



UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION IV
612 EAST LAMAR BLVD, SUITE 400
ARLINGTON, TEXAS 76011-4125

October 18, 2008

EA No. 08-237
NMED No. 080128

Mr. Clinton Lingren, President
SABIA, Inc.
7944 Convoy Court
San Diego, California 92111

SUBJECT: NRC INSPECTION REPORT 030-35997/08-001

Dear: Mr. Lingren:

This refers to the reactive inspection that began on February 29, 2008, at your Idaho Falls, Idaho, facility. The purpose of the inspection was to follow up on your February 29, 2008, telephonic report to the NRC regarding a breached strontium-90 radioactive source at your Idaho Falls, Idaho, facility. This inspection examined activities conducted under your license as they relate to safety and compliance with the Commission's rules and regulations and with the conditions of your license. Within these areas, the inspection consisted of observations of licensed activities, selected examination of procedures and representative records, independent radiation surveys, and interviews with personnel. Following the on-site inspection, the NRC conducted in-office reviews of the information gathered during the inspection and supplemental documentation provided by you. A telephonic exit briefing was conducted with you and Mr. James Miller, Radiation Safety Officer, on September 18, 2008. Enclosure 1 presents the results of the inspection.

Based on the results of this inspection, two apparent violations were identified and are being considered for escalated enforcement action in accordance with the NRC Enforcement Policy. The current Enforcement Policy is included on the NRC's website at www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html. These apparent violations involve failures to: (1) develop, document, and implement a radiation protection program commensurate with the scope and extent of licensed activities and sufficient to ensure compliance with the provisions of 10 CFR Part 20, and (2) perform a leak test of the strontium-90 sealed source when it was removed from storage and prior to being used.

The NRC considers these apparent violations significant because as a result of the apparent failure to develop, document, and implement a radiation protection program commensurate with the scope and extent of dismantling gauges containing radioactive sealed sources, a licensed activity, you were unable to ensure compliance with the provisions of 10 CFR 20.1101(b). Specifically, during the gauge dismantlement operations, you did not use to the extent practical, procedures and engineering controls based on sound radiation protection principles. As a result, your facility became extensively contaminated with strontium-90; one of your employees had considerable external contamination and received an intake of strontium-90; and three other employees were also contaminated to a lesser extent, resulting in occupational doses that

were not As Low As is Reasonably Achievable (ALARA). Furthermore, as a result of the failure to conduct a leak test of the strontium-90 sealed source after removing it from storage and prior to it being used, an employee unknowingly continued to handle the breached source. Handling the breached source in the absence of the leak test analysis results undoubtedly led to additional, unnecessary contamination of licensee employees and the facility. Although your dose assessment for the affected employees did not indicate radiation exposures in excess of any NRC limit, the doses obtained by the employees were avoidable and were not ALARA.

Since the NRC has not made a final determination in this matter, a Notice of Violation is not being issued for these inspection findings at this time. In addition, please be advised that the number and characterization of the apparent violations described in the enclosed inspection report may change as a result of further NRC review.

An open predecisional enforcement conference to discuss these apparent violations has been scheduled on November 10, 2008, at 8:00 AM CST at our offices in Arlington, Texas. An agenda for the predecisional enforcement conference is included as Enclosure 2. Additional details regarding this conference will be provided by separate correspondence.

The decision to hold a predecisional enforcement conference does not mean that the NRC has determined that a violation has occurred or that enforcement action will be taken. This conference is being held to obtain information to assist the NRC in making an enforcement decision. This may include information to determine whether a violation occurred, information to determine the significance of a violation, information related to the identification of a violation, and information related to any corrective actions taken or planned. The conference will provide an opportunity for you to provide your perspective on these matters and any other information that you believe the NRC should take into consideration in making an enforcement decision. In presenting your corrective actions, you should be aware that the promptness and comprehensiveness of your actions will be considered in assessing any civil penalty for the apparent violations. The guidance in Enclosure 3 is an excerpt from NRC Information Notice 96-28, "Suggested Guidance Relating to Development and Implementation of Corrective Action," and may be helpful.

During the predecisional enforcement conference, in addition to the discussion of the apparent violations and your corrective actions, the NRC requests that you address two additional concerns: (1) the status of supplemental surveys to be performed on items from your facility that were previously unconditionally released without adequate supporting survey data, and (2) the validity of some of the assumptions used in the determination of external dose to the most exposed employee.

Following the predecisional enforcement conference, you will be advised by separate correspondence of the results of our deliberations on this matter. No response regarding these apparent violations is required at this time.

In accordance with 10 CFR 2.390 of the NRC's "Rules of Practice," a copy of this letter, its enclosures, and your response, if you choose to provide one, will be made available electronically for public inspection in the NRC Public Document Room or from the NRC's document system (ADAMS), accessible from the NRC website at www.nrc.gov/reading-rm/adams.html. To the extent possible, your response should not include any personal privacy, proprietary, or safeguards information so that it can be made available to the Public without redaction.

If you have any questions concerning any information provided in this letter or the enclosed inspection report, please contact Janine F. Katanic, Ph.D. at (817) 860-8151 or Mr. Jack Whitten at (817) 860-8197.

Sincerely,

/RA/

Arthur T. Howell, III, Director
Division of Nuclear Materials Safety

Docket No. 030-35997
License No. 11-27727-01

Enclosures: 1. NRC Inspection Report 030-35997/08-001
2. Predecisional Enforcement Conference Agenda
3. Excerpt from NRC Information Notice 96-28

cc w/enclosures 1-2:
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RIV Materials Docket File (5th Floor)
 NMSB-A
 NMSB-B

SUNSI Review Completed: ADAMS: Yes Initials: JFK
 Publicly Available Non-Sensitive

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**U.S. NUCLEAR REGULATORY COMMISSION
REGION IV**

Docket No.: 030-35997
License No.: 11-27727-01
Report No.: 030-35997/2008-001
EA No.: 08-237
NMED No.: 080128
Licensee: SABIA, Inc.
Location: Idaho Falls, Idaho
Dates: February 29 – September 18, 2008
Inspectors: Janine F. Katanic, Ph.D., Health Physicist
Nuclear Materials Safety Branch B

Anthony D. Gaines, Senior Health Physicist
Nuclear Materials Safety Branch A

Lawrence Donovan, Health Physicist
Nuclear Materials Safety Branch A
Approved By: Jack E. Whitten, Chief
Nuclear Materials Safety Branch B
Attachment: Supplemental Inspection Information

EXECUTIVE SUMMARY

SABIA, Inc. (SABIA)
NRC Inspection Report 030-35997/08-001

This was a reactive inspection that began on February 29, 2008, and was conducted to review the licensee's February 29, 2008, telephonic report to the NRC of a leaking strontium-90 sealed source at its Idaho Falls, Idaho, facility. The scope of this inspection consisted of observations of licensed activities, review of selected records and procedures, interviews of personnel, radiological surveys, and in-office review of information gathered both during the inspection and in licensee submittals. This report describes the findings of the inspection.

Program Overview

SABIA was authorized under NRC Byproduct Materials License 11-27727-01 for various activities involving the use of byproduct material related to industrial gauging devices. Licensed material was specifically authorized for use at the licensee's facilities in Idaho Falls, Idaho, and at temporary job sites in areas of NRC jurisdiction. (Section 1)

Inspection Findings

On February 29, 2008, the licensee telephonically notified the NRC of a leaking strontium-90 sealed source at their Idaho Falls facility. The inspection revealed that on February 29, 2008, a SABIA employee, in an attempt to remove a strontium-90 sealed source from a source holder, physically impacted the source. The employee continued to handle the breached source while another SABIA employee performed a leak test analysis. When the analysis was complete and excessive removable contamination was detected, the employee who had been handling the breached source was found to be externally contaminated and had received an intake of strontium-90. In addition, the licensee's facility had become significantly contaminated and three other SABIA employees had been contaminated to a lesser extent. (Section 2)

At the request of the Idaho Department of Environmental Quality (IDEQ), during March 2-3, 2008, the U.S. Department of Energy (DOE) Radiological Assistance Program (RAP) Region 6 entered the SABIA facility and conducted surveys in order to determine the scope and extent of radiological contamination. Federal, State, and Local officials performed radiological surveys of potentially impacted offsite locations in the public domain and did not identify any offsite contamination. (Section 2)

On March 5, 2008, the NRC issued a Confirmatory Action Letter (CAL) to SABIA that confirmed it would take specific actions including, but not limited to: making arrangements for dose assessments for all workers potentially exposed to strontium-90; obtaining services of an NRC or Agreement State service licensee to decontaminate its Idaho Falls, Idaho, facility, removal and disposal of contaminated materials; and providing a written report to NRC detailing their corrective actions. (Section 2)

Decontamination Activities of Licensee Facilities

Pursuant to the CAL, the licensee obtained services for the decontamination of their facility and removal of contaminated items. The decontamination plan was reviewed by the NRC prior to the start of decontamination activities. Decontamination activities took

place between April 14-25 and May 5-16, 2008. Reports regarding the results of the decontamination activities were submitted to NRC for review. Based on NRC's review and technical analysis of these reports and requests for additional information, the service provider developed a list of items that they believed necessary to re-survey to support the free release of these items. The results of the additional surveys were provided by SABIA to the NRC on October 16, 2008, and will be reviewed during a future NRC inspection. Radioactive waste shipped for disposal included approximately 49 cubic-yards of contaminated items; cesium-137 sealed sources that had been previously removed from dismantled gauges; and the damaged strontium-90 source. (Section 3)

Personnel Dose Assessment

Bioassay samples were collected from all potentially affected SABIA employees and were analyzed by an independent laboratory for strontium-90. A contractor hired by SABIA to perform the dose assessments determined that the employee who had a known intake of strontium-90 was determined to have received a Total Effective Dose Equivalent (TEDE) of 1.44 rem. The three other SABIA employees were determined to have significantly lower doses. None of the determined doses exceeded any of NRC's regulatory limits. (Section 4)

Causal Factors

The licensee reported to the NRC that the probable cause of the event was that a sealed strontium-90 source was found to be leaking. The licensee indicated that they believed that the 20-year-old source may have been leaking for some time and that when the gauge was dismantled, the contamination was revealed. (Section 5)

For the purposes of the causal factor analysis performed by the NRC, the incident was defined as the strontium-90 contamination event, involving both the licensee's facility and personnel. The NRC has concluded that the incident was directly caused by physical impact on the strontium-90 source and its source holder. The NRC has concluded that the contributing causes that facilitated the incident or made the incident more likely to occur was: the compressed timeline to complete the gauge dismantlement project; "ownership" of the gauge dismantling project; and a lack of understanding of the radiation hazard associated with high energy beta-emitting sources. The root cause of the incident was identified by the NRC as the licensee's failure to comply with 10 CFR 20.1101(a), which requires, in part, that the licensee develop, document, and implement a radiation protection program commensurate with licensed activities (in this case, gauge dismantlement operations) that would be sufficient to ensure compliance with the provisions of 10 CFR Part 20. As a result, SABIA failed to use, to the extent practical, procedures and engineering controls based on sound radiation protection principles, and they did not achieve occupational doses that were As Low As is Reasonably Achievable (ALARA). This failure was identified as an apparent violation of 10 CFR 20.1101(a). (Section 5)

Several items were identified by the NRC that impacted or mitigated the identification and response to the incident. License Condition 14.E. of SABIA's NRC License No. 11-27727-01, Amendment No. 10, requires, in part, that when sealed sources are removed from storage for use and have not been tested within the required leak test interval, they shall be tested before use. The removal of the gauge from storage for

purposes of dismantlement and removal of the strontium-90 sealed source constituted use of the sealed source. A licensee employee removed the gauge containing the sealed source from storage and used the sealed source prior to the completion of the leak test analysis. This failure was identified as an apparent violation of License Condition 14.E. of NRC Byproduct Materials License 11-27727-01, Amendment 10. (Section 5)

Reporting Requirements and Corrective Actions

Following SABIA's telephonic report of the event to the NRC, pursuant to NRC regulations and the conditions of the CAL, the licensee submitted written reports to the NRC. These reports included: a description of the event; information regarding personnel exposures; and information regarding the licensee's corrective actions taken and planned to prevent recurrence. (Section 6)

Report Details

1 Program Overview (87103, 87125)

1.1 Inspection Scope

The license application, supporting documents, and other records and documents provided by the licensee were reviewed. Collectively, these documents described the licensee's radiation safety program. In addition, interviews were conducted with licensee personnel.

1.2 Observations and Findings

At the time of the on-site inspection, SABIA, Inc. (SABIA) was authorized under NRC License No.11-27727-01, Amendment No. 10, for various activities involving byproduct material related to industrial gauging devices. Specifically, the license authorized certain research and development activities involving byproduct material as well as activities associated with the installation, relocation, repair, servicing, removal, and redistribution of industrial gauging devices.

Licensed material was authorized for use at the licensee's facility in Idaho Falls, Idaho, and at temporary job sites in areas of NRC jurisdiction. The Radiation Safety Officer (RSO) authorized on the license was routinely located at the licensee's corporate facility in California. At the time of the incident and during the on-site portion of the NRC's inspection, four licensee employees were stationed at the licensee's Idaho Falls location.

1.3 Conclusions

SABIA was authorized under NRC License No. 11-27727-01, Amendment No. 10, for various activities involving byproduct material related to industrial gauging devices. Licensed material was authorized for use at the licensee's facility in Idaho Falls, Idaho, and at temporary job sites in areas of NRC jurisdiction. At the time of the on-site inspection, the licensee's Idaho Falls staff consisted of four employees.

2 Inspection Findings (87103, 87125)

2.1 Inspection Scope

This was a reactive inspection that began on February 29, 2008, and was conducted to review the licensee's telephonic report to the NRC of removable contamination that had been detected during a leak test of a strontium-90 sealed source. The inspection consisted of observations of licensed activities, selected examination of procedures and representative records, independent radiological surveys, and interviews with licensee personnel. The inspection also included a review of various records and documentation that were provided to NRC following the on-site portion of the inspection.

2.2 Observations and Findings

2.2.1 Background

As part of SABIA's business operations, SABIA provided services for their customers related to industrial gauges that contain byproduct material. The services provided included the removal of industrial gauges and shipping of industrial gauges from customer facilities for the purposes of disposal, redistribution, or transfer. Prior to October 2002, when SABIA personnel removed industrial gauges from customer facilities, they packaged and shipped the gauges to SABIA's facility in San Diego, California, under the provisions of their State of California License No. CA-6663-37. In April 2002, SABIA applied for an NRC license, which was subsequently issued by the NRC in June 2002.

In October 2002, SABIA packaged and shipped 75 industrial gauges from their California location to their Idaho Falls, Idaho, facility. These industrial gauges consisted of four americium-241 gauges, two cobalt-60 gauges, one strontium-90 gauge, and 68 cesium-137 gauges. Starting in November 2002, industrial gauges that were removed in the field by SABIA personnel were shipped directly to their Idaho Falls facility and placed into storage there. As a result, the licensee had approximately 180 industrial gauges that contained byproduct material in storage at their Idaho Falls facility.

SABIA's NRC license was amended in July 2004, in part, to address the industrial gauge storage situation at SABIA's Idaho Falls facility. Specifically, NRC License No. 11-27727-01, Amendment No. 1, contained License Condition 15, which required, in part, that sealed sources containing licensed materials shall not be stored at the licensee's Idaho Falls facility for a period of more than 5 years. The license was subsequently amended several times and in NRC License No. 11-27727-01, Amendment No. 10, this license condition was renumbered to License Condition 16.

On August 18, 2007, the licensee submitted an amendment request to NRC in which it sought an extension of time to dispose of the gauges that were in storage at their Idaho Falls facility. Because many of the gauges had been in storage at their facility since October 2002, the licensee was rapidly approaching the 5 year deadline specified in their NRC license and still had these gauges in storage. The August 18, 2007, amendment request indicated that the licensee lacked proper documentation for several of the sealed sources contained in the gauges and thus would have to disassemble/dismantle each gauge and consolidate the radioactive sources for the purpose of disposal. The proposed schedule outlined in SABIA's amendment request was to commence disassembly of the gauges starting in November 2007 and complete these activities in March 2008, with proposed disposal of the material to occur in April 2008.

In the email and letter dated November 6, 2007, the licensee provided the NRC with supplemental information to support its August 18, 2007, amendment request. This supplemental information described the safety precautions to be utilized by the licensee during the gauge disassembly operations. These safety precautions included the use of shielding, performance of leak tests, and the use of radiation survey instrumentation and dosimeters. After reviewing the supplemental information, the extension of time to dispose of the sealed sources in the gauges was granted by the NRC. As a result, SABIA's license was amended to include License Condition 16.B., which required, in

part, that the licensee may temporarily continue to store sealed sources at their Idaho Falls facility for a period exceeding 5 years to allow for gauge decommissioning as described in the licensee's August 18, 2007, letter. The extension authorized by License Condition 16.B. was set to expire on April 30, 2008.

2.2.2 Sequence of Events Leading to the Discovery of Radioactive Contamination

At the start of the week of February 25, 2008, SABIA employees began the process of disassembling and dismantling the approximately 180 industrial gauges that were in storage. To accomplish the gauge dismantlement and sealed source removal task, the RSO flew in from his California office, and one of SABIA's most experienced technicians was dispatched from another state (hereafter referred to as Employee #1). The licensee estimated that the gauge dismantlement and sealed source removal project would take two weeks to perform, beginning on February 25, 2008. The general goal of the project was to remove the radioactive sealed sources from the gauges so that they could be consolidated and disposed of as radioactive waste. Then, after removing the sealed sources and checking the bulky outer casings for radiological contamination, the casings could be recycled as scrap metal.

On Monday, February 25, 2008, Employee #1 arrived at the Idaho Falls facility, assessed the equipment available for the project, and noted that the tools and equipment available were not sufficient for the gauge dismantlement and source removal activities. On February 25 and 26, 2008, the licensee purchased additional tools and equipment to perform the gauge dismantlement procedures. The tools and equipment purchased included various air-powered tools, such as an air chisel, and various hand tools including wrenches. Also on February 26, 2008, the licensee borrowed a few lead bricks from another local NRC licensee in order to have shielding materials available.

SABIA's facility in Idaho Falls consisted of two high bay facilities in a light industrial building at the Idaho Innovation Center. Each bay was 84 feet long and 24 feet wide. The two SABIA bays were joined in the back by a small vestibule area. The vestibule area had a personnel door to the outside back parking area and a personnel door leading into each bay. Each bay also had large roll-up doors that led to the outside back parking area. The front of each bay had personnel office space and a personnel door that led to the interior corridor of the light industrial building. The work to dismantle the gauges was performed in Bay 3 of the licensee's facility. Bay 3 was the specific location where the gauges were being stored and where the licensee routinely conducted licensed activities. Accordingly, Bay 3 was considered by the licensee to be a restricted area. Prior to the gauge dismantlement project, licensed materials were not used in Bay 4 of the licensee's facility. Bay 4 was instead used for assembling electrical components and other tasks that did not involve the use of licensed materials.

Starting on February 26, 2008, the process of dismantling the gauges began in earnest. Interviews by the inspectors with the licensee's employees determined that there was no formal or written procedure to dismantle the gauges. Instead, SABIA personnel relied on verbal instructions and their mechanical knowledge of industrial gauges to guide them in the dismantlement operations. Both the RSO and Employee #1 were in charge of the actual gauge dismantlement and sealed source removal. Employee #2 was responsible for certain aspects of recordkeeping and also for performing and analyzing the leak tests of the sealed sources and contamination checks of the gauge housings. Employee #3 was also responsible for certain aspects of recordkeeping and, once the sealed sources

were removed from the gauges, was also responsible for taking the empty gauge housings to a local recycling facility as scrap metal. Employee #4 was in charge of operating the fork lift, moving the crates that contained gauges, unbolting the gauges from the crates, and staging the gauges for dismantlement. Because the gauges were heavy, Employee #4 used a chain to drag the gauges along the floor of Bay 3 from the crates to the gauge disassembly area.

On February 26, 27, and 28, 2008, the licensee was making progress in dismantling the gauges, and several gauges containing cesium-137 had been dismantled and the sealed sources removed. However, on February 29, 2008, the RSO did not participate in the gauge dismantlement operations because he had left that morning to return to his office in California. This meant that Employee #1 would not have any hands-on assistance and oversight from the RSO when performing the actual dismantlement and sealed source removal operations. Employee #1 raised this concern with SABIA management, but no actions were taken as a result of the concern. In addition, Employee #4 was scheduled to leave for vacation starting the following day, on March 1, 2008, so there would be one less individual to assist with the dismantlement project.

The morning of February 29, 2008, Employee #1 proceeded with the scheduled operations and dismantled a few gauges containing cesium-137 sealed sources. Although several gauges had been removed from their crates and staged for dismantlement, Employee #1 was unsure of how to remove the sealed sources from several of those gauges, and others were in poor or rusted condition, so he proceeded to dismantle a gauge that contained a strontium-90 sealed source. Employee #1 informed the inspectors that he chose to work on this particular gauge because it looked like it would come apart easily.

On February 29, 2008, during the mid-morning, Employee #1 began to dismantle an LFE Corporation model SLUP-1C frame beta gauge that contained a DuPont Merck Pharmaceutical Co. model NER-592 strontium/yttrium-90 sealed source. This model gauge and sealed source are described in Section 2.2.3. The particular gauge being dismantled by the licensee contained sealed source serial number 1265, with an initial activity of 100 millicuries. On February 29, 2008, the source had decayed to approximately 62 millicuries. The source had previously been leak tested on September 27, 2002, prior to it being shipped in October 2002, from SABIA's California facility to their Idaho Falls facility. If a leak test detects the presence of 0.005 microcuries or more of removable contamination, the source is considered to be leaking. The September 27, 2002, leak test did not detect the presence of removable radioactive contamination in excess of 0.005 microcuries.

Employee #1 described the dismantlement of the strontium-90 gauge to the inspectors. Employee #1 stated that he examined the gauge and attempted to determine how the source could be removed. Upon examination of the shutter mechanism, Employee #1 concluded that the sealed source could not be removed from the front of the gauge and thus would have to be removed from the back. Employee #1 then removed the outer blue-colored cast iron gauge housing, which was attached to the base plate by a gasket. Employee #1 then clipped some internal wiring, and observed the stainless steel source support plate that had a sticker on it that said "RADIOACTIVE" and had the trefoil symbol. The two screws that held down the support plate were removed, thus allowing the plate to be removed. The support plate held the source holder in place, so when the plate was removed, the source holder was free.

Previously, the RSO and Employee #1 had staged a lead container on the top of the wood workbench and labeled it "Sr-90." The intent of the lead container was to place the strontium-90 sealed source inside of this container for eventual disposal. However, when Employee #1 tried to place the source holder inside of the designated container, the source holder was found to be too large to fit inside of the container. Accordingly, Employee #1 decided to remove the strontium-90 sealed source from the source holder, so that the source by itself would fit inside of the staged lead container.

Employee #1 informed the inspectors that he examined the source holder and considered different means to remove the strontium-90 sealed source from the source holder. Employee #1 stated that he observed a piece of foil on one side of the source holder. Employee #1 pulled off the foil, revealing what was described to the inspectors as a "metal disk with a hole in it." A review by the inspector of the Sealed Source and Device Registry (SSDR) Safety Evaluation for the particular gauge indicated that this metal disk was a collimator used with these types of strontium-90 sealed sources to produce a 0.348 inch diameter circular beam. Employee #1 removed the metal disk (collimator) and observed the strontium-90 source held in place within the source holder. After the collimator was removed, Employee #1 stated that he "tapped" the source holder down on top of the cardboard that covered the wood work bench, but the source did not dislodge from the source holder. Employee #1 then observed a "bead" around the edges of the source and suspected that this was preventing the source from coming out of the source holder in the direction that it was being tapped. As a result of not being able to dislodge the strontium-90 source, Employee #1 turned the source holder around and observed a plug in the back of the source holder that was flush with the back of the source holder. Employee #1 removed the plug with a screwdriver. The source holder was then "tapped" down again by Employee #1, but this time in the opposite direction, to try to get the source to come out through the back of the source holder. Following this evolution, the source would still not dislodge from its holder. Employee #1 then used a screwdriver to "tap" on the strontium-90 source in an attempt to dislodge it from the source holder. Employee #1 reported to the inspectors that the source was "dented" by the screwdriver. Then, after denting the source, Employee #1 "tapped" the source holder onto the cast iron surface of a table saw that was in the nearby work area to attempt to dislodge the source from the source holder. Despite these attempts, the source was not successfully removed from the source holder.

When the gauges were disassembled, leak tests would be performed of both the gauge housing and the sealed source. Employee #2 had been assigned to perform the leak tests. Employee #2 informed the inspectors that he was not aware of any written procedure to perform the leak tests. Employee #2 indicated that he had only been working for the licensee for about a month and had been assigned to the Idaho Falls facility primarily for training purposes. In lieu of a formal written procedure for conducting leak tests, Employee #2 indicated to the inspectors that he instead relied on his previous experience with radioactive materials and developed his own method to perform the leak tests. Each gauge was to have two leak tests; one to determine the presence of removable contamination on the sealed source and the other to determine the presence of removable contamination on the gauge housing. Employee #2 stated that in performing the leak test swabs in Bay 3, he would use dry, cotton-tipped wooden sticks to swab the sealed source and the gauge housing. Then he would put the swabs into small plastic bags and transfer them from Bay 3 into Bay 4 for the leak test analysis. The licensee had previously decided that the swabs needed to be analyzed in Bay 4

because the large number of gauges in storage in Bay 3 had created a high background radiation level in Bay 3. In order to decrease the background radiation, the analysis was performed in Bay 4, away from the gauges that were in storage and being disassembled in Bay 3.

Based on interviews with SABIA employees, it is inconclusive at what point during the dismantlement process that the strontium-90 source and gauge housing were swabbed by Employee #2. When the inspector initially interviewed Employee #1, his recollection was that the source was swabbed after the source was "dented." Later, Employee #1 recollected that he was unsure of when the source was swabbed, what portion of the source was swabbed, or how many swabs were used.

Employee #2 also had conflicting accounts of when the swabs were performed. Initially, Employee #2 stated that he was not present when the source was being dismantled in Bay 3, since he would routinely wait in Bay 4. Employee #2 explained that prior to the dismantlement of the gauge that contained the strontium-90 source, only gamma-emitting sealed sources had been removed from gauges by the licensee. The licensee had positioned a radiation detection instrument with its audio indicator in the "on" position in the vicinity of the work area where the gauges were being dismantled. Employee #2 explained to the inspectors that as the gamma-emitting sources were removed from the gauges, they would be removed from their respective shielding and the audio indicator on the instrument in Bay 3 would indicate the detection of radiation by emitting an audible signal. Employee #2 indicated that he would hear the audible signal coming from Bay 3 and leave Bay 4 to collect the leak test swabs. However, when Employee #1 was dismantling the strontium-90 gauge, both he and Employee #2 were unaware of the particular radiological characteristics of strontium-90. Employee #2 indicated that when Employee #1 was dismantling the gauge and removing the source, he continued to wait in Bay 4 for an audible signal but did not hear one. The inspectors concluded that this was likely due to the distance from the strontium-90 source to the instrument and the particular radioactive characteristics of strontium-90. Employee #2 stated that he began to wonder why he was not hearing any audible signal although a significant amount of time had passed since the prior gauge had been dismantled. This lag time is what prompted Employee #2 to enter Bay 3 to check on the progress of Employee #1, who had been "working on the gauge for quite a while." At this point Employee #2 then obtained the leak test swabs of the strontium-90 source and the gauge housing. However, Employee #2 later stated to the inspectors that he recollected that he was present when the source holder was first removed from the gauge and it was at that time that he collected the swabs of the gauge housing and the strontium-90 source.

In determining the sequence of events, the inspectors learned that Employee #3 was not present at the licensee's facility when the gauge containing the strontium-90 source was being dismantled. Employee #3 instead was dropping off empty gauge housings to a local scrap metal recycler. The inspectors learned through interviews that Employee #4 was not in the vicinity of the gauge dismantlement because he was positioned toward the front of Bay 3 unbolting other gauges from crates to stage them for dismantlement. The inspectors concluded that neither Employee #3 nor Employee #4 could attest to when the leak test swabs of the strontium-90 source and gauge housing were obtained.

As a result of the conflicting recollections of Employee #1 and Employee #2, it is inconclusive whether the swab of the source was performed either (1) immediately after

the source holder was removed from the gauge or (2) at some point after the source was physically impacted by tapping on the workbench, table saw, or impacted by the screwdriver. After discussing the matter with SABIA management, on August 29, 2008, the licensee provided the NRC with a written statement prepared by Employee #1 in which Employee #1 indicated that the leak test swab was taken after he had "dented" the source.

Regardless of when the leak test swab was collected, it is well established through interviews with SABIA employees that Employee #1 continued to attempt removal of the strontium-90 source from the source holder prior to the analysis of the leak test being completed. As a result, Employee #1 unknowingly continued to handle the damaged strontium-90 source while Employee #2 concurrently took the leak test swabs to Bay 4 for analysis.

When questioned about the instrumentation he had used to conduct the leak test analysis, Employee #2 informed the inspectors that he had analyzed the leak test swab taken from the strontium-90 source with a "Radiation Alert" model "Inspector." This was a small instrument equipped with a Geiger-Mueller tube to detect radiation and had a "pancake" type window on the back of the instrument to facilitate detection of gamma and beta contamination. The instrument was equipped with a sliding metal plate on the back where a leak test sample could be placed for analysis. Although the sliding plate on the back of the instrument was designed to hold circular-shaped filter-type wipes, the licensee had elected to use cotton-tipped swabs. The instrument was equipped with an audible signal capability, but Employee #2 stated that he had turned the audible signal to the "off" position. Employee #2 stated that when conducting the leak test analysis for the strontium-90 source, he inserted the cotton-tipped swab in between the face of the pancake window and the sliding metal plate and began to collect data. When the 1-minute counting interval was completed, Employee #2 stated that he observed what he characterized as "very high counts" (a few thousand counts per one minute interval) on the instrument display. Employee #2 stated that as a result of the high readings on the instrument display, he suspected that when he began to count the swab, he might have inadvertently neglected to re-set the instrument from the previous leak test swab analysis. Employee #2 noted that if the instrument was not re-set after the previous analysis, it would add the counts from the current analysis to the counts from the previous analysis. Following this rationale, Employee #2 re-set the instrument and began to re-analyze the swab. When the second analysis began, Employee #2 noted that the counts immediately jumped up very high (a few thousand counts). It was around this time that Employee #3 returned from the scrap metal recycler. Employee #2 informed Employee #3 that he suspected that something was wrong with the instrument. In an attempt to resolve the suspected problem, they brought the instrument to the front office area of Bay 4 and changed the batteries. After the batteries were changed, the instrument was turned on with no swab inside of the unit, at which time the instrument display immediately indicated several thousand counts. It was at this point that Employee #2 recognized that there may be actual radioactive contamination and informed Employee #1 to "Stop!" and discontinue his activities involving the strontium-90 source.

2.2.3 Description of Device and Source Involved in the Event

The inspectors reviewed both the gauge and sealed source SSSR Safety Evaluations. The gauge involved in the event was an LFE Corporation model SLUP-1C frame beta

gauge with SSDR No. IL-420-D-165-S. The gauge SSDR Safety Evaluation described the device as being designed to measure product weight per unit area. In an industrial setting, the product to be measured would pass in front of the sealed source contained in the gauge and a detector on the opposite side of the product would measure the absorption of radiation by the product.

The radioactive source contained in the beta gauge was a DuPont Merck Pharmaceutical Co. model NER-592 strontium/yttrium-90 sealed source with SSDR Safety Evaluation No. NR-476-S-829-S. The SSDR Safety Evaluation for the strontium-90 sealed source indicated that it was designed by the manufacturer to emit beta radiation. The conditions of normal use specified in the SSDR Safety Evaluation for the strontium-90 sealed source were listed as industrial and research applications which require high energy beta radiation. The sealed source itself consisted of strontium/yttrium-90 oxide/silicate fused in a glass disc and sealed by welding in a stainless steel capsule. The capsule body was 0.27 inches (6.86 mm) long and 0.40 inches (10.2 mm) in diameter and had a wall thickness of 0.03 inches (0.762 mm). The radioactive material was stored behind a 0.003 inch (0.076 mm) thick stainless steel window. In the SSDR Safety Evaluation, the manufacturer indicated that they concluded that the sealed source would be expected to maintain its containment integrity for normal conditions of use and accidental conditions which might occur during the uses specified in the SSDR Safety Evaluation.

Strontium-90 is a radioactive isotope of the element strontium. Strontium-90 has a half-life of 29.1 years and decays to yttrium-90, which is a radioactive isotope of the element yttrium. Yttrium-90 has a half life of 2.67 days and decays to stable, non-radioactive zirconium-90. If a source is initially mostly pure strontium-90, as the strontium-90 decays, it produces yttrium-90. Eventually the strontium-90 and yttrium-90 are said to be in equilibrium. This means that the activity of strontium-90 and yttrium-90 in the source are essentially the same. Accordingly, each decay of a strontium-90 atom also produces a decay of a yttrium-90 atom. When strontium-90 decays, it emits a beta particle with a maximum energy of 0.546 MeV. When yttrium-90 decays, it emits a beta particle with a maximum energy of 2.281 MeV. Appendix B of 10 CFR Part 20 provides the Derived Air Concentration (DAC) for strontium-90 as 2×10^{-9} microcuries per milliliter. 10 CFR 20.1003 defines DAC as the concentration of a given radionuclide in air, which if breathed by the reference man for a working year of 2000 hours under light conditions of work, results in an intake of one Annual Limit on Intake (ALI).

2.2.4 Licensee Actions Following the Discovery of Radioactive Contamination

When the contamination was discovered, Employee #1 placed the damaged strontium-90 source into a large yellow-painted empty lead container with a red-painted lead lid. This lead container had been previously staged on the floor in Bay 3 as a receptacle for sealed cesium-137 sources that were being removed from gauges during the dismantlement operations. After placing the damaged source into the lead container, Employee #1 removed his leather gloves and at some later time the gloves were placed into a plastic garbage bag that was left on the floor in Bay 3.

Following the discovery of the strontium-90 contamination, the SABIA employees began using their available radiation detection equipment in order to determine the extent of the radioactive contamination. Radioactive contamination was detected on the cast iron surface of the table saw in Bay 3, on the floor in Bay 3, on the floor in Bay 4, and on the

employees. After recognizing the extent of the contamination event, Employee #3 and Employee #4 began to make phone calls to various SABIA personnel. In an effort to obtain assistance and guidance in addressing the contamination event, SABIA personnel attempted to call the SABIA RSO. However, they were unable to reach him directly on his cell phone because the RSO was on a flight returning to California. A message was left on the RSO's cell phone for him to call the facility immediately. In between flights, the RSO received the urgent message and returned the call to the Idaho Falls facility. Because the licensee's pancake-type instrument had become contaminated, the RSO instructed one of the SABIA employees to go to another local NRC licensee's facility and borrow a sensitive radiation survey instrument. Following the telephone call with the RSO, Employee #3 was checked for contamination by another employee, left the facility in a rented truck, went to the other licensee's facility, and borrowed a more sensitive instrument. The borrowed instrument had a large area alpha/beta probe and was suitable for "frisking" or checking for contamination. Employee #3 returned to the SABIA facility with the instrument.

Using the more sensitive survey instrument obtained by Employee #3, the employees further checked themselves for contamination. During the personnel contamination surveys, Employee #1 was determined to be contaminated "from head to toe." Employee #4 was checked for contamination by Employee #2 and was found to only have contamination on his shoes. Employee #4 then removed his contaminated shoes, put on a spare pair of shoes that he kept in his office, and left the facility in his personal truck. Employee #4 went to the lobby of the hotel where Employee #1 had been staying and then proceeded to Employee #1's hotel room. In the hotel room, Employee #4 picked up a change of clothes for Employee #1. After leaving the hotel, Employee #4 went to a local grocery store where he purchased decontamination supplies, including paper towels and foaming hand cleanser. Employee #4 then returned to the SABIA facility with the change of clothes for Employee #1 and the decontamination supplies.

During the time that Employee #4 was out of the facility, Employee #2 helped Employee #1 to decontaminate himself. The decontamination was performed in Bay 4 near the front office area. Because Employee #1 was so heavily contaminated, he removed all clothing except for his underwear. The contaminated clothing worn by Employee #1 was placed inside of a large rubber garbage container. Employee #1 was found to have contamination on his skin as well. Skin contamination was found on Employee #1's arms, above where his gloves had ended and below where his shirt sleeves had been pushed up. Most notably, radiation surveys revealed contamination on Employee #1's face and neck. Contamination was not found on the top of the head likely because Employee #1 was wearing a hat at the time of the incident. Employee #1 used damp paper towels to clean his face and remove the contamination. Employee #1 repeated this process many times, but each time Employee #2 used the instrument over Employee #1's face, contamination was detected. It was noticed that as Employee #1 exhaled through his nose and on to the detector probe of the instrument, the count rate on the instrument would increase. After observing these increased count rates, Employee #1 then concluded that the source of the elevated counts was coming from inside of his nose. Employee #2 instructed Employee #1 to repeatedly blow his nose. The paper towels used to blow his nose were surveyed and found to contain radioactive material. Employee #1 continued to blow his nose until it was dry, and then he took wet paper towels, placed them near his nostrils, and inhaled through his nose. He then blew his nose and repeated this action several times until the count rate of material coming

out of his nose had decreased. Employee #1 re-dressed himself in the clean clothing that had been brought back by Employee #4.

At some point during the personnel decontamination process, when his travels allowed him to make a phone call, the RSO called back to the facility. The RSO was provided with additional details about the incident from the SABIA employees. In addition, at some point during the incident, Employee #3 had called a consulting company in California that had previously performed radiation program audits for SABIA. An employee of the consulting company explained to the SABIA personnel that it would be prudent to take Employee #1 to a medical facility for evaluation.

When personnel decontamination activities were complete, an employee placed signs on the personnel entry/exit doors to the SABIA facility, noting that the facility should not be entered for any reason. After placing the signs on the doors and locking the doors, all four employees left the facility. Employee #1 left in a rental truck, returned to his hotel room, showered, and changed clothes. Employee #2 left in a personal vehicle, returned to his hotel room, showered, and changed clothes. Employee #3 left the facility in a personal vehicle, returned home, showered, and changed clothes. Employee #4 left the facility in a personal vehicle, returned home, showered, and changed clothes. Employee #3 then used a personal vehicle to pick up Employee #1 from the hotel and take him to a local medical facility.

Employee #1 was examined at a local medical facility where one of the medical professionals who examined Employee #1 was familiar with personnel radioactive contamination events through prior work experience. The medical professional in turn contacted the Oak Ridge Institute for Science and Education's Radiation Emergency Assistance Center/Training Site (REAC/TS). Part of the mission of REAC/TS is to provide advice and consultation on radiation emergency medicine. When the medical professional contacted REAC/TS, she provided them with the contamination information that Employee #1 had related. The REAC/TS physician expert and health physics expert determined, using the data provided by Employee #1, that the exposure to Employee #1 was "minimal" and no medical treatment was required.

When the RSO became available during his travel, he called the NRC Region IV office to inquire about how to report a leaking source. When the RSO was questioned about the incident, he provided the NRC Region IV office with additional details about the event. As a result, he was informed by an NRC Region IV management representative that the incident should be telephonically reported to NRC's Headquarters Operations Office. At approximately, 5:52 PM (ET), the RSO telephonically notified NRC's Headquarters Operations Office of the event. At approximately 5:30 PM (ET), NRC Region IV management contacted an NRC inspector who was in southern Idaho on other official NRC business. The inspector was immediately dispatched by NRC Region IV management to Idaho Falls to respond to the SABIA incident and to begin inspection activities. On-scene inspection activities continued through March 6, 2008.

2.2.5 NRC, State, and Local Response to the Contamination Event

On February 29, 2008, the evening of the incident, the NRC inspector arrived in Idaho Falls and at approximately 6:00 PM (MT), began to interview licensee employees. Employee #4 was interviewed that evening since he was scheduled to leave for vacation the following morning. Based on the inspector's interview with Employee #4, and NRC

Region IV management's telephonic conversations with the SABIA's RSO, it became evident to the NRC that the scope and extent of the contamination event were not well understood by the licensee. Likewise, the inspector learned that the licensee had not begun the collection of biological samples for the determination of possible ingestion/inhalation of strontium-90.

On March 1, 2008, the NRC inspector met with and interviewed the remaining three SABIA employees in a common area of a hotel. The inspector then traveled to the SABIA facility and conducted ambient radiation surveys in the back parking area and the common interior hallway. The inspector also conducted limited removable contamination surveys of the door frames, doors, and tile floor of the common interior hallway. Removable contamination surveys could not be conducted in the back parking area due to meteorological conditions (snow). The inspector did not identify radioactive contamination outside of the facility that would indicate a public health and safety threat. Based on the additional interviews with SABIA employees, the inspector confirmed that the scope and extent of radiological contamination inside of the Idaho Falls facility was not well understood by the licensee but was likely to be significant. Furthermore, it was apparent to the inspector that at least one licensee employee had extensive external contamination and had received an intake of strontium-90. In addition, the inspector determined that three other licensee employees had also been externally contaminated to a lesser extent and had the potential for intakes of strontium-90.

On March 1, 2008, NRC officials began to make notifications to State of Idaho officials regarding the SABIA contamination event. On March 1, 2008, several conference calls were held with representatives of the NRC, IDEQ, Idaho Bureau of Homeland Security, U.S. DOE RAP Region 6, and other State and Local officials. Representatives from IDEQ requested that the DOE Region 6 RAP Team provide assistance in response to the event. Also on March 1, 2008, the Idaho Bureau of Homeland Security issued a press release regarding the contamination event at the SABIA facility.

The morning of March 2, 2008, a briefing was held at the IDEQ offices in Idaho Falls. Participants in the briefing included the NRC inspector, as well as Employee #1 and Employee #3 from SABIA, DOE Region 6 RAP Team, IDEQ, Idaho Falls Fire Department, and Bonneville County Emergency Management. Also present was the Director of the Idaho Innovation Center, the light industrial complex where the SABIA facility was located in Idaho Falls. At the briefing, the parties discussed a response plan for addressing the event. It was decided that the DOE RAP Team would perform an entry into the SABIA facility to determine the scope and extent of radiological contamination. The DOE RAP Team's activities would include obtaining airborne radioactivity sampling, conducting radiological contamination surveys of horizontal surfaces, and performing direct radiation surveys for beta and gamma radiation. It was decided that the DOE RAP Team would also provide courtesy surveys of the non-SABIA bays located at the Idaho Innovation Center and that radiological surveys of offsite public areas, such as vehicles, hotel rooms, and residences, would be performed by IDEQ, NRC, and other organizations.

An incident command center was established at the Idaho Innovation Center. The incident command center was staffed by representatives of the Idaho Falls Fire Department, Bonneville County Emergency Management, and other local officials. Site security during the event response was established and maintained by the Bonneville County Sheriff's Office.

The DOE RAP Team arrived at the Idaho Innovation Center at approximately 12:20 PM (MT) on March 2, 2008. Their initial activities were to assess the radiological conditions of the outside parking area adjacent to SABIA's roll-up doors. Removable contamination levels were found by the DOE RAP Team to be less than the minimum detectable activity (MDA) for the instruments that were used. They also assessed the radiological conditions of the common interior corridor of the Idaho Innovation Center. Three small carpets outside of the doors to the SABIA bays were found by the DOE RAP Team to have slight radioactive contamination. These carpets were bagged, appropriately labeled, and placed inside of the SABIA Bay 4 office area. Otherwise, removable contamination levels in the interior corridor of the Idaho Innovation Center were found to be less than the MDA for the instruments that were used.

After conducting their assessments of the common areas outside of the SABIA bays, the DOE RAP Team donned appropriate personal protective equipment and entered Bay 4 through the front office area. In the office, the DOE RAP Team identified that removable radioactive contamination levels on surfaces such as a table approached a few thousand disintegrations per minute (dpm) per 100 square centimeters (cm²) beta/gamma. The DOE RAP team found removable contamination levels in the high bay area of Bay 4 of several thousand dpm/100 cm² beta/gamma and the airborne radioactivity level was measured as 0.07 DAC strontium-90. In Bay 4, the DOE RAP Team located a small plastic bag that was marked as "Source 1265" with a wooden cotton-tipped swab inside. This was confirmed to be the swab taken from the strontium-90 sealed source. When the swab was surveyed by the DOE RAP Team, it indicated a radiation level of 20 millirem per hour beta/gamma. The DOE RAP Team terminated their activities that evening, secured the SABIA facility, and made plans to return the following morning to resume their assessment activities.

On March 3, 2008, with the assistance of a ladder truck provided by the Idaho Falls Fire Department, a member of the DOE RAP Team performed radiological characterization surveys of the roof areas over Bay 3 and Bay 4. Removable radiological contamination was found by the DOE RAP Team member to be less than the MDA of the instrument that was used. Radiological surveys were also performed in the vestibule area between Bay 3 and Bay 4. Removable contamination levels in the vestibule approached a few thousand dpm/100 cm² beta/gamma. The DOE RAP Team then entered Bay 3 through the common corridor into the front office area. Airborne radioactivity levels in the office area of Bay 3 were determined to be 0.2 DAC strontium-90. Removable contamination levels in the office area of Bay 3 were observed to be a few thousand dpm/100 cm² beta/gamma. Just inside of the high bay portion of Bay 3, removable contamination levels of tens of thousands of dpm/100 cm² beta/gamma were detected. When the DOE RAP team was in the vicinity of the wood workbench where the gauge was disassembled, airborne radioactivity levels were found to be 0.3 DAC strontium-90. Removable contamination in this area ranged from 30,000 dpm/100 cm² beta/gamma to 250 millirem per hour measured directly on surface smears. The highest levels were found to be greater than 500 millirem per hour measured at one foot from the cast iron surface of the table saw where the strontium-90 sealed source was "tapped." Radiation levels measured near the lead container that contained the strontium-90 source were measured to be as high as 1 rad per hour at one foot from the container.

On March 3, 2008, the DOE RAP Team also conducted limited-scope radiological surveys of the non-SABIA bays of the Idaho Innovation Center. None of the non-SABIA bays surveyed by the DOE RAP team were found to be radiologically impacted by the SABIA contamination event. The DOE RAP Team concluded their on-scene activities by posting the outside doors and interior corridor doors of the SABIA facility with appropriate radiological postings. On the afternoon of March 3, 2008, a second NRC inspector was dispatched from NRC Region IV and arrived in Idaho Falls to assist with the inspection activities. On March 4, 2008, the NRC inspectors conducted additional interviews with SABIA personnel.

To address public health concerns, the on-scene responders decided to perform radiological surveys of offsite public areas that could have been potentially impacted by strontium-90 contamination. The areas surveyed included: four vehicles, two hotel rooms, two hotel lobbies, one personal residence, a grocery store, a medical center, and another licensee facility. Radiological surveys of these offsite areas were performed by representatives of NRC, IDEQ, Idaho State Police, and the Utah Department of Environmental Quality. No measurements exceeded the MDA of the instruments used, indicating that strontium-90 contamination did not enter the public domain.

On March 5, 2008, the NRC inspectors met with representatives of the DOE RAP Team and discussed their findings. During this meeting, the DOE RAP Team shared their preliminary radiological data and photos of the interior of the SABIA facility with the NRC inspectors. Representatives of the DOE RAP Team expressed concern that the doors to the facility did not seal well, including the Bay 3 rear-roll up door near the highest levels of contamination. There was a concern that if the building became pressurized on a hot day, a natural outgas might occur and strontium-90 contamination might escape from the facility and into the public domain. The NRC inspectors discussed this matter with SABIA management. As a result of this discussion, on or about March 5, 2008, SABIA sealed the two interior corridor doors with duct tape and sealed the three exterior doors (two roll-up and one personnel entry) with expanding foam sealant and duct tape.

On March 5, 2008, based on information developed during the inspection and telephonic conversations between SABIA and NRC management, the NRC issued a Confirmatory Action Letter (CAL) No. 4-08-001 to SABIA. The conditions of the CAL required the licensee to take certain actions including: making arrangements for thorough dose assessments for all workers potentially exposed to strontium-90; confirming certain security requirements had been implemented; obtaining services for decontamination of their facility and removal of contaminated materials; and providing a written report to the NRC detailing their corrective actions.

On March 5, 2008, the NRC issued a press release regarding the SABIA contamination event. The State of Idaho Bureau of Homeland Security had previously issued a press release regarding the SABIA contamination event on March 1, 2008. The NRC's press release described NRC's actions following notification of the event and described the contents of the CAL that was issued to SABIA.

The SABIA contamination event attracted significant local medial interest. The news story of the SABIA contamination event and emergency response activities were covered on three local television stations and reported in the local print media.

2.3 Conclusions

The licensee had approximately 180 industrial gauges that contained radioactive material in storage at their Idaho Falls facility. During February 25-29, 2008, the licensee engaged in activities to dismantle and remove the radioactive sealed sources from the gauges for the purpose of disposal. On February 29, 2008, the licensee notified the NRC of a leaking strontium-90 sealed source at their Idaho Falls facility. On February 29, 2008, an NRC inspector was dispatched to the SABIA facility and began interviewing licensee employees that evening.

The NRC inspector's interviews and observations revealed that on February 29, 2008, a SABIA employee, in an attempt to remove a strontium-90 sealed source from a source holder, had physically impacted the source, causing it to be dented. The employee, not realizing that denting the source had caused it to be damaged and breached, continued to handle the source while another licensee employee performed the required leak test analysis of the swab taken from the strontium-90 sealed source. By the time the leak test analysis was completed and the excessive removable contamination detected, the employee who had been handling the source was extensively externally contaminated and had received an intake of strontium-90. In addition, SABIA's facility had become extensively contaminated with strontium-90. After personnel decontamination efforts were completed, the licensee employees locked the facility and left.

At the request of the IDEQ, during March 2-3, 2008, DOE Region 6 RAP Team performed an entry into the SABIA facility in order to determine the scope and extent of radiological contamination. Federal, State, and Local officials performed radiological surveys of potentially impacted offsite locations in the public domain.

On March 5, 2008, the NRC issued a CAL to the licensee that required they take certain actions including: making arrangements for thorough dose assessments for all workers potentially exposed to strontium-90; confirming certain security requirements had been implemented; obtaining services for decontamination of their facility and removal of contaminated materials; and providing a written report to the NRC detailing their corrective actions.

3 Decontamination Activities of Licensee Facility (87103, 87125)

3.1 Inspection Scope

This portion of the inspection consisted of: a review of the licensee's decontamination proposal, on-site inspection of decontamination activities, and a review of the licensee's post-decontamination reports.

3.2 Observations and Findings

The CAL required, in part, that the licensee obtain services for the decontamination of its facility, including the decontamination of all surfaces and/or removal of all contaminated items. Because SABIA was not authorized on its NRC license nor qualified to perform the decontamination activities themselves, the NRC required that decontamination work be performed by a service provider licensed by NRC or an Agreement State to perform the work.

By letter dated March 19, 2008, SABIA provided to NRC, their contractor's plan for decontamination of the SABIA facility. The organization selected by SABIA to perform the decommissioning activities was Philotechnics, Ltd. (Philotechnics), an appropriately licensed service provider with Commonwealth of Massachusetts License No. 56-0543. Pursuant with the provisions of 10 CFR 150.20, Philotechnics filed for reciprocity with the NRC to perform licensed activities in NRC jurisdiction. The decontamination plan was reviewed by NRC personnel, and on April 1, 2008, the NRC Region IV staff requested additional clarifying information regarding the decontamination plan. By letter dated April 3, 2008, the licensee submitted their contractor's modified decontamination plan. This modified plan was reviewed and found to address NRC's questions and concerns.

The decontamination activities for Bay 4 took place during April 14-25, 2008. During April 16-17, 2008, an NRC inspector performed a reciprocity inspection of the decontamination activities being performed by Philotechnics. The inspector observed decontamination activities in progress in Bay 4. The results of this inspection were characterized in NRC inspection report No. 150-00020/08-001 and issued to Philotechnics following the on-site inspection. On May 16, 2008, NRC received from SABIA, their contractor's decontamination report for Bay 4. The decontamination activities for Bay 3 took place during May 5-16, 2008. On July 8, 2008, NRC received from SABIA, their contractor's decontamination report for Bay 3.

The decontamination reports for both bays were reviewed by the NRC and on July 18, 2008, the licensee was provided with a list of questions regarding the reports. The questions regarded various items that necessitated clarification or further information to support the conclusions drawn in the reports. On July 24, 2008, the licensee provided a response from their contractor. This supplemental information was reviewed by the NRC and found to be responsive to many of the questions originally raised by the NRC. However, a few items necessitated further clarification, including the results of the unconditional/free release survey of items from Bay 3 and Bay 4. On July 31, 2008, the NRC provided SABIA with a list of questions related to their July 23, 2008 supplemental response. On August 14, 2008, SABIA provided a response from their contractor regarding their answers to the NRC's questions. Based on the NRC's review of the response, on August 18, 2008, additional questions regarding the free release surveys were sent to the licensee. On September 9, 2008, SABIA submitted their contractor's response to the NRC. The response addressed the NRC's position that the contractor's original survey data and background radiation determinations by the contractor did not adequately support the free release of many items from the licensee's facility. Accordingly, the contractor re-analyzed the data, corrected certain errors in their determinations, and developed a list of approximately 80 items that had been originally free released by them that they believed necessary to re-survey. The results of the additional surveys were provided to the NRC on October 16, 2008, and this issue will be followed up during a future NRC inspection of the licensee's facility.

The decontamination activities were performed using the guidance in NUREG-1757, "Consolidated Nuclear Materials Safety and Safeguards Decommissioning Guidance" and NUREG-1575 "Multi-Agency Radiation Survey and Site Investigation Manual." A total of 49 one-cubic-yard lift liners filled with contaminated items were shipped from the facility for disposal as radioactive waste. Materials that were disposed of consisted mainly of cardboard boxes, plastic and metal debris, carpeting, upholstered furniture, and small items such as tools where decontamination efforts were not expended due to

a cost/benefit assessment. In addition, two 55-gallon drums were used for the disposal of radioactive sources. One 55-gallon drum contained the lead container that was used to store the damaged strontium-90 source. The entire lead container was placed into the drum and encapsulated with concrete. The other 55-gallon drum contained a different lead container that had been used by the licensee to store cesium-137 sealed sources that had been previously removed from dismantled gauges. This entire lead container was also placed into a drum and encapsulated with concrete. Both drums were shipped for disposal as radioactive waste.

3.3 Conclusions

The CAL required, in part, that the licensee obtain services for the decontamination of its facility, including the decontamination of all surfaces and/or removal and disposal of all contaminated items. To satisfy this element of the CAL, the licensee retained the services of a service provider licensed by an Agreement State to perform the decontamination work. The contractor's decontamination plan was submitted by SABIA to the NRC review prior to the start of decontamination activities. Decontamination activities took place between April 14-25 and May 5-16, 2008. Following decontamination of the licensee's facilities, reports regarding the decontamination efforts were submitted to the NRC. Based on the NRC's review of the decontamination reports, the service provider developed a list of items that they believed necessary to re-survey to support the free release of these items. The results of the additional surveys were to be provided to the NRC and this issue will be followed up during a future NRC inspection of the licensee's facilities. Radioactive waste that was shipped for disposal from the licensee's facilities included 49 one-cubic-yard lift liners filled with contaminated items, one 55-gallon drum that contained cesium-137 sources that had been removed from dismantled gauges, and another 55-gallon drums that was used to encase the damaged strontium-90 source.

4 **Personnel Dose Assessment**

4.1 Inspection Scope

This portion of the inspection consisted of a review of the licensee's dose assessments for all workers potentially exposed to strontium-90 from the damaged source.

4.2 Observations and Findings

The CAL required, in part, that the licensee make arrangements for thorough dose assessments for all workers potentially exposed to strontium-90. As appropriate, this dose assessment was to include, skin dose, critical organ dose, dose to the lens of the eye, and total effective dose equivalent (TEDE). To satisfy this element of the CAL, SABIA contracted with Radiation Safety & Control Services, Inc. (RSCS) to perform the dose assessments.

During the NRC inspector's initial interview of Employee #1, when the intake of strontium-90 was discussed with Employee #1, he was strongly encouraged to begin the collection of biological samples for bioassay determination. Employees #2, #3, and #4, who were contaminated to a lesser extent, were also encouraged to begin the collection of biological samples for bioassay determination. Employee #1 had also been advised by the professional at the medical center to perform bioassay to determine the

magnitude of the intake. Likewise, representatives of the DOE RAP Team discussed the importance of collecting samples for bioassay with the SABIA employees. Following discussions with the NRC inspector and NRC Region IV management, SABIA's management informed the employees that they were arranging for sample collection kits to be delivered to the individuals. However, the inspector determined that the bioassay kits had not been ordered by SABIA management, while the SABIA employees were waiting for the kits to commence sample collection. After the inspector stressed to the SABIA employees the urgency and importance of biological sample collection, the employees purchased generic household storage containers for utilization as sample collection containers. The individuals were instructed on how to collect the samples and what type of data to record. Employee #1 collected urine each day during March 1-5, 2008, and fecal samples each day during March 3-5, 2008. Employee #2 collected urine each day during March 2-5, 2008; Employee #3 collected urine each day during March 2-5, 2008; and Employee #4 collected urine each day during March 3-4, 2008. The biological samples were provided to an independent radioanalytical laboratory for analysis of strontium-90 content.

On August 5, 2008, SABIA submitted to the NRC, a report from RSCS that provided the dose assessment results for the four SABIA employees. Using the bioassay analytical results, RSCS calculated the Committed Effective Dose Equivalent (CEDE) for all four SABIA employees. However, Shallow Dose Equivalent (SDE) and Lens Dose Equivalent (LDE) were only determined for Employee #1. Likewise, Deep Dose Equivalent (DDE) was only provided for Employee #1. The dose assessment results are presented in Table 1. Based on the licensee's evaluation, none of the employees received a dose in excess of NRC's regulatory limits as specified in 10 CFR 20.1201.

TABLE 1 EMPLOYEE DOSE DETERMINATIONS FROM LICENSEE'S AUGUST 4, 2008 REPORT						
	CEDE (REM)	DDE (REM)	TEDE (REM)	LDE (REM)	WHOLE BODY SDE (REM)	EXTREMITY SDE (REM)
Employee #1	1.41	0.030	1.440	0.180	2.22	3.98
Employee #2	0.012	ND	ND	ND	ND	ND
Employee #3	0.011	ND	ND	ND	ND	ND
Employee #4	0.007	ND	ND	ND	ND	ND

ND – Not Determined

As a result of the NRC's review of the August 4, 2008, dose assessment report, on August 18, 2008, the NRC provided a list of questions to SABIA regarding the conclusions made in the report. The majority of the NRC's questions were related to the method and assumptions used by RSCS to perform the external dose determination for Employee #1. For example, the NRC questioned the assignment of 0.030 rem DDE to Employee #1, which was based solely on a reading obtained from a pocket ionization chamber worn by Employee #1. A deep dose contribution from the 2.28 MeV beta emitted by yttrium-90 would have been expected considering that this is a highly

penetrating particle. However, the report developed by RSCS and submitted to the NRC by the licensee indicated that no DDE was received from the strontium/yttrium-90 beta radiation. Also, RSCS calculated extremity exposure to Employee #1 based on the individual handling the source holder by a mounting fixture. Although the SDDR Safety Evaluation indicated that the source plug may be machined with a mounting fixture, the source involved in the incident did not have the mounting fixture. As a result, the calculations for extremity dose to Employee #1 were not based on the actual exposure scenario. This resulted in lower calculated doses than the likely dose because the mounting fixture that was erroneously assumed to be used was made with aluminum and steel, and would have served as sufficient shielding to prevent beta particles from penetrating. Additionally, in order to establish the basis for the external dose determinations, RSCS compared certain radiation data obtained by the RAP Team and by Philotechnics. These measurements were directly compared by RSCS to establish a level of contamination and size of the contaminated area. However, it appears that the radiation data were obtained from two different areas, the workbench and the table saw, and therefore cannot be directly compared without further analysis. These observations and others were provided to SABIA for response.

On August 29, 2008, SABIA provided their response to NRC's inquiry. However, the licensee's response did not provide for any adjustments to the determined doses or further refinement of the methods or assumptions used to perform the determination. In the licensee's response, it indicated that the penetration of a 2.28 MeV beta in tissue was approximately 11 mm and that because of this, there is little or no deep dose radiation and it is proper to assign no DDE. However, 10 CFR 20.1003 defines DDE to apply to external whole body exposure and is the dose equivalent at a tissue depth of 10 mm. Therefore, dose contributed by the 2.28 MeV betas should have been considered as a component of DDE. The licensee agreed that there was no mounting fixture on the back of the source but asserted that the source holder itself was held with pliers, which was not revealed during NRC interviews with Employee #1. Without performing additional calculations, the licensee noted that the earlier calculations were valid and represented a conservative dose assessment. During a subsequent telephone conversation, the RSO told the NRC inspector that he could not convince himself that that further refinement of the dose was necessary because it would not lead to occupational radiation dose levels in excess of NRC's regulatory limits specified in 10 CFR 20.1201.

4.3 Conclusions

To help determine internal dose to occupationally exposed individuals, bioassay samples were collected from all potentially affected employees and analyzed by an independent laboratory. Employee #1, who had a known intake of strontium-90, provided both fecal and urine samples for analysis. Based on the analytical results, it was determined that Employee #1 had received a CEDE of 1.41 rem. Employee #1 also had a DDE of 0.03 rem, resulting in a TEDE of 1.44 rem. Employees #2-4 provided urine samples for analysis. The CEDEs for these employees were all determined to be less than or equal to 0.012 rem and DDEs were not determined for these employees. None of the determined occupational doses exceeded any of NRC's regulatory limits. Although NRC believes that several of the methods and assumptions used to perform the external dose determination were erroneous, further refinement of the doses would not lead to levels in excess of NRC's regulatory limits specified in 10 CFR 20.1201.

5 Causal Factors (87103, 87125)

In its April 1, 2008 report to NRC, the licensee indicated that the probable cause of the event was that a sealed strontium-90 source was found to be leaking. The licensee noted that they believed that the 20-year-old source may have been leaking for some time within the compartment that was held closed by a screwed in metal plate, and that when this compartment was opened, the contamination was revealed.

A causal factor analysis was performed by the NRC. For the purposes of NRC's causal factor analysis, the incident has been defined as the contamination event. This includes both personnel and facility contamination with strontium-90.

5.1 Direct Cause

The direct cause of the incident is that which led directly to the incident without any additional intervening action or failure. The NRC has determined that the incident was directly caused by the physical impact on the strontium-90 source and its source holder. Had the sealed source merely been "leaking," contamination would likely have been localized and limited. However, the source and source holder were physically impacted by "tapping" down onto various surfaces and by "tapping" the source with a screwdriver in an effort to dislodge the sealed source from its source holder. Each of the locations where the strontium-90 source and its holder were physically impacted, such as the surface of the table saw, demonstrated the highest levels of strontium-90 contamination when compared to the rest of the facility. The cast iron surface of the table saw where the source holder was "tapped" displayed the highest levels of strontium-90 contamination when measured by the DOE RAP Team. Likewise, the individual that imparted the physical damage onto the strontium-90 source and its holder was significantly externally contaminated and had an intake of strontium-90.

5.2 Contributing Causes

Several contributing causes have been identified by the NRC that facilitated the incident or made the incident more likely. The contributing causes were identified as: (1) the compressed timeline to complete the gauge dismantlement project, (2) "ownership" of the gauge dismantling project and the safety culture at SABIA, and (3) lack of understanding of the radiation hazard.

5.2.1 Compressed Timeline to Complete the Dismantlement Project

As noted in Section 2.2.1, the licensee had previously requested and been granted by the NRC an extension of time to dispose of the radioactive materials they had in storage. The extension of time authorized by License Condition 16.B. for SABIA to dispose of the gauges that had been in storage for more than five years was to expire on April 30, 2008. Licensee employees had been aware that the extension of time was about to expire and informed the inspectors that they had been repeatedly reminding SABIA's management for some time that this task needed to be performed by the deadline as specified on the license. The licensee's August 18, 2007, letter to the NRC outlined a proposed timeline to dispose of the gauges. The proposed timeline specified by SABIA was to place a contract with a waste broker in September 2007; obtain lead

shielding in October 2007, commence disassembly of the gauges in November 2007, complete disassembly of the gauges in March 2008, and to ship the sources for disposal in April 2008. However, there is no evidence that a contract was ever placed with a waste broker; lead shielding was not obtained until February 26, 2008; and disassembly of the gauges did not commence until February 26, 2008.

The license possessed approximately 180 industrial gauges of various types and models to be dismantled. However, the employees at the Idaho Falls facility were not experienced with dismantling gauges. As a result, SABIA management brought in an experienced employee (Employee #1) from one of their facilities in another state to perform the dismantlement. The individual was scheduled to be at the licensee's Idaho Falls facility for only two weeks. The individual expressed to the inspectors that in order to accomplish the gauge dismantlement and source removal activities, he needed to work as quickly and expeditiously as possible since he only had a limited time to get the job done. Likewise, the RSO was not from the Idaho Falls facility but instead from the SABIA office in California. As such, the RSO also had a limited amount of time to be present in Idaho Falls during the dismantlement project.

Waiting until the close proximity of the authorized deadline before beginning the dismantlement of the gauges, coupled with the limited availability of both Employee #1 and the RSO, contributed to the cause of the event by compressing the timeline to complete the dismantlement project. The constraints of meeting the deadline specified in the license caused SABIA to focus on getting the job completed quickly rather than performing the work with the appropriate mechanisms in place to ensure safety.

5.2.2 "Ownership" of the Gauge Dismantlement Project

The two local SABIA employees and the SABIA employee that was in the Idaho Falls facility for training each expressed that the gauge dismantlement project was "not their project." The gauge dismantling project was seen as "the RSO's project" or "a corporate project" as opposed to a local Idaho Falls issue. The local SABIA employees noted that because they were not really involved in the planning of the project they expected that the RSO would do what was necessary to make the project happen. The local SABIA staff thus did not have a sense of responsibility for the safe conduct of the project; it was seen as a corporate project that happened to be taking place at their Idaho Falls facility. However, the RSO, who for all intents and purposes was considered the owner of the project, did not have a specific plan for the gauge dismantlement project. The RSO believed that by utilizing an experienced person such as Employee #1, the project would be completed in a safe manner. Yet, when interviewed by the inspectors, Employee #1 expressed that he was merely an employee brought in to do some work and that it was not his project, it was the RSO's project.

On or about February 28, 2008, Employee #1 became aware that the RSO would not be present in Idaho Falls for a few days because he would be returning to the SABIA office in California on the following day. Although the RSO would not be present for a few days, he expected that the gauge dismantlement project would continue in his absence. The RSO's departure would then leave Employee #1 with the responsibility of performing the bulk of the gauge dismantlement project by himself. Employee #1 did not work for the RSO but instead directly reported to another member of SABIA management. The evening of February 28, 2008, Employee #1 informed his supervisor that in his view the project as "the biggest job the company has ever done involving

gauges” and as such, the RSO should be present while the project was in process. The evening of February 28, 2008, this concern was provided to the President of SABIA, who was in Wyoming at the time. Although Employee #1 expressed concern about the RSO being absent during the project, no changes were made, and on the following day, February 29, 2008, the project continued in the absence of the RSO. The afternoon of February 29, 2008, the contamination event occurred.

Likewise, Employee #2 noted to the inspectors that he had some concerns over the conduct of the gauge dismantlement project. However, being a relatively new employee who was there primarily for training, he did not feel comfortable raising his concerns.

Although not specific to nuclear materials licensees, NRC’s January 24, 1989, “Policy Statement on the Conduct of Nuclear Power Plant Operations” refers to safety culture as “the necessary full attention to safety matters” and the “personal dedication and accountability of all individuals engaged in any activity which has a bearing on safety.” The gauge dismantling project was not given the necessary full attention to safety matters. No one seemed accountable for the overall safety of the project. One individual engaged in the project expressed concerns over the conduct of the project but his concerns were not addressed. Another individual had concerns but was not comfortable in expressing them.

The lack of “ownership” of and accountability for the gauge dismantling project contributed to the cause of the event because no one assumed overall responsibility for safely and successfully completing the project. Inaction on the part of SABIA management to respond to safety concerns that were raised also contributed to the cause of the event. Furthermore, the project was not given the necessary full attention with respect to safety matters; this also contributed to the cause of the event.

5.2.3 Lack of Understanding of the Radiation Hazards

Of the approximately 180 industrial gauges to be dismantled, only one gauge contained strontium-90, a beta emitter. The licensee’s “General Employee Training,” submitted to the NRC on June 1, 2004, and incorporated into their license through License Condition, described the training program for all SABIA employees working with radioactive materials. The training materials described the characteristics of beta radiation and described methods to shield beta radiation. When Employee #1 decided to dismantle the strontium-90 gauge, he recognized that it contained strontium-90, but he did not recognize that strontium-90 was a beta emitter. Employee #1 therefore did not recognize the potential hazards of handling the source, given that beta-emitting sources are designed differently than the gamma-emitting sources he was accustomed to handling. Although beta-emitting sources must pass rigorous safety tests and analysis, they are not encapsulated in the same manner as gamma-emitting sources because they are designed with comparably thin windows to allow the beta radiation to be emitted from the source.

Employee #1 also did not recognize that it would be inappropriate to shield this type of source with a high atomic number material such as lead. Additionally, the RSO informed the inspectors that he had not handled beta sources before. The RSO noted that although he was aware that strontium-90 was a beta emitter, he did not recognize that it decayed to yttrium-90, which emitted a more energetic beta than strontium-90. When questioned as to why a lead container was staged on the wood workbench for holding

the strontium-90 source, the RSO stated that he had forgotten about the secondary radiations that are produced when beta particles are shielded with high atomic number materials.

Both the RSO and Employee #1 were aware that there was one strontium-90 source in the inventory of gauges to be dismantled. However, both Employee #1 and the RSO did not recognize the potential hazards of handling the strontium-90 source, such as the production of secondary radiations. Even though neither of them had worked with this type of source before, no special provisions were made to handle the source or better understand the radiation characteristics of the source. They also did not recognize that this type of beta source was designed to emit beta particles and thus had a relatively thin window, or source covering, to allow the betas to penetrate. As such, it was unwise to attempt to remove the sealed source from its source holder by impacting it with a screwdriver.

Because the potential hazards and physical characteristics of the strontium-90 source were not understood, this contributed to the cause of the event because proper handling precautions were not taken when dismantling the gauge, the source holder and the source. The source and source holder were handled inappropriately, and the source was shielded in a manner that created an additional radiation hazard.

5.3 Root Cause

The root cause of the incident is that whose existence established the conditions that allowed the contributing causes to develop, which in turn, increased the probability of occurrence of the incident. The NRC has determined that the root cause of the incident was the licensee's failure to develop, document, and implement a radiation protection program commensurate with the gauge dismantlement operations that would be sufficient to ensure compliance with the provisions of 10 CFR Part 20.

10 CFR 20.1101(a) requires that each licensee develop, document, and implement a radiation protection program commensurate with the scope and extent of licensed activities and sufficient to ensure compliance with the provisions of 10 CFR Part 20. Because the licensee did not develop, document, and implement a radiation protection program commensurate with the scope and extent of dismantling gauges containing radioactive sources, a licensed activity, they were unable to ensure compliance with the provisions of 10 CFR 20.1101(b).

10 CFR 20.1101(b) requires that the licensee shall use, to the extent practical, procedures and engineering controls based on sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA.

On February 29, 2008, when the licensee dismantled an LFE Corporation Model SLUP-1C gauge with DuPont Merck Pharmaceutical Co. Model NER-592 strontium-90 source, they did not use, to the extent practical, procedures and engineering controls based on sound radiation protection principles to achieve occupational doses and doses to members of the public that are ALARA.

The licensee's November 6, 2007, letter to the NRC regarding the gauge dismantlement project, tied down by License Condition, stated that "proper procedures and safety precautions will ensure all radiation exposure is kept within ALARA concepts." Yet, the

licensee was found to have no procedures to perform the gauge dismantlement project and had insufficient safety precautions, which led to occupational doses that were not ALARA.

Regarding procedures, the licensee did not develop procedures specific to performing the gauge dismantlement activities. The licensee's ALARA procedure, tied to SABIA's NRC license, stated that prior to the start of any radiation work, the device registration for the radiation gauge to be serviced should be thoroughly reviewed. The ALARA procedure further specified that standard manufacturer's servicing procedures should be reviewed, if available, and that if not available, written procedures for all service work to be accomplished should be written and reviewed. However, when dismantling the strontium-90 gauge, the SSDR Safety Evaluation was not available or reviewed and the manufacturer's servicing procedures were not available or reviewed by the licensee. The licensee employees who were dismantling the strontium-90 gauge did not have copies of the SSDR Safety Evaluation for the particular gauge or the corresponding sealed source. Likewise, written procedures for the gauge dismantling work were not written, reviewed, or approved. Instead, the gauges were dismantled based on verbal discussions and mechanical intuition. In particular, the strontium-90 gauge was dismantled by Employee #1 because it "looked like it would come apart easily."

The licensee's procedures for performing leak tests and responding to contamination events were also lacking. Although the licensee had developed procedures to address leak tests and contamination of personnel, these procedures were inadequate to achieve doses that are ALARA. This is further described in Section 5.4.

Regarding engineering controls, the licensee did not implement controls that were based on sound radiation protection principles. For example, the licensee set up a container made of lead, a high atomic number material, in which they intended to store the strontium-90 source. Because the container was too small to fit the source holder inside, Employee #1 attempted to remove the source from the holder, resulting in the contamination event. Employee #1 then placed the damaged source inside of a different lead container, thus creating an additional radiation safety hazard due to secondary radiations caused by the interaction of the beta radiation with the shielding material. Had the licensee carefully planned the project and understood the hazards, appropriate engineering controls could have been implemented, resulting in doses that were ALARA.

As a result of the SABIA's failure to use to extent practical, procedures and engineering controls based on sound radiation protection principles, SABIA did not achieve occupational doses that were ALARA. As a result of the contamination event, the licensee's facilities became extensively contaminated with strontium-90 and licensee employees were exposed to both internal and external radiation hazards, resulting in occupational doses that were not ALARA. This failure was identified as an apparent violation of 10 CFR 20.1101(a). (030-35997/08001-01)

5.4 Causes that Affected the Identification and Response to the Incident

In addition to the above, a few items have been identified by the NRC that impacted or mitigated the identification and immediate response to the contamination event. In particular, the items included: (1) no audible signal of contamination detected during leak test analysis, (2) operation of the instrument used to perform the leak test analysis, (3) belief that the instrument used to perform the leak test was malfunctioning, (4) not

performing the leak test analysis prior to using the sealed source, and (5) lack of preparation to respond to a contamination event.

There was a delay by SABIA in identifying the contamination event because of issues related to the instrument used to perform the leak test analysis. First, the instrument's audible signal had been turned to "off." Had the audible signal been on, Employee #2 might have recognized earlier that there was a problem with the leak test analysis. Second, when Employee #2 observed the instrument display and saw the very high counts, he made the assumption that when he began to count the swab, he had neglected to re-set the instrument from the previous analysis. If the instrument had not been re-set, it would have summed the counts from the prior and current analysis. Third, when the instrument was re-set and re-started, the counts on the instrument immediately increased. It was suspected that the meter was malfunctioning as opposed to responding to actual contamination. Although the actions of Employee #2 were logical, it is considered a best practice to always trust the readings on your instrument. Had the first reading been trusted, the "stop work" directive to Employee #1 could have come sooner and prevented additional handling of the damaged strontium-90 source. Then there would have been time to sort out any potential equipment problems without leading to Employee #1 further handling the source and spreading contamination to himself and the facility.

License Condition 14.E. of NRC Byproduct Materials License 11-27727-01, requires, in part, that sealed sources need not be leak tested if they are in storage and are not being used. License Condition 14.E. further requires that when sealed sources are removed from storage for use or transferred to another person and have not been tested within the required leak test interval, they shall be tested before use or transfer.

License Condition 23 of the subject licensee requires, in part, that the licensee shall conduct its program in accordance with e-mail dated February 2, 2005. This document specifies that the licensee has implemented a model leak test program which complies with Appendix Q of NUREG 1556, Vol. 12 "Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Possession Licenses for Manufacturing and Distribution." The model leak test procedure in Appendix Q specifies wiping the source, counting the collected sample, and analyzing whether the source is leaking.

The gauge containing the strontium-90 source had been in storage at the licensee's Idaho Falls facility since it had been transferred there from SABIA's California office during October 2002. The SSDR Safety Evaluation for the Model NER-592 (NR-476-S-829-S) indicates that the leak test frequency is 6 months. The source had previously been leak tested on September 27, 2002, and the leak test did not detect the presence of removable radioactive contamination in excess of 0.005 microcuries. Since the source was being removed from storage and had not been tested within the required leak test interval, it was required to be tested before use.

The removal of the gauge from storage for purposes of dismantlement and source removal of the strontium-90 sealed source constituted use of the source. However, prior to using the sealed source, the licensee did not perform a leak test. Instead, a licensee employee dismantled the gauge all the way down to the strontium-90 source holder, and the licensee did not perform a leak test prior to this use. The licensee merely swabbed the dismantled source holder. A "leak test" does not only constitute taking a swab of an item to be leak tested. Instead, a "leak test" is the physical act of taking a swab of an

item to be leak tested and includes the actual analysis of the swab and determination of the quantity of removable contamination in units of microcuries. However, in this case, a licensee employee used the sealed source before the analysis and determination were complete. This failure was identified as an apparent violation of License Condition 14.E. of NRC Byproduct Materials License 11-27727-01. (030-35997/08001-02)

During the September 18, 2008, telephonic exit meeting, when this apparent violation was discussed, SABIA management stated that they believed their procedures allowed them to perform the leak test analysis concurrently with the dismantlement of the gauges.

As a result of not completing the leak test analysis, Employee #1 continued to handle the damaged strontium-90 source, spreading contamination to the facility and himself. Because the employee continued to handle the damaged source in the absence of the leak test analysis and assessment of the removable contamination, he was unaware that the swab taken from the source had large amounts of removable contamination; this would have been a clear indication of a leaking or damaged source. Because the damaged source was further handled in the absence of the leak test analysis and assessment of removable contamination, the licensee's facility was extensively contaminated. The licensee employee that handled the source was externally contaminated and received an intake of radioactive material. In addition, three other licensee employees had a lesser degree of both external contamination and intakes of radioactive material. These occupational does were not ALARA.

In general, SABIA did not anticipate that there would be any problems dismantling the gauges since they were only dealing with "sealed sources." Because they were only licensed to possess and use sealed sources, the licensee's procedures, training, and equipment to handle unsealed radioactive material were inadequate to respond to the contamination event.

The licensee's procedure and training for "Personnel Contamination" stated, "In case of personnel contamination in the use of any sealed source: remove any contaminated clothing, scrub hands or other contaminated areas with soap and water to remove as much contamination as possible, contact SABIA Field Service and the NRC." As a result, the employees were ill-prepared to address the contamination event. Fortunately, as a mitigating factor, Employee #2, who had been recently hired by SABIA, had prior employment experience in which he had been trained in personnel decontamination procedures. When the personnel contamination was discovered, the employees recognized that the supplies at the SABIA facility were inadequate to perform the necessary decontamination. One of the employees was dispatched to obtain the needed supplies, such as soap and paper towels. Based on his prior experience, Employee #2 guided and assisted in the personnel decontamination of Employee #1 and performed the task in a manner that limited the spread of contamination to himself and the other employees.

Also, the licensee only possessed one pancake-type radiation survey instrument that could be used to identify contamination. However, this instrument was also the instrument utilized to perform the leak test analysis, and thus had become contaminated in the process. Because the instrument had become contaminated, it could not be used to determine the extent of the personnel contamination or whether decontamination efforts had been successful. As a mitigating factor, the licensee was able to borrow an

appropriate radiation survey instrument from another NRC licensee. With the borrowed instrument, the employees were able to successfully decontaminate each other, thus reducing the likelihood of the spread of contamination to the public domain.

5.5 Conclusions

For the purposes of the NRC's causal factor analysis, the incident has been defined as the strontium-90 contamination event involving both the licensee's facility and personnel. The NRC has concluded that incident was directly caused by the physical impact on the strontium-90 source and its source holder. The NRC has identified the contributing causes that facilitated the incident or made the incident more likely as: (1) the compressed timeline to complete the gauge dismantlement project, (2) "ownership" of the gauge dismantling project, and (3) lack of understanding of the radiation hazard. The root cause of the incident was identified by the NRC as the licensee's failure to develop, document, and implement a radiation protection program commensurate with the gauge dismantlement operations that would be sufficient to ensure compliance with the provisions of 10 CFR Part 20. As a result, the licensee failed to use to the extent practical, procedures and engineering controls based on sound radiation protection principles, and they did not achieve occupational doses that were ALARA. This failure was identified as an apparent violation of 10 CFR 20.1101(a). (030-35997/08001-01)

Several items were identified by the NRC that impacted or mitigated the identification and immediate response to the contamination event, which included: (1) no audible signal of contamination detected during leak test analysis, (2) operation of the instrument used to perform the leak test analysis, (3) belief that the instrument used to perform the leak test was malfunctioning, (4) not performing the leak test analysis and assessment of removable contamination prior to using the sealed source, and (5) lack of preparation to respond to a contamination event. License Condition 14.E. requires, in part, that when sealed sources are removed from storage for use or transferred to another person and have not been tested within the required leak test interval, they shall be tested before use or transfer. The removal of the gauge from storage for purposes of dismantlement and source removal of the strontium-90 constituted use of the source. However, a licensee employee used the source prior to the completion of the leak test analysis and assessment of removable contamination. This failure was identified as an apparent violation of License Condition 14.E. of NRC Byproduct Materials License 11-27727-01. (030-35997/08001-02)

6 Reporting Requirements and Corrective Actions (87103, 87125)

6.1 Inspection Scope

This portion of the inspection consisted of reviewing the licensee's telephonic and written reports to NRC. There was also a review of the licensee's immediate corrective actions and proposed long term corrective actions to prevent recurrence.

6.2 Observations and Findings

On February 29, 2008, SABIA's RSO called the NRC Region IV office to inquire about reporting a leaking sealed source that had been discovered earlier that day at their Idaho Falls, Idaho, Facility. During the telephonic conversation, the NRC management representative began to understand additional details about the event and determined

that the incident was not just an incidentally leaking source. The RSO was informed by the NRC's management representative that the incident should be telephonically reported to NRC's Headquarters Operations Office. Subsequently, that afternoon, the RSO telephonically notified NRC's Headquarters Operations Office of the event. The event was reported pursuant to 10 CFR 20.2202(a)(2) and 10 CFR 30.50(b)(1).

10 CFR 20.2202(a)(2) requires, in part, that each licensee shall immediately report any event involving byproduct material possessed by the licensee that may have caused or threatens to cause the release of radioactive material, inside or outside of a restricted area, so that, had an individual been present for 24 hours, the individual could have received an intake five times the ALI.

10 CFR 30.50(b)(1) requires, in part, that each licensee shall notify the NRC within 24 hours after the discovery of an unplanned contamination event that: (1) requires access to the contaminated area, by workers or the public, to be restricted for more than 24 hours by imposing additional radiological controls or by prohibiting entry into the area; (2) involves a quantity of material greater than five times the lowest ALI specified in Appendix B of 10 CFR Part 20; and (3) has access to the area restricted for a reason other than to allow isotopes with a half life of less than 24 hours to decay prior to decontamination.

When the event was reported to the NRC by SABIA's RSO, the radiological conditions and extent of contamination of their facility were not well understood. However, byproduct material (strontium-90) possessed by the licensee had contaminated both the restricted and unrestricted portions of their facility. At the time of the incident, the strontium-90 source involved was approximately 62 millicuries. Appendix B to 10 CFR Part 20 indicates that the most limiting ALI for strontium-90 is 4 microcuries. Accordingly, the quantity of material involved was greater than five times the most restrictive ALI. Considering the activity of strontium-90 involved, it could have easily been concluded that, had an individual been present for 24 hours, the individual could have received an intake of five times the ALI. The physical half life of strontium-90 is 29.1 years. Therefore, due to the unplanned contamination event, access to the licensee's facility was going to necessitate a restriction of access for a period of greater than 24 hours for a reason other than to allow for radioactive decay.

Both 10 CFR 20.2202(a)(2) and 10 CFR 30.50(b)(1) require the submission of written reports to the NRC. In general, contents of the required reports include: a description of the event; information regarding the extent of personnel exposures; and information regarding the licensee's corrective actions taken and planned to prevent recurrence. Information regarding the extent of personnel exposures was provided by the licensee under separate correspondence and is described in Section 4 of this report.

The licensee submitted to the NRC a letter dated March 26, 2008, to which their written report detailing the event was attached. In its March 26, 2008, written report, the licensee noted that a strontium-90 source was found to be leaking, resulting in slight contamination to a worker and that some area contamination had been located. The licensee did not discuss their corrective actions to prevent recurrence of this type of event. The licensee's report was reviewed by the NRC and found to be insufficient to meet the requirements regarding the content of this type of written report. A telephonic conversation was held between SABIA management and NRC management and staff.

The licensee was instructed to follow the appropriate written report requirements and to submit a supplemental report to the NRC.

By letter dated April 1, 2008, the licensee submitted a supplemental written report to the NRC. In their description of the event, the licensee noted that when the plate that covered the source compartment was removed, a wipe test revealed a high level of contamination. SABIA's report fails to mention that the source had been physically impacted by a licensee employee. Furthermore, the licensee's supplemental report indicated that a licensee employee had been slightly contaminated. Again, this is contrary to the description of the individuals involved in the event who described the employee as being contaminated "from head to toe" and receiving an intake of strontium-90. As to its corrective actions, the licensee noted that: (1) decontamination of its facility would be performed pursuant to CAL 4-08 001, and (2) in the future they would not disassemble any gauges containing strontium-90.

Item No. 4 of CAL 4-08-001 required that before resuming licensed activities, the licensee provide a written report to the NRC detailing its corrective actions to prevent recurrence of this or a similar event. On June 4, 2008, the licensee submitted the report required by the CAL. In the report, the licensee reiterated that a strontium-90 source was discovered to be leaking, that a worker was slightly contaminated, and some area contamination had been located in their facility. In its corrective actions, the licensee noted that several of its radiological procedures should be changed and updated, including the: ALARA procedure, radioactive materials receipt procedure, leak test procedure, and emergency procedure. However, these procedures were not provided to the NRC for review. It was furthermore noted that all procedures would be reviewed by the supervisor with the worker before critical tasks are performed and that supervisors are responsible for ensuring that personnel are properly trained in the appropriate procedure prior to performing a task. The corrective actions also noted that training was reviewed and is being upgraded to be more inclusive of ALARA procedures, and that a worker feedback program had been initiated. The revised training was not provided to the NRC for review.

On June 18, 2008, SABIA management telephonically contacted NRC regarding their progress toward compliance with the requirements of the CAL. On June 19, 2008, NRC telephonically contacted SABIA management to inform them that they could resume licensed activities at the Idaho Falls facility.

The licensee's corrective actions also included amending their NRC license. Specifically, License Condition 16.B. of License No. 11-27727-01 authorized the licensee to temporarily store sealed sources at their Idaho Falls facility for a period exceeding 5 years to allow for completion of the gauge decommissioning process described in previous correspondence to the NRC. The extension authorized by the license condition expired on April 30, 2008. Because of the event, the licensee was not able to complete the gauge decommissioning process by the expiration date specified in the license condition. In letter dated March 17, 2008, the licensee requested an extension of time to dispose of the remaining stored gauges. Subsequently, on May 21, 2008, the licensee submitted a letter to the NRC in which it requested that its license authorizations be amended to reflect the inventory following the removal of some licensed material by their decontamination contractor. By e-mail dated July 31, 2008, the licensee submitted to the NRC, a current inventory for all byproduct material possessed at its Idaho Falls facility post-decontamination activities. On

August 19, 2008, the NRC issued Amendment No. 11 to License No. 11-27727-01. This amendment approved changes to the license authorizations to reflect the licensee's inventory of byproduct material. An extension regarding the storage of sealed sources to allow for decommissioning of the gauges was authorized and will expire on December 31, 2008. The licensee was reminded in the cover letter to the license that although the extension of storage time was granted, the licensee would need to submit for the NRC's review and approval, revised operating and emergency procedures for removing sealed sources from the devices in their possession.

6.3 Conclusions

The licensee reported the incident to the NRC on February 29, 2008. Pursuant to NRC regulations, the licensee submitted reports to the NRC that included: a description of the event; information regarding personnel exposures; and information regarding the licensee's corrective actions taken and planned to prevent recurrence. The CAL also required that the licensee provide their corrective actions prior to resuming licensed activities. Although the licensee noted several corrective actions to prevent recurrence, the specifics of these actions were not provided to the NRC for review. As a result, the CAL will remain open pending NRC's assessment of the licensee's corrective actions.

7 **Exit Meeting Summary**

A final telephonic exit briefing was conducted with SABIA's President and Radiation Safety Officer on September 18, 2008, to present the preliminary findings from the inspection. Licensee representatives acknowledged the inspector's findings. No proprietary information was identified.

ATTACHMENT
SUPPLEMENTAL INSPECTION INFORMATION

PARTIAL LIST OF PERSONS CONTACTED

Licensee

Clinton Lingren, President and CEO
James F. Miller, RSO
Dan Popovich, local RSO
Jeniece Fresh, Field Service and Manufacturing Administrator
John Hagley, Sales and Application Engineer
Jeff Morse, Field Service Engineer

DOE Region 6 RAP Team

Steven Morreale, Regional Coordinator
Dave Everett, Response Coordinator
Ken Whitham, Team Leader
Gregory Hall, Team Captain

Others

David Jones, Senior Health Physicist, IDEQ
Jon Walker, Division Chief, Idaho Falls Fire Department
John Lund, Captain, Idaho Falls Fire Department
Mike Taysom, Bonneville County Emergency Management
Jeff Krantz, Director, Idaho Innovation Center

INSPECTION PROCEDURES USED

87103 Inspection of Material Licensees Involved in an Incident or Bankruptcy Filing
87125 Materials Processor/Manufacturer Programs

ITEMS OPENED, CLOSED, AND DISCUSSED

Opened

030-35997/08001-01 APV A failure to develop, document, and implement a radiation protection program commensurate with the scope and extent of licensed activities and sufficient to ensure compliance with the provisions of 10 CFR Part 20. [10 CFR 20.1101(a)]

030-35997/08001-02 APV A failure to leak test a sealed source when it was removed from storage and before use. [License Condition 14.E. of NRC Byproduct Materials License 11-27727-01]

Closed

None

Discussed

None

LIST OF ACRONYMS AND ABBREVIATIONS USED

ALARA	As Low As is Reasonably Achievable
ALI	Annual Limit on Intake
APV	Apparent Violation
CAL	Confirmatory Action Letter
CEDE	Committed Effective Dose Equivalent
CFR	Code of Federal Regulations
cm	centimeters
DAC	Derived Air Concentration
DDE	Deep Dose Equivalent
DOE	Department of Energy
dpm	disintegrations per minute
IDEQ	Idaho Department of Environmental Quality
LDE	Lens Dose Equivalent
MDA	Minimum Detectable Activity
MeV	mega electron volts
mm	millimeters
NRC	Nuclear Regulatory Commission
RAP	Radiological Assistance Program
REAC/TS	Radiation Emergency Assistance Center/Training Site
RSCS	Radiation Safety & Control Services, Inc.
RSO	Radiation Safety Officer
SABIA	SABIA, Inc.
SDE	Shallow Dose Equivalent
SSDR	Sealed Source and Device Registry
TEDE	Total Effective Dose Equivalent

PREDECISIONAL ENFORCEMENT CONFERENCE AGENDA

SABIA, INC.
November 10, 2008
8:00 AM - 12:30 PM CST
US Nuclear Regulatory Commission, Region IV
Arlington, Texas

1. INTRODUCTIONS/OPENING REMARKS –
DIRECTOR, DIVISION OF NUCLEAR MATERIALS SAFETY
2. ENFORCEMENT PROCESS –
SENIOR ENFORCEMENT SPECIALIST, NRC REGION IV
3. APPARENT VIOLATIONS & REGULATORY CONCERNS –
NRC
4. LICENSEE PRESENTATION –
SABIA, INC.
5. BREAK - 10 MINUTES
6. RESUMPTION OF CONFERENCE
7. CLOSING REMARKS –
SABIA, INC.
8. CLOSING REMARKS –
DIRECTOR, DIVISION OF NUCLEAR MATERIALS SAFETY