Princeton University
Environmental Health and Safety

December 14, 2006

Mr. James Dwyer
Chief, Commercial and R&D Branch
U.S. Nuclear Regulatory Commission, Region I
475 Allendale Road
King of Prussia
Pennsylvania 19406-1415

Re: License Number 29-05185-24

Dear Mr. Dwyer:

On November 15, 2006, on behalf of Princeton University, I made a telephone call to the NRC Operations Center to report the occurrence of a sealed source leaking in excess of 0.005 μCi, as required by our license condition #16G. This notification was assigned Event No. 42992. Ms. Kathy Modes of Region 1 telephoned me later that day to discuss the incident, and various members of the Region 1 staff have been in contact with me since then for status reports on the incident. This letter provides the written report of the incident as required by 10CFR20.2201(b).

This report refers to individuals as Researcher A, etc., or by their titles, and to locations as Location A, etc.; Appendix A identifies the persons and locations so named.

Description of the Damaged Sealed Source

The damaged source was fabricated in 1959 at Princeton University by unknown Princeton University researchers. At the time of its fabrication, the source contained 554 μCi of Sr-90 deposited onto a metal foil. On November 13, 2006, when the contamination was discovered, the source would have contained 179.4 μCi as a result of radioactive decay, if it was intact. The metal foil is seated within a brass cylinder consisting of two sections: the section containing the source and a collimator section (See Appendix B, Photo A).

Discovery of the Incident

On November 7, 2006, RS Technician A conducted semiannual leak tests on several Sr-90 and Fe-55 sealed sources stored together in a drawer in Location A. The wipes were put in for counting on late afternoon of November 10 and were left to count over the weekend. RS Technician A reviewed the leak test results on the morning of November 13 (at the start of the work week), found that the wipe results for all sources stored in the drawer in Location A were elevated, and discussed the results with the EHS H&S Specialist. RS Technician A and the EHS H&S Specialist promptly returned to Location A to repeat the leak tests. The repeat of the leak tests confirmed the presence of contamination, and the EHS H&S Specialist immediately contacted the RSO to discuss the leak test results. Because three Sr-90 sources and two Fe-55 sources are stored within the same drawer, it was initially uncertain which isotope was responsible for the leak test results. However the disposable gloves worn during the confirmatory leak test on the morning of November 13 were detectably contaminated when surveyed with a G-M detector, which indicated that the contamination was most likely due to Sr-90 rather than Fe-55.

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The RSO and the EHS H&S Specialist returned to Location A on the afternoon of November 13 to examine the sources and to question Researcher A about his use of the sources. The three Sr-90 sources are identified in University records with source IDs PHY-0026, PHY-0028 and PHY-0030. The three sources are identical in design, although they were fabricated over a period of several years. Researcher A explained that sometimes he needed to use one, two or all three sources for his research. When he needed to use a source or sources, he opened the source storage drawer and removed the number of sources required without regard to which specific sources were removed, i.e., he removed whatever sources were closest to hand. The three sources were originally designed to be used without disassembly, i.e., without removing the collimator. When the collimator is not removed from the source assembly, use of the source requires that the collimator button be pressed in order to open the shutter contained within the collimator. However, within the last two to three years, Researcher A sought a more intense radiation beam from each source and had begun the practice of removing the collimator section. This required removing a screw threaded from the collimator into the source cylinder and then manually pulling the collimator apart from the source cylinder in order to more directly expose the foil containing the activity. Researcher A demonstrated the collimator removal procedure and then removed the collimators to allow the RSO to examine each of the foils. Although sources PHY-0026 and PHY-0028 were intact, the RSO observed a puncture in the foil of source PHY-0030. With the source assemblies disassembled, the RSO used cotton swabs to wipe the exposed stainless steel retaining collars (See See Appendix B, Photo A) of each of the source cylinders. The original leak test conducted on November 7 and the repeat test conducted the morning of November 13 involved wipes of the exterior surfaces of the completely assembled source assemblies. However, the RSO's leak test wiped surfaces as close as possible to the foil without actually wiping the foil. The results for the three different leak tests are summarized below:

Source ID	**November 7 Initial leak test (μCi)**	**November 13 Repeat leak test (μCi)**	**November 13 Leak test with collimator removed (μCi)**
PHY-0026	0.0002	0.0010	0.0158
PHY-0028	0.0033	0.0067	0.3405
PHY-0030	0.0143	0.0076	0.8890

At this time, the RSO also took photos of the source assemblies and the damaged foil (See Appendix B, Photo B). Researcher A reassembled the source assemblies and returned the sources to the source storage drawer.

The RSO and the EHS H&S Specialist surveyed Researcher A for contamination with a Ludlum G-M survey meter with pancake probe and found no contamination.

The RSO and the EHS H&S Specialist questioned Researcher A to determine where he had used and placed the sources and how the sources were used during the course of his research. Researcher A reported that, although he stored the sources in a cabinet in Location A, he actually used the sources in Location B. His use of the sources simply required that the source or sources be placed on top of flat experimental chambers with the exposed foil end of the source cylinder resting on the chamber surface. He walked the RSO and the EHS H&S Specialist through Locations A and B to point out locations where he typically worked with and placed the sources. The RSO and the EHS H&S Specialist then conducted a preliminary survey in Locations A and B using Ludlum G-M survey meters with pancake probes to assess the degree of contamination present. This preliminary survey showed that contamination in Location A appeared to be limited to the cabinet in which the source drawer was stored. Contamination was found in

various locations in Location B, generally as discrete spots on bench and chamber surfaces on which Researcher A had placed the sources. This preliminary survey did not indicate the presence of contamination outside the doors to Locations A and B. Consequently the RSO decided to conduct a more extensive meter and wipe survey of Locations A, B, C and adjacent hallways on the morning of November 14.

Researcher A notified the RSO that he had plans to fly on November 14 to Institution A for a one-week stay. Because Researcher A showed no evidence of contamination, had provided sufficient information during the initial interview, and had agreed to stay in contact through e-mail, the RSO agreed that Researcher A could make his scheduled trip.

Before the RSO left Locations A and B on November 13, the RSO posted Location B to indicate that access was restricted and that no entry was permitted without approval from the RSO, the Department Manager or the Department Chair. In addition, the RSO notified Researcher A, Authorized User B, the Physics Department Manager and other members of the Physics Department staff that all of the sources stored in the source drawer in Location A had been taken out of service. The RSO took custody of the sole key to the source drawer to ensure that the sources remained secure and out of use.

When the RSO returned to the EHS office on the late afternoon of November 13, she notified the EHS Director about the details of the leaking Sr-90 source incident. Notifications about the incident were made to the Radiation Safety Committee and the Acting Radiation Safety Chair on November 14.

Regulatory & Other Notifications

Condition 16G of Princeton University's broad license #29-05185-24 states that if a leak test reveals the presence of 0.005 μCi or more of removable contamination, a report shall be filed with the NRC in accordance with 10CFR30.50(c)(2). Because it was not immediately clear to the RSO whether a 30-day phone notification was sufficient or whether more immediate notification was required, the RSO called the NRC Operations Center on the morning of November 15, 2006, to report the leaking source and the subsequent discovery of contamination. Initially, the NRC contact suggested that the notification should be regarded as informational rather than a required notification. However, later in the day on November 15, NRC staff contacted the RSO and informed the RSO that, based on the closure of Location B for more than 24 hours, notification to the NRC was required in accordance with 10CFR30.50(b)(1)(i). Accordingly the RSO made official notification to the NRC Operations Center at that time.

E-mail notification regarding the leaking source incident was made to Mr. William Csaszar, Supervisor of the Radioactive Materials Section of the Radiation Protection Programs for the New Jersey Department of Environmental Protection, on the morning of November 16.

In order to address the possibility of public misinformation and concern, press releases were issued by the Princeton University Communications Office on the evening of November 14 to two local newspapers.

Additionally, the RSO, the EHS Director, the Physics Department Manager and the Physics Department Chairperson met with interested members of the Physics Department on the morning of November 15 to brief them about the incident, answer questions, and address concerns. On November 17, the RSO met with the janitorial staff responsible for Jadwin Hall and provided a briefing about the incident.

Investigation and Surveys

On November 13, 2006, the RSO and the EHS H&S Specialist visited the laboratory and interviewed Researcher A. During this interviews and subsequent interviews, Researcher A reported the following relevant items:

- He had handled the three Sr-90 sources stored together in a drawer in Location A regularly during the period from May 10, 2006 (the date of the previous leak test at which no contamination was present) through September 29, 2006. After September 29, he was away from the University for an extended period and did not handle the sources after his return. Because he maintained control of the key to the source storage drawer, other persons could not have used the sources in his absence.
- He could not provide information to clarify when the damage to the source might have occurred. His research records do not include notations to indicate on which days sources were used and to specify which sources were used.

Survey Summary

This report provides a summary of survey results. However, the detailed survey reports are maintained at the Princeton University EHS Office where they will be maintained indefinitely as part of the University's decommissioning records. The detailed survey reports were inspected by Mr. Dennis Lawyer, an inspector for the NRC, during the 'reactive' inspection conducted on November 22.

G-M meter surveys were performed using several meters owned by the Office of Environmental Health & Safety (EHS). All G-M meters are Ludlum Model 3 survey meters with Model 44-3 pancake detectors. EHS staff perform a preoperational check consisting of a battery check, background check and check source measurement before each use of survey equipment. An electronic calibration and energy efficiency calibration is performed annually for each EHS G-M meter. Wipes from wipe surveys were counted on the EHS Beckman LS6500 Liquid Scintillation Counter, calibrated daily with NIST-traceable sources and operated under a daily QA program.

Appendix C, Figure B shows a floor plan of the affected floor of Jadwin Hall; the map has been marked by crosshatching to indicate areas in which surveys were conducted. After the presence of contamination was identified in Locations A and B, surveys were conducted to determine whether contamination was present in public areas. For example, wipe surveys were conducted in the two hallways which adjoin Locations A and B. No contamination was identified in these hallways or in any area generally accessible to the public.

In Location A, where the sources were stored, contamination was present on much of the floor in amounts of less than 200 – 300 dpm. Since Princeton University policy requires decontamination when wipes containing in excess of 100 dpm are found, the entire floor of Location A was mopped and successfully decontaminated. Otherwise contamination was found in only three locations in Location A: on the floor directly in front of the source storage cabinet, on a shelf of the source storage cabinet and in the drawer in which the sources are stored. The spot of the floor and in the cabinet were decontaminated upon discovery. The source storage drawer has not been decontaminated because there is no immediate need to use or handle the drawer, and it is stored in a closed cabinet that is infrequently used, but the drawer will be decontaminated in the near future.

In Location B, where the sources were used, contamination was found throughout the room. Removable contamination on the floor was present in amounts of 200 dpm or less. Discrete spots of contaminated areas were found throughout the room because Researcher A had experimental chambers set in many locations in the room, and contamination could be expected wherever the sources had been placed. However, contamination was generally limited to three areas of the room: 1) a corner work bench where the contamination was primarily confined to portions of the bench surface, 2) a table in the opposite corner of the room where contamination was found on the surfaces of the experimental chambers sitting on the table and on the tabletop, and 3) a long wooden platform in the center of the room on which most of the experimental chambers were located. Discrete spots of contamination (measuring 240,000 to 350,000 cpm in a few places, but generally less than 50,000 cpm) were found on a variety of chamber surfaces, tools, tubing, and on the wooden platform surfaces.

In Location C, the site of Researcher A's main office, no detectable contamination was found with a G-M survey meter. A wipe survey indicated that removable contamination in amounts <150 dpm was present in two locations. The floor was mopped and successfully decontaminated.

Car & Home Surveys

Researcher A returned from Institution A to Princeton University on the morning of November 22 which coincided with the 'reactive' inspection conducted by Mr. Dennis Lawyer. Mr. Lawyer observed while the RSO surveyed the exterior and interior of Researcher A's automobile with a G-M survey meter. There was no evidence of contamination in or on the vehicle.

After Researcher A returned from Institution A, on November 22, he took home an EHS G-M survey meter and surveyed a pair of shoes that he had worn frequently throughout the summer but had ceased to wear after August when he bought new shoes. He found the soles of that pair of shoes to be contaminated and surveyed other areas of his home where he typically kept his shoes. He reported that he always leaves his shoes at the entrance area of his home and wears slippers throughout the rest of the home. He felt that, if he did not find contamination in the entrance areas, he would not expect to find contamination in other rooms. Additionally he surveyed the stairway and the dining area. Except for the soles of the contaminated shoes, the survey meter readings in all areas were indistinguishable from background. To validate Researcher A's survey technique, the RSO observed Researcher A while he surveyed a previously unsurveyed area in Location A. After the survey of his home, Researcher A brought the contaminated shoes to the RSO. Fixed contamination of 30,000 cpm was measured with an EHS G-M survey meter, and wipes were taken on the shoes. Removable contamination did not exceed 385 dpm. The presence of contamination on these shoes indicates that the damage to the source occurred prior to September because Researcher A did not wear those shoes after August.

Calculation of Activity in Damaged Portion of the Source

In order to make an assessment of the amount of activity involved in the damaged portion of the source, the RSO and the EHS H&S Specialist compared radiation measurements for the damaged source (PHY-0030) and for an intact Sr-90 source fabricated to the same design (PHY-0028). Other than date of fabrication and activity, the sources are identical in size and design.

The measurements were made with a Ludlum Model 3 G- M survey meter, SN 111536, with a Model 44-9 pancake probe, SN 033082. An electronic calibration and energy efficiency calibration for this meter and probe were most recently performed on May 31, 2006.

To make the measurements, the collimator was removed from the source assembly. The detector probe was placed perpendicular to the centerline of the cylindrical sources, i.e., facing the foil end of the assembly, and at a distance of 14 inches from the end of the source cylinder. A count rate measurement was first made with the intact source PHY-0028, and then a second count rate measurement was made with damaged source PHY-0030 in the same position so that the geometry was identical.

Expected Activities for Sources PHY-0028 and PHY-0030 on 11/14/06
PHY-0028: 198.9 μCi
PHY-0030: 179.4 μCi
Ratio of Activity for PHY-0030 to PHY-0028: 0.90

Unadjusted Count Rates
PHY-0028: 365,000 cpm (Unadjusted)
PHY-0030: 290,000 cpm (Unadjusted)

To adjust the count rate for PHY-0028 to account for the difference in activities between the two sources, the unadjusted count rate for PHY-0028 is multiplied by the activity ratio of 0.90.

Adjusted count rate for PHY-0028: 328,500 cpm

If PHY-0030 was undamaged, then we would expect a count rate of 328,500 cpm, based on the count rate for PHY-0028. The actual count rate for PHY-0030 is 290,000 cpm, which is 88% of the expected count rate.

The activity accounted for in the damaged source is therefore estimated to be 88% of the original activity or 158.0 μCi. This means that approximately 21.4 μCi of activity is unaccounted for in Source PHY-0030. The activity is expected to be present as both contamination distributed in the source storage drawer and over the various contaminated surfaces in locations A and B, but it is also expected that some of the 21.4 μCi is still present in the source cylinder as radioactive fragments, pushed deeper into the source cylinder and not as readily detectable. Therefore 21.4 μCi is assumed to be an upper limit on the amount of activity that could have been present in contamination, in radioactive waste generated during decontamination or available for uptake if ingestion had occurred.

Although a rigorous effort was not made to account for activity present as contamination in locations A and B, we estimate that no more than 5-10 μCi was actually present as contamination. The discrete areas of contamination discovered generally measured no more than 1,000 to 80,000 cpm. A very limited number of spots, possibly three or four spots, measured 250,000 to 350,000 cpm. Assuming a detector efficiency of no more than 25%, those few spots with the highest count rates accounted for 2-3 μCi of activity.

Timeline of Significant Events

A timeline of significant events associated with the discovery, investigation, surveys and decontamination efforts related to this incident is provided in Appendix D.

Probable Cause

During the 'reactive' inspection conducted by Mr. Dennis Lawyer on November 22, Mr. Lawyer considered the possibility that the leak test conducted by RS Technician A could have caused the damage to the source. This is not a credible scenario because 1) RS Technician A did not disassemble the source assembly and consequently did not have access to the foil, and 2) Location B contained widespread contamination even though the damaged source was not brought into Location B between November 7 when the leak test was performed and November 13 when the contamination was discovered.

Because access to Source A was limited to Researcher A, there is no reason to believe that the damage to the source occurred as a result of a deliberate act. Researcher A states that he is not aware of any occurrence that could have caused damage to the source. He also states that it was not his practice to look at the foil seated within the brass cylinder, and consequently he would not have noticed that damage to the foil had occurred. We note also that Researcher A was the only person who had a key to unlock the source storage drawer and that he did not loan the key to any other person during the period from May – November 2006.

Because the edges of the hole in the foil are pushed inward, and because the hole is a small circular hole with relatively well-defined edges, we believe that the damage occurred when a small object with a circular profile was pushed against the foil. Our visual inspection of the foil shows the foil to be thick enough that it is unlikely to have been damaged through being jarred or as a result of disintegration due to aging. We cannot be certain, but we suspect that the damage occurred either when the collimator was being removed prior to use or was being placed back onto the source cylinder after use. Figure A shows the presence of two guide pins on the edge of the collimator cylinder. The two guide pins fit into two holes on the edge of the source cylinder. The source cylinder and the collimator cylinder fit together snugly, and it takes some pressure to pull the two halves apart. We suspect that the damage occurred when Researcher A either 1) used sufficient force to pull the two halves apart during disassembly such that recoil pushed a guide pin against the foil or 2) misaligned the guide pins during reassembly such that one pin was pushed against the foil.

Exposures of Individuals to Radiation

Dose to Researcher A

Because contamination was found on surfaces that were touched by Researcher A, we considered the possibility that some Sr-90 may have been taken up internally by Researcher A. During the initial week of the investigation when Researcher A was at Institution A, the RSO contacted the Health Physics Office at Institution A and requested that they conduct a preliminary bioassay solely for the purpose of determining whether this 'screening' bioassay indicated the presence of any radioactivity in the urine. The preliminary assay conducted by Institution A did not indicate the presence of Sr-90 in a statistically significant amount. After Researcher A returned to his home in New Jersey, Researcher A provided a urine sample collected over a 24-hour period, beginning the morning of November 25. Although Researcher A arrived in New Jersey the evening of November 21, the collection of the urine sample was delayed until November 25 to accommodate the Thanksgiving holiday. Radiation Safety Associates, under the direction of K. Paul Steinmeyer, was contracted to perform the processing and radioanalysis of the urine sample and to provide the University with health physics services to determine dose in the event that Sr-90 is found in the urine sample.

Because chemical processing of the sample is required to separate strontium, and because the sample must be allowed to sit for 15 days to allow for ingrowth of Y-90, Radiation Safety Associates informs us that should expect to receive a report of analysis results on or about January 10, 2007. We originally expected to receive urinalysis results by mid-December but Radiation Safety Associates has informed us that they were delayed in processing the sample. We will submit a supplement to this report after we receive the bioassay results.

In the worst possible scenario, Researcher A is assumed to have ingested the entire 21.4 μCi determined to be involved in the damaged portion of the source. The appropriate Annual Limit of Intake for Sr-90 is assumed to be 30 μCi, based on oral ingestion (there is no evidence to suggest that the contamination was airborne). Consequently a worst case analysis indicates that the maximum total effective dose equivalent received as a result of the ingestion would not exceed 71% of the maximum allowable annual dose.

We also considered the possibility that Researcher A may have received radiation exposure to his hands from contamination on his hands. Appendix E provides a detailed calculation of potential dose to Researcher A's hands. Under the most extreme worst case assumptions described in Appendix D, Researcher A is calculated to receive a dose of <5 mrem to his hand. Since the annual maximum permissible dose to extremities established in 10CFR20.1201(a)(2)(ii) is 50 rem, Researcher A is calculated to have received a dose not to exceed 0.01% of the annual dose limit. Even repeated episodes of hand contamination would not cause Researcher A to receive an appreciable fraction of the annual dose limit.

Dose to Other Individuals

Locations A and B are not frequently utilized by persons other than Researcher A and Authorized User B, the faculty member who holds the radioisotope authorization for the damaged source. However, during late July and August 2006, Researcher B also worked in Location B. Researcher B is an undergraduate student who worked in the laboratory for four weeks during the summer assisting Researcher A. The RSO interviewed Researcher B and learned that, although he observed and assisted Researcher A, Researcher B did not handle the radioactive sources at any time. Researcher B presented the only pair of shoes he wore during his summer work in Location B, and the RSO performed a G-M survey and a wipe survey of the shoes. No contamination was found on the shoes or on Researcher B's person.

We do not believe that any person other than Researcher A received any meaningful dose. We base this conclusion on the following factors:

- Although substantial amounts of contamination were present on various surfaces in the research area of Location B, removable contamination was found on only one item in Researcher A's desk area in Location B (the telephone, measuring 44 dpm) and no contamination was found on surfaces, other than the floor, in Researcher A's office (Location C). Additionally, no contamination was found on any surface in Researcher A's car or in his home. Consequently there is no evidence that Researcher A was shedding significant amounts of contamination outside of the research area of Location B.
- The maximum contamination found on any surface likely to be touched by a member of the general public was contamination on a phone located in Location B (44 dpm) and on the doorknobs to Locations A and B (<40 dpm)

- No contamination was found on the shoes worn by Researcher B who, other than Researcher A, spent the greatest amount of time in Location B during the period in question.
- No contamination was found on the two pairs of shoes worn by the janitor who swept the floor in Location B, and the only dust mop to show contamination did not exceed a net count of 200 cpm with a G-M survey meter.

Surveys and Decontamination of Affected Locations

A floor plan of the affected portion of the 3rd floor of Jadwin Hall is provided as Appendix C. Our report provides a summary of the survey findings but does not provide the detailed survey reports. The results of surveys conducted prior his visit were reviewed by Mr. Dennis Lawyer when he conducted his 'reactive' inspection on November 22. All survey reports related to this incident will be maintained at Princeton University indefinitely as part of its radiological decommissioning file and copies will be made available to the NRC upon request.

As of the date of submission of this report, the status of the various locations involved in this incident is as follows:

Location	Status	Follow-up plans
Location A	Minor contamination was originally found on the floor of the room and on limited surfaces in and near the cabinet in which the sources are stored. These surfaces were decontaminated, and a final clearance survey indicated that no contamination remains on those surfaces. Contamination in this room is now limited to the interior of the drawer in which the sources are stored.	Decontamination of the drawer and the various sources stored in the drawer is expected to begin the week of December 18. The Sr-90 sources will not be completely decontaminated since we do not plan to put those sources back into service.
Location B	Contamination of the floor and various surfaces in the room existed at the onset of the incident. Decontamination has been completed. A final clearance survey has been conducted and had indicated that no contamination remains in this room. The room has been opened to all personnel without restriction.	None
Location C	Only minor contamination of the floor originally existed. The floor has been mopped, and a final clearance survey indicated that no contamination remains.	None

Where decontamination was necessary, straightforward cleaning techniques consisting of mopping or wiping surfaces with a solution of Count-Off were generally successful. In a very few locations where wiping of surfaces was not sufficient, slightly more rigorous techniques were successful. These techniques consisted of sandpapering, popping up a few floor tiles where contamination was found in the cracks between tiles, using a chisel to shave away a small amount of a particleboard surface, and in two cases, using a saw to cut out small sections of a wooden shelf.

Corrective Measures

We have concluded that the root cause of this incident was a source design which did not adequately protect the foil surface from being punctured. Corrective measures include the following

- The remaining two undamaged Sr-90 sources of the same design as the damaged source were immediately taken out of service on November 13, 2006, and the RSO took possession of the source storage drawer key to prevent access to the sources. These sources will be decontaminated to the extent possible and then will be set aside for several weeks and leak tested again to verify that they are not leaking.
- The damaged source will be disposed of as radioactive waste. Subject to further evaluation of source needs, it is expected that Sr-90 sources of design similar to the damaged source will be disposed of and replacement sources of a less vulnerable design will be purchased.
- If use of those Sr-90 sources similar in design to the damaged source becomes necessary, precautionary measures will be instituted, including, as a minimum, the use of protective gloves when handling the sources and a post-operational survey with a G-M meter, conducted by the researcher.
- EHS staff have begun a survey of all non-open sources to assess their condition and identify those sources with vulnerability to damage, either due to design or age.
- The RSO will review the assessment survey and will create a list of source-specific precautions. At its next meeting, the RSO will present a proposal to the Radiation Safety Committee to clarify the requirements for sealed sources and for those non-open sources that don't meet the definition of a sealed source as set forth in 10CFR30.4 and 10CFR30.32(g). Non-open sources are defined as those sources that do not present a reasonable potential for contamination during normal use, regardless of whether they meet the NRC's definition for sealed source.
- The RSO will propose to the Radiation Safety Committee that a physical review to assess the condition of all non-open sources be performed at a frequency not to exceed five years. Source-specific precautions may be revised as a result of this review or a recommendation may be made to take sources out of service.

Please direct any questions concerning this report to me at (609) 258-6252.

Sincerely,

Sue M. Dupre
Radiation Safety Officer

SMD/smd

Attachments as indicated below:
Appendix A: Listing of Persons and Locations
Appendix B: Photos of Damaged Source
Appendix C: Floor Plans of Affected Areas
Appendix D: Timeline of Significant Events

Appendix E: Calculation of Dose to Researcher A's Hands

C: Garth Walters, Director of Environmental Health & Safety
Prof. Elizabeth Gavis, Radiation Safety Committee Chair
Prof. James Broach, Acting Radiation Safety Committee Chair
Prof. A. J. Stewart Smith, University Research Board Chair
Laurel Harvey, General Manager for Administration and Compliance
Prof. Kirk McDonald, Professor of Physics
Dr. Changguo Lu, Detector Physicist
Dr. Paul LaMarche, Physics Department Manager
Prof. Daniel Marlowe, Physics Department Chairperson
Stephen Elwood, Health & Safety Specialist
Mr. William Czaszar, NJ Department of Environmental Protection
File 9.1
File 8.3
Departmental File – Physics (d-1)