

## Mount Holyoke College

Dean of Administration  
and Business Manager  
South Hadley MA 01075-1449  
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May 6, 1997

Mr. John D. Kinneman, Chief  
Nuclear Materials Safety Branch 2  
Division of Nuclear Materials Safety  
U.S. Nuclear Regulatory Commission  
Region I  
475 Allendale Road  
King of Prussia, PA 19406-1415

Dear Mr. Kinneman:

This letter is in response to the questions raised in your letter dated April 2, 1997, regarding CAL 1-96-009. The College has not submitted correspondence dated October 26, 1996; however, it did submit an incident report on October 2, 1996. This response assumes you are referring to information in this October 2, 1996, correspondence. The items are referenced according to the notation used in your letter dated April 2, 1997. The College believes that it took Items 2 and 3 into account for its initial dose assessment. Justification for the initial dose assessment is stated below.

Item 1: The College believes the source was intact during its initial loading on August 2, 1996. This is supported by the facts that no contamination was found on the clothing worn by the researcher between August 2 and August 4, in the researcher's home, in the researcher's automobiles, inside the vacuum system where the source was loaded, or in the Radiation Protection Officer's automobile. Also, monitoring of the area during and after the loading showed that the room was not contaminated on August 2, 1996. As stated in our initial report dated October 2, 1996, the contamination incident occurred during the early morning hours of August 5, 1996. It is very difficult to provide detailed information regarding the times of various actions that occurred on August 5. The researcher was unsure of the sequence of some events, and he was also unsure of the time some events occurred on this date. The following is the best estimate for the time of each event:

- a. The time the Cobalt-58 source integrity was compromised.  
The researcher was not sure when the source was compromised on August 5, 1996. Through interviews with various individuals, it is estimated that he removed the source from the vacuum system at 3:30 a.m. This is the time and date used by the College for this event.
- b. The time the initial skin contamination occurred.  
The researcher was not sure when initial contamination occurred on August 5, 1996. The College uses 3:30 a.m. on August 5, 1996, as the time and date for initial skin contamination. The actual time of initial skin contamination must be after the source was removed from the vacuum system and disassembled; however, lacking specific information from the researcher, this is the most conservative time to use for dose estimates.

- c. The time the faculty member washed his hands and tools.  
The researcher reported that he washed his hands several times after discovering the initial contamination and that the total time he worked on the source was probably 30 minutes but not more than 45 minutes. After washing his hands and tools the first time, he did not report checking the tools, only his hands. He stated that he believed his hands were decontaminated. He also stated that his hands were contaminated before he went to put the source back into the DOT shipping container. The researcher reports he completed washing his hands a second time after returning the source to its DOT shipping container and before making several telephone calls. One was to his wife to ask her to bring a change of clothes. At 4:30 a.m. the researcher telephoned the Radiation Protection Officer on call from his office on the second floor to ask for assistance. The researcher reported contamination on his hands and clothes. Contamination was not found on the researcher's telephone so it is estimated that the contamination, easily removed by washing, was removed before this telephone call. Lacking specific times for decontamination efforts, the College uses 4:30 a.m. for the time of initial decontamination and estimates that this was only partially effective since contamination was found on the researcher at Franklin Medical Center.
- d. The time of any other skin decontamination efforts.  
The researcher reports in some interviews washing his hands again and changing his clothes after calling for assistance. The researcher did not assess the contamination after making the telephone calls. He did not assess the contamination after washing his hands a possible third time or changing his clothes. The effectiveness of this washing and the time of this washing is unknown. Since no contamination was found on the telephone in the researcher's office, it is estimated that this decontamination effort was not effective since the contamination, easily removed by washing, appears to have been removed before the telephone calls. The Radiation Protection Officer on call and the department head were estimated to be on the scene by 5:30 a.m. They report monitoring the researcher but they do not report any personnel decontamination efforts.
- e. The time the faculty member was transferred to Franklin Medical Center.  
The emergency room report lists 8:55 a.m. as the time Franklin Medical Center was notified by South Hadley Police that they were en route with a contaminated patient. This report also lists 9:40 a.m. as the time the researcher arrived at Franklin Medical Center.
- f. The time the faculty member was discharged from Franklin Medical Center.  
The emergency room report states that the researcher was cleared for discharge at 12:00 noon and discharged at 1:05 p.m. with "No removable contamination on patient or Decon room" and "One spot on right thumb shows radiation level of 0.12 mR/hr at contact. No removable contamination."

Item 2: This estimate of hand contamination is consistent with contamination found in other areas of the laboratory. Approximately 20 microcuries were found on the lead shielding and workbench where the source was disassembled. The tools were placed in a plastic bag along with the gloves and paper towels used by the researcher to wipe his work area clean. The gloves and paper towels were only slightly contaminated indicating that the work area was not effectively decontaminated. Therefore, the tools were probably not effectively decontaminated since they had the same level of contamination as the work area. The College believes that the tools were not effectively decontaminated, and they remained contaminated at or near their initial contamination level. The researcher estimated that he spent about four minutes decontaminating his hands and tools. It would be reasonable to assume that most of his efforts would be decontaminating his hands and not the tools. We believe that it is reasonable to use the tool's contamination as the initial skin contamination given the researchers anxiety and the short period of time spent decontaminating his hands and tools.

The contamination of 20 nanocuries/cm<sup>2</sup> was estimated from the survey measurements made by Franklin Medical Center upon arrival of the researcher, and the time for the presence of this contamination is from 4:30 a.m. to 12:00 noon when contamination was reported completed. Franklin Medical Center reported measuring 0.14 mR/hr on the right forearm, palm, and thumb. Approximating that the survey was done at an average distance of 1 cm from the skin and using a gamma ray constant of 7 (R cm<sup>2</sup>)/(hr mCi), this reading converts to a 20 nanocuries point source. Since the distribution of the source was not known, using this level of contamination seems reasonable since the dose from a 20 nanocurie point source to a 1 cm<sup>2</sup> area of skin is approximately equal to the dose from a 20 nanocurie/cm<sup>2</sup> source to a 1 cm<sup>2</sup> area of skin.

Item 3: The researcher did not assess the area of contamination when it was first identified sometime between 3:30 a.m. and 4:30 a.m. The Radiation Protection Officer on call reported that his initial assessment of contamination indicated the inside of the right forearm, the right index finger, and the right thumb were suspected of contamination. He determined that decontamination efforts at the scene would not be successful. Therefore, he did not conduct a detailed assessment of the contamination distribution on the researcher. Franklin Medical Center's report states that the emergency room staff identified two areas of the body as possibly contaminated (right forearm and left knee). Decon personnel decontaminated suspected areas on the researcher that included the right forearm, right palm, and right thumb. (See enclosed Franklin Medical Center Report.) Note: No two groups reported the same suspected areas of contamination and no other statements were made about the area contaminated. This lack of information posed several questions. How many discrete particles should be used? Where are the particles located? What is the activity of each particle? (A "typical" activity was not identified in the cleanup process.) How much live skin tissue is receiving a dose? Lacking detailed area and distribution information, the decision was made to dose the total area reported by Franklin Medical Center in its report with a uniform distribution. The area used was taken to be the total area of the outstretched hand of standard man (ICRP 26). The area of the back side of the hand was used to approximate the contaminated area of the inside of the right forearm area. Doses to a 1 cm<sup>2</sup> area are the same for a point and a 1 cm<sup>2</sup> disc source of the same activity for Co-58 with all damage from a point source of Co-58 occurring within a radius of 0.113 cm. Knowing the above information and given the lack of detailed information about this contamination, we approximated this unknown distribution of contamination as a disc source in Varskin using 360 cm<sup>2</sup>. This converts to contaminating the area with 7.2 microcuries. A small fraction of this activity in a discrete source would result in a significantly higher survey meter reading than reported by Franklin Medical Center.

The contamination on the left knee was determined to be a point source from the distribution of the contamination on the jeans. The jeans were contaminated with a single point source on the left knee. If information like this was available for the right forearm, palm, and fingers, it would have been used.

Item 4: The Varskin dose calculations submitted January 3, 1997, are identified as follows:

- a. The 21600 microCurie\*second source represents a discrete 0.8 microcurie contamination source located on the front of the shirt worn by the researcher after 4:30 a.m. at the middle of the torso. The source is estimated to be on the skin for the Varskin calculations, and the irradiation time used for this calculation was 7.5 hours (4:30 a.m. to 12:00 noon). The time clothing was removed is not stated on the report from Franklin Medical Center.
- b. The 10800 microCurie\*second source represents a discrete 0.4 microcurie contamination source located on the left knee of the jeans worn by the researcher after 4:30 a.m. The source is estimated to be on the skin for the Varskin calculations, and the irradiation time used for this calculation was 7.5 hours (4:30 a.m. to 12:00 noon). The time clothing was removed is not stated on the report from Franklin Medical Center.
- c. The 9700 microCurie\*second source represents a discrete 2.7 microcurie contamination source located on the front of the shirt worn by the researcher before 4:30 a.m. just above and to the right of the right breast. The source is estimated to be on the skin for the Varskin calculations, and the irradiation time used for this calculation was one hour (3:30 a.m. to 4:30 a.m.). The time clothing was changed by the researcher is not known.
- d. The 1080 microCurie\*second source represents a discrete 0.3 microcurie contamination source located on the front of the shirt worn by the researcher before 4:30 a.m. at the same location as location subitem (a) above. The source is estimated to be on the skin for the Varskin calculations, and the irradiation time used for this calculation was one hour (3:30 a.m. to 4:30 a.m.). The time clothing was changed by the researcher is not known.
- e. The 360 microCurie\*second source represents a discrete 0.1 microcurie contamination source located on the front of the shirt worn by the researcher before 4:30 a.m. at the waist line under the right shoulder. The source is estimated to be on the skin for the Varskin calculations, and the irradiation time used for this calculation was one hour (3:30 a.m. to 4:30 a.m.). The time clothing was changed by the researcher is not known.
- f. The 1800 microCurie\*second source represents a discrete 0.5 microcurie contamination source located on the front of the shirt worn by the researcher before 4:30 a.m. at the waist line in the center of the torso. The source is estimated to be on the skin for the Varskin calculations, and the irradiation time used for this calculation was one hour (3:30 a.m. to 4:30 a.m.). The time clothing was changed by the researcher is not known.



- g. The 144 microCurie\*second source represents a discrete 0.04 microcurie contamination source located on the front of the shorts worn by the researcher before 4:30 a.m. at the upper center of the right thigh. The source is estimated to be on the skin for the Varskin calculations, and the irradiation time used for this calculation was one hour (3:30 a.m. to 4:30 a.m.). The time clothing was changed by the researcher is not known.
- h. The 298 microCurie\*second source represents a discrete 0.08 microcurie contamination source located on the front of the shorts worn by the researcher before 4:30 a.m. at the front of the left hip joint. The source is estimated to be on the skin for the Varskin calculations, and the irradiation time used for this calculation was one hour (3:30 a.m. to 4:30 a.m.). The time clothing was changed by the researcher is not known.
- i. The 1440 microCurie\*second source represents the discrete 0.4 microcurie contamination source located on the left knee of the jeans worn by the researcher after 4:30 a.m. (subitem b above) being on the knee from 3:30 a.m. to 4:30 a.m. The source is estimated to be on the skin for the Varskin calculations, and the irradiation time used for this calculation was one hour (3:30 a.m. to 4:30 a.m.). The time clothing was changed by the researcher is not known.
- j. The 1840 microCurie\*second source represents the discrete 0.06 microcurie contamination source located on the left knee found by Franklin Medical Center. A discrete source is used for this calculation since the contamination found on the jeans was discrete (subitem b above). The contamination on the jeans is believed to be a portion of the original particle contamination. The source is estimated to be on the skin for the Varskin calculations, and the irradiation time used for this calculation was 8.5 hours (3:30 a.m. to 12:00 noon). The time clothing was changed by the researcher is not known.

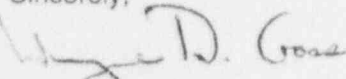
The activity for the contamination was estimated using a Ludlum Model 3 portable survey meter with a GM pancake probe calibrated against the NaI system used to assess surface contamination wipe tests. The portable survey meter was calibrated to equate cpm readings to dpm for Co-58. The activity for the knee contamination found at Franklin Medical Center was estimated using the method discussed in Item 2.

Item 5: F. X. Masse' Associates, Inc., stated in a telephone conversation that a whole body counter was used to assess the researcher's total body content of Co-58. A copy of their report is enclosed.

The name of the researcher has been blacked out on all the reports so they can be placed in the public document room.

Thank you for your assistance in this matter. If you require additional information, please contact myself or Mount Holyoke College's Radiation Protection Officer, Edward L. Wilds, Jr., at (860) 486-1108.

Sincerely,

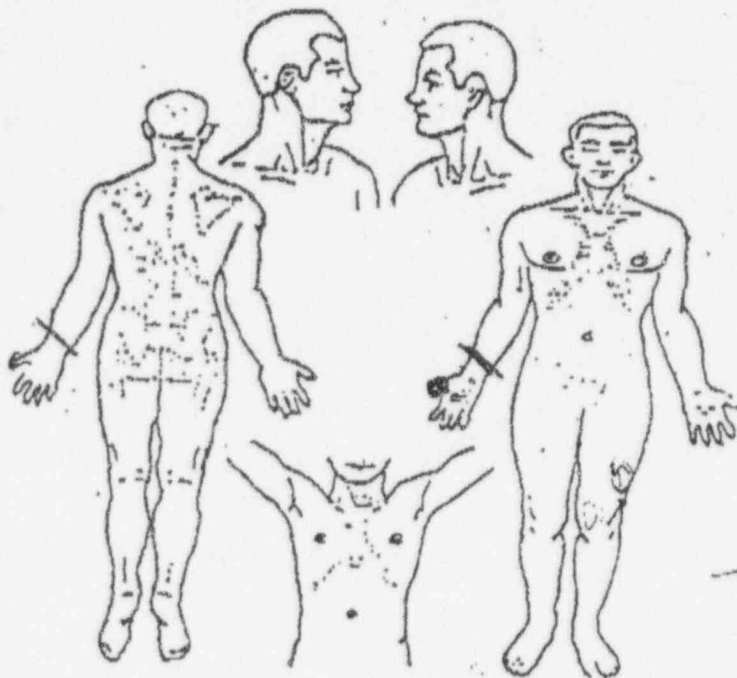
  
Wayne D. Gass

Enclosures

## PATIENT EXPOSURE FORM

PATIENT  
NAME/NUMBER: [REDACTED]LOCATION OF INCIDENT: MT. Holyoke CollegeDATE/TIME OF INCIDENT: 8/5/96SUMMARY DESCRIPTION OF INCIDENT: Splashed  $\pm$  Cobalt 58 on arms & legs  
washed at scene. Assessment PMC @ 9.40am

Indicate on anatomical chart the location of any wounds and any skin contamination readings present:

Have fission products  
been identified? Y/NEstimated dose received  
(if available): \_\_\_\_\_Internal contamination  
suspected? Y/NEstimated internal  
dose: NA

## TREATMENT OF RADIOLOGICAL CONCERNS

## External Exposure

Are symptoms present?

Nausea

Y/N

Vomiting

Y/N

Other?

Y/N

Samples taken:

Blood

Y/N

Hair

Y/N

Nails

Y/N

## Skin Contamination

Decon done? Y/N  
at PMCTechnique: Water + Betadine.  
Soft Soap.Secondary decon  
needed.

Y/N

Technique: \_\_\_\_\_

## Internal Exposure

Samples taken:

Nasal

Y/N

Urine

Y/N

Feces

Y/N

Other

Y/N

Decon of orifices: Negative Samples.Decon fluids kept: Y/N

Radiation levels (mR/hr) on Patient

No Removable  
CONTAMINATIONmR/hr.  
(Contact)ER  
(ARRIVAL)

DECON

Start

END

Rt. Fore Arm

0.14

Palm

0.14

0.04

Left Knee

0.4

Thumb

0.14

0.12

Inside

0.12

0.04

8.5.96

**F.X. MASSÉ ASSOCIATES, INC.**

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August 23, 1996

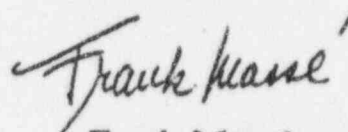
Dean Peter Berek  
Dean of Faculty and Provost  
Mount Holyoke College  
South Hadley MA 01075-1440

Dear Dean Berek:

The whole-body analysis on Professor [REDACTED] conducted on August 22 indicated only a trace of  $^{58}\text{Co}$ , which was identified to a confidence level of 99%, but amounts to only 20 nanocuries with a 20% uncertainty. Correcting to the day of intake yields a maximum intake of about 50 nanocuries, which represents only .005% of the annual level of intake. Since the annual level of intake would yield a maximum occupational annual dose of 5000 mrem, this intake would be expected to result in only 0.25 mrem, which is only a fraction of the whole body effective dose equivalent received each day from natural background.

I conclude that the whole body count convincingly indicates that the internal dose to Professor [REDACTED] as a result of this incident was not significant.

Regards,



Frank Massé  
Certified Health Physicist  
Certified Medical Physicist

FXM/nlm

# RADIOACTIVE PATIENT IN E.R. AT FRANKLIN MEDICAL CENTER

8:55 A.M. Call received by Dr. Brahmavar at BMC. South Hadley Police enroute to FMC with contaminated patient. No information on Radioactive Source or Nature of Incident.

2 calls to Mount Holyoke College (location of incident) failed.

9:10 A.M. FMC Nuclear Medicine Supervisor (Marsha Staples) requested to call "Code Magenta" to prepare E.R. for receipt of patient. Request OK'd by RSO at BMC.

9:20 A.M. Dr. Brahmavar (RSO) and Cathy Miller (ARSO) left with equipment and data books to FMC.

9:40 A.M. Patient arrived at FMC. Code Magenta Team isolated the patient. Radiation survey of patient with two areas of body (right forearm and left knee) identified as possible contamination. Patient covered in plastic sheet and disposal suit waiting in Decon room.

10:00 A.M. Arrival of BMC staff at FMC ER. Resurvey of ambulance staff and policemen, firemen and ambulance. No contamination. All radiation levels  $<0.05$  mR/hr. Released from E.R.

10:10 A.M. Two attempts to reach Mt. Holyoke staff and Jim Tocchi (RSO) failed.

10:25 A.M. Prepared to decontaminate suspected areas on patient.

Cleaned with soap solution, Betadine and saline water. Several cleanings left one spot on right thumb with radiation level (close to area) at  $0.12$  mR/hr. No removable contamination. No removable contamination on left knee area with radiation level at  $0.04$  mR/hr.

Contaminated personal clothes isolated, bagged and held for pick up by Mr. Jim Tocchi.

All personal and Decon room resurveyed and cleared for re-use. The materials used in Decon room free of radiation levels. All bagged and held for pick up by RSO at Mt. Holyoke.

11:20 A.M. Patient resurveyed and given clean Hospital disposal wear. Explained the situation to wife on her arrival. Final wipe test samples taken. Instructed patient to wear disposal glove on right palm for next 48 hours. Six pairs of



Ziplock bag for collection by RSO of Mt. Holyoke (Mr. J. Tocchi).

12:00 Patient evaluated by ER Medical Staff for vital signs, etc. cleared for discharge.

12:25 P.M. Contacted DPH inspector (Ken Tregeda) to communicate incident results. No removable contamination and radiation levels less than 5 mR/hr at one meter. Patient can be released from hospital.

12:40 P.M. Talked to Jim Tocchi (RSO) and Mr. Tom O'Connell (DPH). Communicated all results. No bio-assays done. Nose and ear wipe samples taken. Mr. Jim Tocchi to request patient for urine sample, if needed. No internal contamination expected.

1:05 P.M. Patient discharged from hospital E.R. Samples brought to BMC for counting. Samples will be held for use by Jim Tocchi, if needed.

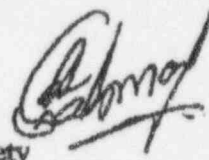
3:40 P.M. Talked to Betsy Ullrich (NRC). Relayed all information. The conversation ended with agreement that all proper procedures have been followed and Dr. Brahmavar will be ready to assist NRC inspectors next day, if needed.

RESULTS:

- \* No removable contamination on patient or Decon room.
- \* One spot right thumb shows radiation level of 0.12 mR/hr at contact. No removable contamination.
- \* All waste held for pick-up by Mt. Holyoke RSO.
- \* All samples show background counts. Samples held for pick-up by Mt. Holyoke College R.S.O.

REPORT PREPARED BY:

Suresh M. Brahmavar, Ph.D.  
Corporate Chief/Director  
Medical Physics & Radiation Safety  
BHS Radiation Safety Officer



DATE:

August 6, 1996

SMB/mzk