



UNITED STATES
ATOMIC ENERGY COMMISSION
DIRECTORATE OF REGULATORY OPERATIONS
REGION 1
631 PARK AVENUE
KING OF PRUSSIA, PENNSYLVANIA 19406

Knapp

APR 26 1974

Nuclear Metals, Inc.
Attention: Mr. W. B. Tuffin
President
2229 Main Street
Concord, Massachusetts 01742

License Nos. SNM-65
SMB-179

Re: Your Letters Dated March 27, 1974 and April 16, 1974
In Response to Our Letter Dated February 15, 1974

Gentlemen:

Thank you for informing us of the corrective and preventive actions you documented in response to our correspondence. These actions will be examined during our next inspection of your licensed program.

Your cooperation with us is appreciated.

Sincerely,

James P. O'Reilly
James P. O'Reilly
Director

bcc:
RO Chief, FS&EB
RO:HQ (4)
L:D/D for Fuels and Mat'l
PDR
NSIC
RO Files
DR Central Files
State of Massachusetts

A/90

OFFICE ▶	CRESS	<i>OK</i>	<i>Therese</i>	<i>Nelson</i>	
SURNAME ▶	Jerman/by <i>YSD</i>	X Knapp	Crocker	Nelson	O'Reilly
DATE ▶	4/24/74	4/24/74	4/24/74	4/25/74	



NUCLEAR METALS, INC.

2229 MAIN STREET
CONCORD, MASSACHUSETTS 01742
TELEPHONE: 617 369-5410

March 27, 1974

U.S. Atomic Energy Commission
Directorate of Regulatory Operations
Region 1
631 Park Avenue
King of Prussia, Pa. 19406

Attention: Mr. James P. O'Reilly, Director

Subject: Region 1 Inspections of December 27 & 28, 1973
and January 8 & 9, 1974

References: (1) License Nos. SNM-65, SMB-179
(2) Inspection Nos. 70-82/73-05; 40-672/73-02
(3) Your letter of February 15, 1974

Gentlemen:

This letter constitutes a response to points raised in the ref. (3) letter as required by Sec. 2.201 of the AEC's "Rules of Practice", Part 2, Title 10, CFR.

Item 1. Surveys:

Reference: Enclosure No. 1, Item No. 1, Ref.(3) letter.

(a) Survey of hand exposures:

1. Steps which have been or will be taken:

Results of surveys of hand exposure conducted prior to Mr. Jerman's inspection of December 27 and 28, 1973 were regrettably not completely available to Mr. Jerman during his visit, since our Safety Engineer was out of plant at that time. While Mr. Jerman reviewed reports of hand dosage provided by the company evaluating dosimeters, these were not identified as to which individuals had worn the dosimeters. The following paragraphs define our usage of finger dosimeters.

During the month of April 1973, 4 gamma finger dosimeters were placed on our employees, 3 on foundry employees and 1 on a machinist, all directly handling uranium. One of the foundry personnel received 50% of the maximum permissible monthly dose to the hand, the other two received 10%, and the machinist received only 1%.

NUCLEAR METALS, INC.

March 27, 1974

USAEC - Directorate of Regulatory Operations

Page -2-

Then in June 1973, 6 of our employees wore gamma finger dosimeters, all of these persons were directly handling uranium, though the portion of working hours spent handling uranium was less than for the group surveyed in April. None of these employees exceeded 0.5% of the maximum monthly permissible dose to the hands. (For purposes of clarification, these calculations are based on dividing the maximum permissible quarterly dose to the hands, as defined in 10CFR20.101 by 4.3 to arrive at a monthly limit).

It has been and continues to be our judgment and the judgment of our consultants that the finding of relatively low whole body dosage to our employees relative to penetrating radiation is adequate indication that the likelihood of approach to hand exposure limits was not of concern, particularly in view of the markedly higher limits for hand exposure as compared to whole body exposure. The body badges have consistently shown low exposure; our report for 1973 appended hereto, shows only 1 person out of 38 wearing body badges who exceeded 25% of the maximum permissible dose to the whole body (his dose was 40%), the average of all employees wearing body badges was only 4% of maximum permissible whole body doses. It does not appear axiomatic that a house averaging 4% of permissible whole body dose has failed in adequacy of hand exposure evaluation when penetrating beta-gamma radiation is under evaluation, particularly including hand surveys of one third of its labor force involved with active materials, when both the total labor force and the segment evaluated with hand dosimeters, each contained only 1 individual exceeding 25% of permissible dose. The language of the "Description of Violations" would make it appear that Nuclear Metals failed to make any assessment of radiation hazard. Para. 10CFR20.201(a) defines a survey as "an evaluation of hazards". We submit that such evaluation may include use of engineering judgment, particularly when the data presented above shows rather low levels of radiation exposure.

Nonetheless, Nuclear Metals has since, on a rotating basis, been placing finger dosimeters on some 3 to 4 of its employees monthly and expects to continue to do so until such time as we judge the accumulation of data to show exposure levels sufficiently low to be beyond concern.

2. Steps to avoid further violation:

We are of the opinion we were not in violation of the requirement for hand exposure evaluation, but nonetheless, as defined above, we are using finger dosimeters on a rotating basis.

3. Date of compliance:

We are surveying some 3 to 4 of our uranium-handling employees on a

March 27, 1974

USAEC - Directorate of Regulatory Operations

Page -3-

rotating basis, monthly, since January 1974 in addition to the surveys performed in April and June of 1973.

(b) Surveys of breathing zone air:

1. Steps which have been or will be taken:

The location of implant air samplers has been well documented in prior correspondence. The location of the air sampler adjacent to the foundry furnace used for the bulk of our uranium melting is in the workers' breathing zone. This sampler is 68.5 inches above the platform floor and is at the entrance of the fume hood, i.e., air entering the fume hood passes by the sampler. The noses of foundry workers in this area are 4 to 6 inches below the entrance to the air sampler. We are of the opinion that this sampler performs an effective function in monitoring breathing zone air.

We are of the opinion we are not in violation on this matter as shown by surveys made in June 1973, but nonetheless, we have ordered and received a portable (Mine Safety Appliances) battery powered air sampler which we are using to monitor breathing zone air for our workers.

2. Steps to avoid further violation:

The use of the breathing zone air sampler is expected to provide additional evidence of acceptable breathing zone air quality. Such air samples will be evaluated for both alpha and beta-gamma activity.

3. Date of compliance:

Air sampling has been a continuing program at this facility for years. We are now enhancing this program with the portable unit and evaluating for both alpha and beta-gamma activity.

(c) Effluents released from stacks:

1. Steps which have been or will be taken:

All stack air samples are now evaluated for beta-gamma activity in addition to alpha activity. We do not understand this to be an uncorrected violation since we find no reference to beta-gamma measurements in prior Region 1 correspondence.

2. Steps to avoid further violations:

Our Safety Engineer, responsible for sending filter discs from air samplers

NUCLEAR METALS, INC.

March 27, 1974

USAEC - Directorate of Regulatory Operations

Page -4-

to our consultants for analysis, assures that the shipping papers accompanying filter discs request measurement of both alpha and beta-gamma activity. Returned reports are also checked and logged in for both alpha and beta-gamma activity.

3. Date of compliance:

Effective with the date of this letter, reports now filed include results of monitoring for beta-gamma activity.

(d) Liquid effluents:

1. Steps which have been or will be taken:

Liquid effluents have been resampled and are under analysis for beta-gamma activity. We do not believe this to be an uncorrected violation, since to our knowledge this matter has not previously been called to our attention.

2. Steps to avoid future violations:

Effective with the date of this letter, all future samples of liquid effluents will be evaluated for both alpha and beta-gamma activity.

3. Date of compliance:

Reports of results of analysis of liquid effluents after the date of this letter will report both alpha and beta-gamma measurements.

Item 2. Environmental Samples:

Reference: Enclosure No. 1, Item No. 2, Ref. (3) letter.

1. Steps which have been or will be taken:

An additional series of soil and water samples are under analysis for beta-gamma activity. We do not believe the lack of evaluation for beta-gamma activity to represent an uncorrected violation, since to our knowledge this matter has not previously been called to our attention.

2. Steps to avoid future violations:

Effective with the date of this letter, all future environmental samples will be evaluated for both alpha and beta-gamma activity.

NUCLEAR METALS, INC.

March 27, 1974

USAEC - Directorate of Regulatory Operations

Page -5-

3. Date of compliance:

Reports of results of analysis of environmental samples dated later than the date of this letter will report both alpha and beta-gamma measurements.

General Note: Alleged Violations relating to Daughter Product
Beta-Gamma Activity

The general tenor of a number of the alleged violations discussed above relates to the discovery of beta-gamma radiation attending the depleted uranium, and coming from the daughter products of uranium. The conclusion of Region 1 has been that since beta-gamma activity exists, the licensee is in violation for performing an incomplete survey.

We wish to bring to your attention the point that Nuclear Metals, Inc. is not processing these beta-gamma daughter products as pure materials, separated from the parent uranium, but rather that any occurrence of beta-gamma radiation attends our work with uranium.

The maximum quantity of daughter product in existence at this facility cannot therefore exceed that amount in equilibrium with the parent uranium. We are therefore in the process of examining the relationship between an equilibrium quantity of parent and daughter in both effluent and inplant air and liquids as compared to allowable limits for these daughters as defined in Appendix B of 10CFR20. Preliminary data suggests it may not be possible to exceed Appendix B limits for these daughters when their only existence stems from the parent uranium. We intend further evaluation of this matter with the intent of better defining one of the aspects of the process of performing a survey in order to assure its completeness.

NUCLEAR METALS, INC.

March 27, 1974

USAEC - Directorate of Regulatory Operations

Page -6-

Item 3. Contamination Control Program:

Reference: Enclosure No. 2, Ref. (3) letter.

1. Corrective steps taken or planned:

- (a) extensive cleanup of operations
- (b) additional surveys
- (c) establishment of restricted area
- (d) implementation of contamination control procedures
- (e) employee instruction in personnel contamination control
- (f) use of shoe covers and lab coats
- (g) implementation of stepoff procedure
- (h) supply of survey meters to employees, including instructions for use
- (i) wipe tests both inplant and beyond plant entrances
- (j) monitoring of janitors' mops
- (k) whole body counting of foundry personnel
- (l) extensive utilization of consultants
- (m) evaluation of both alpha and beta-gamma activity during surveys
- (n) purchase and use of lapel-type breathing zone air sampler
- (o) procedural revisions designed to minimize the number of work areas processing uranium
- (p) substitution of equipment with surfaces easy to decontaminate for equipment more difficult to decontaminate within work areas processing uranium
- (q) extensive use of plastic bagging of uranium objects between processing operations
- (r) enhancement of ventilation around certain equipment processing uranium
- (s) enhancement of filtration of effluent air
- (t) expanded use of dosimeters for hand exposure
- (u) establishment of changeroom in restricted area
- (v) equipment modification to minimize contamination potential of a given process
- (w) procedural modifications to minimize contamination potentials of a given process

2. Steps taken or planned to prevent recurrence:

The items listed above of course also operate in the direction of minimizing the potential for recurrence of spread of contamination beyond work areas processing uranium, but in addition, the magnitude and degree of our attention to control of programs involving uranium merits discussion. Nuclear Metals, Inc. is a company of about 100 employees involved in many phases of specialty metals manufacture. The involvement with uranium constitutes less than 10% of our total business, yet the degree of attention found to be necessary to control uranium operations, including use of our

March 27, 1974

USAEC - Directorate of Regulatory Operations

Page -7-

consultants' time and the time required for performance of purchased services for evaluation functions, exceeds the equivalent of two men working full time. This ratio of more than one fulltime person in control functions per 5% of our total business then greatly exceeds the extent of control effort found to be necessary over the balance of our operations, this balance including control programs to satisfy both the regulations of such agencies as OSHA, EPA and other state, federal and local town agencies, as well as to meet our internal goals for assurance of satisfactory operations.

3. Completion data for action items:

Listed below are each of the action items listed above with projected or actual completion dates:

- (a) cleanup: projected completion about 4/30/74, initiated 1/2/74
- (b) additional surveys: initiated 1/2/74, and continuing
- (c) restricted area establishment: initiated 1/2/74, final permanent barricades projected to be installed about 5/30/74
- (d) control procedure implementation: 1/2/74 and continuing under progressive refinement as needed
- (e) employee instruction: significant numbers of formal meetings with operating personnel during the period 1/2/74 to 1/18/74, and again in the period 2/25/74 thru 2/28/74. Frequent on-the-spot observations and instructions of personnel in a continuing program initiated 1/2/74. This program is a continuing program
- (f) protective clothing: implemented prior to 1/18/74, continuing and under refinement as dictated by experience
- (g) stepoff procedure: implemented prior to 1/18/74, continuing under refinement as indicated by experience
- (h) survey meter use by operating employees: initiated prior to 1/18/74, continuing
- (i) wipe test program expansion: initiated prior to 1/18/74, continuing
- (j) monitoring of janitors' mops: initiated prior to 1/18/74, continuing
- (k) whole body counting: performed prior to 1/18/74. We do not propose whole body counting as an ongoing program, since it is the opinion of our consultants that a more definitive evaluation of body burden is obtained from periodic urinalyses for uranium, this program continues and reveals satisfactory low values
- (l) enhanced utilization of consultants: initiated prior to 1/18/74, continuing. At least one man-day of consultant visitation has occurred weekly since 1/18/74, continuing consultant visitation will of course be on an as-needed basis
- (m) evaluation of both alpha and beta-gamma activity: initiated prior to 1/18/74 and continuing

NUCLEAR METALS, INC.

March 27, 1974

USAEC - Directorate of Regulatory Operations

Page -8-

- (n) use of lapel-type air sampler: initiated 3/21/74 on receipt of the unit and continuing
- (o) minimization of work areas processing uranium: initiated during February 1974 and continuing
- (p) enhanced surface decontamination capability: initiated during January 1974 and continuing
- (q) plastic bagging of uranium: initiated prior to 1/18/74 and continuing
- (r) ventilation enhancement: initiated during January 1974 and continuing with expected completion about 10/30/74
- (s) effluent filtration enhancement: initiated during March 1974 and continuing with expected completion about 10/30/74
- (t) expanded use of hand dosimeters: initiated during January 1947 and continuing
- (u) changeroom establishment: plans formulated during February 1947, equipment relocation to make space available for changeroom progressing as of date of this letter, expected completion of changeroom installation expected about 5/30/74
- (v) equipment modification to minimize contamination: minor modifications completed as of 3/29/74; more major equipment modifications now in planning stage, expected completion about 10/30/74
- (w) procedural modifications to minimize contamination: a continuing program; several procedure changes implemented prior to 1/18/74 have been shown effective in minimizing contamination, results of surveys are used to direct additional procedural modifications as needed.

March 27, 1974

USAEC - Directorate of Regulatory Operations

Page -9-

Item 4. Management Control Systems:

As defined in our letters of May 15 and June 20, 1973, we have implemented a master time schedule/calendar, established by the Safety Engineer as a working tool and control document for our entire Safety Program. This schedule is reviewed weekly both for compliance to the schedule and to authorize the allocation of resources needed to stay on schedule.

This management control system constitutes a complete listing of all operations which require monitoring, inspection, and documentation of results, as a supplement to all other logs and required documentation. The Safety Engineer is responsible for maintaining the document and assuring that all operations have been carried out and properly documented.

Our Director of Industrial Safety performs weekly reviews and sign-offs relative to completion of assigned tasks; the document is further reviewed at monthly Safety Committee meetings and at monthly Management Review Meetings. The purpose of these reviews are to assure that all action items are completed on a timely basis and to discuss any problems which may have arisen and the effectiveness of corrective action.

This procedure has demonstrated its usefulness as an effective Management Control System and is subject to revision as we find ways to improve its effectiveness.

Since 1/18/74, several actions have been taken to enhance our control over operations. These actions include the following:

- a) Doubling of the size of the NMI Safety Committee to include extensive worker representation.
- b) The more extensive use of consultants to the NMI Management Group as defined previously.
- c) Extensive meetings with the Management Group of the Manufacturing Department to define program requirements and assure implementation.
- d) Additional assignment of personnel to assist the Safety Engineer in conduct of his duties.
- e) Allocation of additional financial resources, not only to the operating budget of the NMI Safety Program, but also to equipment and plant modifications designed to enhance contamination control.
- f) Increased utilization of operating plant personnel to enhance contamination

NUCLEAR METALS, INC.

March 27, 1974

USAEC - Directorate of Regulatory Operations

Page -10-

control, i.e., an increased number of manhours per week of operating plant personnel is now invested in assurance of clean areas and in prevention of personal contamination.

Very truly yours,

W. B. Tuffin

W. B. Tuffin
President

DRAFT FORM FOR THE REPORTING OF
RECORDED ANNUAL WHOLEBODY EXPOSURES FOR CALENDAR YEAR 1973

Licensee Reporting (Name & Address)	License No.
NUCLEAR METALS, INC. 2229 MAIN STREET CONCORD, MASS. 01742	SMB-179 SNM-65
Annual Dose Ranges* (rem)	Number of Individuals in Each Range
No Measurable Exposure	4
Measurable Exposure Less Than .100	16
.100 - .250	14
.250 - .500	2
.500 - .750	1
.750 - 1.0	0
1.0 - 2.0	1
2.0 - 3.0	0
3.0 - 4.0	0
4.0 - 5.0	0
5.0 - 6.0	0
6.0 - 7.0	0
7.0 - 8.0	0
8.0 - 9.0	0
9.0 - 10.0	0
10.0 - 11.0	0
11.0 - 12.0	0
12.0 +	0

Total number of individuals reported 38

The above information is submitted for the total number of individuals
or whom personnel monitoring was (check one)

- ☐ required under 10 CFR 20.202(a) or 10 CFR 34.33(a) during
the calendar year.
- ☒ provided during the calendar year.

Individual values exactly equal to the values separating exposure
ranges shall be reported in the higher range.

Handwritten signature
1/24/74



NUCLEAR METALS, INC.

2229 MAIN STREET
CONCORD, MASSACHUSETTS 01742
TELEPHONE: 617 369-5410

April 16, 1974

U.S. Atomic Energy Commission
Directorate of Regulatory Operations
Region 1
631 Park Avenue
King of Prussia, Pa. 19406

Attention: Mr. James P. O'Reilly, Director

Subject: Region 1 Inspections of December 27 and 28, 1973
and January 8 and 9, 1974

References: (1) License Nos. SNM-65, SMB-179
(2) Inspection Nos. 70-82/73-05; 40-672/73-02
(3) Your letter of February 15, 1974
(4) Our letter of March 27, 1974
(5) Telecon from your Mr. Jerman of April 4, 1974

Gentlemen:

This letter provides information supplemental to the ref.(4) letter regarding: (1) usage of gloves for hand protection, (2) monitoring of hand and glove contamination; and (3) usage of our breathing zone air sampler. This additional information is provided in response to telephone requests made on April 4, 1974 by your Mr. Philip Jerman.

Item 1 and 2: Usage of Gloves; Monitoring Hands and Gloves:

The attached memoranda summarize our policies in this regard, though they were issued primarily for the purpose of consolidating prior instructions to operating personnel. We should like to point out that we are currently operating to glove contamination levels of 5 mr/hr and 1 mr/hr and to hand contamination levels at instrument background on an experimental basis only; as we gain experience these levels are subject to modification. We believe these to be extremely conservative levels in that our hand/finger dosimeters have shown very modest exposure of 18.75 Rems per calendar quarter as defined in 10CFR20.101(a) would appear to permit continuous exposure of the hands to 36 mr/hr, based on a 40-hour work week.

Since none of our personnel are continuously handling uranium nor continuously wearing those gloves reserved for uranium handling, it would appear that trigger points markedly higher than 5 mr/hr would continue to

NUCLEAR METALS, INC.

April 16, 1974

U.S. Atomic Energy Commission

Mr. James P. O'Reilly, Director

Page -2-

provide assurance against the likelihood of excessive hand exposure; our continuing program of evaluation of dosimetry data should allow this judgment at some future time.

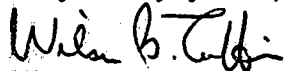
Item 3: Usage of Breathing Zone Air Sampler:

Our Safety Engineer receives daily advices from plant foremen as to operations to be conducted that day with uranium and beryllium, he then selects on a rotating basis those operations that will be monitored by use of the breathing zone air sampler. It is our desire to make use of the sampler each day that either beryllium or uranium operations occur, but at times this may not always be the case, since the instrument has a long recharging time and has been twice repaired since its receipt.

As we build an experience file of breathing zone data, we expect usage frequency to revert to spot checks of repetitive and well characterized operations and to usage for those operations found by experience to possess some real potential for air contamination.

Should you have any further questions, please do not hesitate to contact the undersigned.

Very truly yours,



Wilson B. Tuffin
President

Office Memorandum • NUCLEAR METALS

TO : R. B. MacKay

DATE: April 12, 1974

FROM : A. R. Gilman

SUBJECT: Radiation Exposure to the Hands, Use of Protective
Gloves by Foundry Personnel

This memo serves the purpose of consolidating and definitizing prior memoranda and discussions relative to use of protective gloves by Foundry personnel, and is to be implemented immediately as standard operating procedure.

Category 1. Glove usage when handling uranium, crucibles, molds, and contaminated furnace parts:

(a) A double glove system shall be worn for all Category 1 handling, the inner glove to be rubber to avoid possibility of contamination transfer to the skin of the hands.

(b) The outer glove may be cotton, leather, or a plastic or rubber coated glove as found convenient by operating personnel, though leather is recommended because of its shielding ability (leather reduces the hand dose by half).

(c) The outer glove for Category 1 handling shall be marked with a large yellow U on the back and shall only be used for Category 1 handling. When not in active use, Category 1 gloves shall be placed in plastic bags. It is recommended that such bags be suspended from platform railings to permit easy use of the gloves therein.

(d) After each use in a melt cycle, Category 1 outer gloves shall be monitored for beta-gamma contamination and shall be either cleaned or discarded (at your option) when found to be contaminated in excess of 5 mr/hr when held approx. 2" from the end of the Giger counter probe...

(e) After each removal of Category 1 outer gloves, the operator shall wash and dry his hands while still wearing the inner rubber gloves, and only then may he remove the rubber gloves. The bare hands shall then be monitored and shall be washed on any finding of contamination in excess of normal instrument background.

Category 2. Glove usage for general foundry handling:

(a) Usage of a single glove is permissible for general foundry handling and may be of any material found convenient by the operator.

(b) No special marking is to be applied to Category 2 gloves.

(c) Category 2 gloves are to be monitored at least once daily and are to be discarded or cleaned (at your option) on finding of contamination in excess of 1 mr/hr, monitored under the same practices as for Category 1 gloves.

MEMORANDUM

-2-

April 12, 1974

To: R. B. MacKay
From: A. R. Gilman
Subject: Radiation Exposure to the Hands, Use of
Protective Gloves by Foundry Personnel

(d) On each removal of Category 2 gloves, the operator shall monitor the bare hands and shall wash the hands on any finding of contamination in excess of normal instrument background.



A. R. Gilman

RG:mca

C: W. B. Tuffin
E. J. Martin
R. C. Franks
J. Pulaski
E. Gossen
S. Levin

Office Memorandum • NUCLEAR METALS

TO : R. B. MacKay

DATE: 4-12-74

FROM : A. R. Gilman

SUBJECT: Radiation Exposure to the hands, use of protective gloves by Machine Shop and Fabrication Dept. Personnel

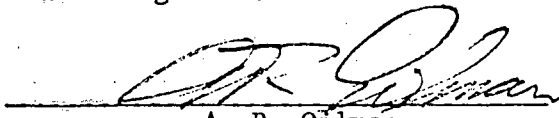
This memo consolidates and further defines prior memoranda and discussions relative to use of protective gloves by Machine Shop and Fabrication personnel, and is to be implemented immediately as standard operating procedure.

Glove Usage When Handling Uranium or Materials Contaminated with Uranium

- (a) Gloves must be worn at all times when actually handling bare uranium or materials and equipment known or suspected to be contaminated from contact with uranium.
- (b) The type of glove is totally at the option of the operator and may be cotton, leather, rubber, asbestos, or plastic, though leather gloves are recommended since the dose to the hands is reduced to half by the shielding effect of the leather.
- (c) It is not the intent of this requirement to encumber or interfere with operation of equipment by requiring wearing of gloves. Operators are encouraged to remove gloves when manipulating the controls of the equipment. For example, when performing lathe machining of U, it is actually desirable to wear the gloves only when loading the uranium piece into the chuck; wearing the gloves when handling the wrench for tightening the chuck or when operating the lathe controls would only transfer the contamination to tools or parts of the lathe that should be kept clean.
- (d) When work is interrupted such as at breaks, lunch, at the end of the day, or on conclusion of a given task, the gloves and hands must be monitored with a Geiger counter.

The operator should hold the gloves about 2" from the end of the probe of the Geiger counter and discard or wash the gloves on finding of contamination in excess of 1 mr/hr. Bare hands should be washed, dried, and rechecked on any finding of contamination in excess of normal instrument background.

ARG:mca


A. R. Gilman

CC: W. B. Tuffin/E. J. Martin/R. Grant/
L. Bruno/R. C. Franks/S. Levin