responsibilities:

1.2.1 The Director shall:

1.2.1.1 Verify qualifications of the Radiation Safety Officer (RSO).

1.2.1.2 Ensure that this procedure is available to all radiation protection personnel.

1.2.2 The Radiation Safety Officer (RSO) shall:

1.2.2.1 Train radiation protection personnel in safe work practices and ensure that they have met training and retraining requirements prior to the start of work.

1.2.2.2 Supervise the day-to-day radiation safety operations of the radiation protection personnel.

1.2.2.3 The Radiation Safety Committee (RSC) shall monitor compliance with this procedure.

1.2.3 The Quality Assurance Officer (QAO) shall:

1.2.3.1 Periodically review employee training records ensuring that Performance Verification Sheets are completed.

1.2.3.2 Through planned and periodic audit, verify that all radiation protection personnel meet the requirements stated herein.

1.2.4 Radiation Protection Personnel

1.2.4.1 Comply with training requirements stated in this procedure.

1.2.4.2 Periodically review procedures.

2 SCOPE

This procedure applies to all Shieldalloy employees, visitors and contractors that provide radiation protection services, including the RSO and the assistant RSO (ARSO).

3 REFERENCES

3.1 ANSI/ANS 3.1, "Selection, Qualifications, and Training of Personnel for Nuclear Power Plants," 1981

3.2 DOE Order 5480.11, "Radiation Protection for Occupational Workers"

3.3 U. S. Nuclear Regulatory Commission, Regulatory Guide 1.8, "Qualifications and Training of Personnel for Nuclear Power Plants", 1975

3.4 Title 10, Code of Federal Regulations, Part 50, "Domestic Licensing of Production and Utilization Facilities"

3.5 Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation"

3.6 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety (SOPRPs) No. ENV-R-001, "Radiation Protection Program Plan".

3.7 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety (SOPRPs) No. ENV-R-011, "Radiation Protection Records".

3.8 U. S. Nuclear Regulatory Commission License No. SMB-743.

4 DEFINITIONS

4.1 Approval - An act of endorsing or adding positive authorization or both.

4.2 Assistant Radiation Safety Officer (ARSO) - An individual who, by virtue of qualifications and experience, has been given the authority to implement the Shieldalloy Radiation Protection Program Plan under the direction of the RSO.

4.3 Director - Designated senior manager of Shieldalloy Metallurgical Corporation with the authority to commit Shieldalloy resources for radiation protection purposes.

4.4 Dosimeter - The thermoluminescence phosphor(s) used for determining external radiation exposure to beta, gamma, x-rays, and neutrons. The words dosimeter and TLD are used interchangeably throughout this procedure.

4.5 May - The word *may* is used to denote permission.

4.6 Radiation Protection Personnel - Personnel who perform radiation protection functions such as release surveys, personnel dosimeter distribution, radiation protection records maintenance, and quality assurance activities as they pertain to radiation protection. Training and qualifications of

radiation protection personnel is contained in ENV-R-017, "Training and Qualifications of Radiation Protection Personnel". The term radiation protection personnel includes the RSO and the ARSO or qualified contractor.

4.7 Radiation Safety Officer (RSO) - An individual who, by virtue of qualifications and experience, has been given the authority to implement the Shieldalloy Radiation Protection Program Plan. The RSO is qualified to use source material for its intended purpose in a manner that protects health and minimizes danger to life or property. The RSO is responsible for recognizing potential radiological hazards, developing a radiation safety program to protect against these hazards, training workers in safe work practices, and supervising day-to-day radiation safety operations.

4.8 Shall - The word *shall* is to be understood as a requirement.

4.9 Should - The word *should* is to be understood as a recommendation.

4.10 Thermoluminescent Dosimeter (TLD) - The thermoluminescence phosphor(s) used for determining external radiation exposure to beta, gamma, x-rays, and neutrons. The words TLD and dosimeter are used interchangeably throughout this procedure.

5 PROCEDURE

5.1 Qualifications of the RSO

5.1.1 The RSO shall have an Associate's degree (or equivalent) in a scientific field, and shall have completed course work and/or have experience with the following:

5.1.1.1 Principles and practices of radiation protection;

5.1.1.2 Radioactivity measurements, monitoring techniques, and the use of instruments;

5.1.1.3 Mathematics and calculations basic to the use and measurement of radioactivity;

5.1.1.4 Biological effects of radiation;

5.1.1.5 Safety practices applicable to protection from the radiation, chemical toxicity, and other properties of the radioactive materials in use at Shieldalloy facilities;

5.1.1.6 Conducting radiological surveys and evaluating results;

5.1.1.7 Evaluating radioactive material processing facilities for proper operations from a radiological safety standpoint; and

5.1.1.8 Familiarity with applicable USNRC, USEPA, and State regulations, as well as the terms and conditions of licenses and permits issued to Shieldalloy by these agencies.

5.2 Qualifications of the ARSO

5.2.1 The ARSO shall have an Associate's degree (or equivalent) in a scientific field.

5.2.2 The ARSO shall perform work under the direct supervision of the RSO until such time as the ARSO meets the qualifications of the RSO.

5.3 Training of Other Radiation Protection Personnel

5.3.1 Training shall be conducted by the RSO.

5.3.2 Each knowledge item required shall be checked off by the RSO on the Performance Verification Sheet (Attachment 1), which is given to new radiation protection personnel during orientation.

5.3.3 Instruction may take the form of practical demonstration, classroom instruction, and/or on-the-job training.

5.3.4 The RSO shall evaluate the knowledge of each individual as they receive training, review procedures and reference materials, and become familiar with each subject/task. The evaluation may be in the form of oral and/or written evaluations.

5.3.5 When the RSO is confident that the individual is knowledgeable of the subject/task, the RSO shall sign the Performance Verification Sheet for the appropriate subject (Attachment #1).

5.3.6 Unless under the direct supervision of the RSO, personnel shall not perform the activities listed on the Performance Verification Sheet until that area is signed off.

5.3.7 Personnel shall be considered fully trained when the Performance Verification Sheet has been completed (all checked subject/tasks signed off).

5.3.8 Continuing training should be conducted a minimum of once a year, and more frequently if a need is identified. Refresher training shall be conducted whenever major changes are made in the radiation protection program, when regulations which affect the radiation protection aspects of the work take effect, or when assigned to a new job with a different exposure potential.

5.4 Standard Operating Procedure for Radiation Safety (SOPRPs) shall be reviewed by all radiation protection personnel on a planned and periodic basis.

6 DOCUMENTATION

6.1 All records associated with implementation of this procedure shall be maintained pursuant to ENV-R-011.

6.2 Completed Performance Verification Sheets shall be maintained in each individual's personnel file.

6.3 Memoranda detailing waivers or exceptions to qualifications stated in this procedure shall be maintained in the individual's training file.

7 ATTACHMENTS

7.1 Attachment 1: "Performance Verification Sheet"

ATTACHMENT 1

PERFORMANCE VERIFICATION SHEET

AREA 1 - Instrumentation

___ 1.1 Select, operationally check, and operate portable radiological monitoring instrumentation based upon expected or supplied radiological conditions.

Completed: _____/_____
Date RSO

___ 1.2 Describe and perform an electronic pulse calibration, source calibration, voltage plateau, and efficiency for portable instruments.

Completed: _____/_____
Date RSO

___ 1.3 Select, operationally check, and operate stationary radiological monitoring instrumentation based upon expected or supplied radiological conditions.

Completed: _____/_____
Date RSO

___ 1.4 Describe and perform an electronic pulse calibration, source calibration, voltage plateau, and efficiency for stationary instruments.

Completed: _____/_____
Date RSO

AREA 2 - Radiation and Contamination Surveys

___ 2.1 Describe radiological surveys to determine dose rate, loose surface contamination, and any posting and/or zoning requirements.

Completed: _____/_____
Date RSO

___ 2.2 State surface contamination limits for Shieldalloy.

Completed: _____/_____
Date RSO

___ 2.3 Describe and perform survey for receiving radioactive material in Shipping/Receiving, and what documentation is required.

Completed: _____/_____
Date RSO

___ 2.4 Describe and perform radiation and contamination surveys performed on site, and complete required documentation.

Completed: _____/_____
Date RSO

___ 2.5 Describe the survey performed for unusual events (spill, accident, etc.) and actions taken if contaminated material is found.

Completed: _____/_____
Date RSO

___ 2.6 Describe radiological surveys of radioactive materials being shipped, including documentation.

Completed: _____/_____
Date RSO

___ 2.7 Describe a radiological release survey.

Completed: _____/_____
Date RSO

___ 2.8 Describe the procedure for perimeter monitoring.

Completed: _____/_____
Date RSO

AREA 3 - Airborne Radioactivity Surveys

___ 3.1 State or indicate when an airborne radioactivity survey would be indicated.

Completed: _____/_____
Date RSO

___ 3.2 Describe the operation and setup of portable air samplers.

Completed: _____/_____
Date RSO

___ 3.3 Describe the procedure for calibration of portable air samplers.

Completed: _____/_____
Date RSO

___ 3.4 Describe the operation of breathing zone samplers.

Completed: _____/_____
Date RSO

___ 3.5 Describe the procedure for calibration of breathing zone samplers.

Completed: _____/_____
Date RSO

AREA 4 - Dosimetry

___ 4.1 Describe the procedure used to issue dosimeters to new Shieldalloy employees.

Completed: _____/_____
Date RSO

___ 4.2 Describe the procedure for preparing and shipping personnel TLDs to be read.

Completed: _____/_____
Date RSO

___ 4.3 State when a bioassay is required.

Completed: _____/_____
Date RSO

AREA 5 - Administrative/Safety

___ 5.1 Inspect fire extinguishers, emergency eyewash and safety showers.

Completed: _____/_____
Date RSO

___ 5.2 Inspect respirators.

Completed: _____/_____
Date RSO

AREA 6 - Unusual Occurrences

___ 6.1 Describe actions taken during emergency situations and explain evacuation procedure.

Completed: _____/_____
Date RSO

	PACKAGING AND TRANSPORTATION OF RADIOACTIVE MATERIALS	Procedure: ENV-R-018
		Page: 1 of 19
		Revision No. 000
		Date: 03/10/94
		Approved by (Director):
		Approved by (RSO):
		Approved by (QAO):
		Approved by (RSC Chair):

TABLE OF CONTENTS

CONTROLLED COPY NO. : _____

1 PURPOSE

1.1 This procedure describes the method for classifying, packaging and shipping radioactive material from Shieldalloy to an authorized recipient.

1.2 Responsibilities:

1.2.1 The Director shall:

1.2.1.1 Review and approve the requirements of this procedure.

1.2.1.2 Supply adequate resources to ensure compliance with this procedure.

1.2.2 The Radiation Safety Officer (RSO) shall:

1.2.2.1 Assure that radiation protection personnel are properly trained in the provisions of this procedure.

1.2.2.2 Confirm the hazardous nature and the correct technical name of the material to be shipped.

1.2.2.3 Confirm that the material or article to be shipped is permitted transport by cargo aircraft or other pertinent carrier.

1.2.2.4 In conjunction with the Shieldalloy Shipping Agent, select the proper shipping category and the proper packaging.

1.2.2.5 In conjunction with the Shieldalloy Shipping Agent, select the correct labels and markings that are to be affixed to the package before shipping.

1.2.2.6 In conjunction with the Shieldalloy Shipping Agent, prepare the Waybill and other shipping papers.

1.2.2.7 Direct remediation of shipping incidents involving radioactive materials.

1.2.3 The Quality Assurance Officer (QAO) shall:

1.2.3.1 Review and approve this procedure.

1.2.3.2 Verify compliance with this procedure during planned and periodic audits of the Radiation Protection Program.

1.2.4 Shieldalloy personnel shall:

1.2.4.1 Notify the RSO if radioactive materials must be shipped.

1.2.4.2 Maintain familiarity with the pertinent provisions of this procedure.

1.2.4.3 Periodically review this procedure, if applicable.

2 SCOPE

2.1 This procedure applies to all shipments of radioactive materials leaving a Shieldalloy facility.

3 REFERENCES

3.1 Container Certification Specification, Mound Laboratory Manual MLM-3245 and supplements.

3.2 Department of Transportation Regulations, 49 CFR, Parts 100 through 178.

3.3 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-017, "Training and Qualifications of Radiation Protection Personnel".

3.4 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-013, "Contamination Control".

3.5 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-012, "Instrumentation and Surveillance".

3.6 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-008, "Receipt, Handling, and Identification of Radioactive Materials".

3.7 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-011, "Radiation Protection Records."

3.8 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-010, "Emergency Response and Notification".

4 DEFINITIONS

4.1 A_1 and A_2 Quantities - The maximum quantity of radioactive material permitted in a Type A package. The A_2 quantity is used when the physical form has not been certified as a special form by the DOT. These quantities are listed by individual isotopes in the DOT regulations, 49 CFR 173.435.

4.2 Approval - An act of endorsing or adding positive authorization or both.

4.3 Corrosive Materials - A liquid or solid that causes visible destruction in human skin tissue at the sit of contact, or in the case of leakage from its packaging has a severe corrosion rate on steel. corrosive material includes but is not limited to liquid with a pH of less than two (pH < 2) o greater than twelve.

4.4 Director - Designated senior manager of Shieldalloy Metallurgical Corporation with the authority t commit Shieldalloy resources for radiation protection purposes.

4.5 Flammable Liquids - Any liquid having a flash point below 100 degrees fahrenheit (< 100°F) c 37.8 degrees centigrade (°C). This includes materials like, acetone, alcohols, hexane and ether Other flammable liquids are listed in the DOT regulations, 49 CFR 172.01.

4.6 Flammable solids - Any solid material, other than an explosive, which under conditions normall incident to transportation, is liable to cause fires through friction, retained heat and when ignite burns vigorously as to create a serious transportation hazard. This includes materials like, charcoa phosphorous, lithium metal and magnesium metal. Other flammable solids are listed in DO regulations, 49 CFR 172.101.

4.7 Inner Container - A container or some other package that surrounds the compound being transporte The inner container provides the first level of containment in order to minimize the likelihood of spill.

4.8 International Air Transport Association (IATA) - Association of commercial airline companies whic publish regulations addressing the conveyance of goods and passengers via air.

4.9 Labels - Shipping labels prescribed by the DOT to provide a warning of the hazard of the materi contained within the package and information about the safe segregation of shipping package Labels are affixed to the exterior of the package.

4.10 Limited Quantity - A maximum quantity of a hazardous material listed by the DOT, for which the are specific exceptions from marking, labeling and packaging. The quantity of radioactive materi that is exempted from these requirements is listed in 49 CFR 173.421.

4.11 Low Specific Activity (LSA) - A concentration of radioactive material that is not likely to result a significant radiation exposure if the integrity of the shipping package is breached. The followi guidelines are used to establish the criteria.

4.11.1 Material in which the radioactivity is essentially uniformly distributed and in which t average concentration of the compound, excluding the weight of the shipping package, do not exceed:

4.11.1.1 0.0001 millicurie per gram (mCi/gm) for isotopes in which the A_2 quantity is n more than 0.05 Curies (Ci); or

4.11.1.2 0.005 mCi/gm for isotopes in which the A_2 quantity is not more than 1 Ci; or

4.11.1.3 0.3 mCi/gm for isotopes in which the A_2 quantity is not more than 1 Ci.

4.11.1.4 Uranium or thorium ores and their chemical concentrates.

4.11.1.5 Tritium Oxide in aqueous solutions in which the concentration does not exceed 5 mCi per milliliter (5 mCi/ml).

4.11.2 Objects of nonradioactive material externally contaminated with radioactive material that is not readily dispersed and the surface contamination, averaged over a square meter does not exceed:

4.11.2.1 0.01 mCi per 100 square centimeters (cm^2) (2.22 x 10^7 dpm per 100 cm^2) for isotopes in which the A_2 quantity is not more than 0.05 Curies; or

4.11.2.2 0.1 mCi/100 cm^2 (2.22 x 10^7 dpm/100 cm^2) for isotopes in which the A_2 quantity is greater than 0.05 Ci.

4.12 Markings - Information printed or durably affixed to the exterior of the shipping package.

4.13 May - The word *may* is used to denote permission.

4.14 Natural Thorium - Thorium with the naturally-occurring distribution of thorium isotopes.

4.15 Natural Uranium - Uranium with the naturally-occurring distribution of uranium isotopes, including Uranium-235 in concentrations not to exceed 0.711 percent (%).

4.16 ORM E - Other Regulated Material (ORM) that may pose an unreasonable risk to health, safety or property when transported in commerce, and does not meet any of the definitions of the other hazard classes. This includes materials such as hazardous substances, n.o.s., polychlorinated biphenyls, mercaptans, or dinitrotoluene. Most shipments of hazardous waste as defined by the EPA and the RCRA regulations that do not satisfy the DOT hazard classes are defined as ORM-E.

4.17 Placard - A large diamond shaped sign indicating the hazard class of the materials being transported. The placard shall be affixed to four sides of the transport vehicle.

4.18 Radiation Safety Officer (RSO) - An individual who, by virtue of qualifications and experience, has been given the authority to implement the Shieldalloy Radiation Protection Program Plan. The RSO is qualified to use source material for its intended purpose in a manner that protects health and minimizes danger to life or property. The RSO is responsible for recognizing potential radiological hazards, developing a radiation safety program to protect against these hazards, training workers in safe work practices, and supervising day-to-day radiation safety operations.

4.19 Radiation Protection Personnel - Personnel who perform radiation protection functions such as release surveys, personnel dosimeter distribution, radiation protection records maintenance, and quality assurance activities as they pertain to radiation protection. The term radiation protection personnel includes the RSO and the Assistant RSO.

4.20 Radioactive Material - Any chemical compound that spontaneously emits ionizing radiation and is found to have a concentration greater than 2,000 pCi/gm (0.002 μCi/gm), evenly distributed throughout the compound.

4.21 Shall - The word *shall* is to be understood as a requirement.

4.22 Shipping Paper - A bill of lading, shipping order, manifest or other shipping document containing information about the materials being transported. The information to be included in this shipping document is prescribed by the DOT in 49 CFR 172.202 through 172.204.

4.23 Should - The word *should* is to be understood as a recommendation.

4.24 Strong, Tight Container - A package not likely to lose its contents under conditions normally incident to transportation.

4.25 Type A Container - A shipping container designated by the Department of Transportation (DOT) to package radioactive materials. The configuration for each package is approved by the DOT and published in the Mound Laboratory Manual, MLM 3245 and supplements. The maximum quantity of radioactive materials is limited to the A_1 quantity for materials certified to be special form or limited to the A_2 quantity for other physical forms.

4.26 Uniform Hazardous Waste Manifest - A shipping paper on which all hazardous waste is identified A copy of the manifest shall accompany each shipment of hazardous waste from the point of pickup to the destination.

5 PROCEDURE

5.1 General Requirements

5.1.1 No Shieldalloy employee, contractor or visitor may offer radioactive material for transportation unless that material is properly classified, described, packaged, marked, and in condition for shipment as authorized by the procedures described below and the Regulations specified by the Department of Transportation for the shipment of hazardous materials, Title 49, Subpart C (49 CFR 171 through 177).

5.1.2 Shieldalloy shall properly classify, package and label materials before offering the package for shipment.

5.1.3 Each radioactive shipment from Shieldalloy shall be authorized by the RSO.

5.1.4 The portable radiation survey meter used to measure the radiation levels on a package to be shipped shall have been calibrated within the last six months as required in ENV-R-012, "Instrumentation and Surveillance".

5.2 Classification of Materials

5.2.1 All packages containing radioactive materials shall satisfy the general packaging requirements described in Attachment 2.

5.2.2 The RSO shall determine the hazardous nature of the material to be shipped. All analytical data should be provided to the RSO to assist in correct characterization of the material to be shipped.

5.2.3 The RSO shall determine the correct technical name or composition of the substance to be shipped, including but not limited to a description of the article.

5.2.3.1 The RSO shall determine whether the name or composition appears in the Hazardous Material Table, 49 CFR 172.101.

5.2.3.2 Materials determined to contain hazardous chemicals (> 10 ppm by volume) and radioactive materials should be packaged in accordance with the requirements for that specific chemical or hazard class as well as the requirements for radioactive materials, whichever is more stringent.

5.2.3.3 The correct shipping classification for an unknown hazardous material shall be selected through a process of elimination, using the DOT classification system equivalent to the list of hazards found in 49 CFR 173.2 a.

5.2.3.4 If the composition is not completely characterized or is unknown, classification shall be based on :

5.2.3.4.1 Knowledge of the material; and

5.2.3.4.2 Selection of the appropriate hazard class.

5.2.4 If the material to be shipped does not appear in the hazardous material table and does not exhibit hazardous properties, the shipment shall not be subject to these requirements.

5.2.5 If applicable, the RSO shall confirm that the material or article is permitted to be shipped by cargo aircraft. (See column 3, 49 CFR 172.101.)

Note: Materials restricted from cargo aircraft shall not be shipped by Federal Express or other overnight carrier. Alternate arrangements for transport shall be made.

5.2.6 The RSO shall select the proper shipping category according to the quantities of radioactive material and chemicals present in the shipping container pursuant to Attachment 3.

5.3 Packaging

5.3.1 The RSO shall base the requirements for packaging on the type of material to be transported.

5.3.1.1 Specific materials shall be packaged as described in Attachments 4, 5, or 6, depending on the type of material being shipped.

5.3.1.2 All packages shipped from Shieldalloy shall satisfy the general packaging requirements described in Attachment 2.

5.3.2 Package configurations shall be approved by the RSO prior to use.

5.3.3 The RSO shall confirm the requirements for marking and labeling and that the correct labels and markings are affixed to the package before it is offered for transport.

5.3.4 With the assistance of the RSO the Shieldalloy Shipping Agent, shall prepare the Waybill and other shipping papers as described in Attachment 7.

5.3.5 The Shipping Agent shall offer the complete consignment for transport.

6 DOCUMENTATION

6.1 Shipping papers shall be maintained in the transport vehicle, within reach of a driver restrained by a lap belt.

Note: Ordinarily, a glove compartment does not meet this requirement.

6.2 All records pertinent to this procedure shall be maintained pursuant to ENV-R-011, "Radiation Protection Records".

7 ATTACHMENTS

7.1 Attachment 1: Hazard Classes Established by the Department of Transportation

7.2 Attachment 2: General Packaging Requirements

7.3 Attachment 3: Selecting the Proper Shipping Name for Radioactive Shipments

7.4 Attachment 4: Packaging Requirements for Radioactive Material, Limited Quantity

7.5 Attachment 5: Packaging Requirements for Radioactive Material, Low Specific Activity

7.6 Attachment 6: Packaging Requirements for Radioactive Material Type A Quantities

7.7 Attachment 7: Shipping Papers

ATTACHMENT 1
HAZARD CLASSES ESTABLISHED BY THE DEPARTMENT OF TRANSPORTATION

Hazard Class	DOT Reference (49 CFR)	Limited Quantity[1]
Radioactive Material	173.421	See Attachment 2
Poison A	173.326	Specific chemicals listed in regulations
Flammable gas	173.306	One quart at less than 170 psi
Non-flammable gas	173.306	One quart at less than 170 psi
Flammable liquid	173.118	See H&S Department
Oxidizer	173.153	One pound per inside container with outside container less than 25 pounds
Flammable solid	173153	One pound per inside container with outside container less than 25 pounds
Corrosive liquid	173.244	See H&S Department
Poison B	173363	Five pounds inside inner container
Corrosive solid	173244	Ten pounds of solids in metal container; five pounds of solids in cardboard container. Outer container not to exceed 25 pounds.
Irritating material	173.381	None specified
Combustible liquid (greater than 100 gallons)	173.118a	100 gallons per container
ORM-A, ORM-B solids	173.505	Five pounds container
ORM-A, ORM-B liquids	173.505	One pint per container
ORM-E	173505	See H&S Department

[1] See Attachment 7.

ATTACHMENT 2
GENERAL PACKAGING REQUIREMENTS

All packages containing radioactive material shipped from Shieldalloy shall be packaged to prevent leakage or spillage during transportation. The following guidelines shall be met for any package regardless of the classification of the material. These guidelines shall be used in addition to the requirements of the specific hazard class for the shipment.

1. The sample container or inner package shall be marked with at least a unique sample number or some other identifying marks in order to confirm that the correct materials are being packaged for shipment.

2. The lid on each sample container shall be secured in order to minimize the likelihood that the sample leaks during shipment. Tape or some other adhesive plastic may be used to secure the lid.

3. The inner packages shall be separated by material that is capable of protecting the containers from striking each other during normal conditions of transport.

4. For liquids or sludge, the material used to separate the packages shall be absorbent and of sufficient volume to absorb two times the volume of liquid in the container.

5. Two double wraps of tape shall be used for each opening or seam for cardboard boxes or other containers.

6. Each package shall be legibly marked to show the correct shipping address including but not limited to, the name of the person or department to which the material is being shipped.

7. Marks and labels shall be legible and neat in appearance. No extraneous marks or labels are permitted. Letters and numerals that are used to define the proper shipping name, UN identification number, and weight shall be at least two inches tall.

8. Markings and labels shall be placed on at least two opposing sides of the shipping package.

ATTACHMENT 3
SELECTING THE PROPER SHIPPING NAME FOR RADIOACTIVE SAMPLES

1. Identify the physical form and quantity of material to be shipped.

2. Identify the radionuclides.

3. Select the appropriate A_1 and A_2 values from the table in 49 CFR 173.435.

4. Determine the total activity present in the container.

   4.1 If it is determined that the quantity of radioactive material is less than 2000 pci/gm, the material may be shipped without regard for the radioactivity.

   4.2 If it is determined that the material is solid and the quantity of radioactive material is less than 10^{-3} x A_2 quantity, the material shall be shipped as a "limited quantity" and be packaged in accordance with the requirements of Attachment 4.

   4.3 If it is determined that the material is liquid and the quantity, the material shall be shipped as a "limited quantity" and be packaged in accordance with the requirements of Attachment 4.

   4.4 If it is determined that the concentration of radioactive material does not exceed the following values, the material shall be shipped as "low specific activity" (LSA) and packaged in accordance with the requirements of Attachment 5.

A_2 Value of isotope (Ci)	Maximum Concentration (mCi/gm)
< 0.05	0.0001
0.05 - 1	0.005
> 1	0.3

   4.5 If it is determined that the quantity of radioactive material exceeds the limits for limited quantity and LSA, but does not exceed the A_2 value, the material shall be packaged in a Type A container in accordance with the requirements of Attachment 6.

5 All packages shall meet the requirements described in Attachment 2.

ATTACHMENT 4
PACKAGING REQUIREMENTS FOR RADIOACTIVE MATERIAL, LIMITED QUANTITY

A package for a limited quantity of radioactive material shall meet the DOT requirements, 49 CFR 173.421. The guidelines listed below are adequate to satisfy the DOT regulations.

1. General requirements for this package are listed in the General Packaging Requirements, Attachment 2.

2. The shipping package shall be at least a strong, tight container, with outer dimensions greater than 4 inches on a side. A inner container shall be used to hold the sample or material. A sealed cardboard box, sealed metal can or taped cooler can be used as a strong tight container. Type A containers can be used as a strong tight container.

3. The inner package shall be marked "Radioactive". A note should be included inside the package which documents that the package conforms to the requirements of the DOT to ship limited quantities of radioactive material. The outer package is exempt from markings.

4. The outer package is exempt from shipping labels.

5. The shipping papers shall document the proper shipping name. A hazardous material waybill is NOT required.

   5.1 For a shipment via Federal Express (or other overnight carrier), the "red bar" hazardous material airbill (or equivalent) shall be used with the bottom section removed.

   5.2 The proper shipping name shall be listed in the Reference line. Specifically, Radioactive material, excepted package - limited quantity. (Reference IATA Regulations, Section 8.2.5).

   5.3 Confirm that the Instructions box is marked correctly. "Dangerous Goods Declaration Not Required X".

   5.4 Confirm that the Special Handling box is marked correctly. Specifically, item 4 "Dangerous Goods" deleted so no extra charge is assessed for this shipment.

6. A radiation survey shall be performed. Confirm that the exposure rate is less than 0.5 mR per hour at the surface of the package. Use a calibrated, radiation survey instrument that is capable of measuring gamma exposure rates, preferably an ion chamber or micro-R meter.

7. A contamination survey shall be performed. Confirm that removable surface contamination is below 22,000 dpm per 100 cm^2 on all outer surfaces.

ATTACHMENT 5
PACKAGING REQUIREMENTS FOR RADIOACTIVE MATERIAL, LOW SPECIFIC ACTIVITY

A package for radioactive material classified as a low specific activity shall meet the DOT requirements, 49 CFR 173.425. The guidelines listed below are adequate to satisfy the DOT regulations.

1. General requirements for this package are listed in the General Packaging Requirements, Attachment 2.

2. The shipping package shall be certified as a Specification 7A, Type A container that has been approved by the DOT.

   2.1 Type A containers approved for dry solids include 55 gallon steel drum 17C or 17H; or 5 gallon metal bucket with closure ring; or 96 cubic foot steel box, B25 or equivalent.

   2.2 Other containers have been approved by the DOT for solids and liquids. Contact the RSO to determine which containers may be used.

   2.3 Samples shall be individually packaged inside the Type A container.

   2.4 Bulk materials shall be packaged in a drum liner or other suitable plastic bag, thickness at least 6 mils.

   2.5 A certificate documenting the test results are maintained by the shipper.

   2.6 A security seal shall be placed on each package before shipment.

3. A strong, tight container may be used to package LSA material if the shipment satisfies the requirements of Exclusive Use. Contact the RSO to evaluate the requirements for an exclusive use shipment.

4. The outer package shall be marked on two opposing sides with the following phrases:

   - Radioactive Material
   - Low Specific Activity
   - UN 2912
   - Package Weight

5. The outer package shall be labeled with radioactive shipping labels, selected according to the radiation exposure rate detected at contact and at 3 feet from the package (transport index):

Shipping Label	Exposure Rate (mR/hr)	
	Contact	Three Feet
White Bar I	< 0.5	< 0.5
Yellow Bar II	< 50	< 1
Yellow Bar III	< 200	< 10

The package is exempt from shipping labels if the packages are being shipped in an exclusive use shipment.

6. Each label shall identify the primary radioactive isotope, content in Curies, and the transport index.

7. The shipping papers shall be completed as indicated in Attachment 7.

8. A radiation survey shall be performed. Confirm that the exposure rate is less than 200 mR per hour at the surface of the package and less than 10 mr/hr at three feet from the package. Use a calibrated, radiation survey instrument that is capable of measuring gamma exposure rates, preferably an ion chamber or micro-R meter.

   Note: It the shipment is an exclusive use shipment, radiation levels shall be below one mr/hr on contact with the package.

9. A contamination survey shall be performed. Confirm that removable surface contamination is below 22,000 dpm per 100 cm^2 on all outer surfaces.

10. Placards shall be placed on four sides of the truck carrying

    - packages bearing a Yellow Bar III label; or

    - strong, tight containers with LSA material designated as exclusive use shipment.

ATTACHMENT 6
PACKAGING REQUIREMENTS FOR RADIOACTIVE MATERIAL TYPE A QUANTITIES

A package for radioactive material shall meet the DOT requirements for a Type A package, 49 CFR 173.411 and 173.412. The guidelines listed below are adequate to satisfy the DOT regulations.

1. General requirements for this package are listed in the General Packaging Requirements, Attachment 2.

2. The shipping package shall be certified as a Specification 7A, Type A container that has been approved by the DOT.

   2.1 Type A containers approved for dry solids include 55 gallon steel drum 17C or 17H; or 5 gallon metal bucket with closure ring; or 96 cubic foot steel box, B25 or equivalent.

   2.2 Other containers have been approved by the DOT for solids and liquids. Contact the RSO to determine which containers may be used.

   2.3 Samples shall be individually packaged inside the Type A container.

   2.4 Bulk materials shall be packaged in a drum liner or other suitable plastic bag, thickness at least 6 mils.

   2.5 A certificate documenting the test results are maintained by the shipper.

   2.6 A security seal shall be placed on each package before shipment.

3. The outer package shall be marked on two opposite sides with the following phrases:

   - Radioactive Material, n.o.s.
   - SPEC 7A TYPE A
   - UN 2982
   - package weight

4. The outer package shall be labeled with radioactive shipping labels, selected according to the radiation exposure rate detected at contact and at 3 feet from the package (transport index).

Shipping Label	Exposure Rate (mR/hr)	
	Contact	Three Feet
White Bar I	< 0.5	< 0.5
Yellow Bar II	< 50	< 1
Yellow Bar III	< 200	< 10

5. Each label shall identify the primary radioactive isotope, content in Curies, and the radiation level measured at 3 feet from the package (transport index).

6. The shipping papers shall be completed as indicated in Attachment 7.

7. A radiation survey shall be performed. Confirm that the exposure rate is less than 200 mR per hour at the surface of the package and less than 10 mR/hr at three feet from the package. Use a calibrated, radiation survey instrument that is capable of measuring gamma exposure rates, preferably an ion chamber or micro-R meter.

8. A contamination survey shall be performed. Confirm that removable surface contamination is below 22,000 dpm per 100 cm^2 on all outer surfaces.

9. Placards shall be placed on four sides of the truck carrying packages bearing a Yellow Bar III label. Other requirements for placards are provided by the DOT, 49 CFR 172.500, Subpart F.

ATTACHMENT 7
SHIPPING PAPERS

Shipping papers shall be completed neatly and provide all information that is required. The DOT regulations, 49 CFR 172.200 define the requirements for the shipping papers. The Radioactive Material Shipment Form lists the information that is required for each shipment of radioactive material. This form is completed by the RSO and accompanies each shipment. The instructions to complete the form are listed below.

1. Complete the correct shipping address including the name of the person who is responsible to receive the material at the destination.

2. Record the Nuclear Regulatory Commission or state agency license number issued to the facility receiving the radioactive material. A copy of the receiver's license should be on file and maintained by the RSO.

3. Enter the proper shipping name and identification number for this shipment. The shipping category was determined with the criteria in Attachment 3. The following shipping names are provided:

Radioactive Material, Limited Quantity, n.o.s.	UN 2910
Radioactive Material, Instruments, n.o.s.	UN 2911
Radioactive Material, Low Specific Activity, n.o.s.	UN 2912
Radioactive Material, n.o.s.	UN 2982

4. The shipping classification is "Radioactive Material".

5. List the name of each radioisotope that comprises more than one percent (1%) of the total quantity.

6. List the activity in millicuries for each radioisotope.

7. Select the form of the material being shipped. The physical form shall be "Normal" unless specific certification has been performed and documented that the radioactive material satisfies the requirements for "Special Form".

8. Describe the physical and chemical form of the material. List the specific chemical compound if known.

9. Describe the shipping labels that are selected for this package. Guidelines to select labels are provided in the respective attachments.

10. Record the Transport Index for packages that require a Yellow II or Yellow III label. The transport index is the maximum radiation level, measured in mR/hour, at a distance of three feet from the package.

11. Record the package dimensions or volume in the space provided.

12. Select the type of package that is required for this shipment. Confirm that the specifications for a Type A package are on file with the RSO.

13. A security seal shall be used for all Type A packages.

14. Select whether shipping placards shall be posted on four sides of the transport vehicle. Radioactive placards are required when the vehicle is carrying:

    - a package bearing a Yellow Bar III label; or
    - LSA materials packaged in strong, tight containers.

    Note: The vehicle shall be an exclusive use vehicle for these LSA packages.

15. Record the radiation levels (mR/hr) measured at contact and at three feet (1 meter) from each package.

16. Record the results of the wipe tests collected to measure the removable surface contamination. The results should be reported in disintegrations per minute (dpm) per 100 square centimeters (100 cm^2). Gross alpha or gross beta analysis is selected depending on the principal radiation known to be emitted. For packages containing uranium isotopes and daughters, analysis for gross alpha and gross beta are required.

17. List the markings that are displayed on the outside of the container. Both markings and labels shall be located on two sides of the container.

18. Record the weight of the package if the package is estimated to be more than 110 pounds.

19. The shipper's certifications shall be signed by the RSO after all of the information on the shipment form is complete and the package is ready to be transported.

20. Shipping papers shall be maintained in the transport vehicle, within reach of the driver when restrained by the lap belt. Ordinarily, a glove compartment does not meet this requirement. [CFR 177.817(e)]

	ENVIRONMENTAL SURVEILLANCE	Procedure: ENV-R-019
		Page: 1 of 11
		Revision No. 000
		Date: 03/10/94
		Approved by (Director):
		Approved by (RSO):
		Approved by (QAO):
		Approved by (RSC Chair):

TABLE OF CONTENTS

CONTROLLED COPY NO. : _____

1 PURPOSE

1.1 This procedure describes the means of evaluating releases of radioactive materials to the environment and for estimating the maximum potential radiation doses to the general public in the vicinity of Shieldalloy facilities as a result of Shieldalloy operations.

1.2 Responsibilities:

1.2.1 The Director shall:

1.2.1.1 Review and approve Shieldalloy's Environmental Surveillance Program.

1.2.1.2 Review and approve quarterly environmental and effluent surveillance reports.

1.2.1.3 Review and approve the requirements of this procedure.

1.2.1.4 Supply adequate resources to ensure compliance with this procedure.

1.2.2 The Radiation Safety Officer (RSO) shall:

1.2.2.1 Collect and interpret environmental and effluent monitoring data.

1.2.2.2 Perform off-site dose assessments and compare results with applicable regulations and standards.

1.2.2.3 Deploy, collect, and transport environmental TLDs.

1.2.2.4 Assure that all radiation protection personnel are properly trained in the provisions of this procedure.

1.2.3 The Quality Assurance Officer (QAO) shall:

1.2.3.1 Review and approve this procedure.

1.2.3.2 Verify compliance with this procedure during planned and periodic audits of the Radiation Protection Program.

1.2.4 Shieldalloy Personnel shall:

1.2.4.1 Comply with applicable requirements of this procedure, as applicable.

1.2.4.2 Periodically review the contents of this procedure, as applicable.

2 SCOPE

2.1 This procedure applies to all environmental and effluent monitoring activities performed at Shieldalloy facilities.

3 REFERENCES

3.1 IT Corporation, "Radiation Dose Estimates for Members of the General Public at the Newfield, New Jersey Facility", by C.D. Berger, IT Corporation Report No. IT/NS-93-107, 1993.

3.2 U.S. Nuclear Regulatory Commission, Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation", January, 1992.

3.3 U.S. Nuclear Regulatory Commission, Regulatory Guide 4.14, "Radiological Effluent and Environmental Monitoring at Uranium Mills", 1980.

3.4 U.S. Nuclear Regulatory Commission, Regulatory Guide 4.1, "Programs for Monitoring Radioactivity in the Environs of Nuclear Power Plants", 1975.

3.5 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-011, "Radiation Protection Records"

4 DEFINITIONS

4.1 Approval - An act of endorsing or adding positive authorization or both.

4.2 CAP88-PC Computer Model - A set of computer programs, databases, and associated utility programs for estimation of dose from radionuclide emissions to air as a demonstration of compliance under the National Emission Standards for Hazardous Air Pollutants. The CAP88-PC computer model computes radionuclide concentrations in air, rates of deposition on ground surfaces, concentrations in food, and intake rates to people from ingestion of food produced in the assessment area.

4.3 Control Dosimeter - A TLD used to measure exposures other than exposures from the measurement of interest. Exposures measured with control dosimeters are used to determine corrections for the measurements of environmental TLDs. Control dosimeters measure exposures received primarily during storage and transit of environmental TLDs.

4.4 Director - Designated senior manager of Shieldalloy Metallurgical Corporation with the authority to commit Shieldalloy resources for radiation protection purposes.

4.5 Dosimeter - The thermoluminescence phosphor(s) used for determining external radiation exposure to beta, gamma, x-rays, and neutrons. The words dosimeter and TLD are used interchangeably throughout this procedure.

4.6 Environmental Monitoring - Monitoring conducted outside of the location which may give rise to the exposure.

4.7 Environmental TLD - A radiological monitoring device placed in a restricted area, an unrestricted area, and/or around the perimeter of Shieldalloy facilities to monitor radiological exposure rates to the work force, and to the general public.

4.8 Field Cycle - The period during which the environmental TLD is located at the perimeter monitoring point (i.e., the frequency of dosimeter exchange and processing).

4.9 May - The word *may* is used to denote permission.

4.10 Monitoring Program - Specifies the type and frequency of measurements; procedures for measurements and for sampling and subsequent laboratory analysis; statistical test procedures; and methods of data handling, interpretation and recording.

4.11 Primary Dosimeter - One of two dosimeters placed at each monitoring station for monitoring exposure rates from Shieldalloy facilities. The primary dosimeter is the initial dosimeter read by the vendor and results are transmitted to the RSO.

4.12 Radiation Protection Personnel - Personnel who perform radiation protection functions such as release surveys, personnel dosimeter distribution, radiation protection records maintenance, and quality assurance activities as they pertain to radiation protection. The term radiation protection personnel includes the RSO and the Assistant RSO.

4.13 Radiation Safety Officer (RSO) - An individual who, by virtue of qualifications and experience, has been given the authority to implement the Shieldalloy Radiation Protection Program Plan. The RSO is qualified to use source material for its intended purpose in a manner that protects health and minimizes danger to life or property. The RSO is responsible for recognizing potential radiological hazards, developing a radiation safety program to protect against these hazards, training workers in safe work practices, and supervising day-to-day radiation safety operations.

4.14 Secondary Dosimeter - One of two dosimeters placed at each monitoring station for monitoring station for monitoring exposure rates from Shieldalloy facilities. The secondary dosimeter is only read by the vendor if the primary dosimeter results are inconclusive or questionable.

4.15 Shall - The word *shall* is to be understood as a requirement.

4.16 Should - The word *should* is to be understood as a recommendation.

4.17 Thermoluminescent Dosimeter (TLD) - The thermoluminescence phosphor(s) used for determining external radiation exposure to beta, gamma, x-rays, and neutrons. The words TLD and dosimeter are used interchangeably throughout this procedure.

4.18 USNRC - Acronym for "United States Nuclear Regulatory Commission," a federal regulatory agency.

5 PROCEDURE

5.1 Environmental Surveillance Requirements

5.1.1 An Environmental Surveillance Program shall be initiated to monitor and define radiation doses to individual members of the public and to radiation doses to individuals in unrestricted areas as a result of Shieldalloy operations.

5.1.1.1 Radiation doses for individual members of the public shall not exceed 0.1 rem in a year

5.1.1.2 The radiation dose to unrestricted areas from external sources shall not exceed 0.002 rem in any one hour.

5.1.2 Environmental surveillance monitoring shall be instituted for all operations which may contribute to environmental exposure at Shieldalloy other than those that are minor from the point of view of normal operation and of potential to cause significantly higher doses.

5.1.3 For all sources of exposure at Shieldalloy, the scale and extent of the environmental surveillance effort will depend on the significance of the expected dose to individuals and surrounding populations.

5.1.4 Environmental surveillance monitoring programs shall be in effect for measurement of dose rates or rates of discharge of radionuclides as a result of the following operations:

5.1.4.1 Ferrocolumbium production process in Building D-111.

5.1.4.2 Storage of slag containing source material in the Shieldalloy Storage Yard.

5.1.4.3 Storage of bag-house dust (lime pile) in the Shieldalloy Storage Yard.

5.1.5 As experience and data accumulate during the operational lifetime of a particular operation, the need for and the extent of the source monitoring program should be reviewed and modified.

5.1.6 Surveillance by the following may be performed for Shieldalloy operations:

5.1.6.1 Environmental TLD monitoring around Shieldalloy facilities.

5.1.6.2 Stack emission monitoring pursuant to Regulatory Guide 4.14.

5.1.6.3 Surface and groundwater sampling pursuant to Regulatory Guide 4.14.

5.1.6.4 Soil and sediment sampling pursuant to Regulatory Guide 4.1.

5.1.7 There shall be planned and periodic reviews of the environmental monitoring program to determine that the pathways monitored remain appropriate.

5.2 Environmental TLD Monitoring

5.2.1 Monitoring Stations

5.2.1.1 Monitoring stations may consist of wooden boxes, enclosed on all sides, and mounted on wooden poles. These monitoring stations are housing units for the vendor-supplied environmental TLDs.

5.2.1.2 Each monitoring station shall be assigned a unique identification name/number for cross reference to environmental TLD results.

5.2.1.3 Access to the contents of the wooden boxes shall be controlled by the use of tamper-evident seals.

5.2.1.4 The base of each box shall be positioned at a height of approximately 1 meter above the ground surface.

5.2.1.5 If the monitoring station is damaged in any way, the TLD may be suspended approximately 1 meter from the ground surface on a nearby object (i.e., or a wire fence, lightweight post, etc.) for a maximum of 24 hours until the monitoring station has been repaired.

5.2.1.6 Monitoring stations shall be established in restricted and unrestricted areas and shall be chosen to be as representative as possible of the genera surroundings.

5.2.1.7 Background monitoring stations shall be located two miles or greater from Shieldalloy facilities and shall form a circle around the facilities. Backgroun stations may be located on the residential property of selected Shieldallo employees.

5.2.1.8 The monitoring stations should be removed as far as possible from large or dense objects that may act as shielding for the radiation field. Acceptable sites should include physically and radiologically uniform open areas.

5.2.2 Field Cycle

5.2.2.1 The length of the Shieldalloy field cycle (e.g., the frequency of dosimeter exchange and processing) should be based upon the constancy of radiological conditions, on expected variations with time, and on the significance of the dose rates to the critical population.

5.2.2.2 The frequency of routine exchange of environmental TLDs shall be at least once per calendar year.

5.2.3 Control Dosimeters

5.2.3.1 All exposures received by the environmental TLDs as a result of storage and/or transit, during the deployment period shall be subtracted from the total exposure by using control dosimeters in order to isolate the field exposure.

5.2.3.2 Measurement of storage exposure shall be achieved by placing a control dosimeter in the shielded TLD storage area designated by the RSO.

5.2.3.3 Measurement of transit exposure shall be achieved by transporting a control dosimeter during deployment and collection of environmental TLDs.

5.2.3.4 Control dosimeters that are received with a field batch of dosimeters shal remain with that assigned field batch during transport to/from the monitoring stations and to/from the vendor.

5.2.4 Dosimeter Storage

5.2.4.1 Dosimeters awaiting deployment or shipment to the vendor for processing including control dosimeters, shall be stored in the shielded TLD storage are designated by the RSO.

5.2.4.2 The background radiation exposure rate in the storage facility shall not exceed 160 millirem over a period of one year, or 40 millirem over a period of thre months.

5.2.4.2.1 If the annual exposure limit in the storage facility is exceeded an investigation into causes shall be initiated.

5.2.4.2.2 Control dosimeter results from this storage area shall be subtracted from the environmental TLDs stored in this area.

5.2.5 Deployment and Retrieval of Environmental TLDs

5.2.5.1 Environmental dosimeter deployment and retrieval to individual monitoring and background locations shall be completed within one twenty-four hour period.

5.2.5.1.1 The Environmental TLD Field Log (Attachment 1) shall be completed for both the previous quarter's field batch and the current quarter's field batch.

5.2.5.1.2 The field batch consists of two vendor-supplied TLDs for each monitoring station and the control dosimeter used for monitoring exposure during transit.

5.2.5.2 During deployment, two vendor-supplied environmental TLDs should be placed at each monitoring station. One TLD is the primary TLD and the other is the secondary TLD. The primary TLD is to be read by the vendor for determining exposure rates while the secondary TLD is to be read only if results from the primary TLD are inconclusive or questionable.

5.2.5.3 Upon arrival at each monitoring station, the individual responsible for deployment and retrieval shall:

5.2.5.3.1 Exchange last quarter's TLDs with the current quarter's *TLDs; and*

5.2.5.3.2 Note any irregularities (i.e., missing dosimeters, damaged monitoring station, etc.) on the appropriate Environmental TLD Field Log.

5.2.5.4 After deployment and retrieval are complete:

5.2.5.4.1 The date of deployment/retrieval for each monitoring location number shall be noted on the appropriate quarter's Environmental TLD Field Log.

5.2.5.4.2 The transit control dosimeter for the newly deployed field batch shall be returned to the shielded TLD storage area.

5.2.5.4.3 The previous quarter's field and control dosimeters shall be prepared for processing and stored in the shielded TLD storage area.

5.2.6 Dosimeter Processing

5.2.6.1 The vendor-supplied TLDs shall be returned to the supplier within 24 hours for processing.

5.2.6.2 A vendor-supplied shipping box should be used for transporting the environmental field dosimeters and the corresponding control dosimeters.

5.2.6.3 The packaged dosimeters shall be shipped to the supplier within twenty-four hours of packaging, using standard, over-night air mail.

5.2.6.4 The primary dosimeter shall be read by the vendor and results are transmitted to the RSO.

5.2.6.5 If results are inconclusive or questionable, then the secondary TLD should be read by the vendor if so instructed by the RSO.

5.3 Airborne Emission Monitoring

5.3.1 Ambient exposure rates from Shieldalloy emissions points (e.g., ferrocolumbium production in D-111) shall be determined from stack emission rates.

5.3.2 Stack emission rates should be measured pursuant to the guidance contained in USNRC Regulatory Guide 4.14.

5.3.3 These airborne emission rates shall then be entered into the CAP88 computer program for establishing radiation doses to the nearest off-site resident from materials discharged based on radioactivity in the stack.

5.4 Surface and Groundwater Sampling

5.4.1 Surface and groundwater sampling may be performed as deemed necessary by the RSO and pursuant to Regulatory Guide 4.14.

5.4.2 Surface and groundwater samples shall be analyzed for gross alpha and gross beta activity.

5.4.3 Isotope-specific (uranium and thorium) analyses shall be performed if one of the following stipulations are met:

5.4.3.1 Gross alpha activity is greater than 5 pCi/L

5.4.3.2 Gross beta/gamma activity is greater than 50 pCi/L.

5.5 Soil and Sediment Sampling

Soil and sediment sampling shall be performed as deemed necessary by the RSO and pursuant to Regulatory Guide 4.1.

5.6 Population Dose Assessment

5.6.1 External radiation dose estimates for a member of the general population at the boundary fence shall be determined from the results of environmental TLDs.

5.6.2 Total effective dose equivalent to the nearest member of the general public shall be determined from emissions measurements.

6 DOCUMENTATION

6.1 All records associated with this procedure shall be maintained pursuant to ENV-R-011.

6.2 The following records shall be maintained:

6.2.1 Environmental TLD Field Logs

6.2.2 Vendor-supplied TLD results

6.2.3 Environmental and effluent monitoring results

7 ATTACHMENTS

7.1 Attachment 1: "Environmental TLD Field Log"

ATTACHMENT 1

ENVIRONMENTAL TLD FIELD LOG

Monitoring Period: From: _____ To: _____

Monitoring Station Number	Vendor TLD Number	Date Deployed	Date Retrieved	Comments

	INTERNAL RADIATION EXPOSURE CONTROL	Procedure: ENV-R-020
		Page: 1 of 18
		Revision No. 000
		Date: 03/11/94
		Approved by (Director):
		Approved by (RSO):
		Approved by (QAO):
		Approved by (RSC Chair):

TABLE OF CONTENTS

CONTROLLED COPY NO. : _____

1 PURPOSE

1.1 The purpose of this procedure is to describe the method for controlling internal radiation exposures. The objective of the procedure is to assure that the potential for internal radiation exposure of Shieldalloy personnel, visitors, and contractors is minimized by establishing and enforcing dose limits and administrative dose control points.

1.2 Responsibilities:

1.2.1 The Director shall:

1.2.1.1 Assure that internal radiation exposures of all employees, visitors and contractors are maintained as low as is reasonably achievable (ALARA).

1.2.1.2 Approve all planned exposures in excess of regulatory or license limits.

1.2.1.3 Disseminate this policy to all applicable personnel.

1.2.1.4 Enforce participation in the monitoring program as scheduled by the RSO.

1.2.1.5 Review and approve the Airborne Radioactivity Sampling Program administered by the RSO.

1.2.2 The Radiation Safety Officer (RSO) shall:

1.2.2.1 Develop and administer an industry-standard internal radiation monitoring program.

1.2.2.2 Approve all planned exposures in excess of administrative, regulatory, or license limits.

1.2.2.3 Administer an airborne radiation monitoring program when required by radiological conditions.

1.2.2.4 Review results of airborne radiation monitoring program.

1.2.2.5 The Radiation Safety Committee (RSC) shall review unusual exposure incidents pursuant to ENV-R-010, "Emergency Response and Notifications".

1.2.3 The Quality Assurance Officer (QAO) shall:

1.2.3.1 Periodically review employee exposure history files ensuring that they are complete and in compliance with this procedure.

1.2.3.2 Through planned and periodic audits, verify that the requirements of this procedure are met.

1.2.4 Shieldalloy personnel shall:

1.2.4.1 Participate in the internal radiation monitoring program as directed by the RSO.

1.2.4.2 Provide past exposure history for the employee exposure history files if designated a participant in the monitoring program.

1.2.4.3 Maintain an awareness of the internal radiation dose limits if pertinent to a job assignment.

1.2.4.4 Comply with this procedure in order to maintain their own internal radiation dose within prescribed limits.

1.2.4.5 Periodically review the contents of this procedure, if applicable.

2 SCOPE

2.1 This procedure pertains to all work activities that involve radioactive materials or the potential for internal exposure to radioactive materials. It applies to all Shieldalloy employees, visitors and contractors performing work in radiologically controlled areas.

3 REFERENCES

3.1 Title 10, Code of Federal Regulations, Part 20, "Standards for Protection Against Radiation", 1991.

3.2 International Commission on Radiological Protection, "ICRP Task Group on Reference Man", ICRP Publication 23, 1975.

3.3 International Commission on Radiological Protection, "Limits of Intakes of Radionuclides by Workers", ICRP Publication 30, 1980.

3.4 International Commission on Radiological Protection, "Individual Monitoring for Intakes of Radionuclides by Workers: Design and Interpretation", ICRP Publication 54, 1987.

3.5 American National Standards Institute, "Practice for Occupational Radiation Exposure Records System", Report No. ANSI N13.6 - 1966 (R1982).

3.6 American National Standards Institute, "Guide to Sampling Airborne Radioactive Materials in Nuclear Facilities", Report No. ANSI N13.1, 1969.

3.7 U.S. Nuclear Regulatory Commission, Regulatory Guide 4.1, "Programs for Monitoring Radioactivity in the Environs of Nuclear Power Plants", 1975.

3.8 U.S. Nuclear Regulatory Commission, Regulatory Guide 4.8, "Environmental Technical Specifications for Nuclear Power Plants", 1975.

3.9 U.S. Nuclear Regulatory Commission, Regulatory Guide 4.15, "Quality Assurance for Radiological Monitoring Programs (Normal Operations) - Effluent Streams and the Environment", 1979.

3.10 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-011, "Radiation Protection Records".

3.11 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-019, "Environmental Surveillance Program".

3.12 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-010, "Emergency Response and Notifications"

3.13 Shieldalloy Metallurgical Corporation Standard Operating Procedure for Radiation Safety No. ENV-R-002, "Training in Radiation Protection"

4 DEFINITIONS

4.1 Activity - Disintegration rate of a radioactive material stated in dps, becquerels, μCi, nCi, pCi, or other acceptable units.

4.2 Annual Limit on Intake (ALI) - The derived limit for the amount of radioactive material taken into the body of an adult worker by inhalation or ingestion in a year. ALI is the smaller value of intake of a given radionuclide in a year by Reference Man that would result in a committed effective dose equivalent of 5,000 millirems or a committed dose equivalent of 50,000 rems to any individual organ or tissue. ALI values are given in Table 1, Columns 1 and 2 of Appendix B, 10 CFR 20.1001-2401.

4.3 Approval - An act of endorsing or adding positive authorization or both.

4.4 Bioassay - Measurement of amount or concentration of radioactivity in the body or in material excreted or removed from the body for purposes of estimating the quantity of radioactive material in the body.

4.5 Breathing Zone - That region adjacent to a worker's mouth and nostrils from which air is drawing into the lungs while performing his/her assigned work. Air sampled from this region represents the air the worker breaths while at work, whether standing, sitting, or moving.

4.6 Committed Dose Equivalent - The time integral, over 50 years, of the dose equivalent rate in an organ or a tissue following intake of a radionuclide:

$$H_{50} = \int_{t=0}^{t=50} H(t)\, dt$$

where t = 0 is the time of intake and H(t) is the dose equivalent rate in an organ or a tissue at time t.

4.7 Committed Effective Dose Equivalent - The sum of the committed dose equivalents to individual tissues resulting from an intake of a radionuclide multiplied by the appropriate weighting factors (w_T):

$$\sum w_T H_T \leq H_{wb}$$

where w_T = the weighting factor representing the ratio of the stochastic risk resulting from irradiation of tissue (T) to the total risk when the whole body is irradiated uniformly; H_T is the dose equivalent received by tissue (T); and H_{wb} is the stochastic dose-equivalent limit for uniform irradiation of the whole body.

4.8 Direct Bioassay - *In vivo* measurements to estimate the quantity of radioactive material in the human body using instrumentation that detects radiation emitted from within the body.

4.9 Director - Designated senior manager of Shieldalloy Metallurgical Corporation with the authority to commit Shieldalloy resources for radiation protection purposes.

4.10 Halflife, Biological (T_b) - The time in which half the quantity of a material in a compartment, in an organ, or in the whole body is eliminated by biological processes.

4.11 Halflife, Effective (T_e) - The time taken for the activity of a radioactive material in a compartment, in an organ or in the whole body to be reduced to half its value by a combination of biological elimination and radioactive decay:

$$\frac{1}{T_e} = \frac{1}{T_b} + \frac{1}{T_R}$$

where T_e = the effective half time; T_b = the biological half time; and T_R = the radiological or physical half time.

4.12 Halflife, Physical (T_R) - The time taken for the activity of a radionuclide to lose half its value by radioactive decay.

4.13 Indirect Bioassay - Estimate of amount of radioactive material in the human body based on measurements of radioactive material in excreta or in other biological materials from the body, and on a biological model for movement of the material in body tissues and organs.

4.14 Intake - Amount of radioactive material entering the body through the nose, mouth, or skin.

4.15 Internal Dosimetry - Specification, analysis, and interpretation of bioassay measurements that result in an estimate of internal dose equivalent or dose commitment.

4.16 May - The word may is used to denote permission.

4.17 Monitored Employee or Personnel - An individual who performs work within a radiologically controlled area and has the potential to receive greater than 100 millirem total effective dose equivalent in one calendar year.

4.18 Monitoring - The measurement of radioactivity in the whole body, in a region of the body, in material eliminated from the body or in the air for purposes of estimating the intake of radioactive material. The term monitoring also includes interpretation of the measurements.

4.18.1 Routine monitoring is monitoring carried out at regular intervals during normal operations.

4.18.2 Special monitoring is monitoring carried out in actual or suspected abnormal conditions.

4.18.3 Confirmatory monitoring is monitoring carried out in situations where workers are unlikely to be exposed to significant intakes, in order to demonstrate satisfactory work conditions.

4.19 Organ - A differentiated part of the body that performs a special function.

4.20 Radiation Protection Personnel - Personnel who perform radiation protection functions such a release surveys, personnel dosimeter distribution, radiation protection records maintenance, and quality assurance activities as they pertain to radiation protection. The term radiation protection personnel includes the RSO and the Assistant RSO.

4.21 Radiation Safety Officers (RSO) - An individual who, by virtue of qualifications and experience, ha been given the authority to implement the Shieldalloy Radiation Protection Program Plan. The RSO is qualified to use source material for its intended purpose in a manner that protects health and minimizes danger to life or property. The RSO is responsible for recognizing potential radiological hazards, developing a radiation safety program to protect against these hazards, training workers in safe work practices, and supervising day-to-day radiation safety operations.

4.22 Reference Man - A person with the anatomical and physiological characteristics defined in the repor of the ICRP Task Group on Reference Man (ICRP Report No. 23).

4.23 Representative - Faithfully showing the quality and characteristics of the entire volume from which a sample is drawn or a measurement is made.

4.24 Retention Function - A mathematical expression for that fraction of the initial body content of radioactive material retained in the organ of reference at time t after intake. The retention function is represented by the expression R(t).

4.25 Sample - A representative portion of an atmosphere of interest, or one or more separated constituents from a representative portion of an atmosphere.

4.26 Shall - The word shall is to be understood as a requirement.

4.27 Should - The word should is to be understood as a recommendation.

5 *PROCEDURE*

5.1 Administrative Dose Limits

5.1.1 Individual internal doses shall not exceed those associated with intake of radioactive materials at 10% of the Annual Limit of Intake (ALI) referenced in 10 CFR 20.

5.1.2 Approval by the RSO is required for any employee, visitor, or contractor to exceed this limit.

5.1.3 An individual shall participate in the monitoring program if the potential exists for intake of greater than 10% of the ALI of any radionuclide or combination of radionuclides.

5.1.4 The RSO shall obtain the results of termination bioassays from previous employers.

5.2 Internal Dose Control

5.2.1 Engineered controls shall be the primary methodology for preventing internal exposures.

5.2.2 The RSO shall take the following steps if there occurs an intake of radioactive materials that exceeds the administrative dose limits:

5.2.2.1 Inform the Director of the occurrence.

5.2.2.2 Investigate the incident immediately pursuant to ENV-R-010, "Emergency Response and Notifications.

5.2.2.3 Determine the root cause(s) and identify corrective actions to prevent recurrence.

5.2.2.4 Inform the Director of the results of the investigation and any corrective actions taken.

5.2.2.5 Deny the individual(s) involved further access into radiologically controlled areas pending assessment of internal dose and investigation of the circumstances of the incident.

5.2.3 For cases in which administrative dose limits have been exceeded, the RSO shall estimate the internal radiation dose. The results of the dose estimate shall be retained permanently in the individual's dosimetry record.

5.3 Direct Bioassay Program

5.3.1 *In vivo* bioassay (whole body counting) equipment may be used to monitor personnel for radionuclides that emit gamma rays or x-rays of energy greater than 200 keV.

5.3.2 *In vivo* bioassay services may be obtained from an outside contractor as deemed necessary by the RSO.

5.3.3 The RSO shall ensure that the requirements listed herein are included in the purchase order with the contractor.

5.3.4 *In vivo* bioassay equipment shall be sensitive enough to detect 10% of the Annual Limit on Intake at the 95% confidence interval for those radionuclides expected to be encountered by personnel.

5.3.5 Software programs for *in vivo* bioassay equipment shall be reviewed by the RSO prior to use to ensure that:

5.3.5.1 The correct radionuclides and their gamma/X ray energies, abundances, and decay factors are used in the program library;

5.3.5.2 Permissible radioactivity values and action levels based upon these radioactivity values are correct; and

5.3.5.3 Calculation methods used to estimate intakes, body burdens and/or internal dose are based upon the correct models.

5.3.6 Abnormal results identified in any calibration or system check shall be reported to the RSO for review and corrective action.

5.4 Indirect Bioassay Program

5.4.1 *In vitro* bioassay may be used to monitor personnel for internal deposition of radionuclides that cannot be detected using whole body counting equipment, or when measurement of individual elimination rates is desired.

5.4.2 *In vitro* bioassay analyses may be obtained from an outside contractor as deemed necessary by the RSO.

5.4.3 Analyses shall be performed when a potential intake of alpha- or beta-emitting radionuclides is suspected.

5.4.4 To assure the quality of the results of the *in vitro* bioassay program, the RSO shall require that the radioanalytical laboratory used for processing of biological samples comply with the recommendations of USNRC Regulatory Guide 4.15.

5.4.5 Biological samples to be collected for *in vitro* bioassay may include urine, feces, nasal smears, breath, blood, or other body fluids.

5.5 Monitoring Frequency

5.5.1 Baseline bioassays shall be performed at the start of employment only for radiation workers who were not provided with exit bioassay at their previous place of employment, or at the discretion of the RSO.

5.5.2 If a baseline bioassay is deemed necessary, it shall consist of one or more of the following as determined by the RSO:

5.5.2.1 Gamma spectral analysis of a twenty-four hour collection of urine.

5.5.2.2 Isotope-specific (uranium and thorium) radiochemical extraction and analysis of a twenty-four hour collection of urine.

5.5.2.3 Isotope-specific (uranium and thorium) analysis of a twenty-four hour collection of feces.

5.5.2.4 Whole body count.

5.5.3 Routine bioassays shall be performed in accordance with the following guidance:

5.5.3.1 Prior to, and upon termination of work within a radiologically controlled area.

5.5.3.2 Throughout the work period at a frequency specified by the RSO.

5.5.4 Special or non-routine bioassays shall be performed:

5.5.4.1 After detection of facial contamination or positive nasal smear results.

5.5.4.2 Following acute exposure to airborne radioactivity without respiratory protection in place.

5.5.4.3 When it is suspected that an individual may have received an internal deposition for any reason.

5.6 Validation of Bioassay Results

5.6.1 The RSO shall determine the validity of bioassay results prior to their inclusion in the internal dose assessment process.

5.6.2 The RSO shall evaluate the following items to ascertain the validity of monitoring results:

- Sample collection errors;
- Radiation background interference during counting;
- Calibration errors;
- Computer software errors;
- Errors due to counting geometry; and/or
- Statistical errors.

5.6.3 Only valid bioassay results, as determined by the RSO shall be used for assessment of internal radiation dose.

5.6.4 If bioassay data are not valid:

5.6.4.1 The RSO shall document the basis for that conclusion and include the documentation in the individual's dosimetry record.

5.6.4.2 The RSO shall also estimate the internal dose to the individual via other means and include the estimate in the individual's exposure history.

5.6.5 Results of airborne radiation monitoring should be considered when calculating an individual's internal radiation dose.

5.7 Interpretation of Bioassay Results

5.7.1 The RSO shall complete the top of the form entitled "Interpretation of Bioassay" (See Attachment 1).

5.7.1.1 The RSO shall identify the route of entry (i.e., inhalation, ingestion, etc.), which should be the most likely route based upon current knowledge of exposure conditions. However, this selection can and should be modified as further information becomes available.

5.7.1.2 The Annual Limit of Intake (ALI) for the radionuclide in question should be obtained from 10 CFR 20, Appendix B, Table 1.

5.7.1.3 The solubility class is only applicable to intake by inhalation and should be based upon current knowledge of the chemical form and/or particle size.

5.7.1.4 If the route of intake is unknown, the route shall be assumed to be "inhalation" until evidence to the contrary is obtained.

5.7.2 Using available bioassay results, the RSO should complete the table on Attachment 1 pursuant to the instructions contained in Attachment 2.

5.8 Action Levels

5.8.1 Selection and conduct of follow-up actions by the RSO should include consideration of the following:

5.8.1.1 The dosimetric significance of all involved radionuclides;

5.8.1.2 The presence of indicator radionuclides;

5.8.1.3 The likely routes of entry of the radionuclide(s) into the body;

5.8.1.4 Suspected biokinetic processes at times shortly after intake;

5.8.1.5 The time required for absorption and elimination to occur;

5.8.1.6 The expected retention or excretion of the radionuclides;

5.8.1.7 The availability of analytical services;

5.8.1.8 The required sensitivity and measurement turnaround time; and/or

5.8.1.9 The required sample size.

5.8.2 The Investigation Level (IL) should be set at the following:

$$IL = 0.1 \times f \times ALI$$

where IL = the Investigation Level, f = the fraction of the year to which a particular routine monitoring result applies, and ALI is the Annual Limit on Intake for the radionuclide in question.

5.8.3 Follow-up actions for deposited radionuclides detected at levels in excess of one IL may include the following, at the discretion of the RSO:

5.8.3.1 Additional measurements; and/or

5.8.3.2 Acquisition of other data necessary to describe the retention of the radionuclide(s) in the body.

5.9 Airborne Radiation Monitoring

5.9.1 An airborne radiation monitoring program shall be maintained if required by radiological conditions , and if necessary for bioassay purposes.

5.9.2 The airborne radiation monitoring program shall be administered by the RSO.

5.9.3 The RSO shall determine the extent and type of sampling required for each radiological condition.

5.9.4 Air samples shall be representative of the bulk stream or volume from which they are taken.

5.9.5 Samples taken in a zone occupied by a worker shall be drawn from a point or series of points within the breathing zone of that worker.

5.9.6 When fixed position samplers are used:

A. Care shall be taken in the selection of the position and number of samples in a given work area.

B. The location shall be selected to be as close to the breathing zone as is practical, without interfering with the work or the worker.

5.9.7 Samples shall be representative with respect to physical and chemical composition.

5.9.8 The samples shall not fractionate by particle size or in other ways distort the physical and chemical properties of the airborne radioactive constituents, however, sampling with deliberate differentiation as to particle sizes may be used to distinguish the particle size distribution in order to evaluate radiological effects.

5.9.9 Procedures to ensure personnel health and safety shall be exercised in extracting a sample from an airstream when the air contains chemically reactive forms of radionuclides (e.g., iodine).

5.9.10 Air Sample Collection

5.9.10.1 Collection system, flow measuring device, and vacuum system shall be assembled in advance.

5.9.10.2 Pump(s) shall be started and needle valves adjusted to obtain the desired flow rate.

5.9.10.3 The system shall be tested for leakage by blocking intake or pinching hose near intake. If flow rate does not drop to less than 10% of initial (unblocked) rate, recheck and tighten connections and components.

5.9.10.4 The starting time and flow rate shall be recorded on an Air Sampling Report (Attachment 3).

5.9.10.5 During sampling, the system should be checked periodically to assure that the desired sampling rate is being maintained, making flow rate adjustments or changes as necessary.

5.9.10.6 The pump should be turned off at the pre-determined time, and the final time and flow rate should be recorded on the Air Sampling Report.

5.9.10.7 Sample collection media should be transferred to appropriate containers and labeled in accordance with this procedure.

5.9.10.8 Equipment shall be cleaned before initiating further sampling.

5.9.11 Air Sample Analysis

5.9.11.1 Canisters, filters and Marinelli beakers shall be transported to the appropriate location for radiological analysis (in-house or vendor-supplied).

5.9.11.2 A copy of the Air Sampling Report shall accompany each sample.

5.9.11.3 Filters shall be analyzed by direct counting and the following results reported:

5.9.11.3.1 Gross alpha and gross beta activity.

5.9.11.3.2 Ratio of alpha-to-beta activity.

5.9.11.3.3 Gross alpha and beta activity corrected for radon daughter contribution.

5.9.11.3.4 Gamma spectral analyses, if significant activity is noted, or if required for other purposes.

5.9.12 Results of the air monitoring program may be used for assignment of committed effective dose equivalents (CEDEs) in place of or in addition to internal radiation monitoring.

6 DOCUMENTATION

6.1 All Records pertinent to this procedure shall be maintained pursuant to ENV-R-011, "Radiation Protection Records".

6.2 Individual Monitoring Records

6.2.1 Internal radiation exposure received during prior employment.

6.2.2 Internal exposure received at other installations during current employment by Shieldalloy.

6.2.3 Results of individual whole body counts and bioassay results.

6.3 Internal Radiation Monitoring Program Records

6.3.1 Procedures and methods for interpretation and evaluation of individual exposure data.

6.3.2 Capabilities of bioassay services.

6.3.3 Program review and audits.

6.3.4 Investigation reports for instances in which significant internal depositions occur.

6.3.5 Procedures and records associated with *in vitro* and *in vivo* bioassay techniques including set-up, testing, calibration, and daily and weekly response checks of whole body counting equipment.

6.3.6 Internal dose assessments, including the bases for the dose assessment.

6.3.7 Results of airborne radiation monitoring.

7 ATTACHMENTS

7.1 Attachment 1 - Interpretation of Bioassay

7.2 Attachment 2 - Instruction Form

7.3 Attachment 3 - Air Sampling Report

ATTACHMENT 1
INTERPRETATION OF BIOASSAY

Subject:	Route of Intake:
Date of Intake:	*Annual Limit on Intake:*
Radionuclide:	Dose Conversion Factor:
Solubility Class: ☐ D ☐ W ☐ Y	

t (days)	Volume (Mass)	Activity	O (corrected)	(a) IRF	(b) O x IRF (needed only for least squares fit)	(c) IRF^2 (needed only for least squares fit)	(d) Intake

Comments:

(e)	(f)	

(g) Intake = Average of (d) =

or

(g) Intake = (e)/(f) =

(h) H_{50} = (g)/(ALI) x 5 =

or:

(i) H_{50} = (g) x DCF =

* Needed only if least-squares fit is required.

Dosimetrist / Date

ATTACHMENT 2

INSTRUCTIONS FOR THE COMPLETION OF INTERPRETATION OF BIOASSAY FORM

1. The value listed for "t" should be the number of days between the suspected date of intake and the date of sample collection for indirect bioassay, or the date of measurement for direct bioassay.

2. Values for "Volume" or "Mass" are applicable to indirect bioassay measurements only.

3. The "Activity" should be the actual activity reported from the bioassay measurement.

4. The values for "O(corrected)" are "Activity" values corrected to reflect the appropriate units of activity in the applicable bioassay compartment. For example, a single 200 ml urine sample is analyzed and found to contain 25 pCi of "Activity". This value must be corrected to reflect the activity in a twenty-four-hour void. Therefore, "O(corrected)" is equal to (25 pCi × 1400 ml) ÷ 200 ml, or 175 pCi.

5. Values for "IRF" shall be selected from those contained in ICRP Publication 54.

6. For a single bioassay result or to obtain the average intake from multiple bioassay results:

   6.1 Values entered in column (c), labeled "Intake", are obtained by solving the equation: "O(corrected)" × "IRF".

   6.2 It is not necessary to complete columns (a) and (b).

   6.3 For multiple bioassay results, the average of the column (c) values is computed and entered in slot (d) below, marked "Intake".

7.0 To obtain a least-squares fit for multiple bioassay data:

   7.1 Columns labeled (a) and (b) should be completed, with the totals for each column entered in slots (e) and (f), respectively.

   7.2 The best estimate of intake should be obtained by solving for (e) ÷ (f), and entering the result in (g).

8.0 An estimate of Committed Dose Equivalent, or "H_{50}", in units of rem, should be obtained by one of the following means:

   8.1 Divide the value entered in either (d) or (g) by the ALI, multiply the result by 5, and enter the result in (h).

   8.2 Multiply the value entered in either (d) or (g) by an appropriate Dose Conversion Factor (Federal Guidance Report #11), and enter the result in (i).

9.0 Since the H_{50} is assigned in the year in which the dose is received, the value of (h) or (i) can be added to the external dose for that year and compared directly to administrative or legal dose limits in order to guide follow-up actions.

ATTACHMENT 3

AIR SAMPLING REPORT