Form AEC-417
(4-68)

UNITED STATES ATOMIC ENERGY COMMISSION

37-30-2
37-30-7

COMPLIANCE INSPECTION REPORT FEB 5 1968

1. Name and address of licensee	2. Date of inspection
UNITED STATES RADIUM CORPORATION Bloomsburg, Pennsylvania	November 13 - 17, 1967
	3. Type of inspection Reinspection
	4. 10 CFR Part(s) applicable 20 - 30

5. License number(s), issue and expiration dates, scope and conditions (including amendments)

License No.	Type	Date of Issue	Expiration Date
37-30-2 amendment #33 (amends the license in its entirety)	Reinspection	amendment #33 4/26/67	amendment #33 5/31/69
amendment #34		9/26/67	Same
37-30-7 amendment #1 (amends the license in its entirety)	Reinspection	2/27/67	4/30/69

6. Inspection findings (and items of noncompliance)

An announced inspection was conducted November 13 - 17, 1967. A review was made of the surveys that the licensee performed during the decontamination of the Americium Laboratory, as well as those surveys performed during startup of Americium Foil Production. A review was made of the overexposures to airborne concentrations of Americium-241, occurring during decontamination and during startup which were reported by the licensee. The current status of items of noncompliance noted during our last previous inspection of May 12 - 19, 1967, and June 12, 1967, were also determined. The items of noncompliance resulting from this inspection are listed below:

License -2

✓ 1. Contrary to 10 CFR 20.201(b), "Surveys", evaluations of the concentrations of Am-241 in air were inadequate to determine compliance with 10 CFR 20.103(a) in that:

✓ (a) the licensee had no knowledge of the concentrations of Am-241 in air which existed in the Americium Laboratory during decontamination due to the fact that although air sampling was performed, the results were not known for several weeks thereafter and not in time to prevent further overexposures. (See paragraphs 76 and 29 - 33, 35 - 40, 43 - 53, 59-62 of report details.)

(Continued)

7. Date of last previous inspection	8. Is "Company Confidential" information contained in this report? Yes ☐ No ☒ (Specify page(s) and paragraph(s))
May 12 - 19, 1967 and June 12, 1967	

DISTRIBUTION:

Eugene Epstein Eugene Epstein
(Inspector)

Approved by: Paul R. Nelson, Senior Radiation Specialist, Region I, Div of Compliance New York
(Operations office)

February 5, 1968
(Date report prepared)

If additional space is required for any numbered item above, the continuation may be extended to the reverse of this form using foot to head format, leaving sufficient margin at top for binding, identifying each item by number and noting "Continued" on the face of form under appropriate item.

16—72814-2 U. S. GOVERNMENT PRINTING OFFICE

RECOMMENDATIONS SHOULD BE SET FORTH IN A SEPARATE COVERING MEMORANDUM

ITEM 6 CONTINUED

(b) the licensee inadequately evaluated the hazards associated with the decontamination and operation of the Americium Production Facility, such as the changing of gloves in an americium production glove box, the decontamination of hoods and the changing of air filters, to ensure compliance with 10 CFR 20.103(a). (See paragraphs noted in 1(a) and particularly paragraphs 20 - 22, 27 - 29, 36, 39, 44, 48, 60, 64, 70, 73, 75, 77, 78, and Exhibit "E", Minutes of Isotope Committee Meetings.)

2. Contrary to 10 CFR 20.201(b) "Surveys", evaluations made of the concentrations of tritium released to unrestricted environs in order to determine compliance with 10 CFR 20.106, were inadequate in that:

(a) stack samples were not taken to determine the concentrations of dry tritium gas released from the Tritium Building during normal foil production, during other routine operations, and during special operations involving up to 1000 Ci of tritium gas. (Uncorrected). (See paragraphs 113, 114 and 117 of report details.)

(b) stack samples have not been taken for approximately two years, of the stack effluent from the Tritium Resin Preparation Laboratory. Prior surveys had indicated excessive concentrations of tritium released via stack discharges. (See paragraphs 118 - 122 of report details.)

3. Contrary to 10 CFR 20.201(b) "Surveys", evaluations were inadequate to determine compliance with 20.103(a) in that the licensee had not evaluated the concentrations of tritium in air to which persons are exposed during a 40-hour work week in the Tritium Building and in the Tritium Resin Preparation Laboratory. (Uncorrected for the Tritium Building). (See paragraphs 138 and 143 of report details.)

4. Contrary to 20.201(b) "Surveys", evaluations of the concentrations of radionuclides in air in laboratories processing Ni-63 and Kr-85 and the extent of removable surface contamination were inadequate to determine compliance with 10 CFR 20.103(a) in that the licensee assumed all air concentrations and removable contamination as tritium without any determination as to the contribution of other radionuclides. (See paragraphs 184, 185 and 190 of report details.)

5. Contrary to 20.103(a) "Exposure of individuals to concentrations of radioactive material in restricted areas", 30 exposures to personnel in the restricted Americium Laboratory occurred between the week of June 19, 1967 and October 30, 1967, to concentrations of Am-241 in air in excess of the limits specified in Appendix B, Table I, of this part. (Recurrent). (See paragraphs 25 - 76 of report details.)

6. Contrary to 20.106(a) "Concentrations in Effluents to Unrestricted Areas", the release of airborne soluble tritium to unrestricted areas via stack discharges from the Gas Fill Facility, have exceeded the concentrations set forth in 10 CFR 20, Appendix B, Table II, when averaged over one year. (See paragraphs 115, 116, 117 and 122 of report details.)

7. Contrary to 10 CFR 20.405(a) "Reports of overexposures and excessive levels and concentrations", no report was made within 30 days to any office of the Commission, that personnel working in the restricted Americium Laboratory, were exposed to excessive concentrations of Am-241 in air. (Recurrent). (See paragraph 76 of report details.)

8. Contrary to 10 CFR 20.206(a) "Instructions", the licensee failed to adequately instruct personnel, conducting general decontamination, changing gloves on contaminated glove boxes and replacing air filters, of the hazards associated with these operations and the safety measures to be taken. (See paragraphs 20 - 22, 27 - 29, 36, 39, 44, 48, 60, 64, 70, 73 - 75, 77, and 78 of report details.)

9. Contrary to License Condition 18 which incorporates the provisions of letter dated April 28, 1961 (committee review) and the letter dated May 9, 1966, (HP. SOP. 27 modification), removable contamination in restricted and unrestricted areas, exceeded the limits set forth. (See paragraphs 98, (e), (i), (s), (v), (y), (a)(1), 180, 181, 182, 186, 187 of report details.)

ITEM 6 CONTINUED

License -7

10. Contrary to 10 CFR 20.201(b) "Surveys", evaluations of the concentrations of tritium released to unrestricted areas were inadequate to determine compliance with 10 CFR 20.106, in that the licensee had not made any evaluations of stack discharges of soluble tritium for the hand paint facility since May, 1967. The few evaluations made prior to May 1967, indicated concentrations in excess of the concentrations permitted in Appendix B, Table II, of this part. (Uncorrected) (See paragraphs 219 - 224 of report details.)

11. Contrary to 10 CFR 20.201(b), "Surveys", evaluations of airborne concentrations of radioactive material in restricted areas were inadequate to determine compliance with 10 CFR 20.103(a), in that:

(a) the licensee had not performed breathing zone air sampling of personnel performing hand application of tritium since May of 1967. Such sampling was needed in view of the high concentrations noted for the few samples taken. (Uncorrected). (See paragraphs 211 - 218 of report details.)

(b) the licensee, except for the week of July 17, 1967, did not determine the exposure to concentrations of Rn-222 for those persons who also work during a seven-day period with radium, americium and tritium in spite of the knowledge that excessive concentrations probably existed. (See paragraphs 197 - 202 of report details.)

12. Contrary to 20.103(a), "Exposure of individuals to concentrations of radioactive materials in restricted areas", several persons performing radium dial screening as well as work with tritium and americium-241 were exposed to airborne concentrations of radon-222 in excess of the limits specified in Table I, Column 1, Appendix B of 10 CFR 20, when averaged over a period of seven consecutive days. (Uncorrected) (See paragraphs 197 - 202 of report details.)

13. Contrary to License Condition 17, which incorporates the provisions of letter dated April 28, 1961, (commission review) and letter dated May 9, 1966, (HP. SOP. 27 modification), removable contamination in restricted and unrestricted areas exceeded the limits set forth. (Uncorrected) (See paragraphs 227 - 234 of report details.)

PARTS 20 and 30 INSPECTION

UNITED STATES RADIUM CORPORATION
4150 Old Berwick Road
Bloomsburg, Pennsylvania 17815

Persons Accompanying Inspector

Mr. Paul R. Nelson, Senior Radiation Specialist, CO:I
Mr. Gen Roy, Inspection Specialist, CO:HQ
Mr. J. Davis, Pennsylvania State Department of Health

Persons Contacted

Mr. E. M. Burtsavage, Chief, Health Physics Branch
Dr. J. MacHutchin, Head of Health Physics, Research and Development and Radioproduct Production
Dr. John S. Krohmer, Consulting Health Physicist (11/16/67 only)
Mr. C. W. Wallhausen, Vice President, Sales (11/16 and 11/17 only)
Mr. R. C. Sorenson, Executive Vice President
Mr. H. Vaughn, Vice President, Bloomsburg Facilities
Mr. W. E. Umpstead, Plant Manager
Others

DETAILS

Recapitulation

9. Our last inspection, performed on May 15 - 19, 1967 and June 12, 1967, revealed that many items of noncompliance noted during previous inspections remained uncorrected. In addition, it was noted that one employee, preparing Am-241 foils, for two years, had received a body burden of 1.8 uCi Am-241 as determined by whole body counting. Several other employees who had worked in this laboratory, also exhibited quantities of Am-241 in their bodies. The body burdens were a result of working in an inadequately equipped laboratory, lack of instructions and procedures, lack of authority by health physics personnel in any conflict with production, and lack of management interest and followup.

10. The licensee discontinued the fabrication of Am-241 foil as requested by the Commission. This was confirmed by Harold Price's letter of June 6, 1967. The licensee continued to use the facility for processing Po-210 and Ra-226 sources, however, until June 12, 1967 when the Am-241 laboratory was closed to all radioisotope processing.

11. The licensee performed his own decontamination of the Am-241 laboratory during the period of June 27, 1967 to October 3, 1967. Am-241 foil production was resumed on October 16, 1967, according to production records. Amendment number 34, authorizing resumption of production, was issued September 26, 1967.

Scope of Inspection

12. This inspector reviewed the decontamination effort, the status of the items of

noncompliance noted during the previous inspection of licenses -2 and -7, and the adequacy of the Am-241 facility.

Organization and Administration

13. Dr. J. MacHutchin, as of October 4, 1967, has been Head of Radioproduct Production, Head of Research and Development and Head of Health Physics. Burtsavage, as Chief Health Physicist, reports directly to MacHutchin, who in turn, reports to Mr. W. E. Umpstead, Plant Manager.

14. MacHutchin stated that Burtsavage now has the authority to stop any operation which, in Burtsavage's opinion, was hazardous, but that such action would be immediately reviewed by the current Isotope Committee, consisting of the following:

Mr. C. W. Wallhausen, Chairman, Vice President, Sales
Mr. W. F. Buck, Secretary, Manager of Production
Dr. J. G. MacHutchin
Mr. E. M. Burtsavage
Mr. H. Vaughn, Vice President, Bloomsburg facilities
Mr. W. E. Umpstead, Plant Manager

15. Burtsavage stated that he has never stopped any operation because he was unsure of his authority. Wallhausen agreed that since the last inspection and prior to October 4, 1967, Burtsavage's authority to halt any unsafe activity was not closely defined and he probably did not have that authority until recently. Wallhausen stated that further directives setting forth his authority would be issued.

16. Burtsavage stated that his health physics staff currently consists of the following:

John D. McGraw, Assistant to Burtsavage, BS in Chemistry, University of Scranton. Prior experience in low level beta counting at Associated Science Laboratories at State College, Pennsylvania. Recently added to this staff.
R. R. Haladay, Technician
R. S. Carl, Technician
C. Berlin, Technician
A. Tyson, Assayer
J. Flynn, Swab and counting duties only
P. Walsh, Swab and counting duties only
W. Beaver, Swab and counting duties only
E. Fisher, Office duties

17. Burtsavage stated that with the exception of McGraw, he could lose any of the others to production at any time. He stated that by union contracts, a person laid off from any job has the right to claim vacant positions in health physics. He also stated that he is staffed with janitors, plumbers and machinists who return to their old jobs upon resumption of activity. He pointed out that this has occurred with such frequency that it has been impossible to maintain a trained staff or conduct needed health physics work. It is noted that this condition existed prior to this inspection and still exists.

18. Burtsavage stated that since the middle of September, he has had to assist in the maintenance of records.

19. Burtsavage stated that John S. Krohmer, a Certified Health Physicist, now employed by the Geisinger Clinic, Danville, Pennsylvania, has been retained by U. S. Radium Corporation (USRC) as a consultant. Kronmer stated that it

is planned for him to visit the licensee approximately one day weekly and that, as of November 16, 1967, he has made three visits to the facility. Plans are, according to MacHutchin, to use Krohmer to train the health physics staff and to recommend changes in procedures or equipment.

Decontamination Effort

20. Burtsavage stated that he was directly in charge of the decontamination effort and reported to MacHutchin and Wallhausen. He stated that personnel doing the decontamination came directly from production and health physics staff. He stated that he would get personnel classified as machinists and laborers from Umpstead, on days when plant production was slack.

21. He stated these persons performed decontamination under the direct supervision of Haladay, Carl or Berlin, Health Physics Technicians. He stated they were instructed in the use of protective equipment, coats, gloves, half-face masks and methods used to monitor themselves for contamination.

22. Burtsavage stated that no instructions are given to decontamination personnel in special precautions and special procedures to be taken for the more hazardous operations such as changing gloves on glove boxes, decontaminating the inside of glove boxes previously used to process Am-241, opening 7 gallon waste cans, on occasions to check contents and in changing roof filters. It was also learned through R. Carl, who supervised the decontamination effort, that the contaminated material in 55 gallon drums was tamped down by hand. Burtsavage repeated that no special procedures were evolved prior to the decontamination effort and no special instructions were ever given to personnel involved in the decontamination effort. He also stated that no evaluation was ever made to assess the hazards associated with the decontamination effort, since he thought the protective apparel worn by decontamination personnel would afford ample protection.

23. He described the protective equipment as consisting of rubber overshoes, jump suits, rubber gloves and MSA "Comfo" half face masks containing two 2" pleated paper breathing filters. This is an ultra filter, cartridge type, having a filtering efficiency of 99.98 percent for 0.3 micron particles. The masks were noted to cover only the immediate area of the nose and mouth.

24. On November 15, 1967, the inspector noted that the mask worn by [redacted] did not fit properly and that he had difficulty keeping it on his face. It was also noted that there was a gap between [redacted] face and the mask lip such that a finger could be inserted in the vicinity of the nose. Burtsavage stated that there was no mask discipline to ensure good fit. He stated that masks were monitored, however, to note the presence of contamination with a PAC alpha detector and that if nonremovable contamination was detected, the mask was disposed of as waste.

25. The licensee, by letters dated September 25, 27 and 28, October 10, 16, 17, 18, 20, and 24, November 2 and 8, 1967 to CO:HQ reported exposures of persons performing decontamination to excessive concentrations of airborne radioactive materials. In the light of these exposures, Burtsavage stated it was apparent that prior evaluations and instructions were necessary. The inspector noted, in addition, that on several occasions, general Am-241 laboratory air exceeded MPC as expressed in Appendix B, Table 1. Some of these personnel exposures were noted to exceed half face mask capability.

26. Inquiry into each of the reported exposures was made and is reported in the following paragraphs.

27. Licensee letter of September 25, 1967 reported an overexposure to [redacted], occurring during the week of June 20, 1967. Burtsavage stated that [redacted] worked only one day during the week for a total of 204 minutes, decontaminating and removing contaminated articles from the Americium glove box and attached Press Hood. In doing so, he inadvertently ripped one of the gloves of the Am-241 glove box and then proceeded to replace the glove without informing health physics or any other person. Burtsavage stated and that inspector noted that this would be a difficult operation because the glove port lip protrudes approximately one-half inch from the face of the box and also the glove ends do not fit this port and have to be folded over in order to make a tight fit. Burtsavage stated that [redacted] action was typical of production personnel and that he always learns of incidents too late to be of assistance.

28. Burtsavage again stated that no instructions or prior evaluation was made of this operation. He further stated that current procedures do not require production personnel to consult with or obtain prior health physics approval.

29. Activity collected, using a Gelman air pump drawing air through an air sampler in [redacted] breathing zone, indicated 1460 x 10^{-12} uCi/ml Am-241 for his entire occupancy of 204 minutes. On the basis of 40 hours, his exposure to concentrations of Am-241 in air was 19.8 times the concentration of 6 x 10^{-12} uCi Am-241/ml air expressed in Appendix B, Table I for soluble Am-241. A half-mask was worn.

30. Laboratory analysis records indicated that particulate air activity collected on the filter paper during [redacted] occupancy was counted on June 28, 1967 and the counting data was forwarded to Burtsavage on July 7, 1967. The overexposure was not reported to the Commission until September 25, 1967.

31. Licensee's letter of September 27, 1967 reported overexposure during the week of July 10, 1967 to three persons performing decontamination and cutting of Am-241 foil. The exposures were based upon general room air sampling with a Gelman pump pulling air from the center of the Am-241 laboratory. B. Z. sampling was not performed on two of the three persons involved.

32. The letter stated that eight general room air samples were taken over a consecutive six day work week period from July 10 - 15 inclusive that an average concentration of 15.59 x 10^{-12} uCi/ml was noted and assigned to three persons working in the Am-241 laboratory.

33. Those working in the laboratory were:

7/10/67 - [redacted] 147 minutes cleaning and wiping previously prepared Am-241 foil. The air in his B. Z. was sampled and Am-241 concentrations noted were 3.16 x 10^{-12} uCi/ml air. General room air concentrations noted during the foil cleaning were noted as 122 x 10^{-12} uCi Am-241/ml air.

7/11/67 - [redacted] was doing general cleanup. No B. Z. sampling was performed. A room air sampler noted Am-241 concentrations as 2.22 x 10^{-13} uCi/ml air for a 473 minute period.

7/12/67 - No work was being performed in the Am-241 laboratory. Room air concentrations for 1397 minutes sampling was noted as 2.56 x 10^{-12} uCi Am-241/ml air.

7/13/67 - [redacted] was cutting on an open table previously processing Am-241 foil. B. Z. concentrations were noted as 7.38 x 10^{-12} uCi/ml air, and general room air concentrations were noted as 8.67 x 10^{-12} uCi/ml air.

7/14/67 - [redacted] were doing general cleanup and records indicated no breathing zone sampling performed. General air was sampled and concentrations of Am-241 were noted as 1.71×10^{-13} uCi/ml air.

7/15/67 - No work was performed on this day and room concentrations were noted as 5.42×10^{-13} uCi/ml air.

Half-face masks were worn.

34. Burtsavage stated no breathing zone sampling was done on those persons performing cleanup but was performed on those persons handling Am-241. He stated he therefore assigned the general room concentrations to those persons involved as being essentially the working environment.

35. Notification to the Commission of the above was made on September 27, 1967. Records of analysis indicated that the filter paper upon which activity was collected on July 10, 1967 was counted on July 13, 1967 and counting data reported to Burtsavage on July 15, 1967. Other filter paper samples were counted on 7/18/67 and counting data forwarded on July 22, 1967. The records also indicated that the results for counting activity on filter apper were available to Burtsavage no later than 10 days after the sample was taken.

36. The licensee, by letter dated September 28, 1967, reported that three persons performing decontamination during July 17 - 22, 1967 in the Am-241 Laboratory were overexposed to airborne concentrations of Am-241. The maximum exposure of 48 times MPC was received by [redacted]. Inquiry revealed the following:

[redacted]

7/20/67 - Decontaminating Am-241 glove box, B. Z. air during 203 minutes of operation 3050 x 10^{-12} uCi Am-241/ml air.

7/21/67 - Decontaminating attached press hood. B. Z. air samples during 318 minutes of work, 311 x 10^{-12} uCi Am-241/ml air.

7/20/67 - Skin contamination of 550 net alpha counts per minute was noted on [redacted] right hand and 900 cpm on his face outside the respirator area.

On July 18 and 19, 1967, [redacted] was sieving Ra-226 phosphor paint inside a glove box in a room directly off the Americium laboratory.

[redacted]

7/19/67 - Decontaminating radiator surfaces in the Am-241 laboratory. Am-241 air concentrations were 2.46×10^{-12} uCi Am-241/ml air for 355 minutes of work.

7/20/67 - Decontamination of SW corner of laboratory, 207 minutes, 207 x 10^{-12} uCi Am-241/ml air for 343 minutes of work.

7/21/67 - General decontamination, 2.95×10^{-12} uCi Am-241/ml air for 402 minutes of work.

7/22/67 - 37.10 x 10^{-12} uCi Am-241/ml air for 400 minutes of general decontamination.

7/18 and 7/19/67 - 1.5×10^{-12} uCi Am-241/ml air during general laboratory cleaning.

[redacted]

7/18/67 - General laboratory cleanup, B. Z. air 1.5 x 10^{-12} uCi/ml air, for 200 minutes of work.

7/19/67 - Helping Kitchen clean up SW corner of lab, B. Z. air 2.46 x 10^{-12} uCi Am-241/ml air for 185 minutes of work.

7/20/67 - Continuing decontamination of SW corner of lab, breathing zone air 94.1 x 10^{-12} uCi Am-241/ml air for 225 minutes of work.

7/21/67 - No work

7/22/67 - General cleanup in lab, B. Z. air 22.8 x 10^{-12} uCi air/ml for 395 minutes of work.

Half-face masks were worn.

37. [redacted] who assisted in cleanup during this week, received a 40 hour exposure to concentrations of Am-241 in air of approximately 0.425 times the MPC of 6 x 10^{-12} uCi Am-241/ml air (soluble) as expressed in Appendix B, Table I, 10 CFR 20.

38. Records of analysis of the above data indicated that the air samples collected on filter paper were counted four to five days after collection, and that the counting data were transmitted to Burtsavage four days later. Burtsavage, according to records, had counting data available to indicate overexposure to personnel no later than nine days after sampling. Notification to the Commission was not made until September 28, 1967.

39. The licensee, by letter of October 10, 1967, notified the Commission of another exposure to [redacted] during the week of July 24, 1967. The letter reported an overexposure of 8.14 times the MPC for Am-241 based on a 40 hour week. Records indicated the following:

7/24/67 - [redacted], decontaminating the Am-241 glove box used to compact Americium oxide poweder. B. Z. 360 x 10^{-12} uCi Am-241/ml air for 331 minutes of work. Skin contamination noted on his right hand of 800 cpm, left hand 200 cpm, head 350 cpm, neck 300 cpm, jump suit 200 cpm. The survey was made with the remote probe of the Eberline PAC-3 alpha detector. [redacted] washed inside the lab and a second survey revealed no personal decontamination. A half-face mask was worn.

40. Records indicated that during the remainder of the week, [redacted] was sieving Ra-226 powder paint in an adjoining Ra room on July 26, 1967, a B. Z. sample in this room revealed air concentrations of 207 x 10^{-12} uCi alpha/ml air, believed to be Ra-226. Alpha contamination of 10,000 cpm was noted both on the tops of the right and left shoes as noted by the PAC survey meter. He worked 158 minutes at this task. A half-face mask was worn.

41. It was noted that [redacted] on July 27, 1967 had breathing zone concentrations of 6.8 x 10^{-13} uCi Am-241/ml air during general lab cleanup. Alpha contamination of 1,000,000 cpm was noted on the surface of his left overshoe and 3500 cpm on his right overshoe. The surface of his half-face mask had removable contamination noted as 300 cpm.

42. Although [redacted] also performed general cleanup during this week, survey records indicate that they were not overexposed to excessive concentrations of Am-241/ml air on the basis of a 40 hour work week.

43. Analysis records indicated that the air activity noted for [redacted] on July 24, 1967 was collected on filter paper which was counted on July 26, 1967.

Although the counting data was reported to Burtsavage on July 29, 1967, notification to the Commission was not made until October 10, 1967.

44. The licensee, by letter of October 16, 1967, reported an exposure of 2.94 times MPC for Am-241 in air to [redacted], occurring during the week of July 31, 1967, while decontaminating the Am-241 laboratory. Contamination of 500 to 900 cpm alpha activity was noted on the exterior of protective jump suit and overshoes.

8/1/67 - [redacted] - general laboratory decontamination, B. Z. 15.6 x 10^{-13} uCi Am-241/ml air for 358 minutes of work. Contamination of 500 cpm alpha activity was noted on overshoes.

8/2/67 - [redacted] - general laboratory decontamination, B. Z. 5.58 x 10^{-12} uCi Am-241/ml air. Alpha contamination 3000 to 4000 cpm on overshoes and 400 - 450 on undershoe tops.

8/3/67 - [redacted] - general laboratory decontamination, B. Z. 5.8 x 10^{-12} uCi Am-241/ml air for 366 minutes. Alpha contamination same as noted on 8/2/67.

8/4/67 - [redacted] - removing some ductwork from the Am-241 lab. Survey records also indicate that some ends of the ductwork were left open without being covered. B. Z. air 33.5 x 10^{-12} uCi Am-241/ml air for 290 minutes of work. Alpha contamination, left hand, 1200 cpm, right hand 500 cpm.

45. [redacted] on August 1, 1967, spent one hour in the Am-241 laboratory performing decontamination of the Am-241 glove box. B. Z. air 211 x 10^{-12} uCi Am-241/ml air. No other work was performed by [redacted] during the week concerned and his 40 hour work week exposure was less than MPC.

46. Others who worked in the Am-241 laboratory doing decontamination during the week of July 31, 1967 were [redacted] No overexposures were noted for these individuals with respect to 40 hour work week exposures to air concentrations. Half face masks were worn by all personnel.

47. Analysis records indicated that the filter paper on which the B. Z. air was collected was counted for activity on 8/7/67 and counting data was reported to Burtsavage on August 14, 1967. No report was made to the Commission until October 16, 1967.

48. The licensee, by another letter dated October 16, 1967, reported two employee's overexposures on the basis of a 40 hour work week to concentrations of Am-241 in air while performing decontamination of the Am-241 laboratory during the week of August 7, 1967.

[redacted] 25.6 times MPC
[redacted] 4.25 times MPC

Half face masks were worn.

8/7/67 - [redacted] decontaminating the waste storage room of the Am-241 lab. B. Z. air 1040 x 10^{-12} uCi Am-241/ ml air for 371 minutes of work. Alpha contamination on protective clothing noted to be 10,000 to 100,000 cpm on his hands .

8/8/67 - [redacted] same as above. B. Z. air 20.9 x 10^{-12} uCi Am-241/ml air for 224 minutes of work. Alpha contamination of 2200 to 5000 cpm noted on the surface of protective clothing and 100 cpm on the outside surface of his respirator.

8/9/67 - [redacted] - general air Am-241 lab decontamination. B. Z. air 2.83 x 10^{-12} uCi Am-241/ml air for 363 minutes of work. Similar removable contamination as noted above.

8/7/67 - [redacted] - decontaminating the SW corner of the Am-241 lab. B. Z. air 72.4 x 10^{-12} uCi Am-241/ml air for 369 minutes of work. Survey report indicates no survey made to determine contamination on Tyson's person.

8/8/67 - [redacted] - decontaminating the Am-241 lab waste storage room. B. Z. air 109 x 10^{-12} uCi Am-241/ml air for 239 minutes of work. Alpha contamination ranging from 7500 to 10,000 cpm was noted on protective clothing surfaces. 1000 cpm on inner shoes. 200 cpm on portion of the face not covered by face mask and 400 cpm on hand surfaces underneath protective gloves.

8/9/67 - [redacted] - general decontamination of the Am-241 lab. B. Z. air 14.2 x 10^{-12} uCi Am-241/ml air for 289 minutes. Alpha contamination from 3000 to 3500 cpm was noted on the surface of protective apparel.

8/10/67 - [redacted] - decontaminating south wall of the Am-241 lab. B. Z. air, 5.69 x 10^{-12} uCi Am-241/ml air for 388 minutes of work. Contaminaation ranging from 5000 to 7000 cpm was noted on the surface of the protective apparel.

8/11/67 - [redacted] - decontaminating floor of Am-241 lab. B. Z. 0.85 x 10^{-12} uCi/ml air for 363 minutes of work. Alpha contamination ranging from 300 to 3200 cpm was noted on the surface of protective apparel.

8/12/67 - [redacted] - decontaminating south wall of Am-241 lab. B. A. 11.4 x 10^{-12} uCi Am-241/ml air for 391 minutes of work. Alpha contamination on the surface of protective apparel was noted as 2500 to 3500 cpm and on the inner street shoes from 200 to 400 cpm.

49. On August 7, 1967, a general room air sample showed concentration of 32.3 x 10^{-12} uCi Am-241/ml during 720 minutes of monitoring.

50. On August 8, 1967, [redacted] cleaned the Am-241 powder glove box for 145 minutes. A B. Z. sample for that period revealed that he was exposed to an average concentration of 48.5 x 10^{-12} uCi Am-241/ml air. His exposure for the 40 hour work week, however, was less than 6 x 10^{-12} uCi/ml.

51. Analysis records indicated that the air samples taken during the week of August 7 - 12, 1967 were counted on August 14, 1967 and the counting data reported to Burtsavage no later than August 15, 1967. Notification to the Commission was not made until October 16, 1967.

52. The licensee, by letter dated October 17, 1967, reported an overexposure to concentrations of Am-241 in air during the week of August 21, 1967 to [redacted] of 24.15 times MPC; during the week of August 28, 1967 to [redacted] of 1.87 times MPC during the performance of decontamination in the Am-241 laboratory. Survey records indicate the following:

8/21/67 - [redacted] - decontamination of former wet chemistry and other hoods in the Am-241 laboratory. B. Z. 47.3 x 10^{-12} uCi Am-241/ml air for 185 minutes of work. Alpha contamination on protective clothing apparel ranged from 2000 to 4500 cpm.

8/23/67 - [redacted] - same as above, B. Z. 1.53 x 10^{-12} uCi Am-241/ml air for 180 minutes of work.

8/24/67 - [redacted] - decontamination of former plating hoods. B. Z. 2010 x 10^{-12} uCi Am-241/ml air for 175 minutes of work.

8/26/67 - [redacted] - general cleanup Am-241 laboratory. B. Z. 1.84 x 10^{-12} uCi Am-241/ml air for 373 minutes of work.

8/29/67 - [redacted] - decontaminating the foil scanning

room of the Am-241 laboratory. B. Z. 66 x 10^{-12} uCi Am-241/ml air for 390 minutes.

9/1/67 - [redacted] - decontaminating north wall of Am-241 lab. B. Z. 7.12 x 10^{-12} uCi Am-241/ml air for 300 minutes of work.

Half-face masks were worn.

53. Analysis records indicated that [redacted] B. Z. samples were counted on August 31, 1967 and the counting data reported to Burtsavage no later than September 5, 1967. The records indicated that [redacted] breathing zone samples were counted on September 5, 1967. The records indicated that [redacted] breathing zone samples were counted on September 5, 1967 and the counting data reported to Burtsavage on September 10, 1967. Notification of the above incidents were not made to the Commission until October 17, 1967.

54. The general room air samples were taken in the Am-241 laboratory during the week of September 5 - 9, 1967.

55. Air concentrations in the center of the Am-241 laboratory were determined by placing a Gelman pump and drawing air at the rate of 57 l/minute through a filter paper, according to Burtsavage. The results recorded in the survey records are as follows:

Date	Concentrations	Sampling Time
9/5/67	5 x 10^{-12} uCi Am-241/ml air	482 minutes
9/6/67	2.53 x 10^{-12} uCi Am-241/ml air	459 minutes
9/7/67	72.5 x 10^{-12} uCi Am-241/ml air	480 minutes
9/8/67	42 x 10^{-12} uCi Am-241/ml air	465 minutes
9/9/67	2.87 x 10^{-12} uCi Am-241/ml air	467 minutes

56. The average concentration noted was 25.2 x 10^{-12} uCi Am-241/ml air and 4.1 times MPC of 6 x 10^{-12} uCi Am-241/ml air as expressed in Appendix B, Table I, 10 CFR 20, when averaged over 40 hours.

57. Analysis records indicated that the filter paper air collection samples were counted for activity on September 10, 1967 and counting data reported to Burtsavage no later than September 15, 1967.

58. Work records indicated that the following persons performed decontamination during the week of September 5, 1967. (Half-face masks were worn.)

9/5/67	9/6/67	9/7/67	9/8/67	9/9/67
[redacted]	[redacted]	[redacted]	[redacted]	[redacted]

59. The licensee, in a letter dated October 18, 1967, reported overexposures during the work week of September 5, 1967 based on breathing zone samples for [redacted]. Burtsavage stated he believed that B. Z. sampling was superior to general room air sampling. The following overexposures were reported:

[redacted]	2.69 times MPC
	5.13 times MPC
	4.40 times MPC
	1.02 times MPC

60. The following B. Z. sampling data was extracted from the licensee's survey records:

Date	Name	B. Z. Conc. in UCi/ml air	Sampling Time (minutes)	Duty
9/5/67	[redacted]	5.61×10^{-12}	379	decon. floor
9/6/67	[redacted]	3.48×10^{-12}	353	decon. storage room floor
	[redacted]	4.74×10^{-12}	474	
9/7/67	[redacted]	5.38×10^{-12}	370	general decontamination
	[redacted]	$\underline{25.3} \times 10^{-12}$	244	decon. NE wall
	[redacted]	6.91×10^{-12}	358	dismantling rollers
	[redacted]	9.44×10^{-12}	388	dismantling rollers
9/8/67	[redacted]	$\underline{121} \times 10^{-12}$	334	dismantling exhaust ducts
	[redacted]	1.94×10^{-12}	367	general decontamination
	[redacted]	$\underline{90.6} \times 10^{-12}$	30	working in press hood
	[redacted]	1.79×10^{-12}	383	general decontamination
	[redacted]	$\underline{8.64} \times 10^{-12}$	383	general decontamination
	[redacted]	5.35×10^{-12}	383	general decontamination
9/9/67	[redacted]	$\underline{23.0} \times 10^{-12}$	395	decon. balance in glove box
	[redacted]	$\underline{231} \times 10^{-12}$	232	dismantling old hoods
	[redacted]	104×10^{-12}	388	decon. of floor
	[redacted]	7.85×10^{-12}	388	decon. of floor
	[redacted]	4.86×10^{-12}	395	general decontamination
	[redacted]	3.20×10^{-12}	386	general decontamination

61. The results indicated that the high general room air concentrations noted on September 7, 1967 occurred because of the dismantling of rollers and decontaminating the NE wall of the Am-241 laboratory. The high general air sample on September 8, 1967, occurred during removal of ductwork.

62. Analysis records indicated that the filter paper upon which activity was collected for the week of September 5, 1967, was counted on September 10, 1967 and the counting data transmitted to Burtsavage no later than September 15, 1967. Notification to the Commission was made on October 18, 1967.

63. The licensee's letter dated October 20, 1967 reported exposures to four persons during the week of September 11, 1967 to excessive concentrations in air of Am-241 while engaged in decontaminating the Am-241 laboratory:

[redacted] - 3.99 times MPC for a 40 hour work week
[redacted] - 2.76 times MPC for a 40 hour work week
[redacted] - 1.27 times MPC for a 40 hour work week
[redacted] - 3.97 times MPC for a 40 hour work week

64. Survey records indicated the following:

Date	Name	B. Z. Conc. in air - uCi/ml	Sampling Time (minutes)	Duty
9/11/67	[redacted]	2.31×10^{-12}	388	decon. lab floor
	[redacted]	6.02×10^{-12}	383	decon. lab floor
	[redacted]	3.40×10^{-12}	383	decon. lab floor
	[redacted]	2.48×10^{-12}	383	decon. lab floor
	[redacted]	1.16×10^{-12}	262	HP monitor
9/12/67	[redacted]	5.41×10^{-12}	326	decon. lab floor
	[redacted]	194×10^{-12}	67	changing absolute filter in penthouse for Am-241 exhaust
	[redacted]	4.15×10^{-12}	326	HP monitor
	[redacted]	9.99×10^{-12}	324	decon. lab floor
	[redacted]	8.32×10^{-12}	323	decon. lab floor at entrance
	[redacted]	5.41×10^{-12}	326	decon. lab floor at entrance - restricted
9/13/67	[redacted]	611×10^{-12}	48	changing penthouse prefilter for Am-241 facility
	[redacted]	7.78×10^{-12}	370	decon. lab floor
	[redacted]	6.11×10^{-12}	370	decon. lab floor
	[redacted]	142×10^{-12}	246	dismantling weigh room glove box
	[redacted]	59.0×10^{-12}	376	decon. lab floor
	[redacted]	10.9×10^{-12}	366	changing floor tiles in Am-241 lab
9/14/67	[redacted]	49.8×10^{-12}	102	decon. floor storage hood
	[redacted]	24.1×10^{-12}	366	decon. weigh room hood
	[redacted]	12.7×10^{-12}	315	decon. weigh room hood
	[redacted]	4.68×10^{-12}	322	general decontamination
9/15/67	[redacted]	1.47×10^{-12}	373	decon. weigh room floor
	[redacted]	25.0×10^{-12}	373	decon. Am-241 lab floor

Date	Name	B. Z. Conc. in air - uCi/ml	Sampling Time (minutes)	Duty
	[redacted]	1.10×10^{-12}	376	decon. weigh room floor
9/16/67	[redacted]	17.0×10^{-12}	395	general decontamination
	[redacted]	6.18×10^{-12}	395	general decontamination
	[redacted]	109×10^{-12}	395	decon. weigh room floor
	[redacted]	49.7×10^{-12}	375	decon. near Am-241 glove box

([redacted] hands were contaminated - 600 cpm alpha prior to washing)

65. No report was made to any office of the Commission of 40 hour work week exposure to airborne concentrations [redacted] of 2.1 times MPC expressed in Appendix B, Table I, 10 CFR 20. During the inspection, it was noted that the B. Z. samples for [redacted] of 59×10^{-12} uCu Am-241/ml air was incorrectly dated October 13, 1967, instead of September 13, 1967, the correct date. The error was discovered by the inspector during checking of the survey records and work schedules. The licensee, in a letter dated November 29, 1967, to CO:HQ corrected this error.

66. The licensee, by letter dated October 24, 1967, reported an overexposure to [redacted] during the work week of September 25, 1967, to airborne concentrlations of Am-241 while decontaminating the restricted Am-241 laboratory.

67. Records of B. Z. sampling results show the following:

Date	Name	B. Z. Conc. in air - uCi/ml	Sampling Time (minutes)	Duty
9/25/67	[redacted]	703×10^{-12}	580	painting cement blocks underneath Am-241 glove box
9/26/67	[redacted]	5.15×10^{-12}	377	general decontamination
9/27/67	[redacted]	1.50×10^{-12}	515	general decontamination
9/28/67	[redacted]	1.20×10^{-12}	527	general decontamination
9/29/67	[redacted]	4.20×10^{-12}	375	general decontamination
9/30/67	[redacted]	4.88×10^{-12}	395	general decontamination

(Half face masks were worn)

68. The letter relates [redacted] overexposure as 24.26 times MPC. Examination of the work schedules and air sampling data indicate that [redacted] worked a total of 2769 minutes over six days between September 25 and September 30 for a total of 46.15 hours. The 40 hour work week concentrations would have to be adjusted as follows:

$$\frac{40}{46.15} \times 6 \times 10^{-12} \text{ uCi Am-241/ml air} = 5.2 \times 10^{-6} \text{ uCi Am-241/ml air}$$

which would have been the correct concentration to use. Using the value of

5.2×10^{-6} uCi Am-241/ml air, [redacted] received an overexposure of 28.8 times MPC rather than 24.6 times MPC as reported by the licensee. Burtsavage in a letter to CO:HQ dated December 4, 1967, explained his logic for arriving at the 24.6 times MPC. Examination revealed that his logic was correct and that the error was probably arithemetic.

69. The licensee, by letters dated November 2, 1967 and November 8, 1967, reported three overexposures during the week of October 2, 1967, three overexposures during the week of October 9, 1967, and one overexposure during the week of October 23, 1967, and one overexposure during the week of October 30, 1967. Exposures were reported as having occurred while performing decontamination and in one case, while plating Am-241 foil.

70. The results, as noted in B. Z. air sampling data, were as follows:

Date	Name	B. Z. Conc. in air - uCi/ml	Sampling Time (minutes)	Duty
10/2/67	[redacted]	9.0 x 10^{-12}	198	decon. Am-241 box
	[redacted]	9.4 x 10^{-12}	373	HP monitor
	[redacted]	7.4 x 10^{-12}	373	general decon.
	[redacted]	4.3 x 10^{-12}	373	general decon.
	[redacted]	3.7 x 10^{-12}	373	general decon.
10/3/67	[redacted]	3.62 x 10^{-12}	102	cutting Am foil
	[redacted]	3.36 x 10^{-12}	373	general decon.
	[redacted]	23.0 x 10^{-12}	235	working with compacts prepared prior to 6/1/67 in Am-241 glove box
10/4/67	[redacted]	11.4 x 10^{-12}	377	decon. Am lab and repair work in waste shed
	[redacted]	320 x 10^{-12}	437	decon. Am-241 lab weigh room and storage basement
	[redacted]	41.6 x 10^{-12}	377	decon. Am-241 lab
	[redacted]	3.73 x 10^{-12}	373	receiving instruction from Baker
	[redacted]	6.78 x 10^{-13}	150	instructing Petroski
10/5/67	[redacted]	19.9 x 10^{-12}	373	decon. basement floor
	[redacted]	66.6 x 10^{-12}	273	decon. basement floor
	[redacted]	6.33 x 10^{-12}	238	Am-241 glove box changing
	[redacted]	4.38 x 10^{-12}	314	general cleaning

	[redacted]	3.68×10^{-12}	373	general cleaning
	[redacted]	3.68×10^{-12}	373	general cleaning
	[redacted]	3.50×10^{-12}	373	HP monitor
10/6/67	[redacted]	$\underline{449} \times 10^{-12}$	380	decon. weigh room in basement and Am-241 lab near glove box
	[redacted]	2.53×10^{-12}	380	rolling foils in hood
	[redacted]	7.23×10^{-13}	380	general cleaning
	[redacted]	5.20×10^{-13}	262	working with old foils
10/7/67	[redacted]	$\underline{14.5} \times 10^{-12}$	19	opening 7 gallon can of radioactive waste
	[redacted]	1.00×10^{-12}	137	opening cans of radioactive waste looking for lost Am-241 source

(Overexposures for the above work week were as follows:)

	[redacted]	-	11.37 times MPC	
	[redacted]	-	10.96 times MPC	
	[redacted]	-	11.06 times MPC	
10/9/67	[redacted]	7.78×10^{-13}	330	working with inactive foil in dummy runs
10/10/67	[redacted]	1.04×10^{-12}	397	same as above
10/11/67	[redacted]	3.50×10^{-12}	385	same as above
10/13/67	[redacted]	$\underline{879} \times 10^{-12}$	415	cleaning inside of hoods prior to startup
10/9/67	[redacted]	9.78×10^{-13}	315	general lab cleanup
10/10/67	[redacted]	$\underline{61.8} \times 10^{-12}$	385	decon. outside room of Am-241 lab
10/11/67	[redacted]	2.52×10^{-12}	384	general cleanup

(Half face masks were worn)

71. The exposure for [redacted] was reported as 27.3 times MPC and that of [redacted] as 1.72 times MPC.

72. An exposure reported for [redacted] in the licensee's letter of November 2, 1967, during the week of October 9, 1967, did not occur during that week, as the B. Z. sample taken on September 13, 1967 was mislabeled October 13, 1967. The overexposures should have been reported as occurring during the week of September 11, 1967. (See paragraph 63 for details.)

73. The licensee, in his letter of November 2, 1967, reported an overexposure to [redacted] of 1.39 times MPC during the work week of October 23, 1967. B. Z. monitoring results are as follows: (A half face mask was worn.)

Date	Name	B. Z. Conc. in air - uCi/ml	Sampling Time (minutes)	Duty
10/23/67	[redacted]	2.95×10^{-13}	420	rolling foil
10/24/67	[redacted]	1.55×10^{-13}	380	rolling foil
10/25/67	[redacted]	1.71×10^{-12}	623	stripping foil
10/26/67	[redacted]	$\underline{7.98} \times 10^{-12}$	423	stripping and plating Am-241 foil
10/27/67	[redacted]	$\underline{38.9} \times 10^{-12}$	427	plating foil
10/28/67	[redacted]	2.66×10^{-12}	309	decon. of small roller

74. The licensee, by letter dated November 8, 1967, reported an overexposure to [redacted] of excessive concentrations to Am-241 foil of 4.72 times MPC during the week of October 30, 1967. A half face mask was worn.

10/30/67	[redacted]	2.46×10^{-13}	385	measuring and cutting foil
10/31/67	[redacted]	3.22×10^{-13}	405	decon. equipment
11/1/67	[redacted]	$\underline{116} \times 10^{-12}$	610	decon. Am-241 glove boxes and cleaning compacts, stripping foil
11/2/67	[redacted]	4.13×10^{-13}	414	plating foil

75. Burtsavage stated that [redacted] was removed from further processing for one day on Friday, November 3, 1967, after the B. Z. sampling results became known to him. He stated this was the first case of all the exposures which had occurred since June 20, 1967 which was discussed by the Radioisotope Committee.

76. As noted in paragraphs 29, 30, 33, 35, 37, 38, 39, 41, 44, 47, 52, 53, 59 and 62 of the report details, reports of these exposures were sent to the Commission two and three months after they occurred and essentially when most of the decontamination effort was over. Burtsavage stated that he received B. Z. and general laboratory air counting data no later than two weeks after the air samples were taken, but that he made no examination of the counting data which clearly indicated high activity, but waited until the actual concentrations had been calculated by [redacted] He added that further delay resulted when [redacted] was taken off these duties to assist in the decontamination effort and when he was away for one week summer vacation. Burtsavage stated he did not get to look at the final calculations showing the results of air sampling, until the first or second week of September 1967.

77. Burtsavage stated he made no further inquiry into the exposures nor did he take steps to avoid further exposures. He stated, and MacHutchin agreed, that the only notification to management concerning these overexposures were copies of the results sent to the Commission. Wallhausen stated he took no action to effect correction, to stop the contamination effort, or to inquire into the causes of the overexposures. Isotope Committee minutes,

included as Exhibit "E" for the meetings of October 3, 4, 6, 16, 30 and 31, 1967 and November 3 and 7, 1967 containing only two references to any overexposures to concentrations of Am-241 in air. See minutes of October 31 and November 3, 1967 meetings. The overexposures occurring prior to October 27, 1967 were never discussed.

78. On November 16, 1967, Wallhausen, Vice President in charge of the decontamination effort, stated he relied on respiratory equipment although he knew that no exemption was allowed for their use by current regulations. He also stated that he was aware of overexposures, but not the extent or degree, and took no action to evaluate the cause. Wallhausen did not receive reports of any overexposures until approximately September 25, 1967 when first reports of overexposures involving the decontamination effort were sent to the Commission. He stated he had not thought it necessary to inquire into the results of air monitoring or reasons for delay in obtaining results.

79. Urinalysis has been performed for persons performing decontamination in the restricted Am-241 laboratory, by collecting 24 hour urine samples. The urines, according to Burtsavage, were collected over a weekend and turned in on Monday mornings prior to going to work to avoide contamination. There were two samplings for most of the personnel on September 19, 1967 and October 26, 1967. Some personnel have had more frequent samplings. Burtsavage stated sampling was not done in relation to incidents or after an exposure to airborne concentrations of Am-241, but only at times when he was free from other duties. Burtsavage stated no action levels had been set as of the date of the inspection as to what activity present in urine would necessitate resampling or removal of a person from processing. He also stated there is still no program for immediate samples following overexposures or incidents.

80. Eberline reported results in dpm Am-241/ml urine, with a minimum sensitivity of ± 0.02 dpm. Burtsavage stated that [redacted] was specifically identifying Am-241 by gamma pulse height analysis using the 60 KEV gamma pulse.

81. The urinalysis results for [redacted], which initially indicated an uptake of Am-241, are as follows:

Sample Date	Date Reported	Results in dpm/1500 ml	Results in dpm/total 24 hr urine elimination
9/19/67	10/23/67	4.6 + 0.8	6.5 dpm/2110 ml urine
10/26/67	11/24/67	4.8 + 0.5	5.7 dpm/1790 ml urine
11/4/67	11/24/67	4.0 + 0.3	4.8 dpm/1789 ml urine
11/11/67	12/6/67	0.63 + 0.1	0.52 dpm/1140 ml urine

82. As noted in paragraphs 45, 64 and 70 of the report details, [redacted] had the following high exposure to airborne concentrations of Am-241 while wearing a half face mask.

8/1/67 - 211 x 10^{-12} uCi/ml air for 60 minutes for decontamination

9/12/67 - 194 x 10^{-12} uCi/ml air for 67 minutes during decontamination

9/13/67 - 611 x 10^{-12} uCi/ml air for 48 minutes during roof filter change

10/7/67 - 14.5 x 10^{-12} uCi/ml air for 19 minutes during opening of a can of radioactive waste.

83. Burtsavage stated that no evaluation was made of [redacted] exposure following the air sample of September 13, 1967, because he had worn protective clothing and a half-face mask. CO:I advised Burtsavage via telephone on November 27, 1967, that the urine results of September 19, October 26 and November 4, 1967 indicated Am-241 deposition in his body and suggested that whole body counting be performed. Whole body counting of Am-241 was performed on December 4, 1967 at the University of Pittsburgh and Burtsavage on December 12, 1967 informed CO:I that the results indicated no internal deposition.

84. The urinalysis records for all persons involved in Am-241 processing or decontamination are included in Exhibit "A". It is noted that most, but not all, of the results above 0.5 dpm/24 hour urine void are for employees whose whole body counts showed measurable body burdens of Am-241. As reported in CO:I memorandum of August 22, 1967, to CO:HQ, the following persons showed measurable body burdens:

[redacted]	-	1.8 uCi
	-	.03 uCi
	-	.034 uCi
	-	.04 uCu
	-	.01 uCi
	-	.02 uCi

85. Samples taken on August 17, 1967, for four persons indicated urine activity ranging from 0.02 dpm Am-241/24 hour void urine to 0.41 dpm Am-241/24 hour void.

86. Samples taken on September 19, 1967 for ten persons indicated urine activity ranging from 0.3 dpm Am-241/24 hour void to 12.5 dpm Am-241/24 hour void.

87. Samples taken on October 12, 1967, for nine persons indicated urine activity ranging from 0.43 dpm Am-241/24 hour void to 2.0 dpm/24 hour void and 1.5 dpm Am-241/24 hour void. [redacted] constantly excretes approximately this amount as a result of his body burden.

88. Samples taken on October 26, 1967 for 19 persons ~~indicaturine~~ indicate urine activity ranging from 0.14 dpm Am-241/24 hour void to 5.7 dpm/24 hour void. [redacted] urine sample showing 5.1 dpm/24 hour void had a body burden of Am-241 of 0.05 uCi during whole body counting of Argonne National Laboratory on July 18, 1967. He is no longer exposed to airborne concentrations of Am241, according to Burtsavage. [redacted], during this sampling had urine activity of 1.6 dpm Am-241/24 hour void. [redacted] has a body burden of .02 uCi Am-241 as noted during whole body counting. He however, as noted in paragraphs 64, 33, 36, 39, 52 and 60 of this report, received the following exposures to airborne concentrations of Am-241 in air:

7/13/67 - 7.38×10^{-12} uCi/ml air

7/20/67 - 3050×10^{-12} uCi/ml air for 203 minutes

7/21/67 - 311×10^{-12} uCi/ml for 318 minutes

7/24/67 - 360×10^{-12} uCi/ml air for 331 minutes

8/21/67 - 47.3×10^{-12} uCi/ml air for 185 minutes

9/9/67 - 23×10^{-12} uCi/ml air for 396 minutes

9/13/67 - 142×10^{-12} uCi/ml air for 246 minutes

9/14/67 - 49.8×10^{-12} uCi/ml air for 102 minutes

9/16/67 - 49.7×10^{-12} uCi/ml air for 375 minutes

(A half face mask was worn during all of the above dates)

89. A summary of [redacted] urinalyses results are as follows:

Date of Sample	Results in dpm/1500 ml	Results in dpm/24 hour urine Am-241
8/11/67	1.4 + 0.3	1.5 dpm/1576 ml urine
9/19/67	9.3 + 0.6	12.5 dpm/2002 ml urine
10/12/67	0.97 + 0.22	2.0 dpm/1330 ml urine
10/26/67	1.2 + 0.2	1.6 dpm/1990 ml urine
11/4/67	0.82 + 0.2	1.3 dpm/2290 ml urine
11/11/67	0.54 + 0.1	1.2 dpm/3346 ml urine

90. The Americium processing facility has been improved since the last inspection by the following steps:

a. The old flooring has been removed and disposed to waste and replaced with new vinyl flooring.

b. The former Am-Po-Ra glove boxes and hoods which had consisted of three sections, an americium compacting glove box, a press and oven hood, and a radium compacting radium box has been modified. The inspector noted that the radium glove port has been eliminated entirely. Glove ports and gloves have been added to the center press and oven hood which has a plexiglass front which is ~~buttoned~~ bolted to the face of the press hood and this effects a tight seal as described in the licensee's letter of September 11, 1967. A pass box has had two inside barriers one at the junction of the glove box and one at the junction of the press hood, formerly only one barrier existed. This pass box has a top lid whereby materials can be inserted or removed from either the compact box or the press hood. (See Exhibit "B" for photographs of thus facility.

c. Two operators which were formerly performed on open tables have been placed inside ventilated hoods. These are the first cutting operations and the welding operation.

91. Magnehelic type gauges have been installed to determine negative pressure within both the compact glove box and the press hood. At the time of the inspection, both gauges read .625 inches. Air from the compact box exhausts via a flexible hose and prefilters into a duct. Air from the press hood exhausts via a filter directly into the hood. A magnehelic gauge on the exhaust duct reads .765 inches indicating negative pressure on the exhaust plenum from the Am-241 compact glove box and press hood in the horizintal duct leading to the vertical roof duct. Air from a welding hood, general work hood and compact cutting hood also exhausts into the main duct, which exhausts to the roof after passing through a rough filter and an absolute filter. The roof exhaust currently discharges air at the rate of 8300 cfm according to a traverse measurement with pitot tubes.

92. During the inspection, Am241 compact operations were suspended due to a spill over from an acid stripping tank which spread removable Am-241 contamination in an area measuring approximately 15' x 25'. This area

in front of the plating tanks was noted by the inspector on November 16, 1967 to be roped off, and posted as a contaminated area.

93. An incident report from [redacted] to Burtsavage, stated that on November 13, 1967, at 3:30 p.m. he inadvertently allowed the acid stripping tank to overflow. An immediate survey was made and swabs of the area showed removable alpha contamination of 400 to 150,000 cpm/100 cm^2 as determined by measurements with an Eberline alpha scintillation detector. Gamma levels of 7.5 mr/hr were noted at 1" distance using a GM survey meter.

94. Persons in the lab. blotting up the liquid on the floor were [redacted]

95. B. Z. air sampling of the above on November 13, 1967, revealed airborne alpha concenttations not exceeding 1.02 x 10^{-12} uCi/ml air.

96. B. Z. air sampling of [redacted] on November 14, 1967 during further decontamination revealed airborne alpha concentrations not exceeding 2.5 x 10^{-13} uCi/ml air. Further surveys revealed no removable contamination bud did reveal fixed contamination of 25,000 cpm alpha/100 cm^2. A smear taken by the inspector of the floor inside the roped off area and analyzed by HASL, NYOO, revealed removable contamination no more than 1.4 dpm Am-241/100 cm^2.

97. [redacted] stated that they are going to sand down the vinyl tile to remove the fixed contamination. Burtsavage stated he had not been consulted on this intended procedure.

98. Activities which have occurred since the resumption of Am-241 foil production as noted by survey and production records are as follows:

a. 10/12/67 - [redacted] unpacking 4.8 Ci Am oxide from ORNL shipping container in storage hood and placing powder in vial in powder compact box. Air concentrations in B. Z. of persons present did not exceed 8.85 x 10^{-13} uCi Am-241/ml air.

b. 10/16/67 - [redacted] working with compacts prepared prior to June 1, 1967, pressing 13 silver blocks 12.5 mCi/block. Room air concentrlations were noted as 1.52 x 10^{-12} uCi Am-241/ml air and individual B. Z. samples were noted as not exceeding 4 x 10^{-12} uCi Am-241/ml air.

c. 10/17/67 - [redacted] rolling Am-241 foil from previous day's silver blocks. B. Z. air did not exceed 2.59 x 10^{-12} uCi Am-241/ml air.

d. 10/18/67 - Plating and stripping foil prepared the previous day. B. Z. air concentrations noted as high as 11.7 x 10^{-12} uCi Am-241/ml air on this day.

e. 10/19/67 - [redacted] working at the welding hood preparing welds on previously prepared foil. B. Z. air did not exceed 1.75 x 10^{-12} uCi Am-241/ml air. Smears of the inside of the weld hood taken after the operation disclosed alpha activity on smears, measured with a PAC-3 portable alpha survey meter, of from 3500 to 2,200,000 cpm/100 cm^2.

f. 10/23/67 - [redacted] rolling three blocks and foil, 56.7 mCi and [redacted] performing second weld operations. B. Z. air did not exceed 8.3 x 10^{-13} uCi Am-241/ml air.

g. 10/24/67 - [redacted] rolling Am-241 foil and [redacted] decontaminating the press hood. [redacted] cleaning and testing completed foils. B. Z. air did not exceed 8.8 x 10^{-13} uCi Am-241/ml air.

h. 10/26/67 - [redacted] stripping and plating foil. B. Z. air did not exceed 7.98 x 10^{-12} uCi/ml air.

i. 10/27/67 - [redacted] plating foil and [redacted] weighing out 420 mCi Am-241 powder prior to compact operations. B. Z. concentrations for [redacted] were noted as 38.9 x 10^{-12} uCi Am-241/ml air during 427 minutes of work. [redacted] B. Z. sample showed 1 x 10^{-13} uCi Am-241/ml air. Each compact contained 73.6 mCi. Removable contamination surveys, made by monitoring paper wipes of inside of the compact glove box and the pass box using the PAC-3 survey meter, revealed the following:

Inside compact glove box	16,000*	50,000**
Inside pass box	200*	2,500**
Outside surface, compact glove box	background (50 dpm)	background (50 cpm)
Floor surface, around glove box	background (50 cpm)	background (50 cpm)

j. Direct physical gamma radiation levels were noted as being 50 mr/hr at the outside edge of the compact glove box, 300 mr/hr at 6" distance from the vial containing 736.4 mCi Am-241 oxide. The filter box into which the air from the glove box directly exhausts had surface radiation levels which ranged from 0.3 mr/hr prior to compact operations and rose to 0.8 mr/hr after operations. At the time of the inspection, on November 16, 1967, radiation levels at the surface of this filter box, as noted by the licensee and the inspector, were 10 mr/hr. Radiation levels outside the glove gauntlets of the glove ports where [redacted] had his hands during the compacting were noted as 140 mr/hr.

k. 10/28/67 - [redacted] cleaning and sintering compacts with gold overcoats. B. Z. air did not exceed 1.27 x 10^{-12} uCi Am-241/ml air.

l. 10/30/67 - [redacted] measured and cut Am-241 foil (89.7 mCi) into strips measuring 12" x 28" long. Radiation levels at contact on each strip were noted as 6 mr/hr. [redacted] decontaminating the Am-241 compact hood and removing waste. [redacted] then performing first rolling operations with 736.4 mCi Am-241. Radiation levels were 270 mr/hr at 6" distance from the compact.

m. The small rollers after rolling operations had removable alpha contamination on the rolls noted as 500 to 50,000 cpm by monitoring paper wipes with the PAC-3 survey meter. B. Z. air samples revealed concentrations no greater than 3.5 x 10^{-13} uCi Am-241/ml air.

---

* Before compacting (cpm alpha/100 cm^2)

** After compacting (cpm alpha/100 cm^2)

n. 10/31/67 - [redacted] cutting and trimming foils down to first stage size. Ten cuts were made and each contained 64 mCi. B. Z. concentrations did not exceed 1.22 x 10^{-12} uCi Am-241/ml air. Radiation levels of 4.0 mr/hr were noted in front of the first stage cutter hood.

o. 11/1/67 - [redacted] making first weld, second weld and third weld. [redacted] stripping six strips of Am-241 foil. Dose rate was 40 mr/hr at 1/4" from each foil. He later spent five hours decontaminating the Am-241 compact glove box. [redacted] as previously noted, by B. Z. air sampling, was exposed to concentrations of 116 x 10^{-12} uCi/ml air for 610 minutes. [redacted] B. Z. sampler revealed concentrations of 5 x 10^{-13} uCi Am-241/ml air.

p. 11/2/67 - [redacted] installed magnehelic gauges on the Am-241 exhaust duct. He swabbed and checked a 38" long piece of Am-241 foil. [redacted] plating, stamping and cutting Am-241 foil. [redacted] trimming and weighing compacts and making first welds and five second welds. B. Z. concentrations in the air did not exceed 2.4 x 10^{-13} uCi Am-241/ml air.

q. 11/3/67 - [redacted] making eleven second welds, 29 mCi/weld, and rolled and stripped one block, 300 mr/hr at 1/4" distance. B. Z. air concentrations did not exceed 7.37 x 10^{-13} uCi Am-241/ml air.

r. 11/6/67 - [redacted] making Am-241 compacts, by weighing out 252 mg AmO_2. Some trouble was noted in making compacts with the press hood and the Am-241 was noted to be evenly distributed inside the gold sandwich. [redacted] left the compact in the center of the press hood and ceased operations. Contamination inside the glove box was noted as 600,000 to 2,000,000 cpm/100 cm^2 by monitoring the paper wipes with a PAC-3 alpha survey meter. B. Z. air concentrations were noted not to exceed 3.6 x 10^{-13} uCi/ml air.

s. 11/7/67 - [redacted] rolling previously prepared foil. [redacted] placed the damaged compact into a vial surrounded by a plastic bag. The bag was placed in a sealed metal can (34.9 mCi). The press hood was cleaned after the damaged compact was removed and the following removable alpha contamination was noted by the same method as above:

floor of press hood	500,000 cpm/100 cm^2
side walls of press hood	38,000 cpm/100 cm^2
outside oven surface	80,000 cpm/100 cm^2
press plate	250,000 cpm/100 cm^2
inside Am glove box	600,000 cpm/100 cm^2
filter above glove box	1.8 mr/hr at surface

t. [redacted] then ground 728.1 mCi Am-241 oxide powder with gold. The filter box at the surface then had radiation levels of 2.8 mr/hr.

u. [redacted] then passed the mixture contained in a pressing die via the pass box to the press hood and then made another survey for removable alpha contamination.

v. inside surfaces of compact hood boxes	800,000 dpm/100 cm^2
inside compact hood	625,000 dpm/100 cm^2
airlock floor	750,000 dpm/100 cm^2

w. Outside the glove box and press hood only background (50 cpm) was noted.

x. B. Z. air concentrations did not exceed 4.7×10^{-13} uCi Am-241 per ml air.

y. 11/8/67 - [redacted] rolling Am-241 foil and making one compact. Trouble was again noted with Am powder spilling out one corner of the compact. Removable alpha contamination noted at follows:

floor of compact glove box	1,500,000 cpm/100 cm^2
side walls of compact box	2,000,000 cpm/100 cm^2
inside compact boxes	2,000,000 cpm/100 cm^2
pass box floor	50,000 cpm/100 cm^2

z. [redacted] rolling foil on large rollers and also doing stripping. The report also states that the compact was not brought out but left inside the press hood inside the can. B. Z. air on that date did not exceed 5.2×10^{-13} uCi Am-241/ml air.

a(1) 11/9/67 - Trouble with first rollers noted and the survey report states that these rollers are worn and will have to be replaced. A contamination survey was made and the following noted:

1st roller after cutting	300,000 cpm/100 cm^2
floor of cutter hood	4,000 cpm/100 cm^2
walls of cutter hood	70,000 cpm/100 cm^2
lever bar activating cutter	150,000 cpm/100 cm^2

a(2) [redacted] on this date, was scanning completed foil. [redacted] encountered difficulty in the first hot roll operation. [redacted] was gold plating completed foil. Maximum B. Z. air were noted as 2.99×10^{-12} uCi/ml air.

a(3) 11/11/67 - [redacted] was rolling and trimming and then cutting while performing second weld operations. [redacted] was performing general cleaning. Maximum B. Z. air concentrations were 1.7×10^{-13} uCi Am-241/ml air.

99. Stack discharges from the roof exhaust which removes air from the Am-241 processing room and a radium sieve glove box was evaluated, according to Burtsavage, daily from November 6, 1967 for five consecutive days. Maximum alpha activity discharged was reported to be 1.0×10^{-13} uCi/ml air, occurring on November 9, 1967.

100. Burtsavage reported that a Gelman isokinetic probe is inserted into the roof stack and draws air from the center of the stack into a Gelman filter paper located approximately one foot from the stack. He stated air was drawn through the probe at the rate of 2 cfm by a Gelman sampler, into glass fiber filter paper for 375 minutes each day and the alpha activity collected counted in an internal gas flow proportional counter 24 hours after collection to allow short lived alpha activity to decay.

101. He stated that no stack evaluations were made during decontamination or during the startup period from October 10, 1967 to November 6, 1967.

Personnel Monitoring

102. Burtsavage stated that weekly whole body film badges supplied and pro-

cessed by the Radiation Detection Company of Mountainview, California, were worn by all persons doing decontamination and processing. In addition, finger ring badges were worn on the middle finger of both hands underneath plastic gloves by the three persons involved in Am-241 processing only: [redacted].

103. Records of film badge exposures indicated that those persons also received the highest whole body exposures as follows:

[redacted]

	10/1 - 11/1	1/1 - 11/1	3rd cal. qtr. 1967
Whole body	20 mr	990 mr gamma 670 mrad β	140 mr gamma 560 mrad β
Right Hand	180 mr	6740 mr gamma 4080 mrad β	3535 mr gamma 1870 mrad β
Left Hand	290 mr	4425 mr gamma 2270 mrad β	3785 mr gamma 1185 mrad β

[redacted]

Whole Body	75 mr	2280 mr gamma	150 mr gamma
Right Hand	1260 mr	5020 mr gamma 7080 mrad β	270 mr gamma
Left Hand	350 mr	5390 mr gamma 5540 mrad β	430 mr gamma

[redacted]

Whole Body	70 mr	1185 mr gamma	1115 mr gamma
Right Hand	540 mr	9940 mr gamma 2520 mrad β	4800 mr gamma
Left Hand	365 mr	17935 mr gamma 1640 mrad β	6290 mr gamma

104. The maximum whole body gamma exposure for any work week for those performing decontamination was noted not to exceed 50 mrem. The maximum third calendar quarter year 1967 whole body exposures to other than the above engaged in decontamination was noted not to exceed.

105. Burtsavage stated that currently processing of the Am appears to give a gamma exposure to fingers of approximately 1 rem/week as noted by the ring badge.

106. [redacted] who now performs most of the Am-241 processing, received, during the period of October 30 to November 4, 1967, a gamma exposure to his right middle fingers of 1190 mrem as noted by the ring badge. The items of noncompliance observed during our last previous inspection of May 15 - 19, 1967, and June 12, 1967, were reviewed with Burtsavage. Each item reported in CO:HQ Enforcement letter of July 20, 1967 , the licensee's response of August 15, 1967 and the current was noted to be as follows:

License Number 37-30-2

Item 1

Contrary to 10 CFR 20.201(b), "Surveys", surveys were inadequate to determine compliance with 10 CFR 20.106 with respect to:

a. The airborne concentrations of dry tritium released via stacks to unrestricted areas from the Tritium Building during foil preparation; and

b. The airborne concentrations of tritium released via stacks to unrestricted areas from the Tritium Gas Fill Facility. In this regard, insufficient samples were taken to adequately determine the quantities of tritium released.

Based on the evaluations that have been made, of the concentrations of tritium released from the Tritium Building and from the Tritium Gas Fill Facility to unrestricted areas, it appears that you may have exceeded the limits specified in 10 CFR 20.106(a), when averaged over a one year period.

Licensee's Response

"1.a. and 1.b.

107. As a result of our conference with members of the Compliance Division, it appears that, quite possibly, surveys were inadequate to determine compliance with respect to airborne concentrations of tritium released to unrestricted areas.

108. Because of the limited number of trained Health Physics personnel and limited amount of equipment, we made the maximum number of surveys possible, attempted to evaluate on the basis of both operating and non-operating periods and felt, prior to our recent meetings with the Compliance Division, that these evaluations were adequate.

109. Corrective action, we believe, involves a simultaneous two-way approach --- first, detection and correction of sources of possible tritium loss and, second, augmentation and further training of our Health Physics staff, as well as making available sufficient equipment to permit more frequent and continuous checks.

110. Additional equipment has been authorized and is being ordered. A program for retraining existing Health Physics personnel has been instituted. A change in job description for Health Physics personnel is being negotiated with our union. This ~~should~~ would permit us to recruit more qualified people for the new openings we have in the present program to increase health physics staff.

The target date for the implementation of the above is December 1, 1967.

111. For immediate further corrective action, the following steps are planned:

a. A survey of stacks referenced in 1.a. and 1.b. for five consecutive periods of time during which tritium foil preparation is occurring in the tritium building, and gas filling operations are being done in the filling facility. We will also include measurements during inoperative periods.

b. If evaluation indicates no excessive discharges during these surveys, further surveys will be done at approximate three month intervals.

c. If evaluation indicates excessive discharges, surveys will be repeated in a consecutive manner as an aid to the determination of cause and correction, and to determine the quantities of tritium released.

112. The two applicable stacks will be considered as priority with respect to planned expansion and the estimated date of full compliance is set at November 1, 1967."

Current Status

Item 1.a.

113. Burtsavage stated that he has not, to the date of the inspection, made any evaluations or surveys to determine the concentrations of tritium gas released to unrestricted environs from the Tritium Building during the incorporation of tritium gas on metallic foil. He stated he had not been sufficient time or equipment to perform the required survey. This item of noncompliance was uncorrected.

114. In addition, Burtsavage stated that he has not made any surveys since May 25, 1967, of any stack releases from the Tritium Building. Other activities occur in this building such as the incorporation of phosphor paint into tritiated resin several days weekly. In addition, [redacted] who incorporates tritium into metallic foil, also once or twice yearly handles a special order involving the incorporation of 500 to 1000 Ci H3 gas onto metallic foil. Burtsavage stated these stack releases from these process operations have not been evaluated.

Item 1.b.

115. Burtsavage stated he took one series of stack samples on May 25 and May 26, 1967, and noted releases of 35 times the MPC of 2 x 10^{-7} uCi/ml air for HTO released from the Gas Fill facility for 24 hours. This was reported in the licensee's letter to CO:HQ dated September 13, 1967. Burtsavage stated this was due to normal processing during filling of glass phosphor tubes with 0.4 Ci H-3 gas each.

116. He stated he made only one other evaluation for stack discharge on two consecutive days. On September 28, 1967, when 31 tubes each containing 0.4 Ci H-3 gas were filled, HTO concentrations exceeded MPC by a concentration of 2 x 10^{-7} uCi/ml air by a factor of 54.77; and on September 29, 1967, during filling of 63 tubes each with 0.4 Ci concentrations averaged over 43.48 times 2 x 10^{-7} uCi/ml air. Burtsavage stated he made no other evaluations of discharges from the stack servicing the Gas Fill Facility but that these concentrations occur daily and result from normal processing.

117. Dr. J. G. MacHutchin stated that a research project was started to reduce the concentrations of HTO discharged from the Gas Fill Stack. As a result of this research to date, several corrective factors have been initiated as follows:

a. Leaking tubes will be placed in the near future in copper tubes with the ends crimped. He stated that the copper oxide is able to absorb any tritium released from the tube.

b. Ends of the tubes filled with tritium, which are cut off after each gas fill run, formerly were placed in a metal can and left inside the Gas Fill Hood. MacHutchin stated that it was determined that these ends were a major contributor to stack concentrations and that they were now being placed in a sealed can and removed from the hood daily and placed in waste.

c. Heating of the uranium resevoirs, as reported during the last

inspection, is no longer done with an acetylene torch. An electric heating envelope is placed around the uranium H-3 reservoir and heat is applied until a flow of H-3 gas is noted on the gas fill apparatus.

d. Two similar systems have been installed on both ends of the gas fill system at the exahust lines of both pumps. The systems consist of copper coils and a tube filled with Drierite crystals, to absorb HOT. MacHutchin stated that H-3 absorbs on copper replacing the oxygen. Any water generated is then absorbed into the Drierite crystals which change color from blue to pink when saturated. Air is passed through the copper coils to regenerate copper oxide. See Exhibit "D" for a copy of the report dated October 27, 1967, which MacHutchin stated he made to the Institute Isotopes Committee. The report shows that with the scrubbers installed, and with the leakers removed, the stack concentrations still exceed MPC by a factor of 7 for HTO during the time when no filling operations are in progress and 12 times MPC during tube filling operations. MacHutchin stated further work is needed to reduce these concentrations. Both scrubbers on the Gas Fill System were experimental units made by Cowan. MacHutchin stated that a Picker Tritium Scrubber unit (copper oxide) has been installed on the exhaust pump of the Tritium Foil Hood in the Tritium Building, but no evaluation as to its effectiveness had been made to the date of the inspection. MacHutchin stated that five other hoods in the Tritium Building also exhaust their effluent to the one stack of the Tritium Building and no corrective action has been considered to date for the releases from these hoods during tritium phosphor paint preparation.

118. An additional facility where H-3 gas is used was noted during this inspection and does not involve the current status of a previously determined noncompliance item. Burtsavage stated that tritium gas is incorporated into plastic resin at least once weekly in the first step in making tritiated phosphor paint. He stated this is done in Lab #4 in the Main Building Laboratory directly across the corridor from the Gas Fill Laboratory. He stated that from 100 to 200 Ci of H-3 gas is incorporated weekly and the tritiated resin is then brought over to the Tritium Building for phosphor paint incorporation. He also stated that he has not made any evaluations or surveys of the concentrations released from this Laboratory #4 for a period of approximately two years. He added that this tritium gas incorporation operation was also a source of release of concentrations of HTO in excess of 2 x 10^{-7} uCi/ml air by factors of 25 to 50 times for daily releases on processing days.

119. MacHutchin stated that he was aware of the problems in this laboratory as well, and that a Picker H-3 scrubber has been ordered for the pump exhaust in the H-3 Resin Incorporator Hood but that it was not installed at the date of this inspection.

120. MacHutchin stated that while the scrubbers will reduce concentrations at individual sources of release within the various H-3 processing systems, they may not be able to reduce concentrations of H-3 exhausted to the stack to a point where compliance with 10 CFR 20.106 will be achieved. He stated that after the scrubbers have been installed, they will do further study and evaluation.

Item 1.b.

121. Item 1.b. has been corrected as far as evaluations for stack concentrations from the Tritium Gas Fill Facility are concerned. They are in noncompliance, however, for failing to perform adequate evaluations of H-3 releases from the Tritium Building and from the Tritium Resin Laboratory.

122. It also appears that concentrations of H-3 released from the Tritium Resin Laboratory exceed MPC, according to surveys made by Burtsavage prior to the inspection. In addition, concentrations released from the Gas Fill Facility exceed MPC, according to surveys made by Burtsavage prior to May 1967 and some 20 independent surveys made by MacHutchin thereafter. Concentrations of H-3 released from the Tritium Building have exceeded MPC, according to surveys made by Burtsavage prior to May 1967. The releases all exceed the MPC of 2×10^{-7} uCi HTO/ml air when averaged over one year. See paragraphs 13, 15, 16 and 25 of the CO:I Form 417 report dated June 23, 1967, and paragraphs 23 and 33 of CO:I Form 592 dated January 9-12,1967.

123. The Institute Isotopes Committee met on September 13, 1967 to discuss the items of noncompliance noted during the previous inspection. The results of the meeting were maintained and comments as to noncompliance Items 1.a and 1.b above were included as follows: Training and program not finalized to date, personnel, ~~cannot~~ CANNOT be spared from duties. No new personnel were added due to union problems. Sampling of the stacks in question by November 1, 1967 will depend on the availability of personnel and the situation in the Am-241 laboratory.

124. A copy of the above minutes included as Exhibit "D" wwere sent to Vaughn, Umpstead, MacHutchin and Burtsavage. The report states further discussion will be held on October 4, 1967. The minutes of the October 4, 1967 meeting were noted to contain no discussion of the items of noncompliance.

Item 2

125. Contrary to 10 CFR 20.201(b), "Surveys", surveys were inadequate to determine compliance with 10 CFR 20.103, with respect to:

a. the airborne concentrations of Ra-226, Po-210, Am-241 to which employees were exposed while working in the Ra-Am Laboratory, and

b. the airborne concentrations of tritium to which employees were exposed while working in the Tritium Building and the Tritium Gas Fill facility.

126. It is noted that insufficient samples were taken to determine whether individuals working with H-3, Ra-226, Po-210 and Am-241 were exposed to concentrations in excess of AEC limits for 40 hours exposure in a period of seven consecutive days.

Licensee's Reported Corrective Action

"2.a.

127. We have been in noncompliance in this area.

128. "Frankly, there is no legitimate reason for noncompliance, except perhaps a false impression which has since been corrected, that powder handling operations were confined to dry boxes and hoods, and that airborne concentrations, were therefore, negligible.

129. For corrective action, the following steps are planned:

a. Concentrations of long-lived alpha radioactive material will be considered as those of the most toxic isotope concerned: Americium-241. This critical MPC will apply to all operations done in the radium-americium laboratory.

1. Decontamination to eliminate removable particulate material from walls, floors, ducts, work areas and equipment has been done. Rules requiring immediate cleanup of work areas has been established and periodic general cleanup procedures have been set up.

2. Personnel performing operations in this area will, in the future, be required to wear respirators and portable air samplers at all times when performing dry powder operations and initially in all subsequent operations also, until it can be established whether such equipment is or is not required in such subsequent operations.

3. General room surveys of airborne concentrations will be made during five consecutive processing operations or phases or processing operations.

4. If surveys indicate satisfactor concentration levels, further surveys will be done at approximately three month intervals.

5. If surveys do not indicate satisfactory concentration levels, surveys will be repeated consecutively to determine cause and correction of excessive levels.

130. Compliance will be achieved immediately upon reopening of this facility.

2.b.

131. We have been in noncompliance in this area.

132. Our reason for noncompliance: insufficient time, personnel and equipment.

133. Please see 1.2. and 1.b. for steps which have been taken with respect to addition personnel, equipment and training. The following program has been established;

Personnel working in the tritium building and tritium gas fill facility will be breathing zone air sampled during five consecutive sessions of processing operations.

1. If surveys indicate satisfactory concentration levels, further surveys will be done at approximately three month intervals.

2. If surveys do not indicate satisfactory concentration levels, surveys will be repeated consequtively to determine cause and correction of excessive levels.

134. Program willbe initiated immediately. Completion date will dpend on out-

come of tests and what, if any, corrective action is necessary with respect to equipment or process changes.

Current Status - 2.a.

135. The use of Ra-226 and Po-210 to make foils has been halted, according to MacHutchin. He stated that the radium compact box has been eliminated and disposed of to waste. He also stated they would not process Po-210 in the same equipment used to process Am-241. The only current use of Ra, which is received as prepared radium phosphor paint from Radium Chemical, Amersham, England, is to strain and sieve the paint. This is done in a separate ventilated glove box located in a room directly off the new Americium Laboratory.

136. As noted in paragraphs 33-74, employees were continuously monitored to determine air concentrations in their breathing zones during decontamination and now during processing of Am-241.

137. Burtsavage stated and the inspector noted that personnel were wearing Mighty Mite battery operated breathing zone samplers. He stated that they are equipped with eight such samplers. Should samplers be inoperative, Burtsavage stated he uses a Gelman air sampler to draw air through a filter paper holder placed directly under an operator's nose area. Item 2(a) appears to have been corrected.

Current Status - 2.b.

138. Survey records indicate, and Burtsavage stated that he has taken breathing zone sampling during five consecutive processing sessions in the Tritium Gas Fill Facility but not in the Tritium Building. He stated he had neither the personnel nor the time and equipment available to do the required surveys. In addition, also not a part of current status of previous noncompliance item, Burtsavage stated he has not performed breathing zone sampling in the Tritium Resin Laboratory.

139. B. Z. sampling, according to surveys and records, were performed of [redacted] on September 15, 16, 19, 20, and 21 for five consecutive processing days.

140. A filter paper sample holder was attached to [redacted] lab coat, in his nasal region and surrounding air was drawn through a water impinger, drying agent and into a Carey vibrating Reed Electrometer by means of a Gelman water impinger. The recorded results are as follows:

9/15/67	Filling 65 glass tubes with 4 Ci H-3 for 320 mins. 5.04×10^{-6} uCi H3 gas/ml air 7.50×10^{-7} uCi H3 sol/ml air 1.10×10^{-9} uCi particulate/ml air
9/16/67	Filling 52 tubes with 4Ci H3 gas in each for 196 minutes 2.00×10^{-6} uCi H-3/ml air 6.57×10^{-7} uCi H-3 sol/ml air 6.23×10^{-9} uCi particulate/ml air
9/19/67	Filling 73 tubes with 4 Ci H-3 for 301 minutes 12.8×10^{-6} uCi H-3 gas/ml air 9.50×10^{-7} uCi H-3 sol/ml air 1.12×10^{-11} uCi particulate/ml air
9/20/67	Filling 50 glass tubes with 0.4 uCi H-3 for 224 mins. 3.00×10^{-6} uCi H-3 gas/ml air 6.06×10^{-7} uCi H-3 sol/ml air 1.75×10^{-9} uCi particulate/ml air
9/22/67	Filling 66 glass tubes with 0.4 Ci H-3 gas for 343 mins.

2.2×10^{-6} uCi H-3/ml air
1.26×10^{-6} uCi H-3 sol/ml air
9.53×10^{-10} uCi particulate/ml air

141. Burtsavage stated and records reflect that the above is a typical 40-hour work week operatinn in the Gas Fill Laboratory.

142. Burtsavage stated that in addition to not determining the 40-hour work week exposure to concentrations of radionuclides in air in the Tritium Building, he has not made surveys or similar determinations in the Tritium Resin Laboratory.

143. The licensee has only in part corrected this item of noncompliance with respect to evaluations made in the Tritium Gas Fill Facility. He is in continued noncompliance with respect to lack of evaluations in the Tritium Building. In addition, the licensee is in noncompliance for lack of evaluation of airborne concentrations in the Tritium Resin Laboratory.

Item 3

144. Contrary to 10 CFR 20.103(a), "Exposure of individuals to concentrations of radioactive material in restricted areas," several individuals were exposed to airborne concentrations of americium 241, radium 226, radon 222 and polonium 210 in the Radium-Americium Laboratory in excess of the limits specified in Table I, Column 1, Appendix B, of 10 CFR 20, when averaged over a period of seven consecutive days, for the weeks of May 25, 1967 and June 5, 1967.

Licensee's Reported Corrective Action

145. "Individuals were exposed to long-lived alpha concentrations in the radium-americium laboratory in excess of permissible limits.

146. Please see 2.a. for reason for noncompliance.

147. Several processing operations, normally considered to be noncontributory from the dust or particulate matter standpoint, were conducted on open work tables and checking for airborne matter was not considered necessary.

148. For corrective action:

a. Respirators and portable air samples will be employed in the future, as outlined under 2.a.

b. The operations contributing to the excessive exposures will be performed in ventilated hoods or enclosures. At the moment all operations in this laboratory are at a standstill and an extensive cleanup and decontamination program is in progress. Upon resumption of activities, estimated at September 15, 1967, evaluations of airborne concentrations met with during operations will be performed during five consecutive periods of operations.

1. If evaluation indicates excessive concentrations, surveys will be consecutively continued until the immediate cause of the excess is determined and the condition corrected.

2. If evaluation indicates that the concentrations are satisfactory, additional surveys will be performed at approximate three month intervals.

149. Because of difficulty of qualitative and quantitative differentiation of the alpha particles concerned and inability to pro-rate the relative concentrations to americium-241, radium-226, radon-222 and polonium-210, airborne concentrations of alpha will be considered as concentrations of americium-241, the MPC for which is the most critical. This procedure of using the most critical MPC is now in force and will remain effective in those facilities where two or more alpha emitters have been processed.

150. Full compliance effective with reopening date of laboratory."

Current Status

151. As noted in paragraphs 25, 27 thru 74 of the report details, there were 28 unreported cases of 40-hour work week overexposures to concentrations of Am-241, Ra-226, Rn-222 and Po-210 during the decontamination effort and two cases of 40-hour work week overexposures to concentrations of Am-241 after 10/16/67 when processing of Am-241 started.

152. It was noted from survey records that cleanup of the Am-241 laboratory is now continuous and that all processing employees wear half face masks and portable breathing zone samplers.

153. It was noted that all operations are not in ventilated hoods. The large rollers are not enclosed and the second cutting operation is still done on an open table top. MacHutchin stated that it is apparent to him that all "meat" (active material) is not contained in the center of the compact and that when cuts are made to separate the meat from inactive portion of the gold coated compacts, some radioactive material is released. He stated cutting and slicing operations have to be studied further.

154. It was also noted that, since the last inspection, in addition to slicing and cutting operations, decontamination of the compact glove box, press box and press hood produces excessive airborne concentrations. See paragraphs 74 and 98 of the report details. MacHutchin stated procedures would have to be developed for these operations as well.

155. It was noted that, since the last inspection, the licensee does use the least restrictive limit, that for Am-241 (sol) in air for all evaluations of airborne concentrations in the Am-241 laboratory.

156. The licensee has continued in noncompliance by continuously exposing personnel in the restricted Am-241 laboratory to concentrations in air which exceed the limits expressed in Appendix B, Table I, Column I, of 10 CFR 20.

Item 4

157. Contrary to 10 CFR 20.201(b), "Surveys," surveys were inadequate to note the presence of Am-241, Po-210, Ra-226 contamination on surfaces in the Radium-Americium Laboratory and on the person and clothing of employees working in the area. We note that the instrumentation used in conducting contamination surveys was not adequate to detect alpha contamination existing in the laboratory and on the clothing of persons working therein.

Licensee's Reported Corrective Action

158. "Contamination surveys in the radium-americium laboratory for alpha contamination on surfaces appear to have been inadequate and unreliable.

159. Thin window instruments were modified to protect the thin windows but recalibration, to correct for added absorber and lower sensitivity was overlooked. Instruments, originally acquired to be used as portable equipment, were gradually appropriated for use as "fixed" location or checkout devices and replacement was also overlooked.

160. For corrective action, one alpha survey meter and one alpha monitor have been purchased and are being utilized now.

161. For further corrective action, an additional alpha survey meter and an additional alpha monitor are in process of purchase, and delivery promised by September 7, 1967. In supplement to the four instruments mentioned, two more alpha monitors and one more alpha survey meter are to be purchased with a tentative delivery date of October 1, 1967. In explanation of the instrumention, that called a survey meter is a more portable battery powered instrument whereas that called a monitor is line operated. Otherwise, both are identical with respect to function and efficiency.

162. "Present acquisition program should be complete by October 1, 1967. If further instrumentation is required, it will be purchased as soon as its need becomes obvious."

Current Status

163. The inspector, on November 16, 1967, noted that there were two PAC-3 survey meters, one a gas-flow and the other a scintillation detector for use inside the Americium Laboratory when conducting necessary surveys to detect removable and fixed contamination as well as to monitor personnel within the Laboratory. In addition, at the step-off area from the Laboratory prior to leaving the contaminated side, the inspector noted an Eberline alpha scintillation detector with a remote probe was available for persons to monitor themselves and their clothing prior to exiting to the clean side of the step-off area.

164. The inspector noted also that since processing has resumed, smear surveys are being made and the results recorded. These records indicate that since cleanup, little or no removable contamination exists in the Am-241 Laboratory, except as has been noted in paragraphs 96 (e), (i), (s), (v) (y) and 186. The records also indicate that persons do monitor themselves prior to leaving the restricted laboratory. This item of noncompliance has been corrected.

Item 5

165. The commission was not notified within 24 hours by telephone and telegraph of an incident which involved the release of gaseous and soluble tritium on February 9 and 10, 1967, in concentrations which, when averaged over a period of 24 hours, exceeded 500 times the limit specified for such materials in Appendix B, Table II of 10 CFR 20, contrary to 10 CFR 20.403(b) "Notification of Incidents".

Licensee's Reported Corrective Action

166. "We believe the incident reported by the inspection team refers to an inventory discrepancy and that, under the circumstances, no reportable incident occurred.

167. The Commission was not notified of the alleged incident of February 9 and 10, 1967, by telephone and telegraph within 24 hours, because the reported tritium loss was not considered as a real loss and, if it were a real loss the form of tritium discharged would have been H-3 (sub) rather than H-3 (s), for all practical purposes. As H-3 (sub), the concentrations per 24 hours did not exceed MPC by 500 times. The presumed loss was predicated on a negative inventory check made for one day at that time. The inventory checks which are made to the best of our ability, preliminary to gas filling operations, have varied by as much as a plus 203 curies to a minus 139 curies. Since January 1, 1967, 68 such inventory checks have been made with average apparent inventory differences of plus 56 curies to minus 41 curies, and the algebraic sum for seven months indicates an inventory excess of 22 curies. This method of inventory checking was intended to show that no excessive concentrations of H-3 (sub) were lost upstack after averaging physical inventories such as these over the period of a year.

168. Source filling and inventory checks are gas pressure differential checks, vary appreciably and over extended periods usually average out to book inventories reasonably accurately.

169. For corrective action the planned stack sampling program mentioned previously should show if negative changes in inventory are actually the result of real gas losses. If so, further investigations will be conducted with a view to determining the sources of loss and to eliminating same."

Current Status

170. It was noted that the licensee's reply was in effect a denial that any item of noncompliance existed. He (Dr. MacHutchin) stated that he wrote the reply without going into the facts. He stated he had thought CO:I made the citation merely on the basis of an inventory loss. The records of the loss were produced for inspection by MacHutchin and he noted as reported that an incident occurred in which several valves and connections in the Tritium Gas Fill System had leaked badly on February 8, 1967, and that a TSM tritium monitor, when the intake hose was placed over one of the leaking valves, had gone off scale on the 100 times scale. MacHutchin then stated that since no stack monitoring had been done on February 8 and 9, 1967, and since several leaking valves and connections, it was proper to note the inventory loss, and assume that this amount had been exhausted. He also examined past stack effluent evaluations made by Burtsavage and stated it appeared that of the total H-3 effluent, a possible 25 to 33% was HTO.

171. The inspector noted no other accidental releases since the date of inspection which required notification.

Item 6

172. Survey data indicated that surfaces throughout your plant contaminated with radioactive material exceeded the contamination limits specified in your letter dated April 28, 1961, and your Standard Operating Procedures 27, contrary to License Condition No. 18, which incorporates the referenced documents.

Licensee's Reported Corrective Action

173. "Surfaces at various locations throughout the plant do show contamination levels in excess of those specified in the various cited documents.

174. Excessive contamination levels are due to a number of reasons, of which we feel the following are typical and probably most important:

a. Various desks, files, chairs, cabinets and other equipment were moved to our Bloomsburg Plant from our New York laboratories, plants and offices, where this equipment was used during World War II and, doubtless, exposed to radioactive materials in the form of radium self-luminous compounds, radon gas, etc.

b. In some instances, offices, conference rooms, and other non-production areas, a degree of contamination exists as the result of bring to these areas treated parts, such as luminous dials and other radioactively treated parts for inspection by supervisory personnel.

c. Some contamination is, doubtless, the result of tracking from one area to another of small amounts of contamination on the person or clothing of personnel who have failed to clean up properly before leaving an active work area.

d. In some areas a degree of contamination is probably due to dissemination of H-3 gas or radon.

175. As corrective measures, the following steps are being taken:

a. Checking, identification and cleanup or disposal of excessively contaminated equipment known to have been transferred from our New York operations.

b. Establishment of new rules for transfer of samples, prototypes, pre-production runs, etc. requiring supervisory personnel to visit the work area for inspection activities rather than having such materials transported to offices, etc.

c. New equipment, procedures and rules relative to personnel checkout from active work areas.

d. A study of sources of tritium and radon gas losses and a reduction of same.

176. The above program is in progress at present and will be a continuous program of checking."

Current Status

177. The inspector noted and records reflect the disposal of contaminated desks, tables and chairs to waste. MacHutchin stated new transfer rules promulgated prohibit the bringing of phototypes or tritiated dials and parts into unrestricted areas.

178. As to new equipment, procedures and rules relative to personnel checkout from active work areas, MacHutchin stated and Burtsavage confirmed that new equipment procedures and rules apply only to the Americium facility and not for areas processing tritium. It was noted that no new equipment, rules or procedure changes were formulated to reduce contamination within tritium areas.

179. Burtsavage stated that the H.P. group takes weekly smears of processing areas and biweekly smears of adjacent restricted areas. The smear survey record indicates that 57 such smears are taken weekly and evaluated in an Eberline internal gas flow proportional counter using 2% efficiency for tritium and 50% efficiency for alpha.

180. The removable contamination limits are specified in the licensee's Procedures, (SOP-27), revised August 8, 1967, as well in a document entitled "Committee Review" dated April 28, 1961. These procedures are included as part of License Condition 18. The limits are given on page 13 of SOP-27 and indicate that contamination limits for restricted areas are as follows:

a. Interior Surfaces of Open Process Boxes and Hoods

alpha emitters	10 cpm/cm^2	equivalent to 2000 dpm/100 cm^2
Sr-90	10 cpm/cm^2	" " 2000 dpm/100 cm^2
tritium	40 cpm/cm^2	" " 200,000 dpm/100 cm^2
other Beta-gamma emitters	50 cpm/cm^2	Not Known

b. All other easily accessible surfaces

alpha emitters	1 cpm/cm^2	equivalent to 200 dpm/100 cm^2
Sr-90	1 cpm/cm^2	" " 200 dpm/100 cm^2
tritium	10 cpm/cm^2	" " 50,000 dpm/100 cm^2
other Beta-gamma emitters	20 cpm/cm^2	Not Known

c. Protective Clothing, Gloves, Footwear

No detectable contamination except tritium - 2 cpm/cm^2 or 10,000 dpm/100 cm^2/ It was noted that nowhere on the licensee's procures are limits set for unrestricted areas.

181. In a typical survey on November 6, 1967, of the Gas Fill Facility, the following activity attributed to tritium was noted:

In corridor outside double door entrance - 23,000 dpm/100 cm^2 (Restricted Accessible Surface)

Table surface in laboratory - 5,000 to 11,000 dpm/100 cm^2 (Restricted Accessible Surface)

On October 19, 1967, the TSM-91A tritium monitor was noted to have surface removable contamination of 740,000 dpm/100 cm^2. A smear of the outside of the uranium storage pots had removable activity noted as 5,000,000 dpm/100 cm^2. (Both restricted accessible surfaces.)

182. In Lab #4, Tritium Resin Laboratory, the removable contamination had been noted as:

Cabinet surface - 3000 dpm/100 cm^2 (Restricted Accessible Surfaces)

Floor area surface - 16000 dpm/100 cm^2 (Restricted Accessible Surfaces)

183. As noted by weekly surveys, the floor surfaces in the Tritium Resin Laboratory appear to always have contamination ranging from 16,000 to 19,000 dpm/100 cm^2. On September 1, 1967, 30,000 dpm/100 cm^2 was noted on floor surfaces.

184. In restricted Lab #2, where Ni-63 plating is performed and where H-3 manufactured sources are stored, the licensee always reports removable contamination as being H-3 without any evaluation as to the extent Ni-63 is present. Removable contamination on the floors in Lab #2, as determined by weekly surveys, has been continuously reported as H-3 contamination ranging from 3000 to 20,000 dpm/100 cm^2.

185. In the Main Building, one laboratory is devoted to filling tubes with Kr-85 gas. Burtsavage stated that although H-3 is not used in this room, he has reported the removable activity as H-3 contamination ranging from 4000 to 23000 dpm/100 cm^2. Burtsavage stated he has never made any evaluation as to the extent that Ni-63 or Kr-85 contributes to the contamination in Lab #2 and the Kr-85 laboratory.

186. In the Tritium Building removable contamination appears continuously present on floors and other surfaces. On September 7, 1967, 100,000 dpm/100 cm^2 contamination was noted on a smear of sink handles in this laboratory. Removable floor contamination in weekly surveys ranges from 4000 to 21,000 dpm/100 cm^2 H-3.

187. In the Americium Laboratory, smear surveys after decontamination on floor surfaces show that the floor around the large rollers have 200 dpm/100 cm^2 on October 31, 1967. The floor around the cutting hood had 100 dpm/100 cm^2 on October 19, 1967, and the floor on the clean step-off area of the lab, had removable alpha contamination of 4000 dpm/100 cm^2 on October 11, 1967.

188. The inspector made smear surveys of floor areas on November 16, 1967, in the Americium Laboratory which were evaluated by HASL, NYOO. Maximum activity on floors was 8 dpm/100 cm^2. A smear of the surface of a metal stand which supports the large rollers, revealed 41 dpm/100 cm^2.

189. The results of smear surveys taken by the licensee in unrestricted areas of the main building were noted as:

R&D Utility Room - November 3, 1967
- Table I - 40,000 dpm H-3/100 cm^2
- Table II - 30,000 dpm H-3/100 cm^2
- Table II - legs - 5000 to 150,000 dpm H-3/100 cm^2

Water Fountain Outside Conference Room

- 3000 dpm H-3/100 cm^2

H.P. Office - November 6, 1967

- 7000 dpm H-3/100 cm^2
- Surface of C. Berlin's desk - 12000 dpm H-3/100 cm^2
- Center shelf surface of book case - 3000 dpm H-3/100 cm^2
- Floor - center of room - 6000 to 7000 dpm H-3/100 cm^2

Machine Shop - October 2, 1967

- Center of packing table - 3000 dpm H-3/100 cm^2
- Center of floor area - 1500 dpm H-3/100 cm^2

190. Burtsavage stated that filter paper smears have only been evaluated for H-3 contamination in the unrestricted areas in spite of the fact that other alpha and beta-gamma emitters were and are being used.

191. It was noted that the licensee has exceeded the above limits in the Americium Facility for removable alpha contamination in and around open cutting hoods, and currently exceeds limits for removable H-3 contamination in the Tritium Building and on articles in the Gas Fill Hood which is an open-type hood. See paragraphs 98(1), (m), (r), (u), (v), (w), (y) and (a)(1); and 181, 182, 186, and 187 of details.)

Items of Noncompliance Noted During Last Previous Inspection - License No. 37-30-7

Item 7

192. Contrary to 10 CFR 20.103(a),"Exposure of individuals to concentrations of radioactive materials in restricted areas" several individuals engaged in radium dial screening operations and tritium dial application work during the week of 2/2/67, in the Ra-226 Screen Facility and the Tritium Paint Facility, were exposed to airborne concentrations of Rn-222 in excess of the limits specified in Table I, Column I, Appendix B of 10 CFR 20, when averaged over a period of seven consecutive days.

Licensee's Reported Corrective Action

193. "Assuming that this was a reportable incident, we are, of course then in violation".

194. "This was not recognized as a reportable incident at the time, since it involved radon and not one of the isotopes covered by A.E.C. regulations. Radon and radium exposures have, for many years, been handled by internal procedures, which involve radon breath analysis and removal of the operator from the particular operation until repeat analysis indicates less than MPC".

195. "The incident was reported to both the A.E.C. and employees on June 19, 1967".

196. "Future incidents of this nature will be reported as required and the requirement is effective as of now".

Current Status

197. The excessive radon concentrations noted above occurred in a facility used to apply radium phosphor paint to watch and other dial surfaces by a silk screen process. The paint was manually applied to the silk screen. H. Vaughn stated on 10/2/67, all operations ceased in this facility because they could not possibly operate in a safe manner. MacHutchin stated the facility was highly contaminated. It was also noted by the inspector on 11/15/67 that at 18" from one wall of the Gas Fill Laboratory, radiation levels were 1 - 1.5 mr/hr. On the other side of the wall is located the Radium Screen Facility. MacHutchin stated this was due to the radium contamination existing inside the closed Radium Screen Facility. He stated that shutting the doors of the Radium Facility on 10/2/67 caused a reversal of air flow in the Gas Fill Facility. Air from this Facility was noted by MacHutchin and the inspector to be exhausting to the hallway entrance with considerable velocity. MacHutchin stated that this would have to be corrected.

198. Burtsavage stated he made only one series of evaluations of Rn-222 concentrations in air in the radium screening room since the last inspection. He also stated that several people in the radium room also worked with tritium and americium.

199. Burtsavage stated he had acquired a Johnson Labs Radon spot check air monitor equipped with a quartz counting chamber in September 1967, but never used it due to lack of personnel.

200. He stated that Eberline Radon Film Badges were used only during the week of 7/17/67. The results reported by Eberline and the resultant Rn-222 concentrations are as follows:

Name	Hours worked	Eberline report	Concentration	Factor X MPC*
[redacted]	46	4.0 $\frac{pci\ hrs}{cc}$	.087 $\frac{pci}{cc}$ or 8.7×10^{-8} $\frac{uc}{cc}$	1.11
[redacted]	49	4.8 "	.098 $\frac{pci}{cc}$ 9.8×10^{-8} $\frac{uc}{cc}$	1.21
[redacted]	40	14.7 "	.370 $\frac{pci}{cc}$ 3.7×10^{-7} $\frac{uc}{cc}$	3.70
[redacted]	52	1.6 "	.031 $\frac{pci}{cc}$ 3.1×10^{-8} $\frac{uc}{cc}$	------
[redacted]	41	1.6 "	.039 $\frac{pci}{cc}$ 3.9×10^{-8} $\frac{uc}{cc}$	------
[redacted]	47	2.6 "	.055 $\frac{pci}{cc}$ 5.5×10^{-8} $\frac{uc}{cc}$	------
Control	48	-------	----------	------

*1×10^{-7} uc/ml air for a 40-hour work week.

201. Burtsavage stated that [redacted] was a janitor who worked in the radium, tritium and americium facilities that week. [redacted] worked in both the radium and americium facilities and [redacted] worked in both the radium and tritium facilities.

202. These overexposures were reported in licensee's letter to CO:HQ on 10/16/67. Burtsavage received the report on 9/18/67 from Eberline.

203. He also stated that radon breath analysis samples were taken on 10/10/67. The radon in expired breath was measured by Dr. Alphonse Weber who reported the results in pci Rn ^{222}/liter expired breath. Weber in his report stated that 1.0 pci Rn ^{222}/liter expired breath is evidence of a burden of 0.1 ugm Ra ^{226} in the whole body.

204. The results of the radon breath analyses were reported as follows:

[redacted] - 0.47 pci Rn ^{222}/liter breath

[redacted] - 0.70

[redacted] - 0.71

[redacted] - 0.77

205. This item of noncompliance is uncorrected.

Item 8

206. The exposures referred to in Item 7 above, were not reported to the Commission as required by 10 CFR 20.405(a), also the exposed individuals were not informed in writing of the nature and extent of other exposures as required by 10 CFR 20.405(b).

Licensee's Reported Corrective Action

207. See paragraphs 193 - 196 corrective action for Item 7.

Current Status

208. On 6/19/67, the licensee sent a letter to the Commission reporting the overexposures noted during the week of 2/2/67. The letter also included copies of the notices sent to each employee involved.

209. The overexposures occurring during the week of 7/17/67 were reported to the Commission in a letter dated 10/16/67. Included with the report were copies of notifications to employees involved. The Commission was notified within 30 days after the licensee was informed of the overexposures by Eberline.

210. This item of noncompliance has been corrected.

Item 9

211. Contrary to 10 CFR 20.201(b), "Surveys", except for the week noted in Item 7 above, surveys were inadequate to determine compliance with 10 CFR 20.103 with respect to the airborne concentrations of tritium to which employees were exposed while working in the Tritium Hand Paint Facility. It is noted that the frequency of samples was inadequate to determine whether individuals working in the facility were exposed to concentrations of tritium in excess of the AEC limits for 40 hours exposure in a period of seven consecutive days.

Licensee's Corrective Action

212. "With respect to both 9. and 10.; exposure of operating employees to tritium in the work area and release of tritium to unrestricted areas, we admit that more frequent and more thorough surveys are required to more reliably determine exposures and releases".

213. "Expansion of Health Physics capabilities and equipment did not keep pace with expansion of activities, principally in the area of plant expansion, and as a result, checking of personnel and work areas has been too sporadic".

214. "Corrective action, as outlined under 1.a. and 1.b., involving acquisition of equipment, new personnel and retraining of existing personnel, has been instituted".

215. "In addition to the general program of locating and minimizing gas losses in all areas, the following specific check program has been instituted, with respect to the two areas of non-compliance cited:

9. a. Surveys of concentrations of tritium to which hand painting personnel are exposed will be done during five consecutive work sessions.

b. If evaluation indicates no excessive concentrations during these surveys, further surveys will be done at approximately three-month intervals.

c. If evaluation indicates excessive concentrations, surveys will be repeated in a consecutive manner as an aid to the determination of cause and correction".

Current Status

216. Burtsavage stated that due to lack of personnel and equipment, he has not made any determination of the concentration of airborne #3 to which tritium hand painters have been exposed at the 12 handpaint stations booths during their 40-hour work week.

217. He stated that he did perform a BZ sampling of Janice Gourdner over four work days during operations of a tritium screening machine located in another room adjacent to the Hand Paint Booths. The BZ samples evaluated tritium gas, tritiated water and particulates. The results were as follows:

10/6/67	HT (gas)	8.04×10^{-7}	198 minute run
	HT (water)	8.17×10^{-7}	
	particulate	2.19×10^{-7}	
10/9/67	HT (water)	7.08×10^{-7}	265 minute run
	particulate	1.60×10^{-7}	
	(No sampling for gaseous tritium performed on 10/19/67)		
10/10/67	HT (gas)	3.61×10^{-6}	413 minute run
	HT (water)	7.65×10^{-7}	
	particulate	1.92×10^{-7}	

10/11/67	HT (gas)	5.70×10^{-7}	411 minute run
	HT (water)	4.93×10^{-7}	
	particulate	7.74×10^{-8}	

218. Burtsavage stated he performed no general room air sampling since the date of last inspection, in either the screening room, hand paint room or radium hand paint area. This item of noncompliance has not been corrected.

Item 10

219. Contrary to 10 CFR 20.201(b), "Surveys", surveys were inadequate to determine compliance with 10 CFR 20.106 with respect to airborne concentrations of tritium released to unrestricted areas from the Tritium Hand Paint Facility. Based on evaluations that have been made of the concentrations of tritium released from the Tritium Hand Paint Facility, it appears that you may have exceeded the limits, specified in 10 CFR 20.106(a), when averaged over one year.

Licensee's Corrective Action

220. "10. a. Surveys of concentrations of tritium discharged from the hand paint facility stack will be done for five consecutive periods of time during which hand painting operations within that facility are in process.

b. If evaluation indicates no excessive discharges during these surveys, further surveys will be done at approximate three month intervals.

c. If evaluation indicates excessive discharges, surveys will be repeated in a consecutive manner as an aid to the determination of cause and correction, and to determine the quantities of tritium released.

221. We expect to be in compliance by December 1, 1967, or earlier, depending upon outcome of the preliminary test program".

Current Status

222. Burtsavage stated that no surveys or evaluations were performed to determine the concentrations of tritium released to unrestricted areas via stack discharges or adjacent occupied unrestricted plant areas since prior to the date of the last inspection. The last stack sampling was performed on 3/3/67, according to Burtsavage and the records maintained by him. The last sampling of adjacent unrestricted plant areas was performed on 3/23/67, according to Burtsavage and survey records. The surveys made prior to April 1967 all indicated releases in excess of permiss concentrations. Burtsavage stated that conditions occasioning such releases still exist with no improvement being made.

223. MacHutchin stated the Hand Paint Facility was a problem area but could not give the date when he could study the problem or effect compliance. He stated he only has one man, Cowan, who has devoted all his time to the effluent discharges from the Gas Fill Facility.

224. This item of noncompliance has not been corrected.

Item 11

225. Survey data indicated that surfaces throughout your plant exceeded the contamination limits specified in your letter dated 4/28/61 and your SOP-27, contrary to License Condition 17 which incorporates the referenced documents.

Licensee's Reported Corrective Action

226. "Please see Item 6. All information with respect to 6 is applicable".

Current Status

227. The records indicate that table work surfaces of the hand paint area are continuously contaminated, and have removable contamination ranging from 9500 to 11500 dpm/100 cm^2 H-3. On many occasions weekly surveys records indicate contamination greatly exceeds this activity.

228. On 8/3/67, work table surfaces had removable H-3 contamination of 250,000 to 3,430,000 dpm H-3/100 cm^2 and after cleanup on 8/7/67 another survey revealed removable contamination of 780,000 to 920,000 dpm H-3/100 cm^2.

229. On 9/27/67, the table surface used by [redacted] when manually applying Ra-226 paint to dials two days weekly and applying H-3 the remaining three days, had removable alpha contamination of 10,000 dpm/100 cm^2.

230. Monthly smear surveys of hands and clothing of tritium dial painters also indicated that they continuously leave restricted work areas with removable contamination.

231. A smear survey made by Berlin, H. P. Technician, at 1:00 pm on 10/17/67 revealed the following contamination on persons returning to the restricted area after having had lunch:

[redacted]	7500 dpm H-3/100 cm^2	Right Hand
	3800 "	Street shoes
[redacted]	32,500 "	Right Hand
	80,000 "	Left Hand
[redacted]	12,500 "	Right Hand
	10,000 "	Left Hand
	6300 "	Street shoes
[redacted]	3800 "	Right Hand
[redacted]	10,000 "	Right Hand
	8800 "	Left Hand
[redacted]	5000 dpm/100 cm^2	Left Hand

232. A smear survey on 9/20/67, after employees returned from midafternoon coffee breaks and prior to entering the restricted area:

[redacted]	5000 dpm/100 cm^2	Left Hand
[redacted]	70,000 "	Right Hand
	97,000 "	Left Hand
[redacted]	80,000 "	Right Hand
	12,500 "	Left Hand
[redacted]	72,500 "	Left Hand
	25,000 "	Right Hand
[redacted]	23,750 "	Right Hand
	120,00 "	Left Hand

[redacted]	37,500 dpm/100 cm^2	Right Hand
	22,500 "	Left Hand
	7500 "	Street shoes

233. The third floor unrestricted cafeteria was smear surveyed on 7/12/67 and again on 9/26/67, according to Burtsavage and records maintained by him. He stated that hand paint employees use this cafeteria for meals and coffee breaks.

7/12/67	Left sill on east window	5000 dpm H-3/100 cm^2
	Center of cafeteria floor	8000 "
	Light switch plate	2000 "
9/26/67	Chair back	7500 "
	Towel dispenser	2500 "
	Table surface	7500 "
	Refrigerator handle	6000 "
	Table surface	3000 "
	Wall surface, unrestricted stairway leading to 3rd floor applications area	26,500 "

234. This item of noncompliance has not been corrected. Burtsavage stated that all personnel, including janitors, were involved in the Americium Laboratory decontamination effort, and as a result, the areas where tritiated paint and radium phosphor paint is used and which generate contamination were neglected.

235. This item of noncompliance was not corrected.

Bioassay Results

236. The licensee, as before, performs urinalyses for tritium by driving off H-3 gas with calcium metal, and collecting and counting the gaseous fraction evolved. Urine samples are taken from 26 persons weekly. The records were examined and showed no overexposures since our last inspection.

237. Weekly urinalyses of [redacted], who work with H-3 gas, show from 6 to 8 uCi H-3/liter urine. Hand painters range from 4 to 12 uCi H-3/liter urine. [redacted], who continuously does silk screening with H-3 phosphor paint, continuously shows from 10 to 12 uCi H-2/liter urine. In all cases, weekly increases were noted never to be more than 8 uCi/H3/liter urine.

238. In CO:HQ letter of 7/20/67, several comments were made as to safety items.

Safety Item A

239. Item A referred to a spread of contamination to unrestricted areas and generalized contamination in restricted areas. The letter stated that no removable contamination should be allowed to remain in unrestricted areas and that contamination in restricted areas should be restricted to levels specified in the license. In addition, the letter stated that daily contamination surveys in restricted and unrestricted areas should be made. The letter also suggested limits for removable contamination for tritium in restricted areas of 50000 dpm/100 cm^2.

Licensee's Reported Corrective Action

240. "The question of spread of contamination to unrestricted areas as well as generalized contamination in restricted areas has been the subject of previous comment. We have mentioned that we are checking a number of these areas, disposing of certain equipment which we know is contributing to this situation and we are, furthermore, establishing certain new rules with respect to transfers of materials from restricted to non-restricted areas.

241. Some of the other items which are also being corrected with respect to more complete checkout of personnel and reduction of gas losses should also minimize the spread of contamination. Whether further action will be necessary will depend upon the results of the steps we are now taking to attempt to correct this situation".

Current Status

242. An examination of the licensee's SOP-27 revealed that he does use the limit of 50000 dpm H-3/100 cm^2 for removable contamination in restricted areas. 10 dpm/cm^2 with 2% efficiency = 50,000 dpm/100 cm^2.

243. Burtsavage stated that the only facility in which daily smear surveys are performed is in the Am-241 Laboratory by operating personnel. He stated his staff makes confirmatory smear surveys in this lab. weekly.

244. He stated that weekly smear surveys are made in tritium facility, Ni-63, Kr-85 and evaporator facilities and monthly smear surveys are made in plant unrestricted areas.

245. As noted in paragraphs 181, 186, 187, 227-233, and 98(e), (j), (m), (r), (u), (v), (w), (y), and (a)(1). of report details, removable contamination still exists in both restricted and unrestricted areas in excess of the limits specified in SOP-27. Moreover, persons working in the restricted hand paint applications area leave this facility continuously with high quantities of removable contamination on their hands and clothing. Burtsavage stated he has not made any studies or determined the reason for this. He stated persons are supposed to wash prior to leaving and pass through an ultra violet scan room prior to leaving the restricted area. He stated this was the only means available to monitor personnel.

Safety Item B

246. CO:HQ letter of 7/20/67, noted that contaminated equipment was used in the licensees tritium analysis, and that the background determinations used in adjusting actual test results were inadequate. The letter expressed the belief that the licensee should re-evaluate the procedures and techniques used on its tritium bioassay procedures.

Licensee's Reported Corrective Action

247. "With respect to the question of accuracy of our tritium bio-assay and the reliability of the method and apparatus, we enclose a copy of publication LA-1894, the subject of which is, "A Portable Apparatus for the Determination of Tritium in Body Fluids and Aqueous Solutions", as a guide in considering the comments which follow.

During demonstrations of the tritium bio-assay method and procedures, the AEC inspector observed and took exception to three points of technique and procedure:

1. Visible remnants of the urine sample inside the gas generator flask condensed on the walls after the decomposition reaction. The question was raised that, since the entire sample had not reacted to gas phase, would not our assay value be significantly and proportionately lower than it should be. That, however, is contrary to the principle of operation of the apparatus.

2. Visible color change of the indicating medium within the drying column of the manifold: The question was raised that, since the column was picking up un-reacted urine, was it not being succeedingly contaminated with each sample run and was not this variation interfering with the accuracy of the individual sample analysis. This premise also is contrary to the principle of operation.

3. Background determinations were made approximately in the middle of a series of bio-assay sample runs. The question was raised that this technique was con trary to the accepted practice of a background run before sample analysis and that this also resulted in the end values being lower than they should be. This point, although arbitrary, in consideration of the apparatus and operation, was changed. The background run is now made at the beginning of the day's sampling session".

248. "The following remarks are made in defense of our bio-assay system:

a. The 8 ml. samples of urine delivered onto 5 grams of metallic calcium in the flask within the evacuated system are optimum quantities necessary to generating enough of a tritium-hyrdrogen mixture to have it pass from flask through manifold and into the one liter ion chamber. Unreacted urine is slightly in excess rather than the calcium, and it does not seem reasonable to assume that the calcium is discriminatory to urine molecules having less tritium than others, or that any tritium is not homogeneously contained throughout the urine, or that the leftover urine has a higher specific intensity than that which was decomposed.

b. The function of the drying column is to pick up tritiated liquid aerosols and allow only the dried gas mixture into the ion chamber. If tritiated moisture filmed the interior surfaces of the ion chamber, then there would be contamination interference in the measurement of urine samples. It is also not reasonable to assume that a sample parcel of gas mixture passing through the drying column elutes the moisture from the dessicant which absorbed urine moisture from previous samples. The dessicant is replaced when the column indicates an approximate 66% depletion.

c. The critical factors considered necessary for good reproducibility of standard and sample measurements have been (a) controlled evacuation of the system inclusive of the gas generator, manifold and drying column, and ion chamber, and (b) controlled filling of the ion chamber with the hydrogen gas mixture. Evaluation of pressure-volume-temperature effects was indirectly made with respect to the background and the subsequent sample runs. That is, a background was measured at the beginning and end of a work day to determine whether changes in baro-pressure or temperature during the day might require compensation of the assay values. The resultant deviations were statistical rather than significant and a midsession background run was made merely on the basis that this might be a better self-integrated value for the session".

249. "The apparatus is calibrated using a NBS tritiated water standard to prepare urine and water samples for determining standard reference data. The spike is added to the sample media binarily in 5 samples with the fifth sample in approximately the 125 to 150 uc/liter range. The ionization output from the standard samples becomes the base line against which personnel urine sample ionization output is compared for determination of the tritium concentration of the urine. Cross calibration checks have been made of the apparatus by graduated spiking of urine samples with our standard solution and having these assayed by an outside service using liquid scintillation counting techniques. The results showed an average 17% difference higher value than our NBS standard value. This difference was considered as a deviation between two standard solutions, and the cross calibration was considered as a satisfactory check on our sensitivity. Reproducibility checks with spiked urine were made at two concentration levels considered optimum. There was a deviation of approximately $\pm$ 5% at the 22 uc/liter level and approximately $\pm$ 10% at the 14 uc/liter level. These checks were made to confirm the calibration nodes and predictable deviation at other concentration levels.

250. "The apparatus and method have been used approximately eleven years for assaying thousands of samples and have been found to be reliable and relatively maintenance free. Before we are requested to change to another system which is not that much superior to ours, overall, we should like a definitive check of our assay results, possibly by the New York Health and Safety Laboratory. If the resulting comparison is out of line, we shall be happy to convert over to the more generally used liquid scintillation method."

251. "We believe that the problem which is confusing the inspector is a question of whether or not it is necessary for the entire urine sample taken for analysis to decompose in order to obtain an accurate indication of tritium content. The principle of operation of this apparatus is such that one collects a sample of the decomposition gasses in an evacuated ion chamber and the sample itself consists of that amount of gas which will bring the ion chamber back to atmospheric pressure. It assumes that the decomposition of tritiated water and normal water in the sample is in direct proportion to the amount of each of these compounds present and, therefore, it is not necessary for all of the sample taken for analysis to decompose."

252. "The fact that the method used has been giving what we consider reliable results, is attested to by the fact that we have obtained comparable results by two different methods of testing and have also checked, with an acceptable degree of accuracy, the results obtained by independent laboratories. We have pointed out that, in general, our results appear to be an average of approximately 17% low when compared with the results from outside laboratories and this correction could well be introduced into our test program. We would be glad to discuss this entire question further with the Compliance Division."

Current Status

253. Burtsavage stated that they have acquired additional reaction trains used in urinalysis and that they thoroughly clean such train prior to use for each analysis so as to avoid contamination carryover.

254. He also stated that they calibrate the apparatus prior to urinalysis by decomposing deionized water and that the calibration is performed prior to urinalysis.

255. He stated they determined as a result of these two new steps, that USRC's urinalysis results for tritium in urine were consistently 17% under that analysis by commercial vendors, New England Nuclear and Isotopes, Inc. He stated as a result, they now apply a +17% correction factor to all tritium urinalysis results they perform.

Safety Item C

256. CO:HQ letter of July 20, 1967, read as follows: "The AEC inspector reported that an air concentration of 1×10^{-10} uc/ml is being applied by the company with respect to concentrations of radioactive material to which employees are being exposed in the Radium Americium Laboratory. It appears that the company is using the insoluble limit for Am-241 without identifying the soluble fraction for Am-241 oxide and without consideration for the other isotopes involved."

Licensee's Reported Corrective Action

257. "With respect to C, we believe there has been some misunderstanding. The Company has not used either the MPC for soluble americium-241 or theMPC for insoluble americium-241, prior to the last A.E.C. inspection. The MPC for soluble radium-226 3×10^{-11} uc/ml, had been used before that time as a matter of judgement based upon the historical processing of more radium than americium. The MPC for soluble americium-241, 6×10^{-12} uc/ml, has been used since the A.E.C. inspection as the applicable MPC to the most hazardous isotope processed within the laboratory."

Current Status

258. Burtsavage stated that since the May 19, 1967, inspection, the date of completion of Part I of our previous inspection, they have been using the most restrictive limit of 6×10^{-12} uCi Am-241/sol/ml air as expressed in Appendix B, Table I, Column I, for air concentrations in the restricted Am-241 Laboratory.

Safety Item D

259. "During the inspections conducted of licenses GL-112, GL-122, and GL-237, the AEC inspector reviewed the procedures used in tests for determining the extent of removable contamination existing in the tritium foils and tubes used in devices manufactured and/or distributed under these licenses. According to the AEC inspector, the instrumentation used in conducting leak tests was not calibrated to permit an adequate evaluation of the concentrations of tritium found during these tests."

Licensee's Reported Corrective Action

260. "With reference to leak test procedures and instrument calibration to permit an adequate evaluation of tritium concentrations found on items manufactured according to GL-112, GL-122 and GL-237: The leak test is performed using a smear paper rather than cotton tipped swab, and the smear is counted by internal windowless gas proportional counting instrumentation. Our counters are calibrated by using a Carbon-14 standard to obtain optimum operating voltage for low energy beta counting. Efficiency of counting, approximately 2% rather than 50%, is derived by comparison of control smears measured by our instrumentation against measurements by a professional analytical service.

261. Recommended modified procedures were put into effect as of June 1, 1967."

Current Status

262. Burtsavage stated that since June 1, 1967, they have used an efficiency of 2% for tritium on filter paper as measured by an Eberline internal gas flow proportional counter. He stated this efficiency was determined by placing a known quantity of NBS standardized liquid on filter paper and counting the filter paper in an Eberline internal gas flow counter. He stated that he also contacted commercial vendors and was informed that the maximum efficiency for counting tritium on a filter paper was 2% by the above method.

Additional Comments

263. CO:HQ, in the letter of July 20, 1967, stated that the licensee's letter of May 9, 1967, had informed CO:HQ that a study as to the causes of the releases and corrective steps taken or planned to assure against recurrence has been initiated. Please inform us of the status of this study.

Licensee's Reported Corrective Action in Letter of August 15, 1967

264. "A study was initiated in May to locate, identify and correct sources of leakage of tritium gas which contributed to the release to unrestricted areas. Most of the effort to date has been concentrated on the tritium gas filling system and a similar program with respect to the tritium foil production laboratory will be undertaken immediately upon completion of the present study and an evaluation of the effectiveness of the corrective steps instituted. We believe that identical corrective procedures will be applicable in both cases.

265. The following is an outline of the actions which have taken place since May:

1. Program to determine source of tritium release from the gas fill facility was initiated during the first week of May 1967.

2. Using a portable "sniffer", the following were found to contribute to release of tritium to the hood exhaust air:

   a. Rotary oil-sealed forepump exhaust.

   b. Accumulation of glass tube "stubs" for disposal.

   c. Heating of U reservoirs to generate tritium gas in system for tube filling and taking of tritium gas inventories.

   d. Disconnection of glass tube "stubs" from filling ports after each tube is filled and sealed.

   e. Warm-up of molecular sieve forepumps at end of each day's filling operations.

   f. Occasional release of air bursts through pumping system which can occur during accidental venting of system through pumps, fracture of glass tube during initial evacuation, etc.

   g. Pump-off of small quantities of gas residual in system after completion of tritium transfer from ORNL shipping containers to our U reservoirs. This residual gas is that which is non-reactive with the spongy U in our reservoirs. This gas is considered to be principally "inert" but does apparently contain detectable amounts of tritium.

   h. Opening of vacuum system to undertake periodic repairs.

   i. Accidental fracture of glass tube during filling and sealing.

   j. Leaking glass tube resulting from incomplete fusion seal."

"3. With regard to above:

Item 2.a, 2.e, 2f, and 2.g: Rotary oil-sealed forepump on the gas fill facility has been replaced by a carbon vane type pump. In addition, a water impinger assembly has been installed after the pump outlet. Present operating schedules require changing the water in the impinger assembly prior to start-up of each day's filling run. The impinger water is disposed of as active waste. Based on results of experimental tests, this modification should assist in minimizing releases of tritiated water to the stack exhaust."

266. "Evaluation tests have indicated also that gaseous tritium is also present in gas emerging from the above water impinger assembly. Next step involves installing a heated copper oxide assembly, backed by a water impinger. The intent here, of course, is to convert the gaseous tritium present to water and collect same in the impinger assembly. The effectiveness of the copper oxide converter will be evaluated and, if found beneficial, such an assembly will be put into routine use on the gas fill facility.

267. This phase of the program should be completed by September 30, 1967.

268. Item 2.b.: Smaller disposal cans have been procured and it is now standard practice to dispose of each day's tube "stubs", rather than to accumulate them over longer periods. If experience indicates this procedure has not improvied the situation, a special disposable receptable will be designed and built.

269. Item 2.c.: Heating of U reservoirs is now done using electric furnaces, rather than by hand torch. Further evaluations on stack exhausts are required in order to determine if the situation has been improved by this change in procedure.

270. An experimental U reservoir has been constructed and a heavy gold plate applied to its inner surfaces. This will next be installed on the system and evaluation tests made to determine if the gold barrier reduces the diffusion of tritium through the reservoir walls.

271. It is also planned to fabricate an electric heater assembly which will allow us to pass a low sweep of air through it when it is placed around a U reservoir. The air emerging from this assembly will be passed through a water impinger unit. If evaluation tests indicate that such a system is effective in tritium removal, it will be adopted as routine practice. It is anticipated that this evaluation study will be completed by October 16, 1967.

272. Items 2.d. and 2.h.: Experimental tests showed that releases of tritium encountered during these operations can be reduced by ensuring that the system is pumped down to a hard vacuum during non-operating periods. Prolonged pumping of the system (12 to 16 hours), prior to undertaking repair work, appears to assist in minimizing tritium releases which might occur when conducting repair work. The above procedure is now in effect.

273. Items 2.i. and 2.j.: Other than emphasizing to the operator that he exercise all due care, we have not as yet been able to conceive of methods whereby the release of tritium from these occasional accidental occurrences will be eliminated. Present practice, when a leaking tube is detected with the "sniffer", is to seal the leaking tube in a disposable vial immediately after it has been detected.

274. With regard to studies on the sources of release from the tritium foil preparation facility, as a result of shortage of manpower and monitoring equipment, no work has been done to date. However, a commercially available tritium scrubber unit (for vacuum systems) has been ordered, with delivery estimated by November 1, 1967. It is our intention to evaluate the performance of the above equipment in minimizing tritium releases from the above facility. Provided the above equipment is received by November 1, 1967, we anticipate that this particular evaluation program will be completed by December 31, 1967."

Current Status

275. All evaluations and studies according to Burtsavage and MacHutchin have been performed only on the Tritium Gas Fill Facility and not on the Tritium Foil Facility or Tritiated Phosphor Paint Preparation, Tritiated Resin Preparation, and Tritium Hand Paint Operations. They stated that each of the above operations' exhaust concentrations of tritium oxide to unrestricted environs in excess of the concentrations expressed in 10 CFR 20, Appendix B, Table II, Column I.

276. As previously noted, even with corrective action, the installation of copper oxide tritium scrubbers, maximum permissible concentrations when averaged over a year would exceed mpc by a factor between 7 and 12 times for the Tritium Gas Fill Facility.

277. MacHutchin stated he was limited because he has only one person, D. Cowan, available to do the required studies and could give no time estimate when compliance with the regulations would be achieved. He also stated that his studies have not been completed in the Tritium Gas Fill Facility and that further studies have to be made.

278. He stated they have discarded the selica gel column because they became saturated with tritium too rapidly and regeneration would cause problems in the tritium releases.

279. He also stated they do not use water impingers because he believes copper oxide removal of tritium to be superior.

Additional Comments

280. CO:HQ letter of July 20, 1967 also commented as to the use of 0.16 uCi Am-241 as a lung burden by the licensee in the letter of June 13, 1967.

Licensee's Reported Corrective Action

281. "Our letter of June 13, 1967, contained a typographical error. The indicated value, 0.16 microcurie, was a typographical error. The value should have been .016 microcurie, and this point was thought to have been clarified with personnel of Region I by telephone.

282. The value of .016 microcurie was furnished us also by telephone by personnel of Region I, your division, with instructions that the value was to be considered as the permissible burden to lung, with lung the critical organ ofreference for reporting the incident.

283. Preliminary information noted during telephone communication with our whole body counting service indicated a body burden of .96 microcuries, hence the stated 60 lung burdens.

284. Paralleling this matter, we would like, for reference and further study, information relative to any literature on the subject of MPC for americium-241 in all critical organs."

Current Status

285. Burtsavage stated that they use a lung burden of 0.016 uCi Am-241 as applicable and that this value was given to them by Dr. Allan Brodsky of the University of Pittsburgh.

Additional Comments

286. CO:HQ letter of July 20, 1967 also commented that the number and recurrence of items of noncompliance noted during inspections conducted during 1967 appear to be indicative of the absence of effective management controls to assure compliance with safety procedures. The letter stated that it appears that there appears to be inadequate indoctrination of personnel in sound safety practices and inadequate management control of the safety aspects of the company's licensed operations.

Licensee's Reported Corrective Action

287. "Several steps have been taken and are being taken to improve the situation with respect to management awareness of existing problems and management control of same. Our Morristown personnel has been augmented by the addition to our staff as of August 1, 1967, of Mr. Richard C. Sorensen as Executive Vice President. Mr. Sorensen is a graduate of the University of Ohio, is an industrial engineer, was formerly President of Tracer Lab and, more recently, General Manager with Liquidometer Corporation. The addition of Mr. Sorensen to our staff will enable us to devote adequate time to supervision by top management. Bloomsburg management is presently under study and a change will be effected as soon as plans are complete.

288. In order to create a greater awareness of situations and needs, the Health Physics Department has been given full authority to order any operation which appears to violate Health Physics principles to discontinue operation until corrective action has been instituted. Any questions which arise with respect to problem areas are to be reported to the Isotopes Committee and to top management by letter simultaneously. Both the Isotopes Committee and top management will have an opportunity to immediately review any situation, determine the legitimacy of the Health Physics Department actions and issue immediate instructions for corrective action, if it is indicated.

289. Other than this, you will note from the review of this letter and our letter of August 8, 1967, to the Licensing Branch (copy enclosed), with respect to the americium foil laboratory, that numerous new procedures have been indtroduced to enable us to more closely check on situations immediately when they occur."

Status as Noted by the Inspector

290. Burtsavage stated that during the decontamination effort he was not sure of his authority and had the distinct impression that he could not stop any operation. Mr. C. Wallhausen, Vice President of Sales and Chairman of the Isotopes Committee, stated it was true that HP could not stop any decontamination effort, but that effective October 4, 1967, the HP, Burtsavage, has the authority to halt an unsafe operation. This is subject to review and approval by the Institute Isotopes Committee. Effective October 4, 1967 also, Dr. MacHutchin was given the responsibility of Head of Health Physics, Head of Research and Development and in charge of Radionuclide Production. Burtsavage as chief of the HP group reports direct to MacHutchin.

291. Wallhausen stated that he himself took control of the decontamination effort and pushed it as much as he could in order to get back into production. He also stated he was not aware of the continued overexposures to decontamination personnel to excessive concentrations of Am-241 in air during the decontamination effort, until the end of September 1967, but believed that the half face masks provided, eliminated the hazard even though he knew of no exemption in the license for the use of face masks.

292. Wallhausen stated that he knew that the items of noncompliance noted in our last previous inspection and reported in CO:HQ letter of July 20, 1967 were not corrected and that the corrective action promised in their letter of August 15, 1967 had not been performed. He stated that corrective action was subordinated to the decontamination effort and everything else was secondary to bringing the americium facility into production.

293. As far as instruction is concerned, MacHutchin stated that they plan to have their consultant, Dr. J. S. Krohmer, give courses to HP personnel and possibly other plant personnel as well.

294. Wallhausen stated that he is currently interviewing people to provide the additional persons with previous health physics training.

Conference with Management

295. A conference with management was held immediately following the inspection on November 17, 1967. Attending the conference, in addition to the inspector, were the following:

Mr. Gen Roy, Inspection Specialist, CO:HQ
Mr. Paul Nelson, Senior Radiation Specialist, CO:I
Mr. Jack Davis, Pensylvania Department of Health

Licensee Representatives

Mr. T. Sorensen, Executive Vice President
Mr. C. W. Wallhausen, Vice President (Sales) and Chairman Isotopes Committee
Mr. H. A. Vaughn, Vice President in charge of Bloomsburg Facility
Dr. J. G. MacHutchin, Director of Research, in charge of Health Physics, Research and Development and Radioproduct Production
Mr. W. E. Umpstead, Plant Manager
Mr. W. F. Buck, Laboratory Manager
Mr. E. M. Burtsavage, Chief, Health Physics Group

296. It was pointed out by the inspector that throughout the decontamination effort, personnel involved in the decontamination effort were exposed to excessive concentrations of Am-241 in air and that management was unaware of these excessive concentrations until the end of September 1967. Further, they did not appear to be concerned or make any inquiries during this period as to the concentrations personnel were being exposed to. It was also pointed out that exposures of employees to excessive concentrations of Am-241 in air had been noted during our last previous inspection and management because of this should have been alert to the possibility of recurrence.

297. Wallhausen stated he was aware of some delay in obtaining air survey results but was not aware that reports were delayed as much as two months or essentially until the decontamination effort was completed. As to the actual overexposures themselves, Wallhausen stated that excessive concentrations might be expected in a "dirty operation" such as decontamination, but that half face masks which were worn should take care of the situation. He admitted, however, that he was unaware that some of the 40 hour average work week concentrations were as high as 50 times MPC. He stated that the lag interval in analysis and reporting of air concentration has now been lowered so that there should not be a delay in reporting results to management. He stated management will take a greater interest in radiation safety.

298. It was pointed out that inadequate evaluations had been made of the hazards concerned with the decontamination and operation of the americium facility such as changing of gloves on glove boxes, decontamination of hoods and equipment and the changing of contaminated filters of exhaust duct work.

299. Wallhausen stated it was true that they jumped into the decontamination effort without prior evaluations and knowledge of excessive air concentrations. He stated that they wished to get the Am-241 facility back into production and all other considerations were second to this aim. He stated this situation would not occur again.

300. The inspector pointed out that during the last previous inspections, citations were made for both license -2 and license -7 for failure to evaluate releases of H-3 to unrestricted areas via stack discharges, and that these items remain uncorrected. It was also pointed out that surveys to determine stack concentrations of H-3 released from operations in the tritium building and the hand application facility had not been performed since May 1967, prior to the last inspection.

301. Wallhausen stated it was true that the program to evaluate tritium hazards suffered and that evaluations were not made because all attention and most personnel were involved in the decontamination effort. He stated however that evaluations will be made and that additional survey equipment has been purchased to accomplish correction.

302. It was noted that proper evaluations were made in one facility under license -2, the glass gas fill facility where an experimental program had been conducted by MacHutchin to determine the nature of and cause of tritium releases from this facility.

303. It was pointed out that stack evaluations had not been performed for approximately two years in another facility under license -2, used to incorporate tritium gas into resin prior to making tritiated luminous paint. It was also pointed out that prior evaluations of stack releases from the tritium building, the tritium resin incorporation laboratory, the hand paint facility and past and present evaluations of releases from glass gas fill facility had all indicated that concentrations of tritium released via stack discharge exceeded the concentrations ~~of~~ expressed in Appendix B, Table II, Column I when averaged over a year. It was also pointed out that this situation has persisted and correction does not seem in sight.

304. MacHutchin stated he could give no date as to when correction could be achieved. He stated he has only one man, R. Cowan, to do the experimentation and study. He stated he needed to do additional studies and expected additional personnel and equipment to accomplish this. The inspector pointed out that MacHutchin is not taking action to reduce the concentrations in the entire effluent*were treated correction could possibly be achieved. MacHutchin stated he was aware of this but that further study was needed.

305. It was pointed out that citations were made as a result of our last previous inspection for failure to evaluate the 40 hour work week concentrations of tritium in the breathing zones of persons working in the tritium building under license -2 and in the hand paint facility under license -7 and that these items remain uncorrected. It was also pointed out that there was a lack of evaluation of breathing zone concentrations for the tritium resin incorporation facility.

306. Burtsavage stated he simply did not have sufficient manpower and equipment to do the required surveys, but that additional portable equipment has arrived and he will soon calibrate and use it to make required surveys. He stated he and most of the health physics personnel were involved in the decontamination effort and, as a result, other required work had to be bypassed. MacHutchin reiterated what Burtsavage stated and said that required surveys will be performed.

307. It was pointed out that in surveys to note removable contamination and surveys to determine air concentrations in laboratories using Kr-85 and Ni-63, Burtsavage had reported activity as only tritium without any knowledge as to the contribution of Kr-85 and Ni-63. MacHutchin stated he had not realized this and it was necessary to determine the contribution of other radionuclides as well as H-3 to existent removable contamination and air concentrations. He stated proper evaluations would be made.

308. It was pointed out that under license -7, the licensee had a facility in which radium dial screening was performed where excessive concentrations of radon-222 in air existed. These levels had beennoted for one week of air sampling during our last previous inspection and again for one week ot sampling noted during the present inspection. Citations made previously for excessive concentrations of Rn-222 in air and inadequate evaluations because of the infrequent sampling remain uncorrected.

---

* but only is attacking individual points where tritium may be released, and that if the entire effluent

309. Vaughn stated that this facility was ordered closed on October 2, 1967 by his order because the conditions in this facility constituted a health hazard. MacHutchin added that there was inadequate ventilation and high levels of removable contamination.

310. It is to be noted that the decision to close this facility has been over-ruled. A letter dated December 6, 1967 from Wallhausen to Low indicates that this facility has been reopened with full knowledge of noncompliance. The facts stated in this letter were not discussed with the licensee.

311. The inspector pointed out again that many instances have occurred where the licensee has exceeded the 30-day reporting requirements in reporting excessive concentrations of radionuclides in restricted working environments. Burtsavage stated the delay occurred because of his preoccupation with actual decontamination operations, vacations, sick leave, and his system of waiting for the final analysis reports. He stated he is aware of the reporting requirements and will comply.

312. It was pointed out that personnel who performed decontamination, changing gloves of glove boxes, and filters of ductwork did not receive instruction as to the hazards involved or the precautions to be taken. MacHutchin stated he realized this was not proper and that each operation will be described in writing with hazards and precautions to be taken. He also stated that the health physics group will be consulted prior to engaging in hazardous unscheduled activities.

313. It was also pointed out that contrary to License Condition No. 18 in license -2 and License Condition No. 17 in license -7 removable contamination present in restricted and unrestricted areas exceeds the limits expressed in the license conditions and that this item remains uncorrected from our last previous inspection with respect to license -7.

314. MacHutchin stated that they have restricted the bringing of items from restricted area to unrestricted areas and have disposed of contaminated chairs, desks and other articles. He stated also that he realizes that excessive contamination is being generated in tritium and radium operations and will have to study the sources generating the contamination. The inspector and MacHutchin on November 17, 1967 noted that the air flow at the entrance door to the tritium glass gas fill facility was reversed and air from this facility was blowing into a hallway. MacHutchin stated this reverse air flow was caused by the addition of the radium screen application facility to the ventilation plenum. He stated the air flow in restricted areas of the main building is not proper because of the constant additions of facilities made to the air plenum without adequate adjustments as to the quantity of air, velocity or pressures.

315. The inspector also pointed out that the present americium production facility is barely adequate and that since resuming production additional overexposures to airborne concentrations of Am-241 in air were noted and reported. It was also pointed out that certain operations in this facility which give rise to airborne concentrations have not been evaluated. MacHutchin stated he realized the need for evaluation of each step in the americium production process and will make such evaluation. Sorensen stated that they are actively looking into the purchase of commerical glove boxes with a view to enclosing the entire or most of the americium production process.

316. Wallhausen stated finally that they have taken steps to strengthen the health physics group by hiring a part time consultant, adding one permanent member and actively recruiting for two more permanent qualified persons. He conceeded that during the decontamination effort the authority of the health physics group was confused and not defined. He stated that as of October 2, 1968, this group now has the authority to halt an unsafe operation subject to immediate review by the Isotopes Committee with himself as Chairman.

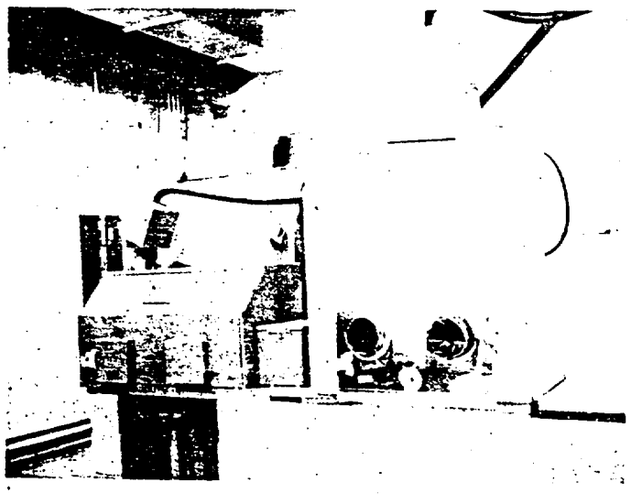
317. In addition, it was pointed out that top management should be better informed of the health physics status of their operations, and that there was a definite need to clarify the authority and responsibility of the health physics group.

U[redacted] URINALYSIS R[redacted]S.

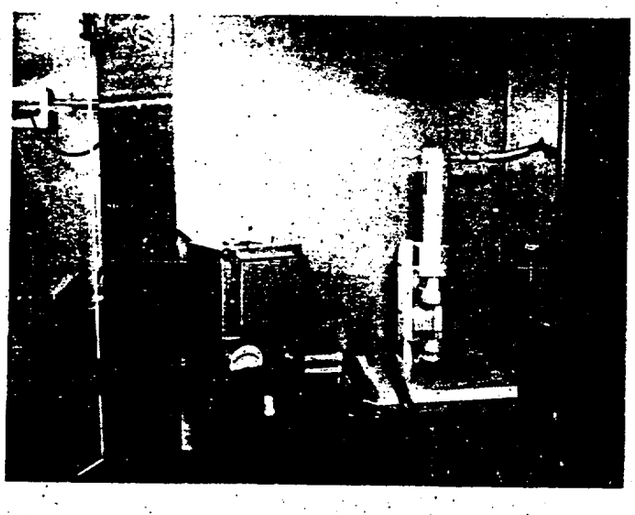
[redacted] dpm/24 hr urine void of Am^{241} repeated by bioassay.

[redacted]	[redacted]	9/19/67	10/12/67	10/26/67	11/4/67	11/11/67	11/12/67
1.[redacted]		12.5	2.0	1.6	1.3	1.2	
		3.7	0.48	2.9		1.3	
		1.6	1.5	0.87			1.6
		3.2		0.59	0.19	0.49	
					0.21		
				0.90			
		6.5		5.7	4.8	0.52	
				0.85			
			0.53	3.6			
			1.2	1.2			
			0.74	0.29		0.56	
		0.30	0.54			2.0	
	0.02	0.36		0.49			
	0.41	0.40					
	0.00			0.56			
				0.61			
			0.81	0.18		~~2.0~~	0.20
				3.1			
		5.2	~~5.1~~	5.1			
	0.24	0.39	0.43	2.5			
				0.14			
						0.14	

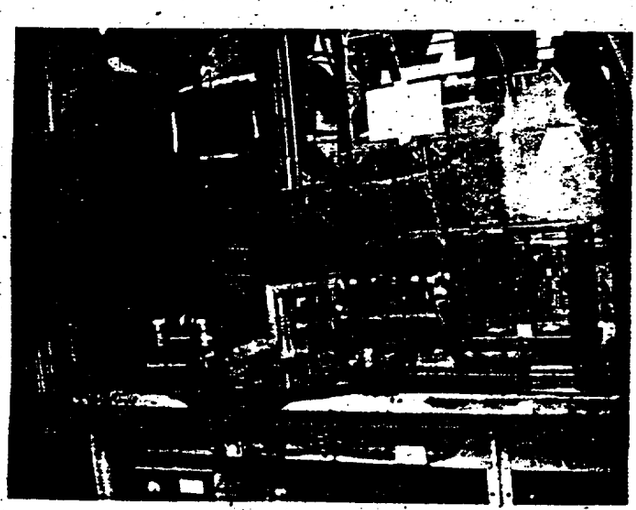
Exhibit "A"



[illegible] compact glove box and press hood

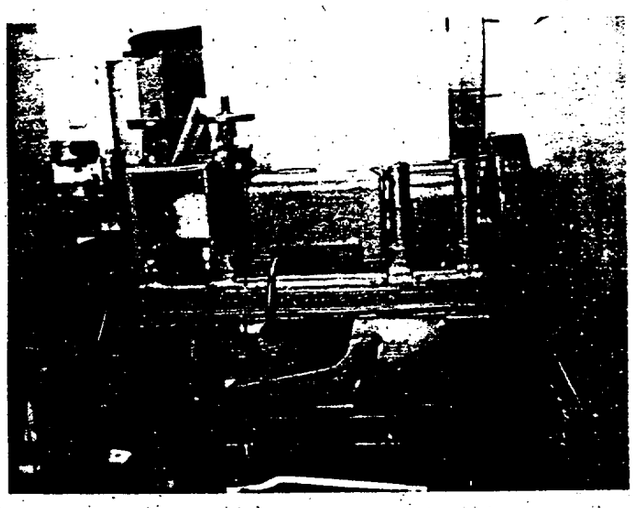


Interior of Press Hood showing Compact Press Sintering Oven and swinging plexiglass door

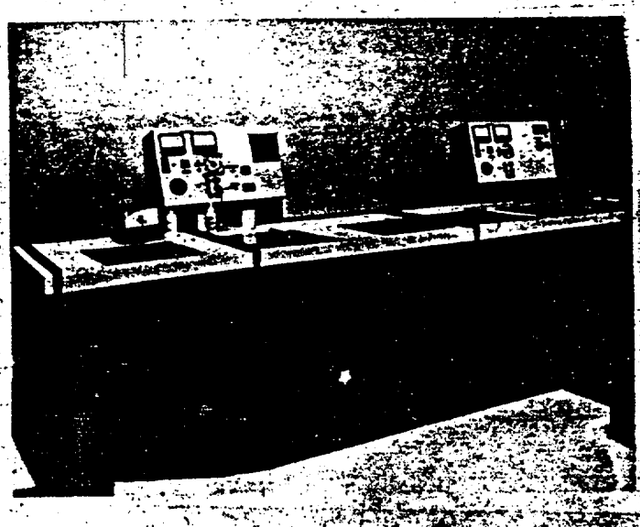


First cutting stage Hood

welding Head



LARGE UNENCLOSED ROLLERS



NEW PLATING TANKS