UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northeast Fisheries Center
Gloucester Laboratory
30 Emerson Avenue
Gloucester, MA 01930

MS-16
K-2

June 5, 1989

Mr. Jack Davis
U.S. Nuclear Regulatory Commission
Nuclear Materials Safety Section A
Division of Radiation Safety and Safeguards
~~631 Park Avenue~~ 475 Allendale Road
King of Prussia, PA 19406

Dear Mr. Davis:

The Department of Commerce, with Chem-Nuclear Systems, Inc. (CNSI), has successfully completed the decommissioning of our Marine Products Development Irradiator (MPDI) facility. The cobalt-60 sources licensed under NRC License 20-05735-03 have been transferred to Louisiana State University.

The attached report documents the decommissioning of the facility and final survey performed after the removal of the sources. The final survey did not identify any radiation levels or contamination above background. Therefore, the Department of Commerce requests termination of the facility license with release of the facility for unrestricted uses.

We appreciate your cooperation in this matter. If you have any questions, please feel free to contact us.

Sincerely,

Robert J. Learson
Officer-In-Charge



Attachments

c: Larry Grob, CNSI

FEE EXEMPT

110495



OFFICIAL RECORD COPY

JUL 13 1989

NRC FORM 314 (11-88)
10 CFR 30.35(d)(1)(iii)
10 CFR 40.42(d)(1)(iii)
10 CFR 70.38(g)(1)(iii)

U.S. NUCLEAR REGULATORY COMMISSION

APPROVED BY OMB 3150-0028 EXPIRES 12-31-91

# CERTIFICATE OF DISPOSITION OF MATERIALS

*(All items MUST be completed, please print)*

FILE CERTIFICATES AS FOLLOWS

IF YOU ARE LOCATED IN:

CONNECTICUT, DELAWARE, DISTRICT OF COLUMBIA, MAINE, MARYLAND, MASSACHUSETTS, NEW HAMPSHIRE, NEW JERSEY, NEW YORK, PENNSYLVANIA, RHODE ISLAND, OR VERMONT, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION I
NUCLEAR MATERIALS SAFETY SECTION B
475 ALLENDALE ROAD
KING OF PRUSSIA, PA 19406

ALABAMA, FLORIDA, GEORGIA, KENTUCKY, MISSISSIPPI, NORTH CAROLINA, PUERTO RICO, SOUTH CAROLINA, TENNESSEE, VIRGINIA, VIRGIN ISLANDS, OR WEST VIRGINIA, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION II
NUCLEAR MATERIALS SAFETY SECTION
101 MARIETTA STREET, SUITE 2900
ATLANTA, GA 30323

ILLINOIS, INDIANA, IOWA, MICHIGAN, MINNESOTA, MISSOURI, OHIO, OR WISCONSIN, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION III
MATERIALS LICENSING SECTION
799 ROOSEVELT ROAD
GLEN ELLYN, IL 60137

IF YOU ARE LOCATED IN:

ARKANSAS, COLORADO, IDAHO, KANSAS, LOUISIANA, MONTANA, NEBRASKA, NEW MEXICO, NORTH DAKOTA, OKLAHOMA, SOUTH DAKOTA, TEXAS, UTAH, OR WYOMING, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION IV
MATERIAL RADIATION PROTECTION SECTION
611 RYAN PLAZA DRIVE, SUITE 1000
ARLINGTON, TX 76011

ALASKA, ARIZONA, CALIFORNIA, HAWAII, NEVADA, OREGON, WASHINGTON, AND U.S. TERRITORIES AND POSSESSIONS IN THE PACIFIC, SEND APPLICATIONS TO:

U.S. NUCLEAR REGULATORY COMMISSION, REGION V
NUCLEAR MATERIALS SAFETY SECTION
1450 MARIA LANE, SUITE 210
WALNUT CREEK, CA 94596

LICENSEE NAME AND ADDRESS

Department of Commerce
National Marine Fisheries Service
30 Emerson Avenue
Gloucester, MA 01930

LICENSE NUMBER: 20-05735-03

LICENSE EXPIRATION DATE: 8-31-90

THE LICENSEE OR ANY INDIVIDUAL EXECUTING THIS CERTIFICATE ON BEHALF OF THE LICENSEE CERTIFIES THAT: *(Check and/or complete the appropriate item(s) below.)*

## A. MATERIALS DATA *(Check one and complete, as necessary)*

[ ] 1. NO MATERIALS HAVE EVER BEEN POSSESSED OR PROCURED BY THE LICENSEE UNDER THIS LICENSE.

OR

[ ] 2. ALL MATERIALS PROCURED AND/OR POSSESSED BY THE LICENSEE UNDER THE LICENSE NUMBER CITED ABOVE HAVE BEEN TRANSFERRED ON

DATE: | TO: | WHICH HAS NRC LICENSE NUMBER:

OR

[X] 3. ALL MATERIALS PROCURED AND/OR POSSESSED BY THE LICENSEE UNDER THE LICENSE NUMBER CITED ABOVE HAVE BEEN TRANSFERRED ON

DATE: 4-15-89

TO: Louisiana State University, Baton Rouge, LA 70803

WHICH HAS LICENSE NUMBER: LA-0001-L01 | ISSUED BY THE STATE OF: Louisiana

AN AGREEMENT STATE PURSUANT TO SECTION 274 OF THE ATOMIC ENERGY ACT OF 1954, AS AMENDED, AND THE ENERGY REORGANIZATION ACT OF 1974.

OR

[ ] 4. MATERIALS HAVE BEEN DISPOSED OF IN THE FOLLOWING MANNER. *(Describe specific disposal procedures—use the reverse of this form, or provide attachments.)*

## B. OTHER DATA

[X] 1. OUR LICENSE HAS NOT YET EXPIRED. PLEASE TERMINATE IT.

2. WAS A RADIATION SURVEY CONDUCTED TO CONFIRM THE ABSENCE OF LICENSED RADIOACTIVE MATERIALS AND TO DETERMINE WHETHER ANY CONTAMINATION REMAINS ON THE PREMISES COVERED BY THE LICENSE? *(Check one)*

[ ] NO

[X] YES, THE RESULTS *(Check one)* [X] ARE ATTACHED, OR [ ] WERE FORWARDED TO NRC ON *(Date)*

3. THE PERSON TO BE CONTACTED REGARDING THE INFORMATION PROVIDED ON THIS FORM

NAME: Kurt A. Wilhelm | TELEPHONE NUMBER: (508)281-9308

4. MAIL ALL FUTURE CORRESPONDENCE REGARDING THIS LICENSE TO

NMFS, Gloucester Lab
30 Emerson Avenue
Gloucester, MA 01930

## CERTIFYING OFFICIAL

PRINTED NAME AND TITLE: Robert J. Learson, Officer-In-Charge | SIGNATURE: Robert J. Learson | DATE: 6-5-89

NRC FORM 314 (11-88)

# FINAL PROJECT REPORT
# UNITED STATES DEPARTMENT OF COMMERCE
# NATIONAL MARINE FISHERIES SERVICE
# GLOUCESTER, MASSACHUSETTS

PREPARED BY:

CHEM-NUCLEAR SYSTEMS, INC.
220 STONERIDGE DRIVE
COLUMBIA, SOUTH CAROLINA 29210

UNDER ARMY CONTRACT NO. DAAA09-87-G-0013
DELIVERY ORDER A0037
AMENDMENT A003701

110495

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(2773U)

U.S. DEPARTMENT OF COMMERCE
MARINE PRODUCTS DEVELOPMENT IRRADIATOR FACILITY

NATIONAL MARINE FISHERIES SERVICE
GLOUCESTER, MASSACHUSETTS

# FINAL REPORT DOCUMENTING THE DECOMMISSIONING AND RADIOLOGICAL SURVEY TO SUPPORT REQUEST FOR TERMINATION OF LICENSE NO. 20-05735-03

PREPARED BY:

L. H. GROB, JR.

AND

T. EASTMAN

CHEM-NUCLEAR SYSTEMS, INC.
220 STONERIDGE DRIVE
COLUMBIA, SOUTH CAROLINA 29210

UNDER ARMY CONTRACT NO. DAAA09-87-G-0013
DELIVERY ORDER A0037
AMENDMENT A003701

# TABLE OF CONTENTS



(2726U)

# MARINE FISHERIES TEXT

## 1.0 INTRODUCTION

On May 4, 1988, the U. S. Department of Commerce, National Marine Fisheries Service requested the Commander, AMCCOM, Rock Island, Illinois, to acquire the services necessary to remove approximately 10.0 kCi of Co-60 located at the Marine Products Development Irradiator (MPDI), Gloucester, MA. and to decommission the facility. The task was awarded to Chem-Nuclear Systems, Inc. (CNSI) to be performed under their BOA, delivery order #A0037, and was completed on April 16, 1989.

## 2.0 DECOMMISSIONING ACTIVITIES

A decommissioning plan was written (Appendix E) and sent to the NRC, Region I (Appendix A), for review and approval to proceed. This approval was given in a letter from Jack Davis of the NRC, to Robert Learson, National Marine Fisheries Service, dated April 14, 1989 (Appendix B).

All work was conducted in accordance with the decommissioning plan, and the Co-60 sources were removed from the MPDI. After removal, a survey of the MPDI was conducted per the plan and the results reported in Appendix C. No activity above background was detected.

The demineralization and recirculation system was surveyed as detailed in the plan with one exception. Due to the physical size and access limitations, the overflow tank could not be entered and directly surveyed. The overflow tank was dewatered to the maximum extent possible, and then surveyed with a micro-R meter. In addition, 6 smears were taken from the inside of the tank to detect loose contamination. No contamination was detected.

Personnel monitoring was conducted. The exposure for the job was well below that projected, and is shown in Appendix D.

## 3.0 CONCLUSIONS

The decommissioning was conducted in accordance with the NRC approved plan. The release survey did not identify any radiation levels or contamination above background. Thus, the conditions for free release of the MPDI have been met.

# DEPARTMENT OF COMMERCE, NATIONAL MARINE FISHERIES
# RELEASE SURVEY OF THE IRRADIATOR FACILITY

In accordance with the Chem-Nuclear Systems, Inc. (CNSI), Decommissioning Plan for Project 48583 at National Marine Fisheries (NMF), a release survey was conducted to achieve the termination of their NRC Radioactive Material License No. 20-05735-03.

It was determined that the existing counting equipment at NMF was incapable of obtaining the minimum sensitivity necessary to ensure that water activity levels met the requirements of the decommissioning plan. Therefore, water samples were drawn and analyzed at the CNSI Environmental Lab to ensure no source leakage existed prior to and during the source handling operation. Additionally, at the conclusion of the source handling operation, a sample was drawn and analyzed by Massachusetts Institute of Technology (report attached) as an outside independent verification of water activity prior to dewatering the pool to facilitate the release survey per the decommissioning plan.

After the walls and floor of the pool were dry, a smear survey of all surfaces was performed. Results of that survey shown in the following tables indicate no activity above background was detected.

Due to physical access limitations and personnel safety constraints, the overflow tank could not be entered; thus, the tank's inner surfaces could not be directly surveyed as detailed in the decommissioning plan. The overflow tank was dewatered to the maximum extent possible, then surveyed by micro-R meter. Smears for removable activity were taken.

The Demineralization and recirculation system was surveyed as detailed in the decommissioning plan. In addition, the system was surveyed by a micro-R meter for indications of internal activity.

The results of the combined surveys indicate all conditions for free release of the irradiator facility have been met as supported by the following data tables:



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## DATA TABLES

I. A grid survey of the pool surfaces was conducted per Steps 7.3.3 through 7.3.5 of the decommissioning plan. The grid numbers correspond to the grid locations shown in Figure 1 of the decommissioning plan.

A. The five random 1 minute scaler counts of Step 7.3.5.a) correspond to readings 'A' - 'E'. The scaler count per Step 7.3.5.b) corresponds to reading 'F'. The 1 minute scaler count reading includes the average of 216 dpm background activity.

| GRID NUMBER | GRID LOCATION | ACTIVITY dpm/PROBE |
|---|---|---|
| 1 | A | 168 |
| | B | 270 |
| | C | 272 |
| | D | 175 |
| | E | 205 |
| | F | 241 |
| 2 | A | 278 |
| | B | 234 |
| | C | 249 |
| | D | 190 |
| | E | 205 |
| | F | 227 |
| 3 | A | 249 |
| | B | 117 |
| | C | 263 |
| | D | 241 |
| | E | 219 |
| | F | 263 |
| 4 | A | 205 |
| | B | 190 |
| | C | 161 |
| | D | 197 |
| | E | 124 |
| | F | 205 |

## DATA TABLES (CONTINUED)

| | | |
|---|---|---|
| 5 | A | 212 |
| | B | 270 |
| | C | 256 |
| | D | 139 |
| | E | 183 |
| | F | 219 |
| 6 | A | 249 |
| | B | 285 |
| | C | 329 |
| | D | 227 |
| | E | 219 |
| | F | 197 |
| 7 | A | 234 |
| | B | 175 |
| | C | 205 |
| | D | 190 |
| | E | 227 |
| | F | 249 |
| 8 | A | 175 |
| | B | 234 |
| | C | 263 |
| | D | 241 |
| | E | 190 |
| | F | 270 |
| 10 | A | 139 |
| | B | 270 |
| | C | 190 |
| | D | 183 |
| | E | 219 |
| | F | 249 |
| 16 | A | 168 |
| | B | 234 |
| | C | 241 |
| | D | 234 |
| | E | 205 |
| | F | 263 |

## DATA TABLES (CONTINUED)

| | | |
|---|---|---|
| 18 | A | 314 |
| | B | 249 |
| | C | 234 |
| | D | 227 |
| | E | 249 |
| | F | 161 |
| 25 | A | 190 |
| | B | 249 |
| | C | 234 |
| | D | 249 |
| | E | 212 |
| | F | 241 |
| 28 | A | 212 |
| | B | 241 |
| | C | 234 |
| | D | 183 |
| | E | 205 |
| | F | 212 |
| 33 | A | 227 |
| | B | 314 |
| | C | 270 |
| | D | 190 |
| | E | 270 |
| | F | 234 |
| 45 | A | 278 |
| | B | 234 |
| | C | 219 |
| | D | 256 |
| | E | 205 |
| | F | 241 |

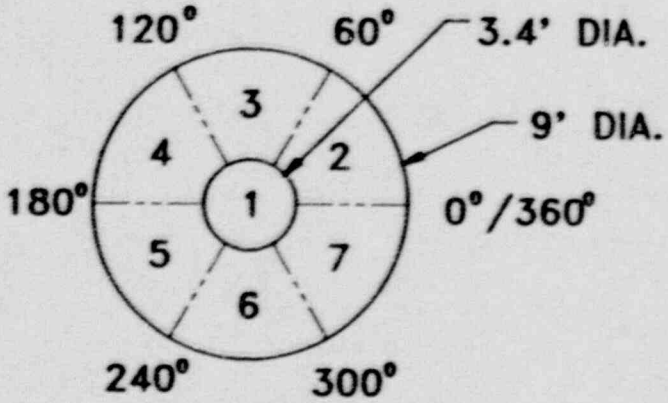
B. Removable contamination survey at location 'F' of grid survey per Step 7.3.5.b) of the decommissioning plan. Each reading includes the average of 315.7 dpm/100 $cm^2$ background activity in the counting location.

| GRID NUMBER | ACTIVITY (dpm/100 $cm^2$ |
|---|---|
| 1 | 291 |
| 2 | 306 |
| 3 | 246 |
| 4 | 328 |
| 5 | 276 |
| 6 | 276 |
| 7 | 246 |
| 8 | 253 |
| 10 | 298 |
| 16 | 246 |
| 18 | 253 |
| 25 | 268 |
| 28 | 276 |
| 33 | 253 |
| 45 | 246 |

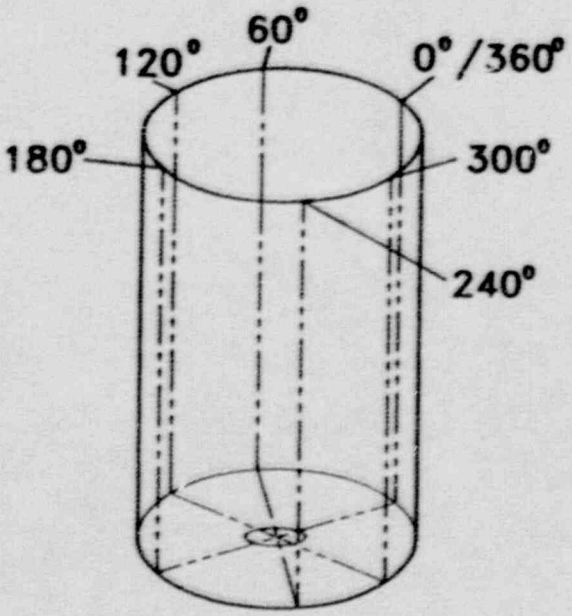
II. The results of the smear and radiation surveys indicate only background levels of activity exist in the demineralization and recirculation systems as shown below. The smear readings include the 315.7 dpm/100 $cm^2$ background activity. The background radiation levels averaged 8 micro-R per hour. Sample numbers correspond to those locations identified in Figure 2.

| SAMPLE NUMBER | LOCATION DESCRIPTION | REMOVABLE ACTIVITY (dpm/100 $cm^2$) | RADIATION EXPOSURE RATE (micro-R/HR.) |
|---|---|---|---|
| 1 | Tank inner surface | 291 | 5 |
| 2 | " " " | 276 | 5 |
| 3 | " " " | 246 | 5 |
| 4 | " " " | 328 | 5 |
| 5 | " " " | 253 | 5 |
| 6 | " " " | 175 | 5 |
| 7 | Sump Drain | 241 | 8 |
| 8 | Sump Floor | 190 | 8 |
| 9 | " " | 249 | 8 |
| 10 | " " | 227 | 8 |
| 11 | " " | 249 | 8 |
| 12 | " " | 249 | 8 |
| 13 | " " | 272 | 8 |

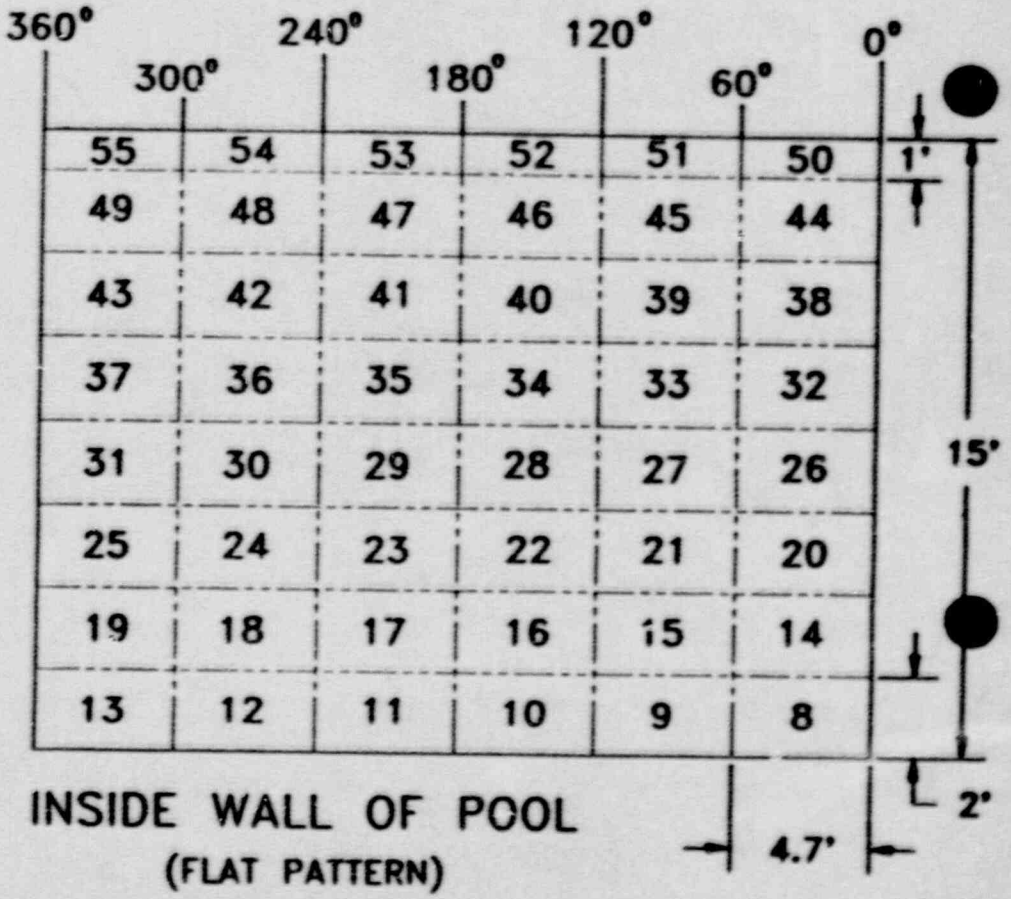
| SAMPLE NUMBER | LOCATION DESCRIPTION | REMOVABLE ACTIVITY (dpm/100 $cm^2$) | RADIATION EXPOSURE RATE (micro-R/HR.) |
|---|---|---|---|
| 14 | Demin. Inlet | 278 | 8 |
| 15 | Demin. Connection | 168 | 8 |
| 16 | Demin, Drain | 241 | 8 |
| 17 | Inside of Demin. | 219 | 8 |
| 18 | " " " | 263 | 8 |
| 19 | " " " | 219 | 8 |
| 20 | " " " | 197 | 8 |
| 21 | " " " | 270 | 8 |
| 22 | Filter 'B' Housing | 256 | 8 |
| 23 | " " " | 139 | 8 |
| 24 | " " " | 227 | 8 |
| 25 | Filter 'C' Housing | 285 | 8 |
| 26 | " " " | 329 | 8 |
| 27 | " " " | 227 | 8 |
| 28 | Internal Piping | 219 | 8 |
| 29 | " " | 183 | 8 |
| 30 | " " | 241 | 8 |
| 31 | " " | 270 | 8 |
| 32 | " " | 234 | 8 |
| 33 | " " | 263 | 8 |
| 34 | " " | 249 | 8 |
| 35 | " " | 241 | 8 |
| 36 | " " | 253 | 8 |
| 37 | Tank Cover Flange | 276 | 8 |




BOTTOM OF POOL

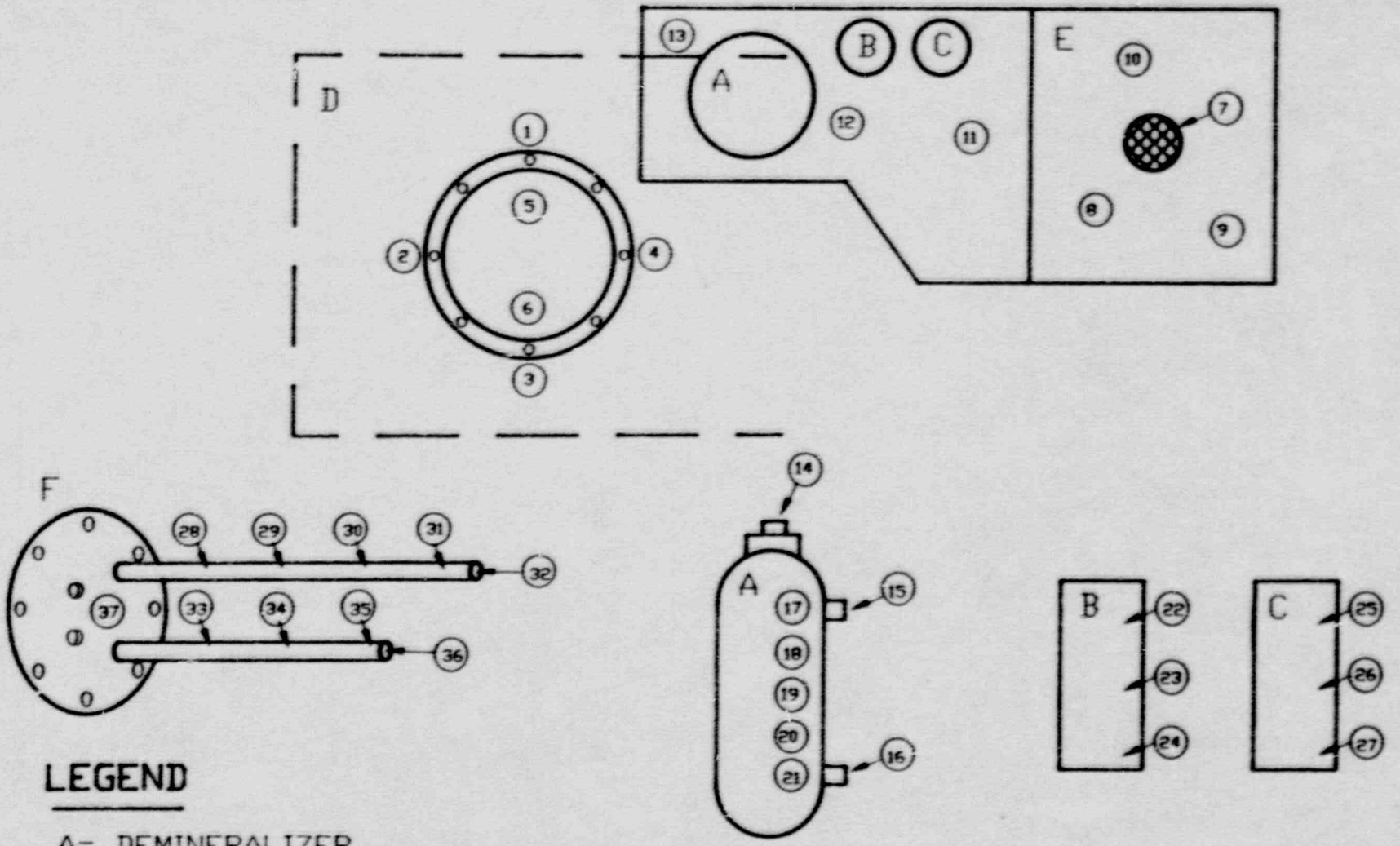



PICTORIAL VIEW




INSIDE WALL OF POOL
(FLAT PATTERN)

PROPOSED SURVEY GRID MAP
FOR MDPI POOL




# SURVEY GRID MAP
# NMF/48583

**BOLTON & GALANEK, INC.**
Consultants · Radiochemistry & Health Physics
P.O. Box 366 M.I.T. Branch
Boston, MA 02139
Tel. (617) 253-2180

Todd Eastman
Chem-Nuclear Systems Inc.
220 Stoneridge Drive
Columbia, S.C. 29210

21 April 1989

Attention: Mr. Todd Eastman

Enclosed are the results of the water sample analysis performed on April 14, 1989. This sample was analyzed for $^{60}Co$ contamination. No detectable activity above background was evident in the sample analyzed.

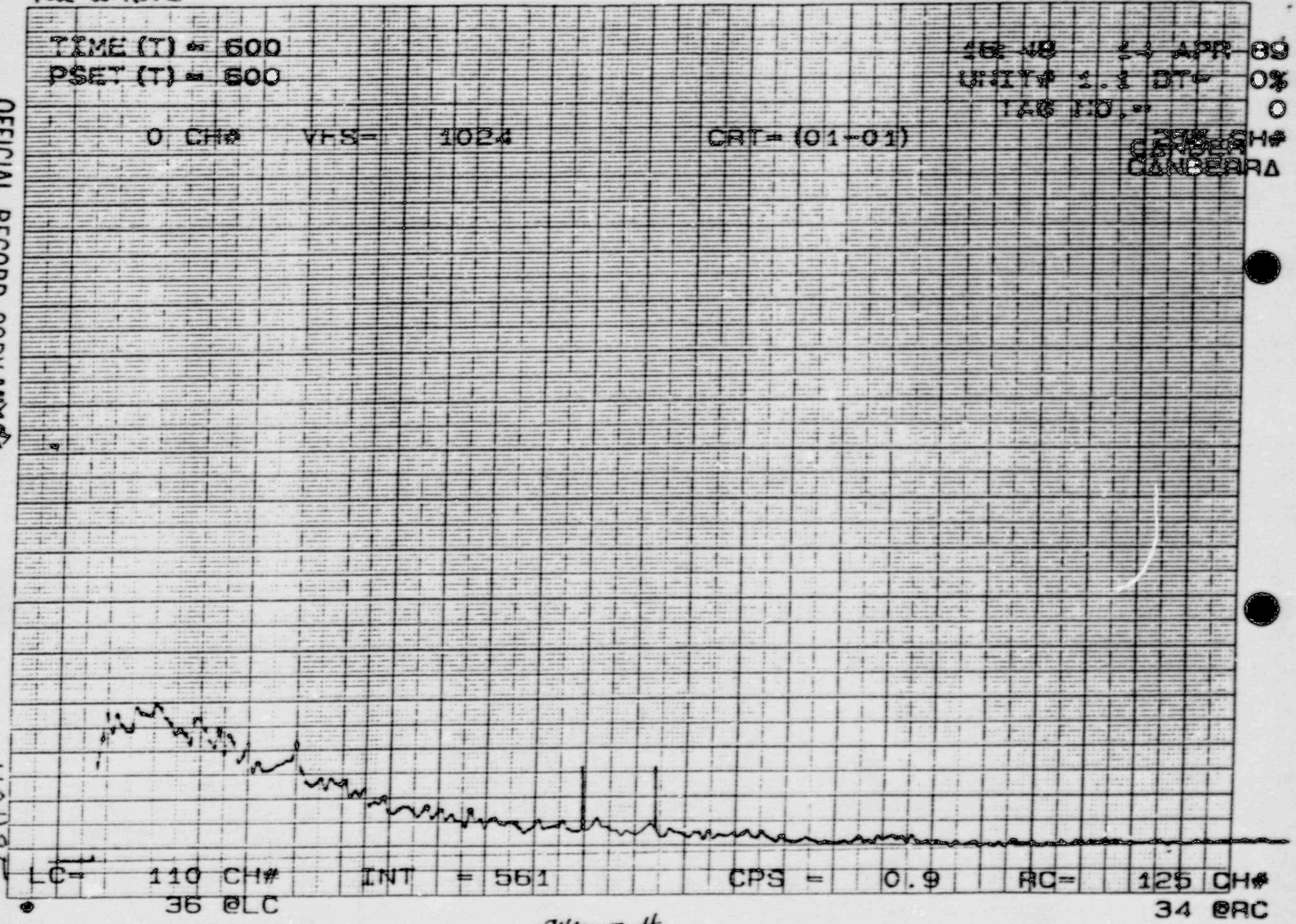
The sample was analysed using a 3" x 3" NaI detector coupled to a Canberra Series 80 multichannel analyser. The minimum detectable activity of the detector system was $5.0 \times 10^{-8}$ uCi/ml based on 4.64 $\sigma_{Bkg}$ for the time counted and the amount of sample analysed.

If you have any further questions, please feel free to call at 617-253-2180.

Margaret Stinson
Health Physicist

Mitchell S. Galanek
Health Physicist

Post WATER 14 April

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110495

APR 14 1989

License No. 20-05735-03
Docket No. 030-06952
Control No. 110495

Department of Commerce
National Marine Fisheries Service
ATTN: Robert J. Learson
laboratory Director
30 Emerson Avenue
Gloucester, Massachusetts 01930

Gentlemen:

This in reference to your proposed Decommissioning Plan dated March 31, 1989 to terminate License No. 20-05735-03 and to release the premises for unrestricted use.

It appears that the plan you have submitted to decommission your facility fulfills the intent of the NRC release criteria. After you have decontaminated the area, made a comprehensive radiation survey, and forwarded the report to this office, the NRC will perform a confirmatory survey to verify your results. If the surveys agree, we will terminate your license and release the premises for unrestricted use.

We will continue our review upon receipt of this information. Please reply in duplicate to my attention at the Region I office and refer to Mail Control No. 110495.

Sincerely,

Original Signed By:
Jack Davis

Jack Davis
Nuclear Materials Safety Section C
Division of Radiation Safety
and Safeguards

DRSS:RI
Davis/tlm
4/10/89

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04/07/89

ML18

APR 14 1989

License No. 20-05735-03
Docket No. 030-06952
Control No. 110495

Department of Commerce
National Marine Fisheries Service
ATTN: Robert J. Learson
Laboratory Director
30 Emerson Avenue
Gloucester, Massachusetts 01930

Gentlemen:

This in reference to your proposed Decommissioning Plan dated March 31, 1989 to terminate License No. 20-05735-03 and to release the premises for unrestricted use.

It appears that the plan you have submitted to decommission your facility fulfills the intent of the NRC release criteria. After you have decontaminated the area, made a comprehensive radiation survey, and forwarded the report to this office, the NRC will perform a confirmatory survey to verify your results. If the surveys agree, we will terminate your license and release the premises for unrestricted use.

We will continue our review upon receipt of this information. Please reply in duplicate to my attention at the Region I office and refer to Mail Control No. 110495.

Sincerely,

Original Signed By:
Jack Davis

Jack Davis
Nuclear Materials Safety Section C
Division of Radiation Safety
and Safeguards

"SECTION COPY"

UNITED STATES DEPARTMENT OF COMMERCE
National Oceanic and Atmospheric Administration
NATIONAL MARINE FISHERIES SERVICE
Northeast Fisheries Center
Gloucester Laboratory
30 Emerson Avenue
Gloucester, MA 01930

March 31, 1989

030-06952

Mr. Jack Davis
U.S. Nuclear Regulatory Commission
Nuclear Materials Safety Section A
Division of Radiation Safety and Safeguards
631 Park Avenue
King of Prussia, PA 19406

Dear Mr. Davis:

Plans are being made to remove the Cobalt 60 sources licensed under NRC License No. 20-05735-03 in our Marine Products Development Irradiator (MPDI). The decommissioning plan for the facility is provided for your review and approval and will lead to eventual termination of the license. Please expedite review of the plan.

The Department of Commerce has made arrangements with Chem-Nuclear Systems, Inc. (CNSI) to remove the sources and perform final surveys of the MPDI facility so that license termination can be granted. The sources will be transported to Louisiana State University (LSU) and installed in the LSU pool irradiator under State of Louisiana License No. LA-0001-L01. Radioactive waste, if any, will be properly packaged and disposed at the CNSI disposal site in Barnwell, South Carolina.

Chem-Nuclear has ample capabilities, equipment, and expertise to perform these activities in a safe manner. Their radiological control procedures are documented in the attached CNSI Procedure FS-RP-001 "Radiological Control Procedure for Field Projects". This manual is the primary basis for the issuance of the attached NRC License No. 39-23004-01. The project-specific work instruction will be followed to perform the removal of the sources, packaging for transport to LSU, and final surveys of the facility. The National Marine Fisheries Service Project 48583 Decommissioning Plan is submitted for your revie

The Project activities have been scheduled with the concurrence of CNSI, LSU, and Gloucester Laboratory to begin on April 13, 1989. CNSI has arranged with a local crane service to remove the sources (in a shielded transfer pig) from the facility and place them into the licensed shipping cask on Saturday, April 15, 1989.

Request for termination of License NO. 20-05735-03 is being made at this time. The disposition of licensed materials will be as discussed above. Activities toward facility decommissioning will proceed upon your approval.

We appreciate your cooperation in this matter. If you have any questions please feel free to contact us.

Sincerely,

Robert J. Learson
Laboratory Director

110495
MAR 31 1989

Attachments
c: Larry Grob, CNSI

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UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION II
101 MARIETTA STREET, N.W.
ATLANTA, GEORGIA 30323

NOV 16 1988

Chem-Nuclear Systems, Inc.
ATTN: William B. House
220 Stoneridge Drive
Columbia, SC 29210

Docket No. 030-20159
License No. 39-23004-01
Control No. 252479

Gentlemen:

SUBJECT: LICENSE RENEWAL APPLICATION

This is to acknowledge receipt of your application for renewal of the nuclear material license identified above. Your application is deemed timely filed, and accordingly, the license will not expire until final action has been taken by this office.

Any correspondence regarding your renewal application should reference the control number and license number specified above.

Sincerely,

Carol Cowell

Nuclear Materials Safety Section
Division of Radiation Safety
and Safeguards

NMS-1 (2/85)

NRC Form 374A (8-82) U.S. NUCLEAR REGULATORY COMMISSION



MATERIALS LICENSE
SUPPLEMENTARY SHEET

License number 39-23004-01

Docket or Reference number 030-20159 (31-11640-02)

Amendment No. 01

Chem-Nuclear Systems
240 Stoneridge Drive
Columbia, South Carolina 29210

In accordance with application dated July 28, 1986, License Number 39-23004-01 is amended as follows:

Items 6., 7., 8., and 9. are amended to read:

| 6. Byproduct, source and/or special nuclear material | 7. Chemical and/or physical form | 8. Maximum amount that licensee may possess at any one time under this license |
|---|---|---|
| A. Any byproduct material except transuranics | A. Any | A. 50,000 curies total |
| B. Any source material | B. Any | B. 5,000 kilograms total |
| C. Any byproduct material with atomic numbers of 93 and above | C. Any | C. 10 curies total |
| D. Special Nuclear Material | D. Any | D. Not to exceed: 350 grams of uranium 235 or 200 grams of uranium 233 or 200 grams of plutonium or any combination of these provided the sum of the ratios of the quantities does not exceed unity. |

MATERIALS LICENSE
SUPPLEMENTARY SHEET

License number 39-23004-01

Docket or Reference number 030-20159 (31-11640-02)

Amendment No. 01

9. Authorized use

A. through D. For receipt, use, and/or possession incident to:

(1) transport in packages or containers approved for use under the provisions of 10 CFR Part 71 for transfer to persons authorized to receive the licensed material pursuant to the terms and conditions of specific licenses issued by the Nuclear Regulatory Commission or any Agreement State,

(2) decontamination of facilities, equipment, and containers,

(3) solidification and treatment of wastes, and

(4) packaging for transport.

---

Conditions 12. and 18. are amended to read:

2. Licensed material shall be used by, or under the supervision and in the physical presence of, L. K. Poppe, Mark S. Whittaker, or any other individuals who meet the training requirements specified in the applications dated March 14, 1983 and July 28, 1986, and have been designated as authorized users by the licensee's Safety Review Board.

18. Except as specifically provided otherwise in this license, the licensee shall conduct its program in accordance with the statements, representations, and procedures contained in the documents including any enclosures, listed below. The Nuclear Regulatory Commission's regulations shall govern unless the statements, representations and procedures in the licensee's application and correspondence are more restrictive than the regulations.

A. Application dated March 14, 1983, with enclosed documents A. through J.

B. Letters dated September 26, 1983 and July 28, 1986.

C. Application dated July 28, 1986 and enclosed Attachments 1, 2, and 3.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

PAUL R. GUINN

Date AUG 20 1986 By Paul R. Guinn

Region II, Nuclear Materials
Safety Section
101 Marietta Street, Suite 2900
Atlanta, GA 30323

(3-83)

U.S. NUCLEAR REGULATORY COMMISSION



# MATERIALS LICENSE

CORRECTED COPY

Pursuant to the Atomic Energy Act of 1954, as amended, the Energy Reorganization Act of 1974 (Public Law 93 - 438), and Title 10, Code of Federal Regulations, Chapter I, Parts 30, 31, 32, 33, 34, 35, 40 and 70, and in reliance on statements and representations heretofore made by the licensee, a license is hereby issued authorizing the licensee to receive, acquire, possess, and transfer byproduct, source, and special nuclear material designated below; to use such material for the purpose(s) and at the place(s) designated below; to deliver or transfer such material to persons authorized to receive it in accordance with the regulations of the applicable Part(s). This license shall be deemed to contain the conditions specified in Section 183 of the Atomic Energy Act of 1954, as amended, and is subject to all applicable rules, regulations and orders of the Nuclear Regulatory Commission now or hereafter in effect and to any conditions specified below.

| Licensee | |
|---|---|
| 1. Chem-Nuclear Systems, Inc.<br>240 Stoneridge Drive<br>2. Suite 100,<br>Columbia, South Carolina 29210 | 3. License number 39-23004-01 |
| | 4. Expiration date November 30, 1988 |
| | 5. Docket or Reference No. 31-11640-02 |

| 6. Byproduct, source, and/or special nuclear material | 7. Chemical and/or physical form | 8. Maximum amount that licensee may possess at any one time under this license |
|---|---|---|
| A. Any byproduct material | A. Any | A. 50,000 curies total |

9. Authorized use

A. For receipt, use and/or possession incident to:

(1) transport in packages or containers approved for use under the provisions of 10 CFR Part 71 for transfer to persons authorized to receive the licensed material pursuant to the terms and conditions of specific licenses issued by the Nuclear Regulatory Commission or any Agreement State,

(2) decontamination of facilities, equipment and containers,

(3) solidification and treatment of wastes containing byproduct material, and

(4) packaging for transport.

## CONDITIONS

10. Licensed material shall be used only at temporary job sites of the licensee anywhere in the United States where the Nuclear Regulatory Commission maintains jurisdiction for regulating the use of licensed material.

(continued)

CONDITIONS

11. The licensee shall comply with the provisions of Title 10, Chapter 1, Code of Federal Regulations, Part 19, "Notices, Instructions and Reports to Workers; Inspections" and Part 20, "Standards for Protection Against Radiation."

12. Licensed material shall be used by, or under the supervision and in the physical presence of, L. K. Poppe or any individual trained as specified in the application dated March 14, 1983 and designated by the licensee's Safety Review Board.

13. This license does not authorize the import of packages containing byproduct material wastes.

14. The licensee may transport licensed material or deliver licensed material to a carrier for transport in accordance with the provisions of Title 10, Code of Federal Regulations, Part 71, "Packaging of Radioactive Material for Transport and Transportation of Radioactive Material Under Certain Conditions."

15. This license does not authorize the possession or use of licensed material at Customer facilities or Customer temporary job sites except as specifically authorized under the Customer's license.

16. The licensee shall notify NRC prior to if practicable, and in any case immediately after, taking any emergency action to decontaminate facilities or equipment; or to confiscate, possess, or receive any quantity of licensed material for purposes of safeguarding the material and/or the health and safety of the public. The licensee shall:

    A. Report by telephone to the Director of the appropriate NRC Regional Office listed in Appendix D of 10 CFR Part 20 immediately after it becomes known to the licensee that due to the presence of licensed material in such quantities and circumstances that a substantial hazard may exist to persons in unrestricted areas;

    B. Describe the proposed actions to be taken to take possession of the licensed material and to alleviate the substantial hazard;

    C. Provide the names of licensee personnel involved in the actions and their telephone numbers where they may be contacted; and

    D. Take only those actions which are concurred in by the Regional Director. The licensee shall comply with any instructions received from NRC, including a request to refrain from performing decontamination activities, taking possession of radioactive material, or a request to surrender material to NRC.

MATERIALS LICENSE
SUPPLEMENTARY SHEET

License number
39-23004-01

Docket or reference number
31-11640-02

(continued) CONDITIONS

17. Each report made pursuant to 16 above shall within thirty (30) days after the licensee has determined that a substantial public hazard existed be reported in writing to the appropriate NRC Regional Office, with a copy to the Director of Inspection and Enforcement, U.S. Nuclear Regulatory Commission, Washington, DC. 20555, setting forth the following information:

A. A description of the licensed material involved including the kind, quantities, chemical and physical form;

B. A description of the circumstances under which the substantial public hazard occurred;

C. A statement of the disposition or probable disposition of the licensed material; and

D. A summary of the radiation exposures to individuals, the circumstances under which they occurred and the extent of the substantial hazard to persons in unrestricted areas.

18. Except as specifically provided otherwise by this license, the licensee shall possess and use licensed material described in Items 6, 7, and 8 of this license in accordance with statements, representations, and procedures contained in application dated March 14, 1983 and attached documents A through J; and letter dated September 26, 1983. The Nuclear Regulatory Commission's regulations shall govern the licensee's statements in applications or letters, unless the statements are more restrictive than the regulations.

FOR THE U.S. NUCLEAR REGULATORY COMMISSION

Date DEC 13 1983

By PAUL R. GUINN
Paul R. Guinn
Region II, Materials Radiation
Protection Section
101 Marietta Street, Suite 2900
Atlanta, GA 30303

NATIONAL MARINE FISHERIES SERVICE

PROJECT 48583

# DECOMMISSIONING PLAN

Prepared by:

CHEM-NUCLEAR SYSTEMS, INC.
220 STONERIDGE DRIVE
COLUMBIA, SOUTH CAROLINA 29210

110495

NATIONAL MARINE FISHERIES

PROJECT 48583

DECOMMISSIONING PLAN

Prepared by: Debbie Eastman for/in place of
Jim Williams

Concurred by: Mark Whittaker for Mark Whittaker
Mark Whittaker, Corporate Health Physicist

William B. House 3-30-89
William House, Director of Licensing

Larry Grob
Larry Grob, Engineering

Approved by: Carl H. Ross 3-30-89
Carl H. Ross, Director of Quality Assurance

Roger W. Johnson
Roger W. Johnson, Manager, Defense Operations

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## 1.0 SCOPE

This is the Decommissioning Plan for the removal of the Cobalt 60 source bars, final surveys, and release for unrestricted use of the Marine Products Development Irradiator Facility (MPDI), for the National Marine Fisheries Service, Northeast Fisheries Center, Gloucester Lab, Gloucester, Massachusetts.

## 2.0 BACKGROUND

Approximately 10,000 curies of Co-60 contained in 96 source bars are currently being stored in a wet storage source irradiator facility in Gloucester, Massachusetts. The U.S. Department of Commerce has entered into a Principle of Understanding (POU) with the US Army and has requested that CNSI assist in decommissioning the facility under contract DAAA09-87-G-0013. The Co-60 sources will be transported to Louisiana State University (LSU), State of Louisiana Radioactive Materials License No. LA-0001-L01, for use in research and as teaching aids.

## 3.0 PURPOSE

This plan describes the work methodology and radiological/occupational safety requirements for this project. The final project report will support MPDI's application to the Nuclear Regulatory Commission for termination of their Radioactive Materials License. Plan changes will be made only with the combined concurrence of CNSI Manager, Defense Operations and CNSI Director, Quality Assurance.

## 4.0 REFERENCES

4.1 Nuclear Regulatory Commission Radioactive Materials License No. 39-23004-01

4.2 Nuclear Regulatory Commission Radioactive Materials License No, 20-05735-03

4.3 State of Louisiana Radioactive Materials License No. LA-0001-L01.

4.4 Nuclear Regulatory Commission Certificate of Compliance No. 9216

4.5 Nuclear Regulatory Commission's "Guideline for Decontamination of Facilities and Equipment" (1982)

4.6 CNSI procedure, CN-AD-019, "Chem-Nuclear Systems, Inc. (CNSI) ALARA Policy".

4.7 CNSI procedure, CN-AD-020, "Chem-Nuclear Systems, Inc. (CNSI) Health Physics Policy Manual".

4.8 CNSI procedure, CN-SF-020, "Minimum Industrial Safety Standards for Chem-Nuclear Systems, Inc."

4.9 CNSI procedure, FS-AD-005, "Field Project Administration and Control Procedure".

4.10 CNSI procedure, FS-RP-001, "Radiological Control Procedure for Field Projects".

4.11 CNSI procedure, FS-RP-002, "Portable Instrument/Survey Record Procedure for Field Projects".

4.12 CNSI procedure, FS-OP-015, "Shipment of Radioactive Material for the United States Government by Unit 573".

4.13 CNSI procedure, TR-OP-013, "Handling Procedure for Transport Cask Number 1-13G, Certificate of Compliance Number 9216".

## 5.0 RADIOLOGICAL CONTROL PROGRAM

The Radiological Control Program at MPDI will be in accordance with CNSI procedures, primarily Reference 4.10.

5.1 All CNSI and CNSI subcontractor personnel shall have attended a site ALARA/Safety briefing provided by the CNSI Radiological Controls Supervisor (RCS) prior to the performance of work. This briefing shall include radiological and occupational health and safety requirements and provide an overview of the work scope to be performed.

5.2 All CNSI and CNSI subcontractor personnel will be currently qualified as radiation workers and/or Radiological Controls Technician as a minimum. Training records shall be on file prior to the start of work and shall be maintained in accordance with Reference 4.10.

5.3 Personnel exposure monitoring shall be accomplished under the existing program of CNSI, primarily Reference 4.7.

5.4 Radioactive waste materials generated during the operation will be packaged and shipped in accordance with Reference 4.12.

5.5 Release surveys for equipment will include direct and removable Beta/Gamma Monitoring. Release limits will be as low as reasonably achievable, but no higher than those stated in Reference 4.5 which are:

Average - 5,000 dpm Beta-gamma/100cm$^2$
Maximum - 15,000 dpm Beta-gamma/100cm$^2$
Removable - 1000 dpm Beta-gamma/100cm$^2$

5.6 Personnel monitoring will be performed with Eberline RM-14's and HP-260 probes (or equivalent).

5.7 Loose surface contamination smears will be counted utilizing a GM detector and scaler instrument with appropriate shielding. Contamination surveys will be accomplished by use of Eberline ESP-1's with HP-210 probes.

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5.7 Loose surface contamination smears will be counted utilizing a GM detector and scaler instrument with appropriate shielding. Contamination surveys will be accomplished by use of Eberline ESP-1's with HP-210 probes.

5.8 All job tasks shall be performed under a Radiation Work Permit (RWP) per Reference 4.10. The RWP will detail all specific radiological and occupational safety measures and precautions for a particular task.

5.9 Instruments to be used by CNSI personnel on this project are:

Instrument/Probe

Eberline E-520 w/HP-270
Eberline ESP-1 w/HP-210 (t) (AL) or HP-270
Eberline ESP-1 w/SPA-3
Eberline SPA-3
Eberline RM-14 w/HP-270
Eberline SH-4A
Eberline 6112B (Teletector)

The above list may have equivalent substitution instrumentation as approved by the project Radiological Controls Supervisor.

5.10 Shipment of radioactive materials and/or wastes generated by this project will be performed by authorized CNSI personnel in accordance with References 4.4, 4.12, and 4.13.

## 6.0 REMOVAL OF SOURCES

6.1 Perform pre-operation test of the source plaque retention pin punch to verify that the punch will not damage the sources when removing the retention pins. Assemble and transport fuel pool handling tools to MPDI as necessary. The source transfer shield shall be wrapped as required prior to placement in the 1-13G cask.

6.2 Mobilize on site at MPDI and obtain material handling equipment.
Issue personal dosimetry devices (TLD and SRPD)
Attend an ALARA/Safety Briefing

Establish an RWP

Verify and/or establish recirculation flow through the on site purification system.

Determine activity of the pool water in accordance with Step 7.3.1.

Adjust pool level as necessary in accordance with existing MPDI procedures to compensate for the additional equipment.

6.3 Disassemble the source bars and place in the source holding basket as follows:

6.3.1 Place required material handling equipment in the pool.

6.3.2 Place the source holding basket into the pool in close proximity to the source plaque handling jig.

6.3.3 Remove one of the source plaques from the source holder.

6.3.4 Lower the source plaque retention pin punch into position and visually verify that it is properly seated.

6.3.5 Extend the punch to remove the source plaque retention pin from the source plaque.

6.3.6 Retract the punch.

6.3.7 Remove the source plaque retention pin punch and transfer it to temporary storage in the pool.

6.3.8 Rotate the source retention bar 90 degrees to allow removal of the source bars from the source plaque.

6.3.9 Remove the source bars from the source plaque and place them into the source holding basket.

6.3.10 Repeat Steps 6.3.3 to 6.3.9 for the remaining five (5) source plaques.

6.4 Package the Co-60 source bars into the source transfer shield and shipping cask in accordance with References 4.1, 4.4, and 4.13 and as follows:

6.4.1 Cover the pool as necessary to prevent debris from falling into the pool.

6.4.2 Remove the roof plug and cover.

6.4.3 Remove the cover from under the roof plug and save for re-use.

**NOTE: ALL CASK HANDLING WILL BE PERFORMED IN ACCORDANCE WITH REFERENCE 4.13**

6.4.4 Remove transfer shield from shipping cask.

6.4.5 Swipe source transfer shield before putting into pool. Perform two large area smears on the exterior of the shield to ascertain the magnitude of any existing removable contamination.

6.4.6 Transfer the source transfer shield into the pool and prepare for loading.

6.4.7 Remove the lid and shield plug from the transfer shield. Place the source basket holder into the source transfer shield.

6.4.8 Reinstall the shield plug in the source shield.

6.4.9 Reinstall the lid on the source shield.

6.4.10 Evacuate all unnecessary personnel from pool vault room. Raise the source transfer shield from the pool. Monitor the change in the area and contact radiation levels with a teletector. Have the crane operator lock the crane lift cable into position above the pool to allow the shield to drain for approximately 20 minutes during the dry air transfer to the cask. Evacuate personnel to a low dose rate area during the draining period.

6.5 Transfer the source shield into the 1-13G cask. Monitor area radiation levels remotely during the transfer of the shield to the cask.

6.6 Reinstall roof cover and plug.

6.7 Sample pool water to ensure that the activity is less than $5.0 \times 10^{-5}$ microCi/ml (10CFR20 Appendix B, Table II, Column 2 limits). This is to ensure the integrity of the sources has been maintained during the handling procedures.

6.8 Prepare the cask for shipment to LSU as per Reference 4.12. Release cask for transport to LSU.

6.9 If pool water concentration is less than $5.0 \times 10^{-5}$ microCi/ml, drain and/or pump the water from pool and overflow tank. Monitor pool radiation level continuously throughout this evolution.

6.10 After pool and overflow tank have been dewatered to the maximum extent possible, enter the pool to perform radiological surveys as per Section 7.0.

6.11 Upon completion of the radiological survey, demobilize from MPDI and proceed to LSU.

6.12 Any radioactive waste produced on site will be shipped to CNSI's DOD Consolidation Facility in accordance with Reference 4.12.

## 7.0 RADIOLOGICAL CONTROL PROGRAM FOR THE RELEASE OF THE MARINE PRODUCTS DEVELOPMENT IRRADIATOR FACILITY

7.1 The purpose of this section is to detail the radiological survey techniques to be utilized at MPDI. The survey will be used by the Department of Commerce to request license termination.

7.2 The source bars have been at the facility since June of 1964; to date no occurrences of source leakage or material contamination have occurred. The facility has not been licensed for any other radioactive material and there is no reason to suspect that other radioactive materials are present. The source bars have been in storage mode since 1981. Due to the above reasons the only areas which will require radiological surveys are the recirculation system, the inside of the pool and the inside of the overflow tank.

7.3 Surveys of the irradiator pool and overflow tank shall be performed and documented in accordance with Reference 4.10 and as follows:

7.3.1 MPDI will determine the pool water and overflow tank activity with on site equipment and existing MPDI procedures.

7.3.2 After the pool and overflow tank have been dewatered to the maximum extent practical, personnel shall enter the pool/overflow tank to remove residual water. The pool and overflow tank will then be marked off in a grid system to assist in survey documentation. The proposed grid system is shown in Figure 1. The grids shall be approximately 1 square meter in area.

7.3.3 All grids on the floor of the pool and overflow tank shall be surveyed. Ten percent of the grids on the pool and overflow tank walls will be chosen at random for survey. All accessible surfaces of the recirculation systems shall also be surveyed.

7.3.4 For each grid that requires surveying, perform the following:

7.3.4.1 Choose 5 areas at random and perform a 1 minute scaler count with an ESP-1 and HP-210 (T) probe within one-half inch of the surface.

7.3.4.2 Perform a slow scan of the grid with an ESP-1 and HP-210 (T) probe in ratemeter mode. At the point of the highest reading, perform an additional one minute count as described above. Also obtain a $100cm^2$ swipe in this area.

7.3.4.3 Any grid that has contamination levels equal to or less than those specified in Reference 4.5 shall be considered to be non-contaminated. See Step 5.5.

7.3.5 For accessible surfaces of the recirculation system, perform 1 minute scaler counts with an ESP-1 and HP-210 (T) probe on at least ten percent of the surfaces.

7.3.6 If all areas surveyed are less than or equal to the limits stated in Reference 4.5, the facility shall be considered to be releasable for unrestricted use.

7.3.7 If any surveyed area is found to be contaminated above the limits stated in Reference 4.5, the Radiological Controls Supervisor (RCS) will contact CNSI's Corporate Health Physicist (CHP) to obtain guidance in what addition decontamination/survey techniques are necessary for release of the facility.

## 8.0 INDUSTRIAL SAFETY

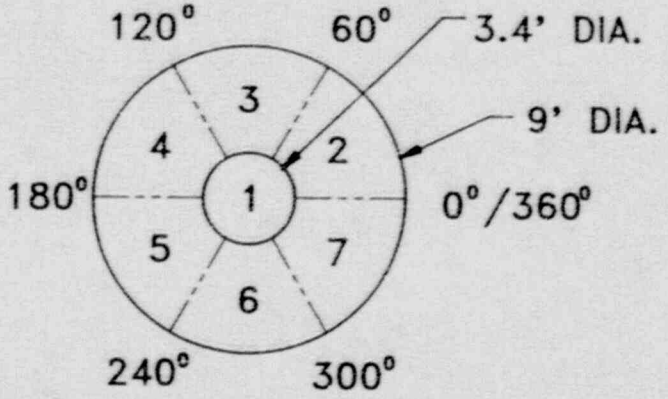
On site safety for CNSI and CNSI subcontractor personnel shall be maintained by and in accordance with Reference 4.8.

## 9.0 RECORDS

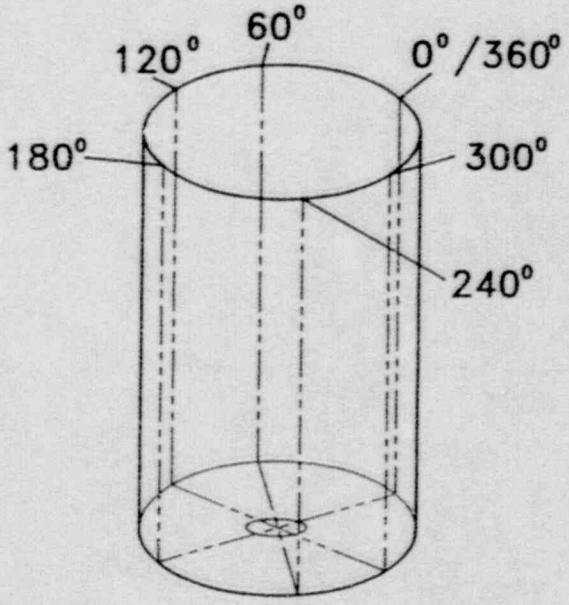
9.1 Records required by this plan and References 4.1, 4.2, 4.3, 4.6, 4.7, 4.9, 4.10 and 4.11 shall be retained as part of the project files. CNSI will provide a copy of any of the above records to LSU or MPDI, if requested.

9.2 A final report of the project activities including the facility radiological survey records shall be provided to MPDI to be used in conjunction with their request for license termination.

FIGURE 1




BOTTOM OF POOL




PICTORIAL VIEW
POOL

| 360° | 300° | 240° | 180° | 120° | 60° | 0° |
|---|---|---|---|---|---|---|
| 55 | 54 | 53 | 52 | 51 | 50 | |
| 49 | 48 | 47 | 46 | 45 | 44 | |
| 43 | 42 | 41 | 40 | 39 | 38 | |
| 37 | 36 | 35 | 34 | 33 | 32 | |
| 31 | 30 | 29 | 28 | 27 | 26 | |
| 25 | 24 | 23 | 22 | 21 | 20 | |
| 19 | 18 | 17 | 16 | 15 | 14 | |
| 13 | 12 | 11 | 10 | 9 | 8 | |

1'
15'
2'
4.7'

INSIDE WALL OF POOL
(FLAT PATTERN)

PROPOSED SURVEY GRID MAP
FOR MDPI POOL

-14-

SH 1011

| SRB APPROVAL | REVISIONS REV. | DESCRIPTION | DATE | APPROVED |
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CNSI SAFETY REVIEW BOARD APPROVAL
BY D. S. Shrivastava
DATE 4/4/86

REVISION STATUS

| SHEET | 1 | 2 | 3 | 4 | 5 | | | | | | | | | | | | |
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| REV. | - | - | - | - | - | | | | | | | | | | | | |
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| REV. | | | | | | | | | | | | | | | | | |

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|---|---|---|
| PREPARED R.R. Mang | DATE 3/26/86 | CHEM – NUCLEAR SYSTEMS, INC. |
| ALARA M. D. Stevenson | 3/26/86 | TITLE |
| ENGINEER | 3/26/86 | RADIOLOGICAL CONTROL PROCEDURE FOR FIELD PROJECTS |
| QUALITY C. M. Kathman | 3-26-86 | |
| APPROVED I. Weeks | 3/26/86 | SAFETY Peggy for J. Salter 3/31/86 |

| DOCUMENT NO. | REV. | SHEET |
|---|---|---|
| FS-RP-001 | - | 1 |

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## 1.0 SCOPE

### 1.1 Purpose

This procedure describes the Radiological Control methods that will be instituted on Decontamination and Decommissioning (D&D) type Field Projects at temporary job sites.

### 1.2 Applicability

This procedure applies to all CNSI personnel and CNSI contractor personnel working at Field Project temporary job sites.

## 2.0 REFERENCES

2.1 CNSI Procedure, CN-AD-020, "Health Physics Policy Manual"

2.2 CNSI Procedure, CN-AD-019, "Chem-Nuclear Systems, Inc. (CNSI) ALARA Policy"

2.3 CNSI Procedure, FS-AD-005, "Field Projects Administration and Control Procedure"

2.4 CNSI Procedure, CN-AD-026, "Radiation Exposure Records and Procedures"

2.5 CNSI Procedure, FS-RP-002 "Portable Instrument/Survey Record Procedure for Field Projects".

## 3.0 REQUIREMENTS

3.1 CNSI personnel, both permanent, and temporary, and contractor, shall be trained in radiation safety, in accordance with Appendix A, "Radiological Control Manual for Decontamination and Decommissioning type Field Projects" prior to beginning radiation work.

3.2 Radiological instruments in sufficient quantities to adequately perform the monitoring required by this procedure shall be available on the job site prior to beginning work.

3.3 An ALARA briefing, as described in References 2.2 & 2.3, shall be held prior to job mobilization.

## 4.0 DETAILED PROCEDURE

4.1 A Radiological Control Supervisor (RCS), designated by Field Services management and approved by the Corporate Health Physicist (CHP), shall be responsible for the implementation of the Radiological Control (Rad Con) program. The RCS shall report to the CHP on radiological matters.

4.2 Personnel Dosimetry

4.2.1 Personnel dosimetry shall be provided, reported, and worn as specified in Ref. 2.4 and Appendix A.

4.2.2 On projects where self-reading dosimeters (SRDs) are used, SRD results shall be reported to the Barnwell Exposure Records Technician weekly (Monday for previous week).

4.3 Instruments shall be set up, checked, and used as specified in Reference 2.5.

4.4 Radiological Control Program

4.4.1 The RadCon program will be designed and implemented in accordance with Reference 2.1, 2.2, and Appendix A. Any changes to Appendix A will be approved by the ALARA committee prior to implementation.

4.4.2 Site specific RadCon procedures, as required, will be developed in accordance with the guidance in Appendix A.

5.0 REPORTS AND RECORDS

5.1 The RCS shall submit a weekly written report to the CHP detailing current Radiological conditions, personnel exposure, and job progress.

5.2 Records shall be maintained throughout the duration of the project, and then retained in the permanent Project file.

APPENDIX A

RADIOLOGICAL CONTROL MANUAL FOR
DECONTAMINATION AND DECOMMISSIONING TYPE FIELD PROJECTS

(118 PAGES)

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# APPENDIX A
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CHAPTER 1

# GENERAL

## 101 PURPOSE

### Discussion

This manual presents relevant limits and protective measures applicable to ionizing radiation and radioactivity which may be associated with Chem-Nuclear Systems, Inc. (CNSI) operations at temporary job sites.

The procedures and limits in this manual do not apply to CNSI operations at NRC-licensed facilities that have procedures and limits meeting the intent of this document.

Radioactive materials in several forms are utilized during various CNSI operations. These materials must be carefully handled to avoid any inadvertent contact by operating personnel and the general public. Unnecessary radiation exposure could be caused through mishandling of radioactive materials by personnel who are either unaware of its presence or nature, or who are not instructed in the proper methods of handling.

The addition of the problems of radiation exposure and radioactive contamination to otherwise normal jobs has required the establishment of numerous radiological controls. The major purpose of this manual is to provide procedures to assure that satisfactory control is exercised over personnel radiation exposure and radioactive contaminations. The limits and procedures of this manual are applicable to radioactive material, and should be implemented for all operations.

## 102 RELATED INSTRUCTIONS

This manual has been developed to provide guidance for compliance with CNSI radiation control policy. This policy is stated in CNSI

procedures CN-AD-019 (Ref. 201.3), CN-AD-020 (Ref. 201.4), and CN-AD-026 (Ref. 201.5).

## 103 SUMMARY OF RADIOLOGICAL CONTROL PROCEDURES

Radiological controls are required by CNSI in areas where radioactive materials are handled or stored, in areas traversed by potentially contaminated personnel and materials, and in other areas where radioactive work is performed.

The radiological controls requirements of this manual include: (1) control of external radiation exposure to personnel by means of personnel monitoring, area monitoring, installed shielding, and planning and execution of radiological work; (2) control of internal radiation exposure to personnel by monitoring for contamination in air and on surfaces, through use of anti-contamination clothing and respiratory protective equipment, and through control of contaminated areas; (3) control of radioactive wastes by means of specified procedures and radiochemical analyses; (4) decontamination; and (5) instructions for receiving, transferring, storing, shipping, and accounting for radioactive materials.

The instructions in subsequent sections are those required to assure radiological safety under most situations. In unusual situations, personnel are expected to perform additional measurements and take other additional precautions as deemed necessary to provide adequate protection.

## 104 SUMMARY OF RESPONSIBILITIES

### Requirements

The following notice to personnel should be conspicuously posted in a sufficient number of places to permit employees working in or frequenting radiation areas or radiological control areas to have access to a copy on the way to or from their place of work.

NOTICE TO PERSONNEL

RADIOLOGICAL CONTROL STANDARDS

STANDARDS

Standards for protection of personnel against ionizing radiation which may be associated with CNSI operations are contained in the "Radiological Protection Manual for Decontamination and Decommissioning," and shall be utilized for CNSI appropriate operations. This manual is available upon your request from the on-site CNSI employee responsible for the project.

YOUR RESPONSIBILITIES

Each individual must constantly remain aware of potential radiological problems. Each of your actions could directly affect your exposure to ionizing radiation. The following rules shall be followed by individuals to maximize radiological control safety:

1. Obey posted, verbal, and written radiological control instructions.

2. Wear TLD and dosimeters as required by signs or if so instructed by radiological control personnel.

3. Keep track of your own radiation exposure status and avoid exceeding limits.

4. In all situations, remain in as low a radiation area as practicable.

5. Do not eat, drink, chew, or smoke in areas where radioactive contamination may be present.

6. Promptly follow health physics direction to prevent contamination spread.

7. Follow all requirements to wear respiratory protective devices. Wear anti-contamination clothing, including respiratory protective devices, properly whenever required by signs or when instructed to do so by radiological control personnel.

8. Remove anti-contamination clothing and respiratory protective devices properly to minimize spread of radioactive contamination.

9. Frisk yourself or be frisked with the proper equipment for contamination when leaving a contaminated area.

10. Minimize the possibility of a radioactive spill by carefully following procedures.

11. For a known or possible radioactive spill, minimize its spread and notify radiological control personnel promptly.

12. Do not unncessarily touch a contaminated surface or allow your clothing, tools, or other equipment to do so.

13. As practical, place all contaminated equipment such as tools and sampling bottles on disposable surfaces (e.g., sheet plastic) when not in use and inside plastic bags when work is finished.

14. Follow good "housekeeping" practices to minimize the amount of material that has to be decontaminated or disposed of as radioactive waste.

15. Report the presence of open wounds to radiological control personnel prior to work in areas where radioactive contamination exists. If a wound occurs while in such an area, report immediately to radiological control personnel.

## YOUR EMPLOYER'S RESPONSIBILITIES

Your employer is required to:

1. Provide training, equipment, and the necessary measures to maintain exposures ALARA (As Low As Reasonably Achievable).

2. Maintain records of your occupational radiation exposure and, upon your written request, advise you of your recorded occupational radiation exposure.

3. Notify you immediately of any radiation exposure which exceeds the quarterly or lifetime cumulative limits.

4. Provide you, after termination of employment, upon your written request and within thirty (30) days after the request, with a written summary of your cumulative recorded occupational radiation exposure received during your period of employment.

5. Notify personnel of the above procedures by posting this Notice conspicuously

## INSPECTIONS

Work involving radiological controls may be subject to periodic inspection by the Nuclear Regulatory Commission, State Regulatory Agency, or any Cognizant Radiological Controls Group.

## INQUIRIES

Inquiries concerning radiological controls should be addressed to your supervisor. Additional inquiries may be addressed to:

Chem-Nuclear Systems, Inc.
220 Stoneridge Drive
Columbia, South Carolina 29210.

105 RADIOLOGICAL CONTROL INSPECTIONS

During the performance of any field job which is expected to last more than 3 months, and for which CNSI has the responsibility for maintaining radiological controls, CNSI Corporate Health Physicist (CHP) or designee shall perform an inspection of the radiation control program. The inspection shall include:

1. A review of dosimetry records of CNSI personnel
2. A review of training records of CNSI personnel
3. A review of the radiation control log
4. An inspection of the facility
5. A review of compliance with the radiation protection program
6. A review of the operating license requirements

106 RADIOLOGICAL CONTROL TRAINING REQUIREMENTS

Discussion

Periodic radiological control training is necessary to ensure that each person understands the general and specific radiological aspects which he might encounter, understands his responsibility to his employer and the public for safe handling of radioactive materials, and understands his responsibility to minimize his own exposure to radiation.

The appropriate degree of training for each individual necessary for the project shall be determined during the ALARA review in accordance with reference 201-9. Personnel need be trained in one of the following categories.

Requirements

1. Personnel Authorized to Receive Radiation Exposure in the Course of their Work: (Radiation Worker):

   a. Personnel who require frequent or routine access to or



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work in high radiation areas, radiation areas, or radiologically controlled areas, shall have met the Radiation Worker Training Standard (Section 107) prior to being issued dosimetry equipment. If it is necessary to issue a person dosimetry equipment prior to completing this qualification, this person must be escorted by a qualified individual when in radiological areas.

b. This training shall be verified by written examination(s) which include questions concerning areas of required knowledge and questions concerning action required by the individual in event of an unusual radiological control situation (e.g., puncture of a contamination containment area). Knowledge, understanding, and practical abilities shall be verified by signature of a designated individual. Such designated individuals may be supervisory personnel, training personnel, or radiological control personnel.

2. Radiological Control Personnel (Individuals responsible for maintaining the Radiological Control Program)

a. Qualified radiological control personnel shall have met the Radiological Control Personnel Training Standard (Section 108), and shall be able to apply this knowledge to situations they might encounter during work.

b. A Radiological Control Supervisor (RCS) shall have at least the same level of technical knowledge and ability as radiological control personnel. However, passing scores on radiological control supervisor examinations shall be higher than those required for radiological control personnel; or supervisor examinations shall be more rigorous than radiological control personnel examinations. Experience shall also be considered in the selection of an RCS.

c. Training shall be performed in accordance with References 201.12 and 201.13. Practical abilities shall be verified by signature of designated individuals. Upon completion of this verification, final comprehensive written and oral examinations shall be given. Written examinations shall include questions requiring evaluation of radiological consequences of a postulated incident. Written examination results should be available to the examiner prior to administering the oral examination so that weaknesses indicated by the written examination can be further investigated during the oral examination. The final comprehensive oral examination shall include questions involving evaluation of symptoms of unusual radiological control situations. The examinee, during the oral examination, should be required to evaluate initial symptoms, state immediate corrective action required, state what additional measurements are required, and do a final analysis of the measurements to identify the specific problem.

3. Visitor Personnel

Management, technical, and other personnel who require occasional access to radiation areas, high radiation areas, radiologically controlled areas, or areas where radioactive materials are stored and who enter these areas for observation or similar purposes shall have the radiological control training necessary for the radiological conditions expected to be encountered or shall be escorted by appropriately qualified personnel at all time. For areas other than high radiation areas or radiologically controlled areas, a continuous escort is not required if the visitor is in continuous view of facility personnel. The presence of personnel normally assigned to these areas fulfills this function. The RCS shall determine the visitor training requirements and shall record the decision.

4. Records

The following records of personnel training and training verification shall be maintained in the permanent project file.

a. All final written examinations.

b. For radiological control personnel, a summary statement of each person's performance during the final comprehensive oral examination and the areas covered by the examination. This statement shall be signed by the person(s) conducting the examination.

c. Training records for each individual which indicate the performance of practical abilities. Verification of more than one practical ability with a single signature is acceptable provided the practical abilities are verified by the same person in a single training session. This is permitted provided the verification form used clearly states what group of specific practical abilities the single signature verifies. For example, an individual's practical abilities could be verified with a single signature, if all practical abilities were performed in the same examination session. However, a single verification signature for these practical abilities could not be used if they were performed in several separate examination sessions.

A signature for a practical ability indicates the individual has correctly performed the operation or demonstrated a certain ability to the person signing. The individual must actually perform the practical task or function. Discussion of the practical task or function with the person signing does not constitute satisfactory accomplishment.

The training records shall also contain a signed statement certifying that the person has completed all requirements for the qualification level indicated (i.e., passed written and oral examinations and has all the signatures on the record card). For radiological control personnel, this certification shall be by a certified Health Physicist. For other employees, this certification shall be signed only by persons approved by the Manager of Field Services.

d. A new training record shall be completed for each verification.

5. Reverification of Training

Reverification of radiological control training of all personnel shall be accomplished annually to requalify as a Radiological Control Person.

Re-verification of training shall include a comprehensive written re-examination. Personnel shall also demonstrate that they retain the practical abilities. Performance of practical abilities during radiological control work in the six months prior to qualification expiration is considered satisfactory demonstration of these practical abilities.

The CNSI Training Review Board (TRB) shall review the duties of personnel who fail to requalify and, based on this review, either disqualify these personnel or limit the duties of these personnel until they satisfactorily requalify.

6. Implementation

The RCS shall ensure that the training requirements of this Section are implemented. Personnel designated to verify practical abilities, conduct classroom and practical training, and conduct oral examinations shall be designated in writing by the CHP or designee.

7. Instruction on Radiation Exposure to a Project to the Unborn Child

The requirements of this Section apply whenever female personnel are to be employed as radiation workers (authorized to receive radiation exposure). Prior to being issued dosimetry equipment, all personnel authorized to receive radiation exposure, and all females authorized to receive radiation exposure as visitors shall be given specific instruction about prenatal exposure risks to the developing embryo and fetus. This instruction shall include both orally and in writing the applicable information in the appendix to U.S. Nuclear Regulatory Commission Regulatory Guide 8.13, "Instruction Concerning Prenatal Radiation Exposure," (Ref. 202.5). Instruction concerning prenatal exposure to the unborn child shall be given during initial and re-verification training. All personnel receiving instruction in accordance with this paragraph shall sign the following statement prior to being issued dosimetry equipment:

"The recommendation of the National Council on Radiation Protection and Measurements to limit radiation exposure to the unborn child to the very lowest practicable level, not to exceed 0.5 rem during the entire period of pregnancy have been explained to me."

Signature_____

Typed or Printed Name_____

Date_____

The signed statements shall be kept with training records. Statements signed by visitors shall be retained for three years.

107 RADIATION WORKER TRAINING STANDARD

Requirements

Personnel authorized to receive radiation exposure in the course of their work shall receive training in the following topics. Each topic is followed by a brief description of each subtopic. Subtopics identified by an asterisk (*) are practical abilities which must be demonstrated.

1. Radioactivity

   a. Atomic structure

   b. Radioactive material, natural and by-product

   c. Radiation types

   d. Biological effects of radiation

   e. Radiation detection

2. Radiation Exposure Control

   a. Whole body penetrating radiation limits. Discussion of the rem as a unit of biological dose from radiation.

   b. How "stay times" are used.

   c. Seriousness of violating instructions on radiation warning signs and unauthorized passage through barriers.

d. Procedures and methods for minimizing exposure such as working at a distance from a source, reducing time in a radiation area, and shielding.

e. Potential sources of radiation associated with work performed by individual's trade or specialty.

f. Where dosimetry equipment should be placed on an individual's body.

g. Various types of self-indicating dosimeters in use.

h. Importance of the individual keeping track of his own exposure.

i. Actions to be taken when an individual discovers his pocket dosimeter is off-scale, or loss of TLD or pocket dosimeter.

3. Contamination Control

a. How contamination is controlled during radioactive work (e.g., containment in plastic bags and use of Contamination Containment Areas).

*b. Procedures for preventing radioactive contamination of personnel and how radioactive contamination is detected on personnel.

c. How contamination is removed from contaminated objects and personnel.

d. Potential sources of contamination associated with work performed by individual's trade or specialty.

e. Beta-gamma surface contamination limit and the meaning of the units of the limit.

*f. Procedures for donning and removing a full set of anti-contamination clothing.

*g. Procedures for entering and leaving a contaminated area including proper procedures for self-monitoring.

h. What radioactive contamination is and the difference between radiation and radioactive contamination.

i. Procedures for working in containment areas.

*j. Procedures for donning and removing the respiratory equipment.

k. Conditions which require wearing masks, air supplied respirators, or air supplied hoods.

4. Incidents

a. Consulting radiological control personnel when questions or incidents occur.

b. Procedures to be followed after a spill of material (liquid or solid) which is or might be radioactive.

c. Procedures to be followed when notified that airborne radioactivity is above the limit.

d. Procedures to be followed when personnel injury occurs.

5. Responsibilities of Individuals

Actions required in order to fulfill the responsibilities of individuals includes the responsibility of the individual to inform his employer of previous or concurrent occupational radiation exposure received prior to employment.

Discussion

This standard outlines the minimum theoretical and practical abilities requirements for radiological control personnel after training. Subtopics identified by an asterisk (*) are practical abilities which must be demonstrated in accordance with Section 106.2.c.

Requirements

1. Units of Radiation and Radioactivity

   a. Define the rem and explain how it differs from the rad and the roentgen.

   b. Explain the meaning of "quality factor" and give the approximate quality factor for each type of radiation.

   c. Define the curie and explain that the curie is a unit of radioactivity.

   d. Explain the unit "dpm," how it is used, and use of appropriate conversion factors, thumb rules.

   e. Convert numerical amounts of radioactivity between curies, millicuries, microcuries, picocuries, and dpm.

   f. Explain the difference between dose and dose rate.

   g. Define half-life. Demonstrate an understanding of the half-life concept by solving various problems.

   h. Discuss biological half-life, effective half-life, and how they are determined.

1. S[illegible] ability to equate quantities [illegible]ctivity to exposure rate by solving various problems. This shall include both the use of applicable formulae and thumb rules.

2. Types of Radiation and Shielding

a. Define the different types of radiation (alpha, beta, gamma, proton, neutron) by discussing:

(1) Source(s) of each type

(2) Charge and relative mass of each, and

(3) Relative penetrating power of each in air and tissue.

(4) Simple mechanisms and materials used for their attenuation.

(5) Method of interaction of each with matter.

b. Explain tenth-thickness and half-value layer concepts.

c. Solve various shielding problems involving different types and thicknesses of shield material by using applicable formulae and thumb rule(s).

d. Describe basic shielding materials and why each type of material is used.

e. Present and explain the shielding thicknesses of water, iron, polyethylene, and lead for gamma radiation and of polyethylene and water for neutron radiation. Know how to use these various thicknesses to predict radiation attenuation.

f. Describe how radiation exposure is controlled by the use of temporary shielding. Determine the amount, type, location, etc., of temporary shielding required for various maintenance problems.

g. Explain how radiation levels decrease from a point source, line source, and plane source.

h. Solve radiation level problems involving line and plane and point sources. State and explain applicable formulae.

i. Explain the relationship between time in a radiation field and total dose; solve problems involving this relationship.

3. Radiation Detection

a. Explain the general principles of operation of gas ionization detectors.

b. Explain the general principles of operation of scintillation detectors.

c. Explain the general principles of operation of personnel dosimetry equipment.

d. Explain how neutrons, which have no charge, are detected with an instrument which depends on ionization.

e. Identify and explain the various types of detection instruments used: (beta-gamma survey meters, e.g. Eberline E-520; frisker, e.g. RM-14 with HP-210 probe; alpha survey meter, e.g. PAC-4G).

f. Explain the type of detection employed in each type of instrument above.

g. Demonstrate how to convert meter readings to appropriate units.

h. Explain the minimum sensitivity of each instrument and explain how this limits the use of the meter.

i. Describe the effect of various types of radiation on indication of a specific radiation detection instrument.

j. Explain how the type of detector used affects the techniques of operation (e.g., directional probe vs. non-directional probe).

k. Explain the devices used for personnel monitoring and the way in which radiation is detected by each device and the range of each device.

l. Explain the term "drift" as applied to a pocket dosimeter and how often a pocket dosimeter should be read and recharged.

m. Explain the types, uses, and requirements for various personnel dosimetry devices.

n. Explain why dry swipes are used.

o. Explain why 100 $cm^2$ is the area swiped when possible.

p. Explain how a correction factor is used for converting swipe activity to a specific isotope basis and why is this correction factor is used.

q. Describe how friskers and beta-gamma survey meters are used to measure surface contamination. State the minimum sensitivity of each instrument and explaining how this sensitivity changes with background radiation levels.

r. Explain under what conditions headsets or speakers should be used with survey instruments.

4. Biological Effects of Radiation and Radioactivity

a. Explain the general effects of various levels of acute exposures; for example, 100 mRem, 10 rem, 100 rem, 1000 rem.

b. Explain the effects of acute and chronic exposures to radiation.

c. Give the basic limit to which external exposures of whole body penetrating radiation is controlled and explain the basis for this limit.

d. Discuss the factors on which the effect of internal radioactivity on the body depends. Explain "body burden" and "critical organ".

e. Discuss the calculation of the dose to the whole body which results over a few years from breathing air with a given Co-60 concentration for a given number of minutes.

f. Explain the significance of personnel radiation exposure.

g. Compare 1 mpc-hr of internal exposure to 2.5 mrem external dose equivalent.

5. Instrument Counting Statistics

a. Identify and explain each of the required counter-scaler instrument checks. Show how different conditions affect counting results.

b. Define minimum detectable activity.

c. Discuss how varying radiation background can affect accuracy of results.

d. Discuss and explain the basis for various means for increasing the accuracy of a given measurement.

6. Radiation Surveys

a. Demonstrate an ability to use and care for all radiation detection instruments (i.e., field check, etc.).

b. Explain how routine surveys are conducted in radiation areas for alpha, beta, gamma, and neutron, and how to properly log the results and perform a representative demonstration. Pre-determined locations will be identified where the ability is to be demonstrated so that time in the area can be reduced.

*c. Explain how a radiation survey using high and low-range gamma survey meters is conducted and how to properly log the results and perform a representative demonstration. Pre-determined locations will be determined where the ability is to be demonstrated so that time in the area can be reduced.

d. Discuss the specific procedures for performing each of the radiation surveys and the reason for each of the steps and techniques.

e. Explain how to review and interpret the results of radiation surveys. Explain the normal levels to be expected and what action must be taken if actual reading exceeds the expected readings or the limits.



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f. Describe how beta radiation is detected by beta-gamma survey instruments, and discuss the relationships between the meter reading and actual beta field. Explain why this difference exists.

g. Explain how to check detection equipment for proper response to radiation.

h. Explain what information is obtained using the battery-check position on the instruments. State how often the instruments are to be calibrated.

7. Airborne Radioactivity Surveys

a. Explain how to conduct an airborne particulate activity measurement with a portable air particulate sampler and how to properly log the results. Demonstrate as appropriate.

b. Discuss in detail the specific procedures for performing each of the measurements and the reasons for each of the steps and techniques.

c. Explain how to review and interpret results of an airborne survey. State what levels are normally expected and what action must be taken if actual readings exceed the expected readings or the limits.

d. Estimate the airborne activity levels which will result from various casualties or incidents.

e. Explain how internal contamination of personnel is controlled.

f. Discuss MPC Hours and how calculated.

g. Discuss the determination of CAM alarm set points.

8. Contamination Surveys

a. Explain how to conduct routine contamination surveys and how to properly log the results. Demonstrate as appropriate.

b. Discuss in detail the specific procedures for performing each of the contamination surveys and the reasons for each of the steps and techniques.

c. Explain how to review and interpret the results of contamination surveys.

d. Explain how counting statistics affect the determination of swipe activity.

9. Anti-contamination (Anti-C) Clothing

a. Demonstrate proper procedure for donning and removing a full set of anti-C clothing.

b. Demonstrate the proper method of wearing and removing dosimetry equipment with anti-C clothing.

c. Discuss in detail the specific procedures for performing each of the above items and the reasons for each of the steps and techniques.

d. Explain what anti-C clothing should be worn under various circumstances.

e. State and explain the requirements for donning respiratory protection.

f. Demonstrate the proper procedure for putting on and removing masks, air-supplied respirators, and air-supplied hoods, including leak checks for masks and air-supplied respirators. For personnel who are required to wear respiratory equipment with anti-contamination clothing, this demonstration shall be performed when donning and removing anti-contamination clothing as required.

g. State the conditions which require wearing masks, air-supplied respirators, or air-supplied hoods. Discuss the need for controlling radioactive work so that respiratory equipment need not be worn.

10. Contamination Control

a. Explain the set-up of a typical control point.

b. Establish requirements for entry into a radiologically controlled area.

c. Demonstrate the procedure for surveying personnel with an alpha and beta-gamma low-range survey meter and with a frisker.

d. Demonstrate how to isolate and post a radiologically controlled area.

e. Establish the necessary radiological controls for removing a contaminated filter from a ventilation system.

f. Discuss in detail the specific procedures for performing each of the above items and the reasons for each of the steps and techniques.

g. Describe the construction and proper use of the several different types of containment areas. Certify proper setup of a containment area.

h. Describe the proper method for removing contaminated piping or ductwork.

i. Describe the proper method for venting radioactive systems.

j. Describe "controlled surface contamination area."

k. Explain the difference between fixed and loose contamination and explain that fixed contamination is controlled on the basis of radiation levels.

l. Explain why a swipe technique is not normally used for surveying personnel for contamination.

m. Explain the radiological control requirements for making an actual entry into a high radiation and controlled surface contamination area.

11. Decontamination

a. Discuss the different techniques of decontaminating an area, tool, or component, and properly handling the waste.

b. Explain the technique used when decontaminating areas where large variations exist in contamination levels.

c. Describe provisions for proper disposal of the removed radioactivity, isolation of area, steps to limit spread of surface contamination, adequate ventilation, use of high efficiency filtered vacuum cleaners, and use of respiratory protection.

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d. Describe the procedures for decontamination of personnel and the reasons for each of the steps and techniques.

12. Exposure Control

a. State the appropriate limits for whole body penetrating radiation. State where the limits established for skin, forearms, and extremity doses are found and when to use them.

b. Explain why limits for doses to the skin, forearms, and extremities are set at higher levels than external whole body exposure limits.

c. Explain what types of radiation result in whole body or skin doses.

d. Discuss the guidelines which should be used for radiation exposures during emergency situations.

e. Explain the significance of "stay time" and how it is determined. Consider situations involving limiting radiation levels to extremities as well as situations involving only whole body radiation levels.

f. Define the term "High Radiation Area," describe how these areas are marked, and list and explain the precautions required.

g. Define the term "Radiation Area." Describe how these areas are marked, and list and explain the precautions required.

h. Describe the personnel exposure "alert" system procedure and explain how and why it is used.

i. Discuss the action which should be taken if an individual exceeds exposure limits for external or internal radiation.

j. Discuss the procedures for exposure control in various practical situations similar to the following:

1. Transfer of a multicurie Co-60 or CS-137 source from a storage well to a shipping container.

2. Decontamination of a building containing 500-2000 dpm/$cm^2$ removable contamination.

k. Explain who established the CNSI radiation exposure control levels and the approvals which must be obtained before exceeding the levels.

l. Discuss procedures and methods for minimizing the radiation exposure of all persons associated with radioactive work.

m. Discuss proper procedures and methods for handling and storage of radicactive components so as to minimize personnel radiation exposure.

n. Explain what action is required when an individual discovers that his pocket dosimeter is "off-scale" or TLD or pocket dosimeter is lost.

13. <u>CNSI Procedures</u>

Discuss the following procedures.
CN-AD-001 SAFETY REVIEW BOARD
CN-AD-003 PROCEDURE FOR DOCUMENT PREPARATION
CN-AD-005 INCIDENT REPORTING PROCEDURE

CN-AD-019 CHEM-NUCLEAR (CNSI) ALARA POLICY

CN-AD-020 CHEM-NUCLEAR (CNSI) HEALTH PHYSICS POLICY MANUAL

CN-AD-026 RADIATION EXPOSURE RECORDS AND PROCEDURES

CN-EM-001 CNSI EMERGENCY RESPONSE PLAN

CN-SF-019 REPORTING ON THE JOB INJURIES

FS-RP-002 PORTABLE INSTRUMENT/SURVEY RECORD PROCEDURE FOR FIELD PROJECTS

FS-AD-005 FIELD PROJECT SET UP PROCEDURE

FO-AD-005 NUCLEAR SERVICES PERSONNEL TRAINING IMPLEMENTATION PROCEDURE

FO-AD-006 TRAINING REVIEW BOARD

14. Incidents

a. Discuss performing corrective action for the following incidents:

(1) Spill of radioactive liquid;
(2) High airborne radioactivity;
(3) Contaminated, injured man;
(4) High radiation casualty;
(5) Loss of radioactive material.

b. Explain the reasons for each immediate and supplementary action taken for the above incidents.

c. Discuss the radiological problems resulting from the above incidents. Estimate the total dose, dose rates, activity concentrations, etc., which will result from the incidents.

d. Indicate possible causes for the above incidents. Discuss the limitations imposed by the casualty and the consequences of failure to take proper corrective actions.

15. Responsibility of the Individual

Discuss the individual's responsibility to inform his employer of any previous or concurrent occupational radiation exposure received outside CNSI.

109 RADIOLOGICAL INCIDENT REPORTS

Discussion

The procedure for incident reporting is CNSI Procedure CN-AD-005 "Incident Reporting Procedures" (Ref. 201.2). This procedure describes the circumstances and reporting requirements for incidents.

CHAPTER 2

This chapter contains lists of CNSI procedures, Federal ( and State) Regulations, and Radioactive Materials Licenses with which the Radiation Control Supervisor (RCS) shall be familiar prior to beginning a project. Copies of these documents should be available at the job site, as applicable.

201 CNSI PROCEDURES

| | | REFERENCES |
|---|---|---|
| 1. | CN-AD-003 | Procedure for Document Preparation |
| 2. | CN-AD-005 | Incident Reporting Procedure |
| 3. | CN-AD-019 | CNSI ALARA Policy |
| 4. | CN-AD-020 | CNSI Health Physics Policy Manual |
| 5. | CN-AD-026 | Radiation Exposure Records and Procedures |
| 6. | CN-EM-001 | CNSI Emergency Response Plan |
| 7. | FS-RP-002 | Portable Instrument/Survey Record Procedure for Field Projects |
| 8. | RA-OP-001 | Brokering of Radioactive Materials at Commercial Facilities |
| 9. | FS-AD-005 | Field Project Administrative and Control Procedure |
| 10. | CN-AD-001 | Safety Review Board |
| 11. | FS-OP-015 | Shipment of Radioactive Materials for the U.S. Government by Unit 571. |
| 12. | FO-AD-005 | Nuclear Services Personnel Training Implementation Procedure |
| 13. | FO-AD-006 | Training Review Board |

202 REGULATIONS AND LICENSES

| | | |
|---|---|---|
| 1. | 10 CFR 20 | Standards for Protection Against Radiation |
| 2. | 49 CFR 172-178 | Hazardous Materials Shipping and Handling Regulations |
| 3. | USNRC License | 39-23004-01 |
| 4. | State Regulations (as applicable) | |
| 5. | USNRC Regulatory Guide 8.13, "Instruction Concerning Prenatal Radiation Exposure | |

CHAPTER 3

# RADIATION EXPOSURE LIMITS

## 301 GENERAL

### Discussion

Exposure limits are established to control personnel exposure to ionizing radiation. Federal and State Regulations outline the maximum exposures that a person may receive. These radiation protection regulations stress maintaining personnel exposures As Low As Reasonably Achievable (ALARA).

## 302 CNSI EXPOSURE LIMITS

CNSI has established administrative exposure limits for exposure of personnel to ionizing radiation below the Federal and State limits. CNSI procedure CN-AD-020 "Chem-Nuclear Systems (CNSI) Health Physics Policy Manual" (Reference 201.4) provides the general control procedures and exposure limits for personnel working on CNSI projects. During a field project, a current copy of Reference 201.4 will be available.

## 303 RADIATION EXPOSURE LIMITS FOR THE UNBORN CHILD

"During the entire gestation period, the maximum permissible dose equivalent to the fetus from occupational exposure of the expectant mother should not exceed 0.5 rem."

CNSI policy is that particular efforts shall be made to keep to the very lowest practicable level exposure to the unborn child from radiation associated with CNSI operations.

Personnel shall be trained on the biological risks to the embryo and fetus from radiation in accordance with Section 106.

304 RADIATION EXPOSURE TO THE PUBLIC

CNSI personnel shall ensure that as a result of CNSI operations

1. No member of the public shall receive whole body dose in one year exceeding 0.5 Rem, and
2. radiation levels in unrestricted areas shall not occur that could cause an individual continuously present in the area to receive 2 mRem in one hour or 100mRem in seven consecutive days.

# RADIATION SURVEY AND POSTING REQUIREMENTS

## 401 CALIBRATION AND MAINTENANCE OF RADIATION DETECTION INSTRUMENTS

This section provides the minimum calibration and maintenance requirements for radiation detection instruments. Only instruments with a current calibration label shall be used for conducting surveys. Instruments suspected of providing incorrect measurements should be removed from service and tagged pending a satisfactory response check.

The requirements for instrument set up and checks are found in Reference 201-7. When this manual is used in the field a current copy of Reference 201-7 is to be available.

## 402 SAFETY PRECAUTIONS

### Requirements

The following safety precautions should be observed by personnel using radiation detection equipment.

1. Only personnel trained in the use of portable radiation monitoring equipment should be allowed to use this equipment.

2. Damage to or loss of a radioactive source may result in the spreading, inhaling, or ingesting of contamination. If a source is lost, immediate steps should be taken to recover the source and minimize radiation exposure to or contamination of personnel as a result of the lost source.

3. In order to prevent sources from being inadvertently lost. all sources should be held under signature custody. These procedures are in addition to and do not supercede the accountability requirements for sources controlled under Nuclear Regulatory Commission or Agreement State Licenses.

4. Except for sources which are permanently attached to detection instruments (e.g., check sources), check sources which are not in use shall be kept in a locked cabinet. The number of keys to the cabinet and the number of personnel having access to the keys should be kept at a minimum.

## 403 RADIATION SURVEYS

### Requirements

Radiation surveys are performed as necessary to ensure personnel do not exceed radiation exposure limits and to meet requirements for posting radiation areas. These surveys are performed to determine whether abnormal radiation levels exist and to determine the extent and magnitude of radiation levels. The surveys in this section shall be the minimum performed. Surveys are to be performed and documented as stated in Reference 201.7.

1. Facilities Containing Radioactive Material

   a. Radiation surveys shall be performed to control radiation exposure whenever operations are performed that might be expected to change existing radiation levels. Examples of such operations include movement or removal of shielding, radioactive waste processing, and relocation of radioactive materials.

   b. Temporary boundaries (e.g., rope boundaries) of radiation areas shall be surveyed daily to ensure radiation areas do not extend beyond posted boundaries.

   c. Gamma surveys shall be performed at least weekly in occupied posted radiation areas, high radiation areas, and in radioactive material short-term storage areas. Long-term storage areas should be surveyed at least monthly.

d. When highly radioactive equipment (i.e., contact radiation level greater than 100 mRem/hr) is moved, gamma surveys should be performed in spaces surrounding work areas (including the spaces above and below them if applicable) where personnel are likely to be exposed to radiation.

e. Potentially contaminated ducts, piping, and hoses outside radiologically controlled areas shall be surveyed at least monthly for gamma radiation when in use or at least annually when not in use (e.g., deactivated systems).

f. Beta-gamma surveys of ventilation filters shall be performed whenever work is performed on these filters.

g. Other surveys should be performed as necessary to control personnel exposure to gamma, beta, and alpha radiation. Such surveys should include: (1) a gamma survey during initial entry into a tank containing potentially radioactive piping; (2) gamma surveys in spaces where significant radiation levels might exist from an adjacent operating facility; (3) beta as well as gamma (use of open-window G-M detectors is acceptable) measurements when personnel might come in contact with surfaces exposed to beta-emitting contamination.

h. Surveys shall be conducted when performing operations which could result in personnel being exposed to small intense beams of radiation. These operations include working with spent fuel handling containers, when removing shielding, or when opening shipping/storage containers of radioactive equipment. When surveying areas or equipment where intense small beams of radiation could be present, the instrument should be used with an audible response (e.g., earphones).

An audible response is necessary since the visible meter response is usually considerably slower. The probe should be moved slowly enough so that the instrument has a chance to give an audible increase for a large radiation level increase. If an audible increase is noted, the probe should be moved to the location producing maximum response and the meter read. If general dose rates are high such that a change in audible response is not detectable, slower surveys should be performed so that beams will be detectable by observing the meter. The speed of moving the probe is determined by considering the size of the probe, the instrument response time, the possible intensity of the beam, and the general dose rates in the area. Particular attention shall be given to thoroughly scanning suspected areas such as portable shield sections and areas which are or are likely to be occupied. For equipment with complex shield design, surveyors should be briefed on the equipment design so that areas most likely to have small beams can be given special attention.

1. Gamma radiation surveys shall be performed monthly on a revolving basis in the areas of the work site where radioactive materials are not stored or handled. The survey should consist of a scan of accessible areas and lockers with either a G-M dose rate meter or a portable gamma scintillation survey meter (if available).

## 404 CONTROL OF RADIATION AREAS

### Requirements

Specified below are requirements for the posting of radiation areas. It is permissible to cover (but not remove) permanently posted signs if the area referred to by the sign is not a radiation area. When such signs are temporarily covered, positive control must be

established to ensure the signs are uncovered prior to subsequent operations that require the area to be posted.

1. High Radiation Areas

Accessible areas where a major portion of the body could receive a dose in excess of 100 mRem in one hour shall be designated as high radiation areas. Major portions of the body include any portion of the head and trunk. Such areas shall be posted and locked or guarded. The requirement to lock or guard a posted high radiation area does not apply to tanks or voids posted as high radiation areas if entry requires the removal of complex closures. Positive control shall be established for each individual entry into a high radiation area and shall be established in such a way that no individual is prevented from leaving the high radiation area. Prior to locking an unoccupied high radiation area, the area shall be inspected to ensure that no personnel remain inside. No loitering or entry by unauthorized personnel shall be allowed in these spaces. High radiation areas shall be posted at all entrances into the area. Signs shall contain the conventional magenta three-bladed symbol on yellow background and the words "CAUTION: HIGH RADIATION AREA". In addition, "DOSIMETRY BADGE REQUIRED" and "CONTACT RCS PRIOR TO ENTRY" shall be posted. Instances in which high radiation areas are not controlled in accordance with the requirements of this paragraph (e.g., locking personnel in a high radiation area or failure to lock or guard a high radiation area), shall be reported to the CHP.

2. Radiation Area

Any area accessible to personnel in which there exists radiation at such levels that a major portion of the body could receive in any one hour a dose in excess of 5 mRem, or in a 5 consecutive day period a dose in excess of 100 mRem, shall be posted as a radiation area. To mark such areas, signs shall be

conspicuously posted; signs shall contain the conventional magenta three-bladed symbol on yellow background and the words "CAUTION RADIATION AREA"; signs are permitted to state the general area radiation level. In addition, "DOSIMETRY BADGE REQUIRED" shall be posted. No loitering is allowed in these spaces.

3. Radioactive Materials Area

Entrances to areas where radioactive materials are handled or stored shall be posted with signs having the conventional magenta three-bladed symbol on yellow background and the words "CAUTION: RADIOACTIVE MATERIAL." This posting is in addition to posting required for control of radiation area, high radiation areas, and radiologically controlled areas.

4. Exclusion Areas

Areas where access would result in personnel exceeding the radiation exposure limits of Section 302 in a very short time shall be designated Exclusion Areas and personnel access strictly controlled. Areas where general area radiation levels exceed one R/hour shall be operated using a written procedure, approved by the Safety Review Board (SRB), which provides positive control of personnel entering this area.

# PERSONNEL MONITORING FOR RADIATION EXPOSURE

## 501 CNSI DOSIMETRY PROGRAM

The monitoring of personnel radiation exposure with all CNSI activities is centrally controlled by the CNSI Exposure Records Section at Barnwell, South Carolina. CNSI procedure CN-AD-026 "Radiation Exposure Records and Procedures" provides the procedures for the issue, processing, and recording of personnel radiation exposures of all personnel working on CNSI projects.

Personnel dosimetry requirements for each project (in addition to those defined in this Section) snall be determined and approved by the CHP in the ALARA briefing conducted in accordance with Reference 201.9.

In this manual, "TLD" means a thermoluminescent dosimeter or equivalent personnel monitoring device.

## 502 PERSONNEL MONITORING

a. TLD's shall be worn on the area of the body expected to receive the highest radiation dose; under most circumstances this will be on the frontal area of the chest or waist. When the location of the body which will receive the maximum dose is not certain, for instance, trunk of the body or head, additional TLD's shall be worn; radiological control personnel shall specify the location of these additional TLD's. When exposure to extremities (hands and wrists, feet and ankles) or forearms is expected to exceed 25 percent of the administrative limits of Section 302, additional TLD's and pocket dosimeters shall be worn on the exposed extremity or forearm. When additional TLD's are worn, results of TLD processing for all TLD's shall be included in individual personnel exposure records. Care

shall be taken to ensure separate recording of exposures for extremities or forearms and for the whole body radiation exposure.

b. In situations where beta radiation is significant, personnel shall be shielded from the beta radiation using masks or eye protection, and/or anti-contamination clothing. If the beta radiation cannot be shielded, methods for controlling beta radiation exposure shall be evaluated and implemented to control exposures to established limits from skin exposures.

c. Certain radioactive isotopes given to personnel for medical diagnostic purposes can result in measurable radiation levels for some period after receiving the treatment. If such a situation becomes apparent, the person shall be restricted from wearing TLDs until the medical isotope is eliminated from the body to the extent that it will not affect TLD measurements. The only purpose of restricting this individual from wearing a TLD is to avoid including radiation exposure from the medical isotope to that received from CNSI operations. Such personnel shall also be restricted from entering areas requiring monitoring for radiation until the medical isotope is eliminated from the body to the extent that it will not affect personnel monitoring.

d. Lost TLDs or SRDs shall be reported as specified in Reference 201.5.

e. TLD measurements shall be made available to personnel on request so as to enable them to keep track of their own exposure.

503 SELF-READING DOSIMETERS (SRDS)

1. Requirements

SRDs shall be worn to control radiation exposure accumulated

between readouts of TLDs. The following personnel shall be monitored with a SRD.

a. All personnel entering a high radiation area or in radiation areas where they could receive a dose in excess of fifteen (15) mrem in one day shall be monitored by a SRD worn at the same location on the body as the TLD. The above does not preclude use of SRDs for other exposure monitoring.

b. An individual reaching 80% of the appropriate administrative limit of Reference 201.4 shall be placed on an Alert List and shall additionally wear a SRD. The Radiological Control Supervisor (RCS) shall closely observe the exposure of individuals on the alert list to prevent exceeding administrative limits.

c. Additional SRDs are required if the location of the maximum dose on the body is not certain. This is discussed in paragraph 1.d above for TLDs.

2. SRD Records

a. In addition to the requirements of the Alert System of paragraph b. above, the RCS shall maintain a log of all SRD resets between routine TLD readouts. Before the pocket dosimeter is re-zeroed, the measured radiation exposure is recorded, and the individual's quarterly and yearly exposure totals are determined. The individual is thereby prevented from inadvertently exceeding the control levels.

b. SRD exposure results shall be reported to the Barnwell Exposure Records Technician (ERT) weekly.

3. Reading SRDs

a. SRDs, whether low or high range types, shall be read by the wearer prior to entering radiation or high radiation areas and periodically thereafter to control his own radiation exposure while in these areas.

b. To prevent an off-scale reading, higher range dosimeters shall be read, recharged, and doses recorded whenever the reading exceeds three-fourths of full scale.

c. When a pocket dosimeter reading is off-scale or a dosimeter is lost under conditions such that a high exposure is possible, the person's TLD shall be processed immediately and the person removed from Radiological areas until his exposure has been determined. Notify the ERT for appropriate dosimeter processing and reporting.

4. SRD Testing Requirements

SRDs in use shall be tested at least every six months to ensure accuracy and drift standards. If dosimeters do not meet standards or fail in use, the RCS shall initiate action to correct the problem.

## 504 EXPOSURE RECORDS

The RCS shall keep records of personnel exposure and shall forward those records and data as required by Reference 201.5 to the Exposure Records Technician.

505 VISITORS

Requirements

1. Visitors shall not receive radiation doses which when added to previous doses will cause limits of Section 302 to be exceeded. Before receiving exposure, a visitor shall be questioned to determine his known or estimated dose for the current calendar quarter and year; unless a written record of his previous cumulative dose and the dose for the current calendar quarter and year is obtained, he shall not be allowed to exceed (1) a dose of 100 mRem per week (or 100 mRem per visit if the visit is shorter than one week) or (2) limits allowed by Section 302 if this requires less than 100 mRem per week. Visitors shall also be questioned to provide some assurance that visitors with medical disqualifications (such as personnel undergoing extensive radiation treatments) do not receive significant radiation exposure. In view of the above, visitors should be requested to fill in and sign the following statement before issue of dosimetric equipment.

   "My known or estimated occupational radiation exposure is _____ mRem for the current calendar quarter and _____ mRem for the calendar year. I know of no medical disqualifications which should prevent my receiving a radiation dose within prescribed Federal Standards."

2. The radiation standards of Section 301 through 304 shall be shown or explained to the visitor.

3. When the exposure received by a visitor is greater than zero, a report of the exposure should be sent to the individual's organization promptly. Reports of zero exposures should be provided upon request. All records of visitors' exposures shall be retained in the project file.



110495

1. Requirements

Internal contamination monitoring shall be performed when personnel are regularly exposed to airborne contamination exceeding 0.25 MPC as defined in Appendix B, Table I of 10 CFR 20. This requirement is in addition to the internal dosimetry program of Reference 201-5.

Additionally, suspected intakes of radioactive materials, such as may occur when there is significant external contamination, should be investigated by internal monitoring.

The RCS shall contact the CHP or the Director, Regulatory Affairs for direction if the need for internal monitoring is uncertain. The need for routine internal monitoring shall be established during the ALARA briefing.

2. Methods

The selection of internal monitoring technique shall be made by the CHP or Director, Regulatory Affairs.

a. Bioassay - the amount of internal contamination is estimated by measuring the radioactivity in collections of urine, blood, breath, or feces and relating the excretion rate to body burden by the use of biological models.

b. Whole body counting - An estimate of the amounts of internal contamination by gamma-emitting nuclides is obtained by counting the gamma rays emitted from the body and analyzing the pulse-height spectrum. This technique can also be used to measure the bremsstrahlung from energetic beta emitters.

3. Procedures

The procedures for collection of bioassay samples shall be specified by the CHP; Director, Regulatory Affairs; or an approved vendor who has contracted to perform the analysis. Sample analysis shall be performed by the Barnwell Dosimetry Laboratory or by an approved vendor. Whole body counting shall be performed at the Barnwell Dosimetry Laboratory or by an approved vendor.

4. Reports

All reports of internal contamination monitoring shall be maintained in the permanent project file with copies to the Director, Regulatory Affairs and the CHP for evaluation, and as required by References 201.2 and 201.5.



110495

# GUIDELINES FOR CONTROLLING RADIATION EXPOSURE

## 601 MINIMIZING RADIATION EXPOSURE

### Requirements

CNSI activities shall maintain personnel radiation exposure ALARA. A continuing effort is required to meet this goal by developing and implementing improvements to work procedures and work performance. Procedures for managing the ALARA Policy is found in CNSI Procedure CN-AD-019 "Chem-Nuclear Systems, Inc. (CNSI) ALARA Policy", (Reference 201.3). The following are to assist in meeting this goal.

1. Work shall only be performed in a radiologically controlled area under the direction of an approved procedure, approved work instruction, or RWP.

2. Individual work procedures shall specify applicable actions (e.g., mockup training or removal of equipment from high radiation areas) to be used to minimize radiation exposure while working.

3. Supervisory personnel and radiological control personnel shall ensure that personnel are not waiting unnecessarily in radiation areas.

4. Before entering controlled areas, a worker shall receive specific job training and/or briefings necessary to enable him to perform his work with minimum radiation exposure. Examples include mockup training in shops for specific jobs or periodic briefings by supervisory personnel for routine work.

5. Radiation levels in high radiation areas shall be identified by the use of signs which clearly show the areas with the high and low radiation levels.

6. CNSI shall maintain records of the cumulative radiation exposure involved in performing work as necessary to improve methods to minimize personnel radiation exposure in future work.

602 PROCEDURES AND WORK INSTRUCTIONS

1. Major work in a radiologically controlled area shall be performed under the guidance of a task specific procedure written in accordance with Reference 20?.1 and approved by the SRB. Determination of the need for a specific approved procedure shall be made by the CHP.

2. Work in radiologically controlled areas may be performed under the direction of a written work instruction as authorized by the CHP.

3. Work instructions shall describe the task, radiological conditions, and radiological controls, and shall be approved by the CHP or designee.

4. A pre-job briefing shall be held prior to beginning work performed under a procedure or work instruction to ensure all personnel understand the task, radiological conditions, and radiological controls.

603 RADIATION WORK PERMIT

Discussion

The Radiation Work Permit (RWP) shall be used to delineate conditions and protective measures to prevent inadvertent exposure of personnel to radiation or radioactive contamination. A procedure approved by the SRB or written work instruction approved by the CHP that includes

necessary radiological controls may be substituted for the RWP. The radiological conditions associated with the work to be performed shall be recorded in the procedure or on the RWP. Also specified are the protective measures required by personnel entering the designated area. The following requirements are established to assist in the proper use of the Radiological Work Permit.

Requirements

1. The RWP shall be obtained for work operations not specifically covered by an approved procedure or work instruction that are performed in an area where any of the following conditions exist or could be produced:

   a. Airborne radioactivity resulting in greater than 2 MPC-hours daily intake.

   b. Surface contamination in excess of the amount specified for clean areas.

   c. Radiation levels that would require posting of the area, as specified in Section 404.1 or 404.2.

   d. Whenever the need for an RWP is in question, such as when soil is to be excavated adjacent to a radiologically controlled facility, the RCS shall be contacted to determine if potential radiological problems may be encountered. The RCS will then determine if an RWP is required.

2. Signs indicating the need for the RWP should be conspicuously posted at the entrances to areas where the RWP is required.

3. It is the responsibility of supervisors proposing to conduct work activities within posted radiation/contamination areas to initiate the issuing of RWP's. Generally, the initiator will be the supervisor in charge of proposed activities.

4. RCS shall complete the RWP after discussion of proposed work activities with the supervisor and performance of appropriate surveys.

5. Prior to beginning work, the RCS shall hold a pre-job conference with the supervisor and all personnel working under the RWP; items discussed shall include: work scope, dosimetry and protective clothing requirements, survey results, stay time limits, and emergency actions. The workers shall sign the RWP to indicate an understanding of the requirements. Workers added to the RWP after initiation of work shall be briefed by the RCS prior to starting work and shall sign the RWP.

6. During operations under valid RWPs, if radiological conditions change, the scope of work is changed or expected to change, another RWP will be required and a pre-job conference will be performed.

7. The RCS shall determine the degree of monitoring required for a specific operation. This determination should be based on the potential for radiological problems and the experience of the personnel conducting the operation.

8. An RWP shall terminate five calendar days following its initiation. If the work is to be continued, a new RWP shall be initiated.

9. The total dose received by each individual, as indicated by SRD, shall be recorded by the RCS (or designee) on each terminated RWP.

10. The RCS (or designee) shall monitor that all RWP's are terminated within the time allotted by paragraph 8 above, and shall maintain copies of all terminated RWPs in the permanent project file.

CHEM-NUCLEAR SYSTEMS, INC. RADIATION WORK PERMIT (RWP)

Project/Location _____

Initiating Supervisor _____ Date/Time _____

Description of Work _____

Special Work Instructions _____

MINIMUM REQUIREMENTS FOR WORKING IN THIS AREA:

Protective Clothing (Anti-Cs)

| Head Covering | Body Covering | Hands | Feet |
|---|---|---|---|
| ____ Hood | ____ Coveralls | ____ Surg. Gloves | ____ Shoe Covers |
| ____ Cap | ____ Plastic Suit | ____ Rubber Gloves | ____ Rubbers |
| ____ Other: | ____ Other: | ____ Other: | ____ Other: |
| _____ | _____ | _____ | _____ |

| Dosimeters | Respirator Protection | | Other Requirements |
|---|---|---|---|
| ____ TLD | ____ Particulate | ____ Half Face | _____ |
| ____ SRD | ____ Vapor | ____ Full Face | _____ |
| ____ Other: | ____ Other: | ____ Air Fed | _____ |
| _____ | _____ | _____ | _____ |

RADIATION/CONTAMINATION CONDITIONS IN THE WORK AREA:

| General Area Radiation Levels | "Hot Spots" |
|---|---|
| ____ mR/hr Location _____ | ____ mR/hr Location _____ |
| ____ mR/hr Location _____ | ____ mR/hr Location _____ |

| Typical Loose Contam. (dpm/100 $cm^2$) | | Maximum Contam. (dpm/100 $cm^2$) | |
|---|---|---|---|
| ____ Beta/Gamma | ____ Alpha | ____ Beta/Gamma | ____ Alpha |
| Note(s) _____ | | Location(s) _____ | |

PERSONNEL AUTHORIZED TO WORK IN THE AREA AND ACCEPTANCE OF RESPONSIBILITY:

| Worker's Name | Signature | Total Dose | Worker's Name | Signature | Total Dose |
|---|---|---|---|---|---|
| | | | | | |
| | | | | | |
| | | | | | |

Signing the RWP indicates that you have had a pre-job conference and fully understand all requirements related to this job.

Pre-Job Conference Held: Date/Time _____

Health Physics Tech. _____ RCS Approval _____

TERMINATION OF RWP: Date/Time _____ Signature _____

Comments _____

## 604 TEMPORARY SHIELDING

### Requirements

Since incorrect installation, unauthorized movement, or removal of temporary shielding can result in large changes in work area radiation levels, control of temporary shielding is essential.

1. Temporary shielding installation and removal shall be controlled by written procedures. These procedures shall specify locations and amounts of temporary shielding. These procedures shall require the approval of appropriate technical and radiological control personnel.

2. After installation, temporary shielding shall be inspected to ensure it is properly located.

3. Periodic radiation surveys conducted in accordance with Section 403 shall be reviewed to ensure that shielding maintains its effectiveness in reducing radiation dose rates. In reviewing these surveys, particular attention shall be paid to components which had radiation levels greater than 1 R/hr prior to shielding, since personnel could receive high radiation exposure in a short time if the shielding has lost its effectiveness.

4. Lead shot may be used for temporary shielding, but is <u>not</u> recommended.

CHAPTER 7

# LIMITS AND PROCEDURES FOR CONTROLLING AIRBORNE RADIOACTIVITY

## 701 GENERAL

### Discussion

The basic criterion used for control of airborne radioactivity is that internal radiation exposure resulting from inhalation of airborne radioactivity should be minimized. Levels of internal exposure to airborne radioactivity are measured in units of MPC-hours (Maximum Permissible Concentration multiplied by hours of exposure).

Radioactivity in the form of radioactive particles, gases, or both can become airborne through sources such as (1) radioactive system leaks, (2) grinding or welding a contaminated component, (3) decontamination operations, (4) disturbing surface contamination in a work area, (5) improper use of containment enclosures, (6) inadequate vacuum cleaner and ventilation system control, (7) inadequate application of procedures for venting and draining radioactive systems or components, (8) damage or defect in radioactive instrumentation calibration and check sources, and (9) radon from radium sources and from trace amounts of natural radium impurities in construction materials.

The Radiological Control Supervisor (RCS) or designee will provide the continuous or periodic sampling required to detect and evaluate the levels of airborne radioactivity in work areas and exhaust air systems.

It should be noted that this monitoring is primarily concerned with the control of particulate airborne activity. For operations or materials which may result in the discharge of gaseous airborne activity, contact the Corporate Health Physicist for specific guidance.

## 702 LIMITS FOR AIRBORNE RADIOACTIVITY

### Requirements

The CNSI limit for occupational exposure to airborne radioactivity is set at 2 MPC-hrs per day. The MPC can be found by referring to Appendix B Table I, air concentration limits of Reference 202.1.

### 1. Limit for Occupied Areas

Airborne radioactivity in occupied areas resulting from CNSI operations should be controlled so that personnel are not exposed to radioactivity levels that would require use of respiratory protection equipment.

### 2. Investigation Levels

Any measurement of airborne radioactivity (e.g., continuous air monitor, or portable air monitor sample) which indicates the airborne radioactivity concentration to be in excess of 25% of the applicable MPC shall be investigated to determine the cause of the airborne radioactivity levels and appropriate controls shall be implemented to maintain the airborne radioactivity levels ALARA.

## 703 PROCEDURES FOR CONTROLLING PERSONNEL EXPOSURE TO AIRBORNE RADIOACTIVITY

### Discussion

Personnel exposure to airborne radioactivity is controlled using contamination containments and respiratory equipment as required below. In addition, many organizations have required use of respiratory equipment for work in areas with high levels of surface contamination (e.g., 50,000 dpm/100 $cm^2$) because of the likelihood that this surface contamination could become airborne. In some

circumstances, respiratory equipment might be necessary for work in areas where surface contamination exists at lower levels.

Requirements

1. Contamination containments shall be used to the maximum extent practicable to prevent personnel from being exposed to airborne radioactivity above the limits of Section 702. These containments are required during radioactive work which has been known to cause or is expected to cause airborne radioactivity.

2. The need for personnel to wear respiratory equipment in accordance with Section 707 in areas where airborne radioactivity exceeds the applicable limits of Section 702 shall be evaluated and documented prior to area entry.

3. Personnel shall not be regularly exposed to airborne radioactivity such that their daily intake exceeds 2 MPC-hours.

4. Signs shall be posted at entrances to areas where airborne radioactivity levels exceed 25% of an MPC. These signs shall contain the conventional three-bladed magenta symbol on yellow background and the words "CAUTION: AIRBORNE RADIOACTIVITY AREA." These requirements to wear respiratory equipment shall also be included on a sign with the anti-contamination clothing requirements. Radiological Work Permits or work procedures may be required in these areas.

5. When personnel not wearing respiratory equipment may be exposed to airborne radioactivity above the limit of Section 702, a ventilation system should be operated which will remove airborne particulate radioactivity to a controlled ventilation system or other system with a high efficiency filter. For example, during such operations as machining contaminated surfaces, vacuum cleaners fitted with high efficiency filters,

or flexible ducts connected to a filtered ventilation exhaust shall take suction from within about one foot of the work. Experience has shown that some operations within containments, such as grinding on highly contaminated components, require exhausting the containment through a ventilation system with an installed high efficiency filter, such as by using a vacuum cleaner, to prevent high airborne radioactivity outside the containment. Exceptions to this requirement are permitted with approval of the RCS when use of a ventilation system will cause spread of radioactive contamination.

6. a. High efficiency particulate air (HEPA) filters defined in Section 708 should be installed in the ventilation exhaust from radioactive work areas in which work in progress could cause the discharge of airborne radioactivity to the environment.

   b. HEPA filters shall be installed in the exhaust from contamination containments to prevent personnel from being exposed to high airborne radioactivity.

   c. HEPA filters should be installed in vacuum cleaners used around loose surface contamination.

7. Monitoring for airborne radioactivity shall be performed in accordance with Section 705.

8. Positive pressure breathing apparatus, air supply masks, or hoods shall be worn when airborne particulate activity exceeds 100 times the MPC limit of 10 CFR 20, Appendix B, Table I. The filter mask which does not have an air supply shall not be worn in this situation since it is only 99 percent efficient and the one percent penetration would be at concentrations greater than the one MPC of 10 CFR 20, Appendix B, Table I.

Personnel shall not enter areas where the airborne particulate activity level exceeds 1000 times the limit of MPC of 10 CFR 20, Appendix B, Table I. This restriction applies even to personnel wearing oxygen breathing apparatus or air supply respirators. If personnel entry is required to these areas, containment or filtered ventilation shall be used to reduce airborne radioactivity levels to below 1000 times the MPC of 10 CFR 20, Appendix B, Table I.

Respirators shall be selected such that the ratio of the Protection Factor from Reference 201.4 to the airborne level (in MPCs) does not exceed one (1).

## 704 HIGH AIRBORNE RADIOACTIVITY PROCEDURE

### Discussion

High airborne particulate radioactivity associated with CNSI operations can result from any of the causes in Section 701. It can be indicated by an continuous air monitor (CAM), by a portable air sample exceeding the applicable limit of Section 702, by an airborne radioactivity measurement using a portable radiation survey meter, or by an indication of a radioactive system leak or rupture. General procedures for controlling personnel exposure to airborne radioactivity are contained in Section 703.

### Requirements

The procedures in this article shall be followed for controlling high airborne radioactivity in locations as indicated below:

1. Particulate Radioactivity Above the Limits of Section 702 in Occupied Areas

a. Immediate Action--These actions should be performed nearly simultaneously.

(1) Don respiratory equipment in affected areas in accordance with Section 707.

(2) Stop operations which might be causing high airborne radioactivity until adequate control of airborne radioactivity is established.

(3) Evacuate unnecessary personnel from affected areas.

(4) Secure unfiltered ventilation from the affected spaces to other spaces. Secure unfiltered ventilation to the environment from affected spaces. Ventilation systems which contain high efficiency filters in exhaust ducts need not be secured.

(5) Determine the extent of the airborne radioactivity by sampling the affected area and adjacent areas using portable air samplers.

(6) Measure gamma radiation at the CAM to determine if the CAM alarm was caused by high radiation levels external to the CAM. If radiation levels are high, determine the source of the high levels by conducting additional surveys and confirm airborne radioactivity is below the limit of Section 702 by taking portable air samples. (Action

in the subsequent steps need not be taken if the alarm was caused by high external gamma radiation levels.)

(7) If the high airborne radioactivity is indicated by an CAM alarm, the recorder chart does not show circuit failure and the meter indication is above the alarm point, steps (3) through (8) shall be initiated simultaneously and completed as soon as possible. If the high airborne radioactivity is indicated by a portable air sample, steps (4) through (8) shall be initiated simultaneously and completed as soon as possible.

(8) If the high airborne radioactivity is indicated by alarm of a CAM monitoring a ventilation exhaust or a work area, check the recorder chart on the CAM panel and the meter indication to determine that the CAM alarm is not the result of circuit failure or an electrical transient. If the recorder chart shows circuit failure or if the meter indication is below the alarm setting, confirm airborne radioactivity is below the limit of Section 702 by taking a portable air sample. The subsequent actions of this procedure need not be carried out if the airborne radioactivity is confirmed to be below the limit of Section 702.

b. Supplementary Action

(1) Attempt to identify the radionuclide causing the airborne radioactivity, for example, by promptly measuring the sample for alpha

radioactivity and determining the approximate half-life or by gamma energy analysis.

(2) In order to minimize the need for respiratory equipment, and reduce personnel exposures to airborne radioactivity, consideration shall be given to ventilating the facility with additional HEPA filtered ventilation systems. When ventilating, avoid spreading airborne radioactivity to other spaces. Periodically monitor radiation levels on ventilation filters. To minimize contamination of the ventilation system while ventilating, operate the ventilation system in accordance with applicable procedures using the minimum number of fans to achieve stable conditions in the affected spaces.

(3) Perform gamma surveys of ventilation filters and ducts and measure surface contamination in the vicinity of the ventilation exhaust discharge point.

(4) Measure and control surface contamination in areas affected by high airborne radioactivity.

(5) When resuming operations, take portable air samples to verify that the cause of high airborne radioactivity is corrected.

(6) Monitor evacuated personnel for contamination and decon as necessary. A check of personnel exposed to high particulate radioactivity for internal radioactivity may be required.

2. Reports

A report of any incident involving high airborne radioactivity (above the limits of Section 702), in areas occupied by personnel not wearing respiratory equipment shall be made in accordance with Reference 201.2. This report shall include the results of monitoring personnel for internally deposited radioactivity as required.

705 MONITORING FOR AIRBORNE RADIOACTIVITY

Requirements

1. The system used for monitoring airborne radioactivity shall have an MDA not greater than 10% of the applicable MPC. Refer to Reference 201.7 for MDA calculations.

2. Air particle surveys shall be performed with portable air samplers as follows:

   a. At least every four hours (1) in radiological facilities when radioactive work is performed in these facilities, (2) during radioactive work which has been known to cause or is expected to cause airborne radioactivity, and (3) in occupied areas where surface contamination exceeds 20,000 dpm/100 $cm^2$ beta or 5,000 dpm/100 $cm^2$ alpha. These portable samples are not required if continuous monitoring is performed in accordance with paragraph 4 following. If the installed continuous air particle detector for a ventilation exhaust is inoperative and radioactive work is being performed, portable sampling every four hours is required.

   b. Before initially entering tanks or voids containing potentially radioactive piping.

c. Whenever airborne radioactivity levels above the limit of 702 are suspected.

2. Records of the above airborne radioactivity surveys may be required to serve legal purposes and therefore shall be maintained neatly and retained in the permanent project file. These records should include at least the following information, as specified in Reference 201.4.

   a. Date and time of measurement.

   b. Location.

   c. Reason for measurement (e.g., 4 hr. CAM).

   d. Instrument used (e.g., portable sample measured with MS-2).

   e. Results of most recent efficiency, MDA, and background measurements.

   f. Airborne radioactivity in μCi/ml.

   g. Remarks.

   h. Signature of surveyor.

   i. Signature of persons reviewing records.

3. Portable air particulate sampling equipment shall be immediately available to sample air during abnormal conditions. The following outline procedures for taking air samples with high and low volume samplers.

a. High Volume Air Samples

1. Obtain a calibrated high volume air sampler.

2. Insert a filter paper on the sampler.

3. Determine the time necessary to sample a volume sufficient to ensure that an adequate MDA is obtained.

4. If entering a high contamination area, protect the sampler by wrapping it in plastic (do not cover intake or exhaust of the sampler).

5. Turn on the sampler and note the time started.

6. At the completion of the sampling time remove the sample from the sampler and place it in an envelope. Label it with the sampling time, flow rate and location of the sample.

b. Low Volume Sample

1. Ensure that the low volume sampler has been calibrated.

2. Determine the time necessary to sample a volume sufficient to ensure that an adequate MDA is obtained.

3. Turn the sampler on and ensure that the flow rate is approximately 80 to 85 lpm.

4. If entering a high contamination area, protect the sampler by wrapping it in plastic

(do not cover intake or exhaust of the sampler).

5. At the start of sampling note the start time and flow rate.

6. At the completion of sampling note the time and flow rate. Remove the filter and place it in an envelope; record the sampling time, beginning and ending flow rate, and area sampled.

4. Continuous Air Monitors (CAMS) shall be used to continuously monitor air particle radioactivity if portable air sampling described in paragraph 3.b above is not performed. Continuous air monitoring shall be conducted in accordance with the following requirements:

a. Continuous air monitor alarm points shall be set as close to the limits of Section 702 as practicable without causing excessively frequent spurious alarms.

b. In the following instances, it is permissible to temporarily increase the CAM alarm setting. The purpose of this higher setting is to provide warning of further increases in airborne radioactivity or to prevent spurious alarms. In each case where the alarm setting is temporarily increased, it shall be promptly returned to the previous alarm setting when the condition necessitating the increase subsides.

(1) If an CAM continues to alarm because of radioactivity associated with operations, it is permissible to temporarily increase the alarm setting to 50 percent above the indicated reading with the approval of the Radiological Control Supervisor (RCS).

(2) If the indicated reading of an CAM approaches or exceeds the alarm set point and the increase if confirmed to be a result of radon daughter products from an atmospheric temperature inversion, it is permissible to temporarily increase the alarm setting to 50 percent above the present alarm set point with the approval of the RCS. Confirmation that the increase in airborne radioactivity is a result of radon daughter products shall include all of the following three indications: (1) detection of alpha radioactivity on a portable air sample, (2) an indication of noticeable decay of the radioactivity on a portable air sample filter in a short period of time (i.e., several hours), and (3) an indication of equivalent levels of airborne radioactivity on a portable air sample taken outdoors upwind of ventilation exhausts.

c. Meter indications of CAMs should be recorded at least every four hours when a CAM is operating. When continuous recorders are used, reading and separate recording of indications is not necessary. Use of continuous recorders is not required. Records of meter indications and recorders should be retained as specified in Section 705.2.

d. Extension tubing on the CAM inlet is permitted to monitor a work area. However, this tubing should be less than ten feet in length, smooth and without sharp bends or internal obstruction to minimize radioactive particle deposition in the tubing which will cause the meter to read lower than actual concentrations.

e. CAMs monitoring work areas from ventilation exhaust shall sample from an area where concentrations are representative of the work area.

f. The CAM shall be located in low background radiation levels or shielded such that the CAM alarm can be set as near the limit of Section 702 as practicable.

g. When sampling areas where airborne radioactivity exceeding 1,000 times the limits or Section 702 is likely, the exhaust of portable air samplers or continuous monitors shall be exhausted through a high efficiency filter, returned to the monitored area, or returned to a controlled exhaust system to prevent contamination of uncontaminated areas.

706 AIR SAMPLE COUNTING

General

When handling air samples collected from areas known or suspected of containing airborne radioactivity care should be taken to prevent the spread of contamination and cross contamination of samples taken. The samples shall be initially counted and again 24 hours later to determine the actual long lived alpha activity if significant radon daughter concentrations are expected.

Counting Activities

1. Scaler-Counters used for counting air activity shall be set up in accordance with manufacturers instruction and CNSI procedure FS-RP-002 "Portable Instrument/Survey Record Procedure for Field Projects," Reference 201.7.

2. The following steps shall be followed for calculating Air Sample Concentrations.



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a. Determine the air volume drawn through the filter (V).

$$V = \bar{F} t_s$$

where $V$ = total air volume (ml)

$\bar{F}$ = average flow rate (ml/min)

$$= \frac{(f_i + f_f)}{2}$$

$f_i$ = initial flow rate

$f_f$ = final flow rate

$t_s$ = sampling time (min.)

b. Determine the activity on the filter (A).

$$A = \frac{(C_n \div t) \times F_a}{(E) \times (2.22 \times 10^6)}$$

where $A$ = activity on the filter (mCi)

$C_n$ = net counts on the filter

$= {}_g C \; {}_b C$

$C_g$ = gross counts on the filter

$\bar{C}_b$ = average background counts

$t$ = counting time (min.)

$F_a$ = filter absorption factor

- 1.25 for alpha counting with a glass fiber filter
- 1.00 for other counting

$E$ = counter efficiency

$2.22 \times 10^6$ = conversion factor from dpm to mCi

c. Determine the airborne radioactivity concentration [A].

$$[A] = \frac{A}{V}$$

[A] = concentration of airborne radioactivity (in mCi/ml)

A = activity (mCi)

V = air volume (ml)

707 DETERMINATION OF MPC-HOURS

Discussion

An MPC-hour is a quantity of radioactive material equal to the quantity of material that would be inhaled if an individual occupied an area containing airborne activity at a concentration of one MPC (Maximum Permissible Concentration), as found in Appendix B, Table I (air) of Reference 202-1, for a period of one hour.

Requirements

1. Prior to entry by an individual to an airborne radioactivity area, the RCS shall determine the individual's expected daily intake, in MPC-hours, to ensure that the limit of 2 MPC-hours is not exceeded.

2. The airborne concentration $[A]_{MPC}$ of an airborne area, in MPC, shall be determined by dividing the measured airborne concentration [A] by the concentration which equals one MPC.

$$[A]_{MPC} = [A] \div MPC$$

3. An individual's expected daily intake ($I_e$) shall be determined by multiplying the planned number of hours worked in an airborne area ($t_w$) by the measured airborne level, $[A]_{MPC}$.

$$I_e = [A]_{MPC} \times t_w$$

4. If ($I_e$) might exceed two (2) and [A] cannot be reduced, respiratory protection equipment shall be used or the working time shall be reduced.

5. The actual daily intake ($I_a$), of each individual entering a posted airborne radioactivity area shall be recorded in the HP log and reviewed daily by the RCS.

708 PROCEDURE FOR USE OF RESPIRATORY EQUIPMENT

1. Discussion

10 CFR 20 Appendix B lists concentration limits for continuous exposure to airborne radioactivity of personnel occupationally exposed to radiation. Additionally, Nuclear Regulatory Commission regulations permit upward adjustment of these limits for exposure periods of less than 40 hours per week. When airborne radioactivity exists above the limits of Section 702, the actions of Section 704 limit its duration to short periods of time.

Even though it should rarely be required by regulation, CNSI requires the use of respiratory equipment as a supplementary control to keep personnel exposures ALARA.

2. Requirements

a. Prior to the use of respiratory protection equipment each individual shall be certified by a licensed physician as capable of wearing respiratory protective devices.

b. Prior to wearing a mask, air-fed respirator, or hood in an area where airborne radioactivity exceeds the limit of Section 702, personnel shall be trained in the use of this equipment and shall have passed a respirator

fit test as described in ANSI Z88.2, Practices for Respiratory Protection. As part of this training, personnel should demonstrate the proper procedure for putting on and removing masks, air-fed respirators or hoo including leak checks for mask and air-supplied respirator.

c. The RCS is responsible to ensure the above requirements are met and documented for personnel using respirators.

3. Use of Respirators

a. To assure that a proper seal between the individual's face and the mask of the respiratory equipment is obtained, the wearer should check the mask fit with a negative pressure test each time a mask is donned. A test, for example, consists of covering the inlet opening, inhaling gently so that the face piece collapses slightly, and holding the breath for approximately ten seconds. If the face-piece remains in its slightly collapsed condition and no inward leakage is detected, the tightness of the mask is satisfactory.

b. Respiratory equipment shall normally be specifically assigned to an individual for daily use.

4. Cleaning and Inspection

a. Assigned respiratory equipment shall not be used for more than one day without cleaning and inspection.

b. Used respiratory equipment, e.g. masks, shall be cleaned, surveyed, and inspected prior to re-use. Equipment exceeding the following limits shall not be used:

| Alpha | Beta-Gamma |
|---|---|
| Loose: 22 dpm/100 $cm^2$ | Loose: 220 dpm/100 $cm^2$ |
| Fixed: 100 dpm/100 $cm^2$ | Fixed: 0.10 mR/hr |

Acceptable equipment shall have a new or re-certified filter attached as appropriate and shall be tagged and bagged and may be issued for re-use.

c. Used filter canisters shall be inspected and surveyed after use. Filters with no physical damage and radioactivity levels not exceeding those in 4.b above, may be re-certified by DOP (or equivalent) testing. Only certified (new) or re-certified filter canisters shall be used.

d. Half-face respirators shall not be used for radioactive work without prior approval of the RCS.

## 709 HIGH EFFICIENCY PARTICULATE AIR (HEPA) FILTER REQUIREMENTS

### Requirements

The following requirements for high efficiency particulate air filter systems apply:

a. HEPA filtered systems shall be tested prior to use following each set up and after each filter change. Acceptance criteria is a transmission of 0.05% or less dioctyl phthalate (DOP) particulate per applicable DOP test procedure.

b. Great care shall be used in installing HEPA filters to assure the filter material separators are in the vertical position, tight seals are made around the edges of the filters, and that filters are not damaged

during installation. Minor damage will greatly reduce the efficiency of these filters.

c. Used filters shall be disposed of as radioactive waste since loose surface contamination could be present on interior pleats.

d. Instructions in manufacturers' manuals shall be followed for use and filter change-out.

## 710 PORTABLE VENTILATION SYSTEM

### Discussion

A portable ventilation system can be constructed by adapting a portable electric blower with a high efficiency filter. Such a system can be used during maintenance or a high airborne radioactivity condition to reduce airborne radioactivity without contaminating installed ventilation systems.

A vacuum cleaner with installed high efficiency filter can also be used effectively to reduce airborne radioactivity in a space by recirculating the air in the space through the high efficiency filter.

Such a system must be DOP tested prior to use.

## 711 PROCEDURES FOR CONTROLLING RELEASE OF AIRBORNE RADIOACTIVITY TO THE ENVIRONMENT

### Requirements

The requirements for environmental monitoring shall be determined as part of the ALARA briefing conducted per reference 201-9.

CHAPTER 8

## SURFACE CONTAMINATION LIMITS

### 801 GENERAL

Radioactive contamination of surfaces (such as floors, equipment, clothing and skin) may result from work operations, leaks of radioactive fluids, or gradual precipitation of airborne radioactive contamination onto exposed surfaces. The primary reason for limiting surface contamination is to minimize possible ingestion or inhalation of radioactivity. In addition, surface contamination is limited to minimize buildup of radioactivity in the environment. In case of very high levels of surface contamination, control of external radiation exposure from this contamination may be necessary. Surface contamination is divided into two classes in this section: (1) loose contamination can be removed from surfaces by dry swipes, and (2) fixed contamination remains on affected surfaces and is not further reduced by normal decontamination techniques.

Swipes are usually pieces of dry filter paper which are wiped over a surface and then measured for radioactivity. Materials which have become radioactive through exposure to neutrons are treated similarly to those with fixed contamination when performing operations, (e.g., machining) which may spread radioactivity.

Chapter 8 states the limits for surface contamination. Chapters 9, 10 and 11 describe monitoring procedures, anti-contamination clothing and decontamination procedures, respectively. Procedures for controlling contamination during radioactive work are contained in these chapters. Contamination control procedures should be considered in planning and performance of all jobs. However, the extent of the contamination control procedures used should be consistent with the amount of radioactivity being handled. The extent of contamination control procedures shall be established during the ALARA briefing required in Reference 201.9.

802 SURFACE CONTAMINATION LIMITS IN UNCONTROLLED AREAS

Radioactive loose and fixed contamination limits are dependent upon (1) the scope of work to be performed, (2) Nuclides most likely to be encountered, (3) Engineering and customer considerations.

Limits for loose and fixed contamination will be established during the pre-job ALARA briefing, usually based on release limits in the following table taken from NRC Reg. Guide 1.86.

Selection of the limit for loose surface contamination in 802 was based on consideration of the following:

1. The limit should be low enough that personnel do not ingest significant amounts of radioactivity from normal contact with areas or parts contaminated at the limit.

2. The limit should be low enough that significant levels of airborne radioactivity do not result.

3. The limit should be near background levels of surface contamination to prevent an increase in environmental radioactivity over large areas. This consideration is the most restrictive.

4. The limit should be such that measurements are as convenient as practicable.

The standard area for swipes of 100 $cm^2$ has been selected because (1) filter paper tends to disintegrate when wiped over a larger area, (2) this is a convenient area to swipe, (3) this area gives an optimum efficiency for collecting and measuring contamination.

TABLE I

ACCEPTABLE SURFACE CONTAMINATION LEVELS

| NUCLIDES [a] | AVERAGE [b c f] | MAXIMUM [b d f] | REMOVABLE [b e f] |
|---|---|---|---|
| U-nat, U-235, U-238, and associated decay products | 5,000 dpm α/100 $cm^2$ | 15,000 dpm α/100 $cm^2$ | 1,000 dpm α/100 $cm^2$ |
| Transuranics, Ra-226, Ra-228, Th-230, Th-228, Pa-231, Ac-227, I-125, I-129 | 100 dpm/100 $cm^2$ | 300 dpm/100 $cm^2$ | 20 dpm/100 $cm^2$ |
| Th-nat, Th-232, Sr-90, Ra-223, Ra-224, U-232, I-126, I-131, I-133 | 1,000 dpm/100 $cm^2$ | 3,000 dpm/100 $cm^2$ | 200 dpm/100 $cm^2$ |
| Beta-gamma emitters (nuclides with decay modes other than alpha emission or spontaneous fission) except SR-90 and others noted above. | 5,000 dpm βγ/100 $cm^2$ | 15,000 dpm βγ/100 $cm^2$ | 1,000 dpm βγ/100 $cm^2$ |

[a] Where surface contamination by both alpha- and beta-gamma-emitting nuclides exists, the limits established for alpha- and beta-gamma-emitting nuclides should apply independently.

[b] 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.

[c] Measurements of average contaminant should not be averaged over more than 1 square meter. For objects of less surface area, the average should be derived for each such object.

[d] The maximum contamination level applies to an area of not more than 100 $cm^2$.

[e] 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. When removable contamination on objects of less surface area is determined, the pertinent levels should be reduced proportionally and the entire surface should be wiped.

[f] The average and maximum radiation levels associated with surface contamination resulting from beta-gamma emitters should not exceed 0.2 mrad/hr at 1 cm and 1.0 mrad/hr at 1 cm, respectively, measured through not more than 7 milligrams per square centimeter of total absorber.

803 CONTROLLED SURFACE CONTAMINATION AREAS (CSCAs)

1. Areas where surface contamination exceeds the established limits and areas where equipment or materials are handled with exposed parts exceeding these levels shall be designated Controlled Surface Contamination Areas (CSCAs) until such areas, equipment, or materials have been adequately covered or decontaminated to meet these limits.

2. Access to a CSCA shall be limited to allow only personnel in appropriate anti-contamination clothing to enter. Choice of appropriate clothing is discussed in Section 1002.

3. Open wounds shall be adequately protected from contamination prior to a person's working in a CSCA.

4. Entrances to CSCAs and potentially contaminated areas shall be posted conspicuously with signs, stating the access restrictions, requirements for anti-contamination clothing and masks, levels of loose surface contamination and radiation dose rates (or permissible stay times). These signs shall contain the conventional magenta three-bladed symbol on yellow background. If the entrance to a controlled surface contamination area is not at a door, barriers shall be used to mark the affected area clearly.

5. Smoking, eating, drinking and chewing shall not be permitted in CSCAs, or potentially contaminated areas. This provision is essential to minimize the possibility of transferring contamination from the hands or other areas to the mouth. For the same reason, hands should be kept away from the face, nose, mouth, and ears when in controlled surface contamination areas. Drinking shall be prohibited in controlled surface contamination areas.

6. Where operations such a grinding or machining are being performed without containment on contaminated components or equipment, the areas of the operations shall be considered subject to the spread of loose contamination and shall be posted as a controlled surface contamination area.

7. Where surveys for loose contamination have not been made, but contamination is suspected, the area shall be posted as a controlled surface contamination area pending the results of contamination surveys.

8. Levels and extent of loose surface contamination inside controlled surface contamination areas shall be limited to control possible airborne radioactivity to facilitate limiting the spread of contamination, to simplify subsequent decontamination, and to minimize personnel radiation exposure.

9. Personnel leaving a controlled surface contamination area shall (a) remove their anti-contamination clothing and (b) monitor or be monitored for surface contamination in accordance with 1204 at the exit of the controlled surface contamination area. Exceptions to these provisions are permitted in special circumstances in accordance with paragraphs 803.10 and 803.11 following.

10. If radiation levels do not permit personnel monitoring at the exit of the controlled surface contamination area (such as tents in high radiation areas) personnel exiting may be permitted to cross areas where personnel are not wearing anti-contamination clothing provided:

    a. Personnel remove all anti-contamination clothing (outer set if double anti-Cs are worn) at the exit of the controlled surface contamination area.

b. Personnel go directly by designated passageways to the nearest monitoring station.

11. In order to minimize areas which are designated controlled surface contamination areas and the potential that contamination will be spread throughout these areas, it is normally desirable to establish small controlled surface contamination areas within the radiological facility. To promote work efficiency, it may be desirable to permit personnel to move between such small controlled surface contamination areas without completely removing anti-contamination clothing.

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CHAPTER 9

## CONTROLLING SURFACE CONTAMINATION

### 901 GENERAL

This part identifies some of the problems which may be encountered in attempting to institute efficient, detailed instructions for control of radioactive contamination. The following describes procedures applicable inside and outside radiologically controlled areas. In order that personnel will have the necessary training and skills in controlling contamination, particular attention will be given to training personnel in operations such as working in glove bags or containments.

### 902 CONTAMINATION CONTROL POINT

A contamination control point is a location on the perimeter of a controlled surface contamination area or surrounding area through which all entries and exits are made and where attention is taken to prevent the spread of radioactive contamination to adjacent uncontaminated areas. The dimensions and material requirements depend on the type of work to be performed, the number of personnel involved, and the location of the work. The following items outline the basic considerations for establishing a contamination control point.

1. Determine the extent of the area to be isolated and the location where entry and exit will be controlled.

2. Plan for physical boundaries to prevent inadvertent or unauthorized access to the contaminated area. Boundaries shall be marked. Existing walls and equipment may effectively be used as boundaries.

3. Cover the floor of the contamination control point using paper or plastic sheet or other material provided for this purpose.

The intent is to provide an easily removal walking surface within the contamination control point to prevent tracking of contamination from the area. Maintain a supply of the material to replace floor covering as necessary.

4. Provide a "step-off pad" at the exit from the contamination control point. This is to be used when removing clothing during exit from the area.

5. Provide easily accessible receptacles for radioactive waste and contaminated clothing at the contamination control point. A supply of plastic bags shall be available as necessary for receiving contaminated equipment and tools.

6. Provide radiation detection instruments for monitoring personnel and equipment. Frisking should be performed in a low radiation background and where the audible response of the frisker can be heard.

7. Provide means of recording stay times, as may be required, at the entrance of the areas for personnel. It may be necessary to provide a record of previous radiation exposure received by personnel entering a radiation area so that maximum allowable time in the radiation area can be determined.

8. Radiation tags or labels should be available to identify contaminated items being removed from the area.

9. At the entrance to the contamination control point, information shall be posted concerning radiation and contamination cordi-tions, precautions for entry, precautions for exit, step-off points, clothing and waste receptacles, and personnel survey.

10. The control point is maintained by Radiological Control. The Radiological Control Supervisor (RCS) shall assign a qualified person to the control point to ensure that personnel and

equipment are adequately surveyed prior to leaving the area and that all logging requirements of Reference 201.4 are met.

11. In some instances where high level contamination exists, it may be necessary to wear two sets of anti-contamination clothing. The outer garments should be removed at a designated location close to the contaminated work to minimize tracking to the contamination control point.

12. When adequately trained, personnel may be permitted to assist in frisking other personnel and themselves.

## 903 VENTILATION

The RCS shall consider the following when using ventilation systems in a contaminated area.

1. Ventilation should be controlled during operations involving radioactivity to prevent spreading the radioactive contaminants through an area. The basic methods of controlling contamination by ventilation are by preventing supply air or recirculated air from blowing into the contaminated work area and by providing filtered exhaust ventilation close to the work or from a containment enclosure erected around it.

2. High efficiency filters are normally installed in permanent ventilation systems servicing radioactive work areas. These filters may become contaminated so that dropping a used filter may spread contamination. Therefore, great care should be exercised when removing used filters. Filters may require replacement because of plugging (high differential pressure), high radiation level (in some areas contamination levels may cause significant personnel radiation exposure), or lack of effectiveness in removing radioactivity (usually caused by damage during or prior to installation).

Filters may be significantly contaminated even though never used for radioactive work. Contamination has been measured in high efficiency filters from natural radioactivity in the air. Contaminated used filters are normally removed into plastic bags. Contamination in the adjacent duct shall be wiped up before it spreads during the subsequent new filter installation.

3. A buildup of detectable levels of surface contamination can occur through the deposition of activity from the air without having significant levels of airborne radioactivity. Therefore, even though the air particle detector has never alarmed, ventilation exhaust ducts or ventilation system ducts from radioactive work areas should be considered potentially contaminated. When opening these potentially contaminated systems, they should be monitored with swipes and decontaminated as practical. One method of decontamination is to use a vacuum cleaner with high efficiency filter. For similar reasons, if a portable exhaust blower is used in a contaminated space, surface contamination should be checked on surfaces exposed to the filtered exhaust of this blower.

4. Exhaust blowers are normally used to exhaust air from many work areas, particularly when welding or grinding. To prevent spread of radioactive contamination when using a blower in a controlled surface contamination area, the intake to the blower shall be filtered through a high efficiency filter. A high efficiency filter is best installed at the intake side of the blower so that air is filtered prior to being exhausted and positive pressures upstream of the filter are avoided. It may be preferable to locate the filter inside the areas to minimize the amount of ducting which becomes contaminated. The blower exhaust should be directed so as to prevent stirring up contamination in the area in which it is used. When removing these blowers, flexible ducts and filters, precautions are required to prevent spilling contamination from them.



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5. When high efficiency filters are installed in ventilation systems for radioactive service, labels should be prominently affixed verifying proper installation of the filters. These labels should be located so that they are destroyed when the filters are removed.

6. Potentially contaminated air that has not passed through a high efficiency filter should not be discharged to locations occupied by personnel or where supply ventilation can return it to an occupied area.

7. Consideration should be given to controlling contamination which has been collected in ventilation equipment and systems not normally used for radioactive work including those systems in adjacent spaces which may become contaminated in event of a spill. Prior to work on these items, radiation measurements should be taken, the items treated as contaminated, and radiological control precautions established to prevent spreading contamination.

## 904 ENCLOSURES FOR CONTAINING CONTAMINATION

The most effective means of controlling radioactive surface contamination is through use of enclosures around the contaminated item to keep the radioactive material inside. Containment should be used as much as practicable when working on the surfaces of components which have been exposed to radioactive contamination. Plastic sheet, bags, or Contamination Containment Areas may be used to enclose clean material and prevent contamination of clean items inside the enclosure. The following specific requirements shall be followed when working or handling contaminated equipment and materials.

1. Maximum practical use shall be made of containment enclosures when working on contaminated systems or contaminated equipment and material.

2. Instructions for using containment enclosures shall be readily available.

3. Containment enclosures shall be inspected by the RCS prior to use to determine if they are properly constructed and ready for use. Enclosures shall then be marked to certify this inspection was completed. In addition, containment enclosures shall be inspected daily when in use and the marking updated. Personnel using containment enclosures shall inform radiological control personnel of any damage to containment enclosures which occurs during work. When a containment enclosure is damaged or is unfit for use, the enclosure shall be conspicuously tagged to prevent its inadvertent use by personnel unaware of the problem. Containment enclosures shall not be removed or altered without approval of the RCS.

CHAPTER 10

## MONITORING FOR SURFACE CONTAMINATION

### 1001 METHOD FOR MEASURING SURFACE CONTAMINATION

Requirements

A rate meter with an HP-210 probe or equivalent will detect radioactive beta-gamma surface contamination on materials and personnel by slowly scanning the probe held within about 1/2 inch of the surface. A rate meter with the HP-210 or equivalent, should be used with a background radiation level of less than 300 counts per minute. If background levels are above 300 cpm, equipment or personnel to be monitored for release shall be relocated to an area of lower radiation levels or the area shielded to lower background levels. A reading of 100 cpm above background indicates contamination. Alpha-emitting contamination is normally monitored using the PAC 4G or equivalent. A reading of 20 cpm above background indicates contamination.

When monitoring personnel, any indications above background shall be investigated as possible contamination.

### 1002 METHODS FOR TAKING SWIPES FOR LOOSE CONTAMINATION

Requirements

1. A swipe should be taken by firmly wiping a piece of dry swipe material over about one hundred square centimeters (an area about four inches by four inches) of the surface being monitored. In controlled surface contamination areas and where contamination is suspected, rubber gloves shall be worn when taking swipes to limit contamination of the hands. Rubber gloves need not be worn in uncontrolled areas for taking swipes if contamination is not expected.

2. The swipe should be counted in the field with a scaler-counter using a HP-210 probe or equivalent in a planchet holder for beta-gamma wipes and an alpha counter such as an Eberline SAC-4 for counting alpha contamination. An Eberline "Rascal" provides the capability for counting both beta-gamma and alpha using the same scaler with different probes for each type of radiation. The detectors shall be set up and checked as required in Reference 201.7.

3. When the item to be swiped has less than 100 square centimeters of surface area, the entire item should be swiped and the contamination level reported as "dpm/swipe" instead of "dpm/100 $cm^2$." Since the efficiency of collecting loose contamination with a swipe varies considerably with the size of the area swiped, contamination measured with one size swipe area cannot be directly multiplied by the ratio of areas to obtain the result for a different swipe area. For example, if a swipe area from a 100 $cm^2$ area measures 2,500 dpm, a swipe of ten times the area (1,000 $cm^2$) of the same surface might measure only four times the activity (10,000 dpm). In meeting limits of Section 802, swipes from less than 100 $cm^2$, the measured dpm/swipe results shall be used and shall not be multiplied by the ratio of 100 $cm^2$ to the area swiped.

4. Dry swipes are normally used to measure loose surface contamination since the results are more representative of the spread of contamination by personnel brushing past these surfaces than if wet swipes were used.

1003 METHOD FOR MONITORING FIXED CONTAMINATION

Fixed contamination may be measured with an E-120 ratemeter with HP-210 probe or equivalent for beta/gamma contamination, and the PAC-4G or equivalent for alpha contamination. Since these survey instruments alone do not differentiate between fixed and loose contamination, the measured fixed contamination levels are actually

the total radioactivity and may include some loose contamination. For fixed beta-gamma contamination, levels are usually expressed in dpm per probe. When searching for fixed contamination, or when trying to find the most highly contaminated portion of contaminated materials or areas, earphones or audible instrument response should be used. Visual meter indications respond more slowly than audible indication. When surveying to demonstrate lack of residual contamination, a portable scaler, such as the Eberline PRS-1, is recommended to reduce the MDA for the measurement.

1004 METHOD FOR MONITORING PERSONNEL CONTAMINATION

1. Personnel monitoring (frequently referred to as "frisking") shall be performed when leaving controlled areas in accordance with Section 1202 and after personnel decontamination. Monitoring of personnel for surface contamination should be done with an alarming rate meter and GM pancake probe (RM 14 and HP-210) or equivalent in accordance with Section 901 and the established limits used for such frisking. The probe should be moved slowly over the body with the probe within about one-half inch of the body surface, giving special attention to the face, throat, chest, back and abdomen in order to obtain an indication of any internal deposited radioactivity When monitoring personnel, searching for fixed contamination, or when trying to find the most highly contaminated portion of contaminated materials or areas, earphones or audible instrument response should be used. Visual meter indications respond more slowly than audible indications. Frisking for alpha contamination is performed using an alpha probe in a manner similar to that described above except that light contact between the probe and surfaces being monitored should be maintained. Alpha friskers should have an alarm set point indicating the reading corresponding to the contamination limit.

2. Monitoring of personnel by taking swipes for loose surface contamination on the skin or clothing shall not be done since swipes may tend to imbed radioactive particles.

3. When personnel have been adequately trained in frisking procedures, requiring personnel to frisk themselves may be desirable. Self-frisking can reduce the number of radiological monitors required to perform a job. When self-frisking is used, arrangements should be made such that personnel do not rely on meter response which may be slow.

4. If facial contamination is detected, or it is suspected that radioactive nuclides have been taken into the body even though no facial contamination is evident, the individual shall be monitored for internal radioactivity. Measurements of the radioactivity of nose and throat swabs have sometimes been used. However, the radioactivity of these swabs cannot accurately be correlated to the amount of radioactivity in the body.

1005 FREQUENCY OF SURVEYS FOR MONITORING SURFACE CONTAMINATION

Routine surveys of surface contamination should be performed with the frequencies indicated below, or more often if necessary.

1. During Routine Operations

   a. Surveys shall be performed at least daily in occupied areas surrounding controlled surface contamination areas and particularly in the vicinity of exits from controlled surface contamination areas. Surveys shall be performed at least daily in occupied, controlled surface contamination areas.

   b. Surveys shall be performed at least weekly in all occupied radioactive material areas where there is frequent handling or short-term storage of radioactive

materials. Long-term radioactive material storage areas shall be swipe surveyed at least monthly.

c. Surveys shall be performed monthly on a revolving basis in work and storage areas outside areas where radioactive materials are stored or worked on.

2. Sealed radioactive test sources (licensable quantities) are leak-tested by swiping quarterly. For a sealed source that is stored in a container designated to minimize radiation levels from the source or in a complex device requiring extensive disassembly to expose the source, it is permissible to perform the required leak test on the outside of the container or complex device. In this case, the source shall be tested by swiping when the container or device is next opened for other reasons.

3. In addition, operations such as the following require surveys:

a. Decontamination of equipment.

b. Inspection or maintenance on components and piping or radioactive or potentially radioactive systems.

c. Areas where radioactive liquid leaks have occurred or where airborne radioactivity has exceeded the concentrations of Section 702. Surveys are required to determine the need for anti-contamination clothing and to determine the extent of contaminated areas.

d. Upon initial entry into tanks or voids containing potentially radioactive piping and when opening ventilation exhaust ducting from radioactive work areas.

e. In addition, any normally uncontaminated system which is suspected of radioactive contamination shall be surveyed when opened for inspection, maintenance or

repair. Contamination control procedures should be used until the portion of the system being worked on is proven to be uncontaminated. Water drained or flushed from these systems shall be treated as radioactive.

f. Contamination surveys should be taken in plenums downstream of high efficiency particulate air filters during routine filter replacement or at least annually to check on radioactivity buildup in ducts downstream of filters.

g. Prior to replacing filters on inlet ducts to the radiological work areas, these filters should be surveyed to determine if radioactivity is present. Such radioactivity can result from fallout and naturally occurring radioactivity.

h. Surveys for contamination fixed in paint should be performed prior to removal of paint in potentially contaminated areas. These surveys should be performed by counting paint scrapings for gross activity.

1006 INSTRUCTIONS FOR CONTROLLING RADIOACTIVE SPILLS

This article contains general procedures to be followed in the event of small spills of radioactive liquids or solids (including finely divided particles which may disperse rapidly in air).

1. Since each spill will require different detailed actions for effective control and recovery, personnel shall be trained to take appropriate supplementary actions depending on the location and potential consequences of the specific incident. For locations where spills are most probable or would have the worst consequences, each facility should train appropriate personnel in controlling and recovering from radioactive spills. Equipment for containing spills should be prepared in advance and located in work areas.

2. The following steps shall be followed in the event of a radioactive spill:

a. Immediate Action

(1) Stop the spill.

If the spill is from a system which may have more material (either airborne particulate radioactivity or fluids) to leak out, promptly stop the leak if possible. If the spill is from an overturned container, try to set it upright if all the contents have not escaped. The amount of time spent stopping a difficult leak should depend upon the radiation levels involved, the possibility of inhaling airborne radioactivity from the spill, and the consequences of not making a prompt closure. In some cases, a prompt closure may not be necessary.

(2) Warn other personnel.

Other personnel who may become contaminated by the spill or who may be able to help control it shall be warned immediately. Ensure radiological control personnel and area supervisor are notified of the spill.

(3) Isolate the spill area.

Keep unnecessary people away from the area affected by the spill to minimize spread of contamination. This action may require closing doors, roping off the area, and verbally warning approaching personnel.

(4) Minimize personnel exposure to contamination and radiation.

Personnel in the spill area should remain at the edge of the area until radiological control personnel advise otherwise. Personnel should keep to the edge of the affected area taking care to minimize spread of contamination. It may be advisable to set up recovery operations outside the area where a spill occurred and close the access.

(5) Secure ventilation in the spill area other than filtered exhausts.

It may be desirable also to shut down exhaust systems in adjacent areas to ensure that air does not flow out of the spill area. Filtered exhausts in the spill area should also be shut down if necessary to minimize spread of high levels of radioactive contamination. Ventilation supplies should be shut down when exhausts are turned off.

If the spill is minor (for example, a few milliliters of water with low radioactivity spilled on a smooth surface), immediately cover the spill with the most convenient absorbent material available, such as absorbent paper or rags to soak up the liquid. For minor spills involving small amounts of radioactivity, wiping up the spill, even though gloves are not available, probably will not result in additional contamination of the individual. Personnel shall be surveyed and decontaminated as necessary.

The senior man in each area is in charge until relieved by the Radiological Control Supervisor (RCS). The man

in charge should organize the personnel available and initiate action to control and correct the spill. It is important that this individual makes both his presence and the fact that he is in charge known to all others at the scene. On arrival of the RCS, the status of corrective action taken or in progress shall be immediately brought to his attention. The person in charge shall perform or designate available personnel to perform the following immediate actions:

b. Supplementary Action

Steps (1) and (2) below are actions to evaluate the extent of the problem and to recover from the spill. The designated supervisor shall consult with Radiological Control personnel to ensure the performance of specific portions of the steps below.

(1) Measure radioactivity levels.

Measure contamination on personnel who may have been affected, make contamination surveys in the area adjacent to the spill, measure airborne radioactivity inside and outside the spill area, and measure radiation levels in affected areas, particularly on ventilation filters. Monitor ventilation systems to determine if the spill has caused them to be contaminated. If it is suspected that radioactive nuclides have been taken into the body or if facial contamination is detected, the personnel monitoring procedures shall be followed (see Section 904).

(2) Take subsequent radiological control and cleanup actions in accordance with other appropriate articles in this manual.

The designated supervisor shall minimize personnel radiation exposure and generation of radioactive waste consistent with the requirements to recover the spill.

1007 RECORDS OF CONTAMINATION

1. Records of the following abnormal spreads of radioactive contamination should be maintained in the permanent project file and will be reported in accordance with Reference 201-2.

   a. Any occurrence which results in loose surface contamination greater than 1000 dpm/100 $cm^2$ beta-gamma or 50 dpm/100 $cm^2$ alpha in uncontrolled areas with unlimited personnel access (such as office areas, shops and corridors).

   b. Any spread of contamination in radiologically controlled areas or controlled surface contamination areas which result in work being stopped for more than four hours or take more than four hours to clean up.

2. Records of surface contamination surveys shall be retained in the permanent project file. The survey information shall be recorded on a standard form in accordance with reference 201.7 and will include the following information:

   a. date and time of survey;

   b. location (may be shown on a survey map or listed in a table);

   c. reason for survey and type of radiation measured (e.g., daily beta-gamma swipe survey);

d. instrument set-up, efficiency checks and minimum detectable activity (MDA);

e. background beta gamma radiation level where measurements were made;

f. remarks;

g. signature of surveyor;

h. signature of persons reviewing logs (e.g., RCS).

1008 REQUIREMENTS AND PROCEDURES FOR RELEASING PREVIOUSLY CONTAMINATED FACILITIES AND AREAS FOR UNRESTRICTED USE

The requirements and procedures of this Section shall be applied when releasing previously contaminated areas or radiologically controlled facilities for unrestricted use (e.g., use of the area is not controlled by radiological control procedures). Typical areas and facilities include facilities used for decontamination and repair or assembly of contaminated equipment, radioactive waste processing facilities and systems, exhaust ventilation systems for radioactive work areas, radioactive material storage areas, and outside areas accidentally contaminated.

Criterion 1

A Decommissioning plan will be approved by the customer and the Corporate Health Physicist (or his designee) prior to releasing any facilities or areas.

Criterion 2

Equipment, parts, materials, and waste which have been exposed to radioactive contamination shall not be released for

unrestricted use until they are surveyed and meet the criteria of Section 802.

Criterion 3

Earth (e.g., sand or soil), ground covering (e.g., asphalt or porous concrete), paint (which may have absorbed radioactive contamination), etc., shall not be released for unrestricted use until the area is inspected and samples do not exceed a concentration in pCi/gram for the radioactivity in question using the criteria established in the approved decommissioning plan.

2. Procedures

In order to ensure compliance with the criteria above, the following procedures shall be followed as applicable:

a. General

Prior to initiation of final surveys, records should be reviewed and investigations made to determine if contamination existed in any area and was covered over to prevent its spread, such as by wall boarding, floor tiling, or paving. Such identified areas should be inspected, action shall be taken to decontaminate the area below the criteria of 1 above, or dispose of the contaminated material as radioactive waste.

b. Facilities

In certain areas where a potential existed for only low levels of radioactivity (less than 1,000 dpm/100 $cm^2$) to be deposited on small areas as a result of accidental low-level spills such as in radioactive storage areas, controlled corridors and passageways, and con-

trolled areas where only contained contaminated material was handled, it can be assumed that radioactivity normally would not be deposited or spread to inaccessible locations, such as in crevices, under floor tile, or in wall or ceiling joints to a degree to warrant detailed and complete examination. As a minimum, a complete survey should be made with particular attention to potential areas of contamination, such as along walls at shoulder and waist height, and over floor areas.

In other areas where a potential existed for higher levels of loose contamination (between 1,000 and 10,000 dpm/100 $cm^2$) to be deposited at times on larger areas as a result of work on uncontained contaminated material such as in contaminated welding and machine shops, it might be expected that radioactivity could be deposited or spread to a few inaccessible locations. As a minimum, a thorough survey should be made of all surfaces. Selected floor tile should be removed and selected wall joints should be opened for survey along the heavy traffic routes and at the previous work stations.

For highly contaminated areas, such as decontamination rooms and liquid waste storage and processing areas, it is necessary to completely strip all floor coverings other than coverings without crevices, such as stainless steel, and open up and expose all wall and floor crevices and joints in order to perform a satisfactory survey.

c. Ventilation Ducting usually can be surveyed internally.

An adequate survey of internal surfaces may consist of spot checking (1) the first few feet of the inlet and

outlet ductwork, (2) a few feet upstream and downstream of a filter (after filter removal), and (3) in the vicinity of handhole openings. If contamination is found, a more complete survey is required.

d. Equipment

Equipment such as drains, piping, tanks and hoses which have been previously exposed to radioactive liquids usually shall be removed and discarded as radioactive waste if no longer useful since it is highly improbable that such equipment can be economically decontaminated.

e. Outside Earth or Ground coverings

Outside earth or ground coverings should be slowly scanned over the entire area surface with a gamma survey meter and representative samples should be counted for gross activity. If the contamination has been covered over, it should be re-exposed for a proper survey.

3. Records

A record of these surveys shall be retained in the permanent project file for all facilities and outside areas released for unrestricted use.

CHAPTER 11

# ANTI-CONTAMINATION CLOTHING AND EQUIPMENT

## 1101 GENERAL

Anti-contamination clothing (often referred to as anti-C clothing) is used to help keep personnel from spreading radioactive contamination outside controlled surface contamination areas and to keep the wearer's body free from contamination. Anti-contamination clothing is required when either surface contamination or airborne radioactive contamination may exceed prescribed limits. In the following section, the recommended type of anti-contamination clothing is described, and instructions for wearing it are given. In addition, miscellaneous equipment used for the control of radioactive contamination is described.

## 1102 REQUIREMENTS FOR WEARING ANTI-CONTAMINATION CLOTHING

RCS shall determine the appropriate requirements for anti-contamination clothing based on the following.

1. When first entering an area which may be contaminated, prior to determining the extent and level of contamination, full anti-contamination clothing shall be worn. Full anti-contamination clothing consist of hoods, coverall, rubber and loth gloves and shoe covers.

2. Full anti-contamination clothing shall be worn when working in highly contaminated areas (greater than 20,000 dpm/100 $cm^2$). Full anti-contamination clothing may be required in areas with less contamination if personnel contamination is probable. In addition, if contamination may seep through openings such as at wrists and ankles, these openings should be sealed with tape. Full anti-contamination clothing is also necessary in other

situations, such as when initially opening a radioactive system without containment.

3. A face shield, waterproof apron and rubber gloves should be worn during operations such as sampling of radioactive waste tanks and processed water tanks.

4. a. When working in very highly contaminated areas (greater than 50,000 dpm/100 $cm^2$) double suits of anti-contamination clothing should be worn. Double suits limit the contamination which may penetrate the material during work, and they also improve the ease of controlling spread of high levels of contamination. The outer suit is normally removed prior to leaving the region of very high contamination and the inner suit is normally removed at the boundary of the controlled surface contamination area.

   b. When only the hands and arms are in contaminated areas such as glove box, rubber gloves attached to the glove box may substitute for the anti-contamination clothing.

   c. When working in a contaminated wet area or when contaminated liquid is likely to spray on the clothing, the outer coveralls shall be waterproof (e.g., when entering a contaminated liquid waste collection tank, disconnecting a used demineralizer or resin column, or when opening a radioactive liquid system).

5. If contamination is confined to floors, or if personnel can pass through a controlled surface contamination area without touching other contaminated surfaces, it may suffice for personnel to wear shoe covers and rubber gloves (without the other anti-contamination clothing). If wearing gloves without anti-contamination coveralls, care should be taken not to transfer contamination from the gloves to personal clothing.

6. It may be desirable to remove personal clothing before putting on anti-contamination clothing for comfort when working in high temperature spaces. Removing personal clothing is not usually required for adequate radiological control as long as the anti-contamination coveralls do not tear and the anti-contamination clothing is taken off properly after use.

7. Masks should be worn in conjunction with anti-contamination clothing if the concentration of airborne radioactive particles may exceed the limits of Section 702. Masks or face shields shall be worn if covering is needed to avoid contamination of the face.

8. When reading a pocket dosimeter in a contamination area, provisions should be made so that the dosimeter does not become contaminated. Use of a transparent plastic bag has been effective for this purpose.

1103 PROCEDURE FOR DONNING ANTI-CONTAMINATION CLOTHING

The anti-contamination coveralls, hood, shoe covers, and gloves should be donned in accordance with the following:

1. Plastic shoe covers should be put on first. They should extend up over the worker's lower pant leg.

2. Long cotton gloves are put on next and drawn up the forearm.

3. Don the coverall making sure they fit over the plastic shoe cover.

4. Rubber overshoes are put on over the plastic shoe covers.

5. The hood is put on next and secured at the neck.

6. Rubber gloves should be put on last.

7. Tape openings as necessary.

1104 PROCEDURES FOR REMOVING ANTI-CONTAMINATION CLOTHING

Procedures for removing anti-contamination clothing shall be posted at exists from controlled surface contamination areas or surrounding areas where radiological control personnel are not personally present to direct the removal. The following procedure shall normally be used for removing full anti-contamination clothing starting prior to leaving the area:

1. Remove tape (if used) and place in waste container. (Some types of garments still in use might require taping.)

2. Remove rubber gloves (inside out) and place in designated container. Leave on cloth gloves.

3. Remove hood and mask and place in designated containers. To remove mask, grasp mask by canister or air inlet connection, bend head down and remove by pulling out and away from body.

4. Remove rubber overshoes and place in designated container.

5. Remove coveralls inside out to avoid transferring contamination from the outside of the coveralls to personal clothing. Place coveralls in designated container. If feasible, considering design of coveralls and shoe covers, remove shoe covers as in steps 6 and 7 simultaneously with coveralls.

6. Remove shoe cover from one foot and then place this foot on a designated step-off area. Shoe covers should not touch outside, and clean shoes should not touch inside the controlled area.

7. Remove shoe cover from other foot and step on step-off area. Place shoe cover in designated container.

8. Remove cloth gloves (inside out) and place in designated container.

9. Frisk yourself or be frisked by radiological control personnel, paying particular attention to shoes, elbows, knees, palms and head.

CHAPTER 12

# RADIOACTIVE DECONTAMINATION

## 1201 GENERAL

Decontamination may be required for components, tools and equipment, work areas, clothing or personnel. Each of these subjects is discussed in the following sections. Alternatives to decontamination are also discussed in these sections. These include, in some cases, storage for decay, disposal without decontamination, or restricted use without complete decontamination. By the very nature of decontamination operations, the disposal of the waste radioactivity must be considered. Volumes of both solid and liquid wastes shall be minimized. Unauthorized chemicals shall not be used. These may cause difficulties in waste processing. Most radioactive contamination can be removed by normal cleaning. Wiping with a damp rag soaked with detergent will usually provide satisfactory decontamination.

If large variations in surface contamination levels exist on highly contaminated surfaces, cleaning shall be from less contaminated toward more contaminated areas (otherwise radioactivity might spread to less contaminated areas). Cleaning solutions and cloths used in these decontamination operations shall be disposed of as radioactive waste. During decontamination operations, precautions shall be taken to limit the spread of contamination, such as by taking care not to splash solutions, by properly wearing anti-contamination clothing, and by wearing masks as necessary. Filtered exhaust ventilation is also normally required to minimize the possibility of contamination being breathed by personnel performing the decontamination.

## 1202 DECONTAMINATION OF TOOLS AND EQUIPMENT

In decontaminating tools and equipment, appropriate radiological control shall be exercised for spread of contamination, airborne



110495

radioactivity, and radiation exposure. The following procedures apply to decontaminating tools and equipment.

1. Tools and equipment which may be used again in contaminated areas may be temporarily stored in the contaminated area or in a contaminated tool room without decontamination. If certain tools are to be used solely in controlled surface contamination area, such as a set of hand tools for the decontamination room, these tools should be durable and distinctively marked to indicate they are always treated as potentially contaminated. Heavily contaminated tools can spread significant surface contamination within a controlled area. Therefore, such tools should normally be partially decontaminated, such as by wiping with a cloth. Heavily contaminated tools can be readily identified without taking swipes by measuring their radiation level. Heavily contaminated tools can be decontaminated separately in an ultrasonic tank or treated as in the following paragraphs.

2. Many lightly contaminated tools may be treated together in an ultrasonic tank without time-consuming scrubbing by hand. These tools need to be swiped or frisked at completion of decontamination to verify the effectiveness of the treatment.

3. In some cases, the need for decontaminating tools may be minimized by taping some portions such as the handles prior to use and stripping off the contaminated tape after use. Large tools are often wrapped in plastic instead of tape. If tape is used to cover parts of tools, after tape removal, the residual adhesive shall be removed to minimize contamination that may be picked up in future uses of the tool.

4. Tools which are used solely in controlled surface contamination areas can normally be surveyed after decontamination with a beta gamma or alpha survey meter instead of swipes. The purpose of decontaminating these tools will usually be to

reduce their radiation levels rather than to remove all loose surface contamination.

5. When only a few tools require decontamination, wipe with cloths soaked in detergent is a convenient, effective procedure. This method is also useful when only a portion of a tool is contaminated. A disadvantage of wiping procedures is the large amount of solid radioactive waste produced.

6. Dishwashers have proven effective for tool decontamination. Provisions must be made for disposal of contaminated wash water.

7. Mechanical decontamination methods, such as using abrasives which remove some of the surface of the tool, can be useful in special circumstances where contamination is not removed by chemical cleaning. In such cases, control of possible airborne radioactivity is essential.

8. The cost of some tools may not justify efforts to decontaminate the tools. In such cases, disposal as radioactive waste may be warranted or the tools may be retained solely for use in controlled surface contamination areas.

9. In decontaminating oily or greasy tools or equipment, consideration should be given to the fact that oil or grease will inhibit waste processing. Therefore, initial degreasing with rags, or with degreasing solutions which are disposed of by solidification, may be necessary.

## 1203 DECONTAMINATION OF AREAS

Contaminated areas shall first be isolated and radioactivity then removed while being careful to avoid spreading contamination. In some cases, tape may be used to lift loose contamination from the surfaces. Wiping with damp rags soaked in sudsless detergent is generally the most effective decontamination method. If

contamination levels are not sufficiently reduced, use of solvents, strong chemicals, or mechanical removal of some of the surface may be necessary. In all cases where liquids are used in decontamination, care shall be exercised to avoid spreading radioactivity. The areas shall be surveyed by direct survey with the HP-210 and PAC-4G and by swiping or by other methods detailed in the decommissioning plan prior to release to ensure surface contamination is below the established limit. On painted or covered surfaces, if washing will not remove the contamination, the paint or covering shall be removed and the surface repainted or recovered. During the process of paint removal, control of the spread of airborne and surface contamination in dust and paint chips will be necessary.

Because of these radiological control problems, and because paint can chip or wear off exposing underlying contamination, painting is not normally considered an acceptable substitute for decontamination in controlling loose surface contamination.

Contamination areas should be decontaminated as soon as practicable to minimize spread of contamination and to facilitate removal before the contamination is fixed on the surface. Normally, areas are decontaminated by starting at the edge and working toward the area of highest contamination. If high radiation levels from the contamination contribute significantly to personnel radiation exposure during cleanup, it may be desirable to decontaminate the most heavily contaminated area first.

## 1204 DECONTAMINATION OF CLOTHING

Anti-contamination clothing shall normally be laundered and/or surveyed before reuse to minimize the possibility of spreading radioactive contamination to the wearer.

1205 DECONTAMINATION OF PERSONNEL

1. Objectives

The objectives of skin decontamination are to remove as much of the radionuclide as practicable in order to reduce the surface dose rate and to prevent activity from entering the body. An over-aggressive skin decontamination effort must be avoided since it may injure the natural barriers in the skin and so increase absorption.

2. Techniques

2.1 Carefully survey the area to determine the extent of contamination.

2.2 Mix a mild solution of soap and warm water.

2.3 Wash only the contaminated areas. Indiscriminate washing may spread contamination.

2.4 Gently wash contaminated area two to three minutes. Monitor and repeat if necessary. Dab skin dry before monitoring.

2.5 If contamination persists, wash two more times using a soft bristle brush. Do not brush hard enough to cause skin abrasion.

2.6 If contamination on the skin persists, contact the RCS or Corporate Health Physicist.

2.7 If contamination is in the hair, wash the hair away from the face into a collection basin for further analysis. If the contamination cannot be removed, contact the RCS or Corporate Health Physicist.

2.8 If contamination exists near the eyes or other body orifices, always wipe contamination away from these areas to prevent internal contamination. If contamination in these areas persists, contact the RCS or Corporate Health Physicist.

3. Wound Decontamination

Immediate flushing of a minor wound is usually desirable to minimize absorption of radioactivity. Upon decontamination, the wound area should be monitored for internally deposited radioactivity and results of this survey recorded. An incident report shall be filed in accordance with Reference 201.2.

CHAPTER 13

# PROCEDURES FOR HANDLING RADIOACTIVE MATERIALS

## 1301 GENERAL

### Discussion

This chapter presents procedures applicable to radiological safety considerations for controlling radioactive material associated with CNSI operations. Strict radiological control procedures are mandatory for such material to minimize the external and internal radiation exposure received by personnel and to prevent the uncontrolled spread of radioactivity to areas where the public might be affected.

## 1302 RECEIPT OF RADIOACTIVE MATERIAL

### Discussion

Radioactive material shall be received in accordance with the applicable operating license.

Radioactive material received by CNSI requires special control procedures to ensure that adequate radiological safety precautions are observed, both in unpacking and in subsequent use of the material. Potential radiological problems can include external exposure, surface contamination and airborne radioactivity. Some packaging material requires disposal as radioactive waste. In addition, special precautions are required if damage has occurred during shipment.

### Requirements

The following procedures shall be used for radioactive material received at CNSI work sites.

1. The RCS shall be familiar with the applicable radioactive material receipt conditions of the operating license.

2. When received, the material shall be inspected. This inspection shall be performed no later than three hours after receipt if received during normal working hours or eighteen hours if received after normal working hours. This inspection shall consist of verifying radiation levels on the outside of the package and verifying that the package was properly transferred. For packages which are shipped, this inspection shall verify that the package was shipped in accordance with state and Federal regulations.

3. The package shall not be opened solely for survey purposes unless the package shows signs of damage. If damage to the radioactive material package has occurred, the RCS shall report the incident per Reference 201.2.

4. Received packages shall be inventoried as soon as possible. Inconsistency between the observed contents and the content indicated on the shipping document shall be brought to the attention of the shipper of the material. If the possibility exists that radioactive material has been lost in shipment the RCS shall report this incident per Reference 201.2.

5. Care shall be taken in unpacking to ensure that all radioactive items in the package are accounted for and to ensure radiological control requirements are followed. Unpacking is sometimes performed in an area which is not a radiologically controlled area, but shipping containers, if suspected to be contaminated, and packing material shall be surveyed and meet the criteria of Section 802 to release for unrestricted handling.

6. Following satisfactory inventory, a receipt shall be returned promptly to the organization transferring or shipping the item, whether a receipt is requested or not.

1303 PACKAGING RADIOACTIVE MATERIALS

Requirements

Radioactive materials shipped for disposal or to another location shall be appropriately packaged and treated as required by applicable Federal and State regulations and applicable disposal site criteria. Decisions on radioactive material packaging shall be made with the approval of a CNSI Broker.

Precautions for Waste Shipments

Shipments of radioactive material must be properly packaged in order to meet all applicable Federal and State regulations. Radioactive wastes being shipped for disposal, in addition to meeting Department of Transportation regulations, must meet the acceptance criteria (and/or license) of the receiving disposal site. The following waste characteristics shall be considered during decision making on waste packaging.

| | |
|---|---|
| Free liquids - | Free liquids are generally prohibited in wastes. |
| Oil - | Oil in excess of trace quantities is generally prohibited. |
| Stabilization - | Certain wastes require stabilization; determined by radionuclide concentration. |
| Transuranics - and SNM | The concentration of transuranics in waste may require stabilization or exceed acceptance limits. |
| Pyrophoric - Material | These materials are generally prohibited for disposal. |

The RCS shall contact a CNSI Broker for specific requirements in dealing with wastes being shipped for disposal.

1304 RADIOACTIVE MATERIAL STORAGE

Storage of radioactive material should be in accordance with the following:

1. Fire Protection Practices

Proper selection of a fire resistant storage area for radioactive material will minimize release of radioactivity to the environment in the event of a fire. The safety briefing in Reference 210.7 shall include discussion of fire protection. However, the following additional fire protection practices shall be considered for storage of radioactive material to minimize the possibility of a fire and spread of contamination in the event of a fire.

a. Storage of radioactive material in fire-resistant containers is desirable to minimize contamination spread. In addition, containers of highly flammable radioactive materials such as plastic bags of radioactive waste shall be stored in areas segregated from other storage to reduce the risk of spreading a fire.

b. Smoking shall not be permitted in radioactive storage areas because radioactive materials are frequently wrapped in combustible materials.

c. An up-to-date list of locations where radioactive materials are stored shall be available to personnel who might be called to fight a fire in such areas. This list shall also identify unusual problems which may be present.

# 2

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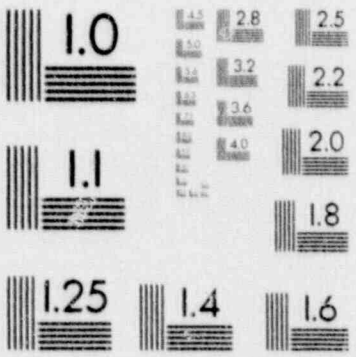


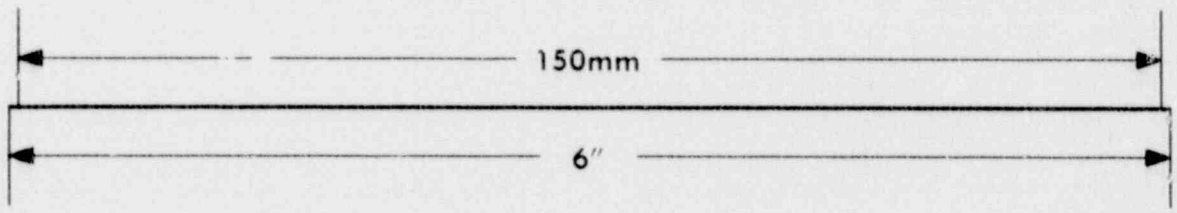



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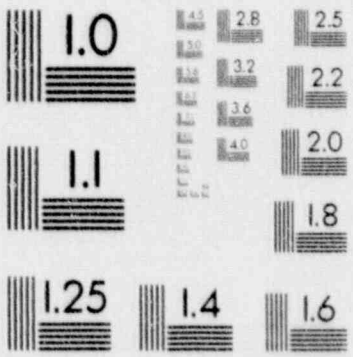


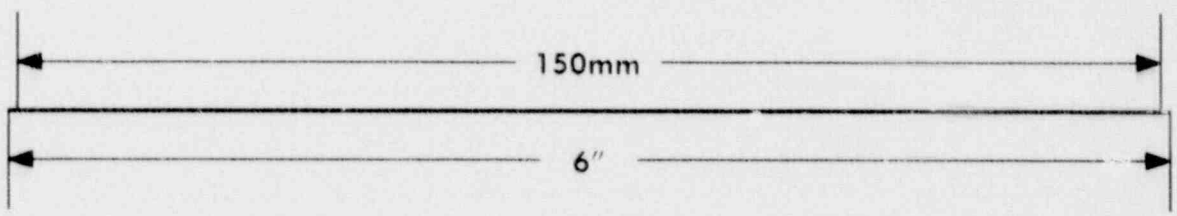



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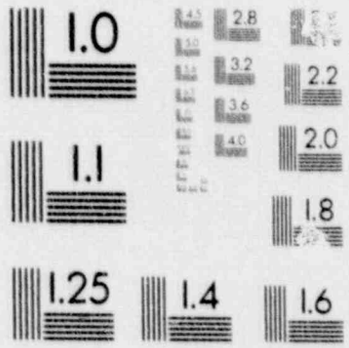


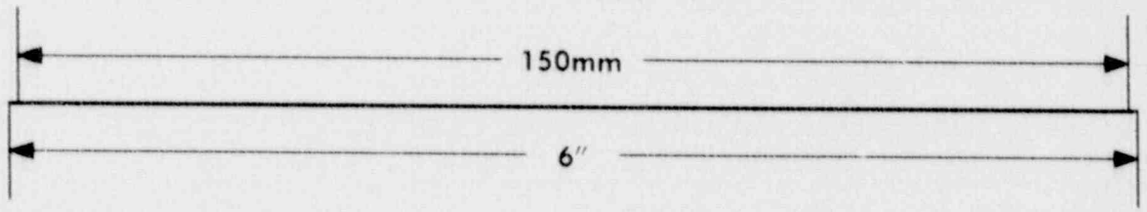



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d. Periodic inspections of radioactive material storage areas shall be made to identify fire hazards. Deficiencies shall be promptly corrected.

e. Fire drills should be performed periodically with both fire fighting and radiological control personnel participating.

f. Combustible materials shall be minimized inside radioactive material storage areas and should not be stored next to surrounding walls. Welding, burning, or other operations which may cause a fire shall not be conducted inside or next to radioactive material storage areas without prior authorization of the RCS or his designated representative.

2. Contamination Control

Contaminated items are often stored in plastic bags which might break. Liquid inadvertently left in a container might leak out, and condensation of moisture from the atmosphere might drip on exposed, contaminated surfaces. Unless all contaminated surfaces of stored materials are appropriately wrapped or contained to prevent the spread of contamination, the storage location shall be considered potentially contaminated. Personnel in these areas, particularly if they handle contaminated material, shall wear necessary anti-contamination clothing. Reasonable care shall be taken in packaging and storing contaminated items to prevent the spread of contamination and to ensure that entry to areas where such storage is permitted does not result in the contamination of personnel or other areas.

3. Radiation Exposure Control

Storage of radioactive materials can result in possible personnel radiation exposure in the storage area and surrounding areas. For example, a component or bag of contaminated waste measuring one rem per hour, if stored at the entrance to the storage area would expose everyone who entered to high radiation levels. If stored in a far corner of the area, high radiation levels might be caused in surrounding areas. Facilities should store radioactive materials so as to minimize the radiation exposure of personnel entering or working in the area and of personnel in surrounding spaces. Radiation surveys of the storage area and of spaces immediately around the storage area shall be performed to ensure proper posting of radiation areas and prevent inadvertent exposure of personnel in the storage space or surrounding spaces. When necessary, temporary shielding should be used to reduce radiation levels.

4. Outdoor Storage

Radioactive materials should be stored where they are protected from adverse weather. Normally, radioactive material should not be stored outdoors except during short periods. However, protection from adverse weather should be considered in selection of these temporary storage locations. Large items which are designed for outdoor use, such as radioactive liquid collection tanks, may be stored outdoors. However, mechanical joints or capped pipes which may leak radioactive liquids shall be wrapped with weather resistant materials.

5. Minimize Radioactive Material in Storage

In order to minimize the complexities of accounting for a large amount of radioactive material and possibility of

losing radioactive material, it shall be consolidated in as few areas as practicable and minimize the amount of radioactive material in storage.

## 1305 SHIPPING RADIOACTIVE MATERIALS

### Requirements

All shipments or transfers of radioactive material over public areas (i.e., public highways, waterways, airways, etc.) including shipments made with private or government vehicles, must comply with appropriate Federal, State and local transportation regulations.

The Radiological Control Supervisor (RCS) shall be responsible for maintaining cognizance of the regulations for transportation of radioactive material. Shipments of radioactive material shall be performed by a CNSI Certified Broker in compliance with RA-OP-001, "Operating Procedure for Brokering of Radioactive Materials at Commercial Facilities" (Reference 201.8) or FS-OP-015, "Shipment of Radioactive Material for the United States Government by Unit 571 (Field Services)" (Reference 201.11).

## 1306 ACTIONS AND REPORTING IN CASE OF LOSS OF RADIOACTIVE MATERIAL

### Requirements

If radioactive material associated with CNSI operations is lost, these procedures shall be followed:

1. Immediately conduct a search for the lost material. A primary purpose of this search is to ascertain that no persons will receive inadvertent internal or external radiation exposure from this material.

2. Notify CNSI Regulatory Affairs in accordance with Reference 201.2.

CHAPTER 14

# ENVIRONMENTAL MONITORING

## 1401 GENERAL

Environmental monitoring consists of measurements, sample collection and analysis, and dose assessment to determine if radionuclides are being released to the environment from a facility or site and, if so, what the effect is on the surrounding population. An environmental monitoring program generally consists of measurements and sample collection at the site boundary and at off-site locations. The types of samples and analyses are dependant on the radionuclides at the site and the possible release mechanisms. All potential exposure pathways should be monitored. The CHP and the customer shall specify the environmental monitoring requirements in the decommissioning plan for the project.

## 1402 METHODS

A typical environmental monitoring program provides for monitori of direct radiation, air, water, and soil.

Direct radiation is typically monitored by TLDs placed at the site boundary and at off-site locations.

Air monitoring usually consists of taking air samples for particulate concentrations at the site boundary and at off-site locations. The techniques used are typically the same as those used to monitor occupational airborne activity.

Water monitoring is usually performed by ing water samples of surface runoff and from wells both on-and off-site followed by an analysis for radionuclide content.

Surface soil samples are usually collected and analyzed for radioactivity.

A comprehensive program may also include flora & fauna sampling.

1403 REQUIREMENTS

For those CWSI projects where the potential exists for releases to the environment exceeding the limits of 10 CFR 20, an environmental monitoring program shall be designed and implemented. The need for an environmental monitoring program shall be discussed during the ALARA briefing (Reference 201.9).

If an environmental monitoring program is required, it shall be designed and implemented with the approval of the CHP or Director, Regulatory Affairs, and shall include:

Sampling Locations
Types of Samples
Sampling Frequency
Types of Analyses
Action Levels
Required Actions

1414 RECORDS

All records of samples collected, analyses performed, results and actions taken shall be maintained in the permanent project file.

110495

BETWEEN:

LICENSE FEE MANAGEMENT BRANCH, ARM
AND
REGIONAL LICENSING SECTIONS

(FOR LFMS USE)
INFORMATION FROM LTS

PROGRAM CODE: 03521
STATUS CODE: 0
FEE CATEGORY: EX 3G
EXP. DATE: 19920531
FEE COMMENTS: _____

LICENSE FEE TRANSMITTAL

A. REGION

1. APPLICATION ATTACHED
APPLICANT/LICENSEE: COMMERCE, DEPARTMENT OF
RECEIVED DATE: 890331
DOCKET NO: 3006952
CONTROL NO.: 110495
LICENSE NO.: 20-05735-03
ACTION TYPE: TERMINATION

2. FEE ATTACHED
AMOUNT: $-0-
CHECK NO.: ---

3. COMMENTS

SIGNED B. J. Brown
DATE 89-04-03

B. LICENSE FEE MANAGEMENT BRANCH (CHECK WHEN MILESTONE 03 IS ENTERED /__/)

1. FEE CATEGORY AND AMOUNT: _____

2. CORRECT FEE PAID. APPLICATION MAY BE PROCESSED FOR:
AMENDMENT _____
RENEWAL _____
LICENSE _____

3. OTHER _____
_____

SIGNED _____
DATE _____