THE UNIVERSITY OF IOWA
IOWA CITY, IOWA 52240

Radiation Protection Office
Medical Laboratories
Area 319:353-3458

6 September 1968

Director
Division of State and Licensee Relations
United States Atomic Energy Commission
Washington, D. C. 20545

Dear Sir:

In compliance with 10CFR 20.405, the following report is submitted for your consideration.

On Tuesday, July 30, 1968, R. S. Landauer Jr. and Company notified me that the film packets worn by Nuclear Medicine personnel during the period of July 1, 1968 to July 14, 1968, were so badly contaminated that they could not be properly analyzed. Subsequent investigation indicated general contamination throughout the Nuclear Medicine facility. However, the investigation by my office and that conducted by representatives from Region III, USAEC, Compliance, failed to pin point the exact cause for the contamination of the film packets.

Following is a calendar of events from July 30, 1968 to the present.

July 30, 1968

-- Conducted dry smear survey of Rooms C-141B (hot lab), C-141, C-142-A; main hallway; waiting room; C-138A; and hallway in C-138 complex (see attached drawing). Contamination levels in C-141, C-141B, and C-140-2 ranged from 60 dpm/100 cm^2 to 174,486 dpm/100 cm^2. Majority of samples taken (63) were greater than 1000 dpm/100 cm^2. Contamination levels in other areas ranged from 26 dpm/100 cm^2 to 8782 dpm/100 cm^2. 33 of the 63 samples were less than 1000 dpm/100 cm^2. Contaminant was identified as Mo^{99}-Te^{99m}. (Samples were counted in a Beckman Wide Beta II gas flow system and analyzed in a Nuclear Data Multichannel Analyzer.)

July 31, 1968

-- Shoes of all personnel in Nuclear Medicine were monitored. All showed some level of contamination.
-- Rooms C-139; C-138C; C-139C; C-138A; C-139D; C-139B; C-141B; and C-140-2 were monitored. Contamination levels in all rooms monitored other than C-141B and C-140-2 ranged from 22 dpm/100 cm^2 to 4322 dpm/100 cm^2. All but three of the samples taken (39) were less than 1000 dpm/100 cm^2. Survey in Rooms C-141B and C-140-2 indicated contamination on door handles, faucets, etc.

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-- Rooms C-141, C-141B and C-140-2 were closed down
-- Notified via telephone AEC, Region III, Compliance Office of possible incident. This was prior to closing down the above mentioned rooms.
-- Conference was held with B and C. A informed B and C of the action taken. During the course of this meeting, the following action was decided upon:

1- Rooms C-141, C-141B and C-140-2 would be closed till cleared by Radiation Protection Office.
2- The production technique for Te^{99m} would be changed from the liquid-liquid extraction system to a commercial generator system. (It appeared that the liquid-liquid extraction system was the cause of the contamination.)
3- Decontamination techniques would be employed throughout the facility. Housekeeping would be advised not to clean Nuclear Medicine till notified.
4- All diagnostic techniques involving isotopes other than Te^{99m} would be allowed to continue.
5- D would be allowed into Hot Lab (C-141B) when the commercial generator system was to be milked. Generator scheduled to arrive and be used on August 5, 1968. D would be under supervision of Radiation Protection Office personnel and B. B was designated as A's replacement while A was fulfilling his military obligation (August 3-19).

August 1, 1968

-- Officially notified AEC, Region III, Compliance Office 9:00 A.M. via telephone of incident and actions taken.
-- Officially notified AEC, Region III, Compliance Office via telegram.
-- Conducted survey of floor tile in 141B to check removability of contamination.
-- Air samples taken in C-141B, C-141, C-138 hallway. Maximum air sample taken near hood containing the liquid-liquid extraction system indicated 4.0×10^{-11} microcurie per cc. A Staplex Air Sampler was used to collect sample and a Nuclear Data Multichannel Analyzer was used to analyze sample.
-- Decontamination of bench top and verticle cabinet surfaces in 141B by D and G.
-- Conducted survey of bench top and cabinets in 141B. Survey of bench top indicated nothing above 135 dpm/100 cm^2. However, several handles on cabinets, refrigerator and hood showed contamination levels up to 11690 dpm.
-- Verticle cabinet surfaces decontaminated a second time.
-- Conducted re-survey of cabinet surfaces after second decontamination. No appreciable change noted from survey performed prior to decontamination.
-- Floor of Room C-141B decontaminated by D.
-- Conducted survey of floor of C-141B to check effectiveness of decontamination. Contamination levels ranged from 976 dpm/100 cm^2 to

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29,572 dpm/100 cm^2. No appreciable change noted from previous survey.
-- Conducted survey of all rooms except C141, C141B, C140-2 to evaluate necessity of decontamination. Contamination levels ranged from 18 dpm/100 cm^2 to 1776 dpm/100cm^2. All samples, with one exception, were below 1000 dpm/100 cm^2.
-- Floor of C-141B decontaminated for second time.
-- Conducted survey of C141B to check levels of contamination after two decontamination attempts. Contamination levels ranged from 1096 dpm/100 cm^2 to 20,414 dpm/100 cm^2. Some decrease in contamination levels noted from previous surveys.
-- Floors of C141 and C140-2 decontaminated.
-- Conducted survey of C141 and C140-2. Contamination levels ranged from 700 dpm/100 cm^2 to 8200 dpm/100 cm^2. Considerable improvement noted from previous surveys.
-- Whole body count on E. Results indicated 0.05 microcuries of Mo^{99}. Count was taken in the Whole Body Counter located at Veterans Hospital, Iowa City, Iowa.
-- Urine analysis of H, D, I, J, K, G, L, M, N, results indicated no radioactive contamination in urine. (Urine counted in NaI gamma well counter.)

August 2, 1968
-- Mr. Schultz of Region III, AEC Compliance arrived to conduct investigation into the cause of the incident.
-- Conducted survey of E's car. Localized contamination indicated mainly on floor.
-- Floor, seats and dash of E's car decontaminated.
-- Re-survey of E's car. Level of contamination less than 100 dpm/100 cm^2.
-- Conducted survey of badge holders of Nuclear Medicine personnel. E's badge only one that indicated appreciable contamination (1800 dpm.)
-- Whole body counts on L, D, J. Results of L indicated 0.005 microcuries of Mo^{99}. D and J negative.

August 5, 1968
-- Conducted survey of bench top and paper floor covering in C141B before allowing D access to room. Contamination levels on covered floor area all less than 100 dpm/100 cm^2. Contamination levels on bench top ranged from 8 dpm/100 cm^2 to 544 dpm/100 cm^2. Nine of the twelve samples taken were less than 50 dpm/100 cm^2.
-- Conducted survey of C141 and C140-2. Contamination levels ranged from 0 dpm/100 cm^2 to 2580 dpm/100 cm^2. Thirty-three of the fourty samples taken were less than 1000 dpm/100 cm^2.
-- Access to C141B granted to D.
-- D sets up new Mo99m commercial generator system under supervision of B.
-- Conducted survey of uncovered floor in C141B. Contamination levels on uncovered floor area ranged from 122 dpm/100 cm^2 to 6618 dpm/100 cm^2. Half of the samples taken (19) were less than 1000 dpm/100 cm^2.

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-- Conducted survey of rooms C142A, C139A, C139B, C139C and C138A. Contamination levels ranged from 0 dpm/100 cm^2 to 414 dpm/100 cm^2. All but one of the samples taken (47) were less than 100 dpm/100 cm^2.
-- Conducted survey of area around the commercial generator system.
-- Conducted survey of C138 hallway. No sample indicated more than 40 dpm/100 cm^2.

August 6, 1968
-- Conducted survey of waiting room and C138 hallway. No sample indicated more than 70 dpm/100 cm^2.
-- Conducted survey of E's trailer. No sample indicated more than 28 dpm/100 cm^2.
-- Conducted survey of C142A. No sample indicated more than 26 dpm/100 cm^2.
-- Conducted survey of D's car. No sample indicated more than 40 dpm/100 cm^2.
-- Conducted survey of C139D and C140. No sample indicated more than 36 dpm/100 cm^2.
-- Conducted survey of C141B after use of new Mo^{99m} commercial generator system. No new contamination indicated as a result of this procedure.
-- Conducted survey of hospital hallways in vicinity of Nuclear Medicine. No sample above 82 dpm/100 cm^2 average.

August 7, 1968
-- Conducted survey of C138, C139C, C140 hallway, C142A, C139, C138C, C138B, C138A, C139A, C139B. No sample above 42 dpm/100 cm^2.

August 9, 1968
-- Conducted survey of rooms C141, C141B and C140-2. Contamination levels ranged from 0 dpm/100 cm^2 to 3966 dpm/100 cm^2. Of the ninety-six samples taken (64) sixty-four indicated 100 dpm/100 cm^2 or less; (25) twenty-five samples indicated more than 100 dpm/100 cm^2 but less than 1000 dpm/100 cm^2.
-- Conducted survey of shoes of Nuclear Medicine personnel. Maximum contamination indicated on any shoe was 44 dpm.
-- Conducted urine analysis of D, G, I, M, O, J. P. No indication of radioactive contaminant.

August 12, 1968
-- Conducted survey of C140-2, C141, C141B. Contamination levels ranged from 0 dpm/100 cm^2 to 458 dpm/100 cm^2. Sixty-four (64) of the seventy-eight (78) samples indicated 100 dpm/100 cm^2 or less.

August 16, 1968
-- Conducted surveys of C142A, C139A, C138 hallway, C139C, C139,

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-- C138C, waiting room, C139B, C139D, C138A, C138B, C141B, C141, C140 hallway. Contamination levels ranged from 0 dpm/100 cm^2 to 152 dpm/100 cm^2. All samples, with two exceptions, were below 100 dpm/100 cm^2. The two exceptions were found in C141B (hot lab). One hundred ninety (190) samples were taken throughout the complex. It was decided to release Rooms C141, C141B and C140-2 from Radiation Protection Office control on August 19, 1968.

-- Conducted surveys of rooms C141, C140-2, C141B, C139D, C138 hallway and C139A. No contamination levels in excess of 50 dpm/100 cm^2 found on any floor area. Seventy-three floor samples taken. Rooms C141, C141B, and C140-2 released by Radiation Protection Office.

SUMMARY

The substance of this report has dealt with the contamination found in the Nuclear Medicine facilities on July 30, 1968. However, this contamination does not explain the contamination of the Nuclear Medicine personnel badges worn during the period July 1, 1968 to July 14, 1968. Therefore, I will attempt to specify what, in my opinion, was the cause of the contaminated badges and the cause of the general contamination throughout the laboratory.

It has been our practice to send Nuclear Medicine film packets to the secret of Nuclear Medicine in a single envelope. This envelope is opened and placed on the secretary's desk with a return envelope next to it. Individuals are required to replace their own film packet. Therefore, an individual with contaminated hands could conceivably contaminate the entire batch of film packets. Several factors seem to point to this being the cause.

(1) The control badge for the Nuclear Medicine section never left our office. It is always stored in a lead safe. This badge showed contamination.

(2) It was noted that approximately six badges from other departments indicated some contamination. These badges were in the shipment from our office to Landauer and could have been contaminated from the Nuclear Medicine film badges.

(3) It was noted in subsequent reports that a badge turned in late by D for the period in question (July 1, 1968 to July 14, 1968) did not indicate any contamination whatsoever.

The contamination of the Nuclear Medicine facility appears to have happened either on July 29th or July 30th, 1968. Several factors point to this being true.

(1) On July 9, 1968, the Nuclear Medicine hot lab and surrounding area was generally free of contamination when monitored by our office. Therefore, this would narrow the occurrence between July 9 and July 30th. During the questioning of Nuclear Medicine personnel, there was only one occurrence that any one could remember which was out of the ordinary. This occurred on July 29th when D and L loaded the liquid-liquid extraction apparatus. Neither one had, to our knowledge, experience in performing this procedure. E was not available since she was ill.

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(2) On July 30, 1968, E examined the apparatus and discovered that Ketone and various other substances had been distributed throughout the tubing and flasks where they should not have been. E then initiated a system clean-up.

(3) The test results from the samples taken of the contaminant indicated Mo^{99}. This is the first time Mo^{99} has ever been detected as a contaminant. To our knowledge, it is not possible to have Mo^{99} under normal operating conditions. Therefore, it is our conclusion that the Mo^{99} contaminant was the result of a faulty set-up (29th) or the clean-up (30th).

Both situations discussed above appear to be the result of the following:

(1) Lack of adequate instrumentation. There were several items of instrumentation that were available to the personnel. However, personnel were unknowledgeable of the fact that they were operable and it was shown that one of the monitors situated in the hot lab was too sensitive for satisfactory operation.

(2) Lack of instruction to personnel with regard to health physics laboratory procedures.

(3) Failure to delineate individual responsibility among the personnel in the Nuclear Medicine facility or failure of the personnel to know their responsibilities.

CONCLUSION

In order to prevent these types of incidents from re-occurring the following actions have been or will be taken:

(1) Laboratory procedures have been decided upon. Copies of these procedures will be distributed to all present Nuclear Medicine personnel at a meeting with A and H sometime in September. Additional copies will be distributed to all in-coming personnel. (Copy of procedures attached.)

(2) Emergency procedures have been developed. These procedures will be posted at the entrance of the lab and within the hot lab itself. (Copy of the emergency procedures also attached.) These procedures have been kept to a minimum. However, recommended methods of handling various contingencies have been printed up and will be distributed to personnel. A copy of these procedures is also attached.

(3) E has been delegated the responsibility of supervising the health physics program within the Nuclear Medicine section. This will entail daily monitoring, assuring that procedures mentioned above are followed and assuring that all personnel engaged in any procedure within the hot lab are knowledgeable in that procedure and familiar with all laboratory health physics procedures.

(4) The lock to the door to the hot lab will be changed. This modification has been requested and will be made as soon as possible. At present, it is anticipated that only two keys will be available, one being assigned to E and one being assigned to H.

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(5) The following instruments have been considered and will be purchased if found to be adequate.

(a) Nuclear air sampling device capable of detecting air contamination on a 24 hour basis.

(b) Geiger counter survey meter which will also be used to count dry smear samples.

(c) A rate meter attached to the wall outside the hot lab with a detachment probe which will be used as a hand-foot monitor. Present plans also call for us to have a strip chart recorder hook-up which would be on a 24 hour surveillance.

Q was contacted and arrived in Iowa City, Iowa on August 28, 1968. He and A discussed equipment requirements for the Nuclear Medicine facility. The above mentioned equipment was agreed upon with the air monitor being optional. We are presently waiting for a quotation which is due prior to September 13, 1968. An order will be placed and hopefully processed within September. There will then be a 30 day interval between the order and the receipt and installation of equipment.

Complete records of personnel examinations and area surveys will be maintained in this office. Should you require any additional information, I will be glad to supply it.

A copy of this report has been sent to Region III Division of Compliance.

Sincerely yours,

William E. Twaler

William E. Twaler
University Health Physicist

WET:bam

Enc.

IDENTIFICATION OF INDIVIDUALS INVOLVED

Identification Symbol	Name and Title
A	[redacted] Health Physicist
B	[redacted] Ph.D. Assoc. Prof.- Radiology
C	[redacted] M.D. Prof. - Radiology
D	[redacted] Chief Technologist Nuclear Medicine
E	[redacted] Ph.D. Instructor-RadioChem. Nuclear Medicine
F	[redacted] Ph.D. Internal Medicine
G	[redacted] Technician - Nuclear Med.
H	[redacted] M.D. Prof. - Nuclear Medicine
I	[redacted] Technician - Nuclear Med.
J	[redacted] Technician - Nuclear Med.
K	[redacted] Secy. - Nuclear Medicine
L	[redacted] Student - Nuclear Medicine
M	[redacted] Chemist - Nuclear Medicine
N	[redacted] Technician - Radiology
O	[redacted] M. D. Asst. Prof.- Internal Med.
P	[redacted] Technician - Nuclear Med.
Q	

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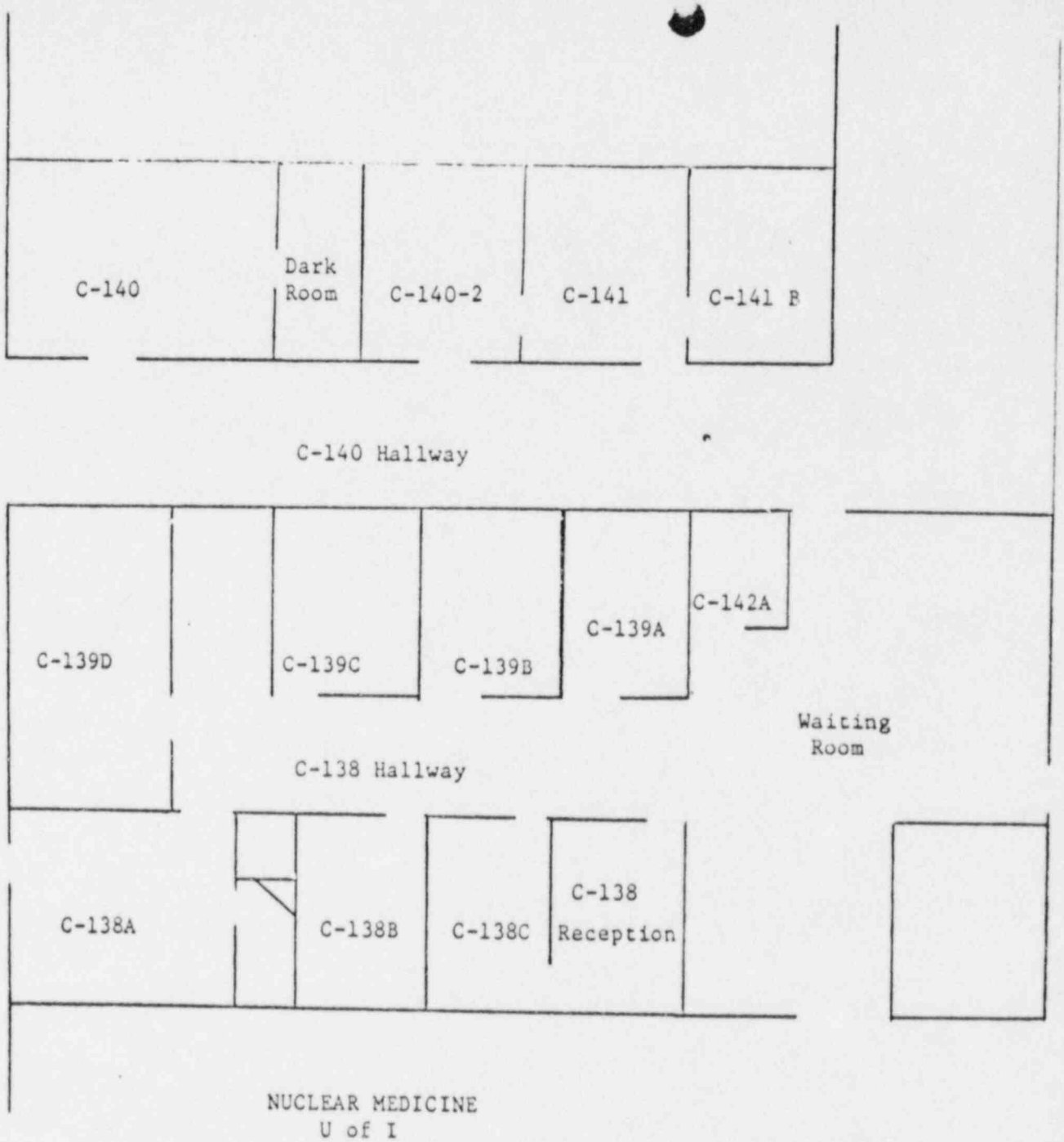
BDG

R. V. Roberts



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