



UNITED STATES  
NUCLEAR REGULATORY COMMISSION  
REGION III  
2443 WARRENVILLE ROAD, SUITE 210  
LISLE, ILLINOIS 60532-4352

October 24, 2018

EA-18-132  
EN 53507  
NMED No. 180340 (closed)

Mr. Paul Galdes, P.E.  
Vice President  
Fleis & VandenBrink Engineering, Inc.  
2960 Lucerne Drive SE  
Grand Rapids, MI 49546

SUBJECT: NRC REACTIVE INSPECTION REPORT NO. 03033539/2018001(DNMS) AND  
NOTICE OF VIOLATION – FLEIS & VANDENBRINK ENGINEERING, INC.

Dear Mr. Galdes:

On July 19 and 20, 2018, an inspector from the U.S. Nuclear Regulatory Commission (NRC) conducted a reactive inspection at your facility in Grand Rapids, Michigan, and at a temporary jobsite in Big Rapids, Michigan, with continued in-office review through September 24, 2018. The purpose of the inspection was to review the circumstances, root and contributing causes, and corrective actions for an event involving a damaged portable moisture density gauge, reported to the NRC on July 16, 2018, and to review activities performed under your NRC license to ensure that activities were being performed in accordance with NRC requirements. The in-office review included an assessment of the extent of radiation exposure to licensee personnel as a result of this event, as well as a review of your written report of the event. The enclosed inspection report presents the results of the inspection (Enclosure 2).

During this inspection, the NRC staff examined activities conducted under your license related to public health and safety. Additionally, the staff examined your compliance with the Commission's rules and regulations as well as the conditions of your license. Within these areas, the inspection consisted of selected examination of procedures and representative records, observations of activities, and interviews with personnel.

Based on the results of this inspection, two apparent violations of NRC requirements 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 <http://www.nrc.gov/about-nrc/regulatory/enforcement/enforce-pol.html>. The apparent violations concerned: (1) the inadvertent unauthorized detachment of a cesium-137 sealed source from the source rod of a damaged portable gauge, contrary to the prohibition on such activities in Condition 14 of NRC License No. 21-26580-01; and (2) the handling of an unshielded source rod and its contents, contrary to the prohibitions on such activities in your Operating and Emergency Procedures, as committed to via Condition 20.A of the same license.

Because the NRC has not made a final determination in this matter, the NRC is not issuing a Notice of Violation for these inspection findings at this time. Mr. Ryan Craffey of my staff discussed the circumstances surrounding these apparent violations, the significance of the issues, and the need for lasting and effective corrective action with Mr. Richard Thorne of your staff at the inspection exit meeting on September 24, 2018.

Before the NRC makes its enforcement decision, we are providing you an opportunity to either: (1) respond in writing to the apparent violations addressed in this inspection report within 30 days of the date of this letter, or (2) request a Predecisional Enforcement Conference (PEC). **Please contact Mr. Aaron T. McCraw, Chief of the Materials Inspection Branch, at 630-829-9650 or [aaron.mccraw@nrc.gov](mailto:aaron.mccraw@nrc.gov) within 10 days of the date of this letter to inform the NRC of your intended response.**

If you choose to provide a written response, it should be clearly marked as "Response to the Apparent Violations in Inspection Report No. 03033539/2018001(DNMS); EA-18-132," and should include, for the apparent violations: (1) the reason for the apparent violations, or, if contested, the basis for disputing the apparent violations; (2) the corrective steps that have been taken and the results achieved; (3) the corrective steps that will be taken to avoid further violations; and (4) the date when full compliance was or will be achieved. 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 NRC Information Notice (IN) 96-28, "Suggested Guidance Relating to Development and Implementation of Corrective Action," may be useful in preparing your response. You can find the information notice on the NRC website at: <http://www.nrc.gov/reading-rm/doc-collections/gen-comm/info-notices/1996/in96028.html>. Your response may reference or include previously docketed correspondence, if the correspondence adequately addresses the required response. Your response should be sent to the NRC's Document Control Desk, Washington, DC 20555-0001, with a copy mailed to the NRC Region III Office, 2443 Warrenville Road, Suite 210, Lisle, Illinois 60532, within 30 days of the date of this letter. If an adequate response is not received within the time specified or an extension of time has not been granted by the NRC, the NRC will proceed with its enforcement decision or schedule a PEC.

If you choose to request a PEC, it will afford you the opportunity to provide your perspective on the apparent violations and any other information that you believe the NRC should take into consideration before making an enforcement decision. The topics discussed during the PEC may include the following: 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 to be taken. If a PEC is held, the NRC will issue a press release to announce the time and date of the PEC. The PEC will be open to public observation.

Because your facility has not been the subject of escalated enforcement action within the last two inspections, a civil penalty may not be warranted in accordance with Section 2.3.4 of the Enforcement Policy. In addition, based upon NRC's understanding of the facts and your corrective actions, it may not be necessary to conduct a PEC in order to enable the NRC to make a final enforcement decision. Our final decision will be based on your confirming on the license docket that the corrective actions previously described to the NRC staff have been or are being taken.

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. You will be advised by separate correspondence of the results of our deliberations on this matter.

As a result of this inspection, three additional violations of NRC requirements were identified. These violations were also evaluated in accordance with the NRC's Enforcement Policy, and were both categorized at a Severity Level IV (SLIV). The violations involved: (1) failure to maintain control of licensed material, required by Title 10 of the *Code of Federal Regulations* (CFR) 20.1802; (2) failure to maintain immediate control of a portable gauge at the more restrictive level specified in the licensee's Operating and Emergency procedures committed to via Condition 20.A of the license; and (3) failure to periodically provide hazardous materials transportation refresher training per 49 CFR 172.704(c)(2), as required by 10 CFR 71.5(a). The violations are cited in the enclosed Notice of Violation (Enclosure 1). The NRC is citing the violations in Enclosure 1 because the inspector identified them.

The NRC normally characterizes violations involving the failure to maintain control and constant surveillance of portable gauges on a temporary jobsite at a Severity Level III, and therefore considers them for escalated enforcement action. NRC Enforcement Guidance Memorandum (EGM) 18-002, "Interim Guidance for Positioning Violations for Failure to Control and Maintain Constant surveillance for Portable Gauges," provides for categorizing a violation of 10 CFR 20.1802 at Severity Level IV if the following conditions of the EGM are met: (1) the failure to maintain control and constant surveillance of the portable gauge occurred during operational conditions; (2) the failure to maintain control and constant surveillance of the portable gauge was an isolated, non-willful occurrence and the non-compliance was of short duration and circumstance and did not cause a security access concern, and (3) no unauthorized individual contact with the portable gauge occurred and no unintended exposure to an individual occurred. Criteria 3 of the EGM was not satisfied as an individual picked up the source with his bare hands and received an unintended exposure as a result of his actions; therefore, discretion to categorize the violation at Severity Level IV in accordance with the EGM was not met. However, the agency recognizes that although the gauge user did not stay close enough to maintain *immediate* control of the device as required by your Operating and Emergency Procedures, he still maintained surveillance of the gauge to make an attempt to protect both the gauge and himself upon encountering unexpected and uncontrollable events on the job site.

Because the gauge user maintained surveillance of the gauge, and because he made an attempt to regain control without jeopardizing his own safety, the NRC concluded that the violations for failure to maintain control were more appropriately characterized as a Severity Level IV problem.

You are required to respond to this letter regarding these SLIV violations, and should follow the instructions specified in the enclosed Notice when preparing your response. The guidance in NRC IN 96-28 may also be useful in preparing your response to the SLIV violations. The NRC will use your response, in part, to determine whether further enforcement action is necessary to ensure compliance with regulatory requirements.

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

P. Galdes

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Please feel free to contact Mr. Craffey if you have any questions regarding this inspection. Mr. Craffey can be reached at 630-829-9655.

Sincerely,

*/RA/*

John B. Giessner, Director  
Division of Nuclear Materials Safety

Docket No. 030-33539  
License No. 21-26580-01

Enclosures:

1. Notice of Violation
2. IR No. 03033539/2018001(DNMS)

cc w/encls: Mr. Richard Thorne,  
Radiation Safety Officer  
State of Michigan

Letter to Paul Galdes from John Giessner, dated October 24, 2018.

SUBJECT: NRC REACTIVE INSPECTION REPORT NO. 03033539/2018001(DNMS) AND NOTICE OF VIOLATION – FLEIS & VANDENBRINK ENGINEERING, INC.

DISTRIBUTION w/encls:

- Steven West
- Darrell Roberts
- John Giessner
- Christine Lipa
- Kenneth Lambert
- Paul Pelke
- MIB Inspectors

**ADAMS Accession Number: ML18296A714**

OFFICE	RIII-EICS*	C	OE	C	RIII	C
NAME	JCameron		JPeralta CFranklin for via email		JGiessner Clipa for	
DATE	10/23/2018		10/19/2018		10/24/2018	

\*1(OE) review and concurrence received via e-mail from J.Peralta on 10/11/18

**OFFICIAL RECORD COPY**

## NOTICE OF VIOLATION

Fleis & VandenBrink Engineering, Inc.  
Grand Rapids, Michigan

License No. 21-26580-01  
Docket No. 030-33539  
EA-18-132

During a U.S. Nuclear Regulatory Commission (NRC) inspection conducted on July 19 and 20, 2018, with continued in-office review through September 24, 2018, two violations of NRC requirements were identified. In accordance with the NRC Enforcement Policy, the violations are listed below:

- A.1. Title 10 of the *Code of Federal Regulations* (CFR) 20.1802 states that the licensee shall control and maintain constant surveillance of licensed material that is in a controlled or unrestricted area and that is not in storage.

Contrary to the above, on July 16, 2018, Fleis & VandenBrink Engineering, Inc. failed to maintain control of a portable moisture/density gauge containing a nominal 10 millicuries of cesium-137 and 40 millicuries of americium - 241 that was in an unrestricted area.

- A.2. Condition 20.A of NRC Materials License No. 21-26580-01 requires, in part, that the license shall conduct its program in accordance with the statements, representations, and procedures contained in the letter, dated April 1, 2014, and its enclosures, and that the U.S. Nuclear Regulatory Commission's regulations shall govern unless the statements, representations, and procedures in the licensee's application and correspondence are more restrictive than the regulations.

In an enclosure to the April 1, 2014 letter, the licensee committed to implement and maintain the operating and emergency procedures in Appendix H of NUREG-1556, Vol. 1, Rev. 1, dated November 2001.

The Operating and Emergency Procedures contained in Appendix H of NUREG-1556 Vol. 1, Rev. 1 require, in part, that personnel always maintain constant surveillance and immediate control of the gauge when it is not in storage. At job sites, do not walk away from the gauge when it is left on the ground. Take action necessary to protect the gauge and yourself from danger of moving heavy equipment.

Contrary to the above, on July 16, 2018, Fleis & VandenBrink Engineering, Inc., failed to maintain immediate control of a moisture density gauge, specifically, an authorized gauge user left a portable moisture density gauge containing licensed material on the ground at a temporary job site and walked approximately 15 feet away from it to retrieve a clipboard.

This is a Severity Level IV problem (Section 6.3).

- B. Title 10 CFR 71.5(a) requires that each licensee who transports licensed material outside the site of usage, as specified in the NRC license, or where transport is on public highways, or who delivers licensed material to a carrier for transport, shall comply with the applicable requirements of the DOT regulations in 49 CFR parts 107, 171 through 180, and 390 through 397, appropriate to the mode of transport.

Title 49 CFR 172.702 requires that each hazmat employer shall ensure that each hazmat employee is trained and tested, and that no hazmat employee performs any

function subject to the requirements of 49 CFR Parts 171-177 unless trained, in accordance with Subpart H of 49 CFR Part 172. The terms Hazmat Employer and Hazmat Employee are defined in 49 CFR 171.8.

Title 49 CFR 172.704(c)(2) requires, in part, that a hazmat employee receive the training required by this subpart at least once every three years.

Contrary to the above, as of July 19, 2018, Fleis & VandenBrink Engineering, Inc. did not provide recurrent training at least once every three years to two hazmat employees that satisfied the requirements in Subpart H of 49 CFR Part 172, and the licensee otherwise meets the definition of a hazmat employer in 49 CFR 171.8. Specifically, two hazmat employees had not received this training in over three years: one had not completed it between March 2012 and July 2018, a period of six years, four months; the other had not completed it between March 2015 and May 2018, a period of three years, two months.

This is a Severity Level IV violation (Section 6.3).

Pursuant to the provisions of 10 CFR 2.201, Fleis & VandenBrink Engineering, Inc. is hereby required to submit a written statement or explanation to the U.S. Nuclear Regulatory Commission, ATTN: Document Control Desk, Washington, DC 20555-0001, with a copy to the Regional Administrator, Region III, within 30 days of the date of the letter transmitting this Notice of Violation (Notice). This reply should be clearly marked as a "Reply to a Notice of Violation" and should include: (1) the reason for the violations, or, if contested, the basis for disputing the violations or their severity level, (2) the corrective steps that have been taken and the results achieved, (3) the corrective steps that will be taken, and (4) the date when full compliance was or will be achieved. Your response may reference or include previously docketed correspondence, if the correspondence adequately addresses the required response. If an adequate reply is not received within the time specified in this Notice, an order or a Demand for Information may be issued as to why the license should not be modified, suspended, or revoked, or why such other action as may be proper should not be taken. Where good cause is shown, consideration will be given to extending the response time.

If you contest this enforcement action, you should also provide a copy of your response, with the basis for your denial, to the Director, Office of Enforcement, U.S. Nuclear Regulatory Commission, Washington, DC 20555-0001.

Your response will be made available electronically for public inspection in the NRC's Public Document Room or from the NRC's Agencywide Documents Access and Management System (ADAMS), accessible from the NRC's website at <http://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 publicly available without redaction.

In accordance with 10 CFR 19.11, you may be required to post this Notice within two working days of receipt.

Dated this 24<sup>th</sup> day of October 2018.

**U.S. Nuclear Regulatory Commission  
Region III**

Docket No. 030-33539

License No. 21-26580-01

Report No. 03033539/2018001(DNMS)

EA No./NMED No. EA-18-132 / 180340

Licensee: Fleis & VandenBrink Engineering, Inc.

Locations Inspected: 2960 Lucerne Drive SE  
Grand Rapids, MI 49546  
  
Temporary jobsite on Ives Avenue  
Big Rapids, MI 49307

Inspection Dates: July 19-20, 2018

Exit Meeting Date: September 24, 2018

Inspector: Ryan Craffey, Health Physicist

Approved By: John B. Giessner, Director  
Division of Nuclear Materials Safety

## **EXECUTIVE SUMMARY**

### **Fleis & VandenBrink Engineering, Inc. NRC Inspection Report 03033539/2018001(DNMS)**

This was an announced reactive inspection, conducted to review the circumstances surrounding an event involving a damaged portable moisture density gauge on a temporary jobsite in Big Rapids, Michigan. The event occurred on July 16, 2018, and was reported to the U.S. Nuclear Regulatory Commission (NRC) on the same day. The inspection also incorporated a routine evaluation of the licensee's implementation of its radiation safety program.

As a result of this inspection, the NRC identified two apparent violations of regulatory requirements: one for inadvertently detaching a cesium-137 sealed source from the source rod of the damaged portable gauge, contrary to the prohibition in Condition 14 of NRC Materials License No. 21-26580-01; the other for handling that unshielded source rod and its contents, contrary to the prohibitions in the Operating and Emergency procedures committed to via Condition 20.A of the same license.

The NRC also identified three Severity Level IV violations of regulatory requirements: (1) for failure maintain control of licensed material, required by Title 10 of the *Code of Federal Regulations* (CFR) 20.1802; (2) for failure to maintain immediate control of a portable gauge at the more restrictive level specified in the licensee's Operating and Emergency procedures committed to via Condition 20.A of the license; and (3) for failure to periodically provide hazardous materials transportation refresher training per 49 CFR 172.704(c)(2), as required by 10 CFR 71.5(a).

The circumstances surrounding this event, as well as a discussion of root causes, contributing factors, and the licensee's corrective actions provided to date, are discussed in more detail in the enclosed report.

## **REPORT DETAILS**

### **1 Program Overview and Inspection History**

Fleis & VandenBrink Engineering, Inc. (the licensee) was authorized by NRC Materials License 21-26580-01 to store portable moisture density gauges at its facilities in Grand Rapids, Michigan; Kalamazoo, Michigan; and Indianapolis, Indiana; and to use these gauges at temporary jobsites in NRC jurisdiction. The licensee had eight Troxler 3400 series gauges and over a dozen individuals trained to use them.

The NRC last conducted routine inspections of the licensee on April 24, 2009, and September 30, 2013. Both inspections included observations of licensed activities at temporary jobsites. No violations were identified as a result of either inspection.

### **2 Sequence of Events and Licensee Response**

#### **2.1 Inspection Scope**

The inspector toured various locations, including the temporary jobsite where the incident occurred; interviewed licensee staff and gauge manufacturer representatives; and reviewed a selection of records to obtain a detailed understanding of the circumstances surrounding the event and to evaluate the licensee's response.

#### **2.2 Observations and Findings**

##### **A. Sequence of Events Leading up to the Incident**

On or around July 13, 2018, a construction technician based in Big Rapids, Michigan, took possession of a Troxler 3430 portable moisture density gauge (Serial No. 23659) from the licensee's Grand Rapids office for use on a road reconstruction project along a three-block stretch of Ives Avenue (from Magnolia Street to Oak Street), a residential street in Big Rapids. The gauge, manufactured in May 1994, contained two sealed sources of radioactive material: one comprised of cesium-137 (s/n 75-5723, assayed at 8 mCi in 1994, with approximately 4.6 mCi remaining by July 2018), the other comprised of americium-241 in a beryllium matrix (assayed at 40 mCi in May 1994, with effectively the same remaining by July 2018). The technician was an authorized gauge user with over 20 years' experience using gauges. He had last completed gauge safety training in June 1993, and DOT hazmat refresher training in March 2012 (see section 5.2). The technician served as the Resident Project Representative for the work on Ives Avenue, and was stationed full-time at the site. He was responsible for day-to-day oversight of the project on behalf of the licensee, including routine evaluations of work done by contractors. One of these evaluations involved measuring the compaction of the road's sub-base placed by McGuirk Sand and Gravel.

On July 16, the technician began conducting density testing with the gauge as heavy equipment operators for McGuirk placed and then compacted layers of sub-base. The placement and compaction began at Ives and Magnolia, and progressed northwards. By the end of the day, the operators had placed and compacted the bottom layer (gravel) of almost an entire block, from Magnolia to Cedar Street. At approximately 5:45 p.m., the technician retrieved his gauge, along with a bucket of equipment (alignment plate, stake, large hammer, etc.) and a clipboard from his truck, which was parked near the intersection of Ives and Magnolia, to perform a set of density measurements along the segment of compacted gravel, approximately halfway up the block. Struggling to carry

all of the equipment at once, the technician opted to drop his clipboard in the grass adjacent to the intended test site. He then walked approximately 15 feet onto the gravel surface, and prepared the site for a density test.

After placing a hole in the gravel using the alignment plate, stake and hammer, the technician extended the source rod of the gauge approximately 10 inches into the sub-base, and began the test. The technician backed away from the gauge about eight feet, utilizing the distance to minimize exposure to the Cs-137 source at the end of the source rod, and waited for the test cycle to complete (typically around 60 seconds). Upon completion of the test, the technician approached the gauge to read the results, but then realized he had left his clipboard, with the recording form, back on the grass. With the source rod still extended, the technician walked away from the gauge momentarily to retrieve the clipboard.

Upon retrieving the clipboard, the technician heard shouting coming from the next block up. The foreman and another employee for McGuirk, standing at the intersection of Ives and Cedar, were yelling at a crawler dozer that had been placing gravel near that intersection, but was now rapidly reversing in the direction of the technician and his gauge. However, the dozer, a Komatsu D51PXi series [see Figure 1], had a fully enclosed cab, and the operator apparently made no attempt to look backwards in the direction of his travel.

The technician, at approximately 15 feet from the gauge, considered making an attempt to retrieve the gauge, upon realizing that the dozer may run it over. However, at the dozer's apparent rate of speed, the technician realized that he may not be able to make it there and retrieve the gauge in time, so decided not to risk his own safety. He too yelled and waved at the operator vigorously, but to no avail. The dozer ran over the gauge with its left tread, then proceeded forward again on Ives towards Cedar, where the foreman finally flagged down the operator and detained the equipment.



*Figure 1: The dozer, still on the Ives Ave job site*

#### B. Licensee's Response to the Incident

The technician walked back to the gauge to assess the damage. The technician found that the dozer had pressed the gauge into the gravel, cracked and broken the plastic case and electronics panel, and sheared the indexing rod (which stands parallel and adjacent to the retracted source rod and provides latch stops at regular intervals to assist in extending the source rod to the desired depth). He looked underneath the broken electronics panel and found that the Am-241:Be source at the bottom of the case appeared to be undamaged. He also attempted to pull on the handle of the source rod to retract it into its shielded position, but it did not move. He picked up the gauge momentarily, and found that although the source rod appeared to be intact, the dozer's weight had bent it approximately eight degrees from vertical. In this shape, the technician recognized that the rod would not be able to retract into the gauge through the narrow inner diameter of its lead shielding.

The technician quickly located a section of construction fence and cordoned off a 10 foot by 15 foot square area around the damaged gauge. The only other individuals in the vicinity at the time were the abovementioned McGuirk employees, but they soon departed. No other bystanders, pedestrians, nearby residents, or other members of the public approached the area for the remainder of the incident.

At approximately 6:00 p.m., the technician made contact with the Radiation Safety Officer (RSO) at his residence and provided him with a summary and cursory assessment of the situation. The licensee's RSO had approximately eight years of experience using gauges, and fourteen months' experience as an RSO. He had last completed gauge safety training in March 2009, DOT hazmat refresher training in February 2017, and had completed a manufacturer's RSO training course in March 2016 prior to assuming the role of RSO.

After speaking with the technician and the technician's supervisor, the RSO contacted the licensee's office technician, who was still at the licensee's main office in Grand Rapids, and requested that he collect the licensee's TroxAlert Survey Meter (s/n 2050, last calibrated in September 2017) and emergency contact information, and meet him at the temporary jobsite, approximately 65 miles north of the office. The office technician had previous experience as a gauge user and RSO, although he had not used a gauge in his four years with the licensee. He had last completed gauge safety training in September 1985, and DOT hazmat refresher training in February 2017.

At approximately 7:45 p.m., the RSO and office technician met the field technician on the jobsite. The RSO first conducted surveys of the gauge, the dozer involved in the incident, and the surrounding area. The RSO noted readings of 0.06 to 0.08 millirem (mrem) per hour at three feet from the gauge, 20-30 mrem per hour at one foot from the exposed Cs-137 source, and no readings distinguishable from background around the dozer.

Shortly after 8:00 p.m., the RSO contacted the manufacturer of the gauge using the emergency contact number listed on the gauge's bill of lading and provided the representative with a summary and cursory assessment of the event, including survey readings. The licensee stated that it was "advised that nothing should be done with the gauge until the rod could be retracted into the safe position and the source shielded." The office technician and field technician then proceeded to make various attempts to retract the source rod, while the RSO called the field technician's supervisor and requested that he notify the Michigan State Police, in case they might be needed to assist in maintaining control of the site.

The technicians first attempted to retract the bent source rod by pulling up on its handle, as would be done under normal circumstances. Failing that, the technicians then attempted to bend the rod manually; first using their bare hands to grasp the rod at the base of the gauge (approximately eight inches from the exposed source, for up to two minutes), and then using leverage from a nearby piece of stationary heavy equipment as they held on to the sides of the gauge. Failing that, the office technician took the field technician's hammer from his bucket of density testing equipment, and struck the rod on the end (i.e. where the source was located) in an attempt to overcome the broken locking mechanism and force the rod back into its shielding. On the second hammer strike, the welded cap on the end of the rod shattered [see Figure 2], and the now singly-encapsulated Cs-137 sealed source, a QSA Global, Inc. model CDC.W556, fell out of the cup on the end of the source rod.

The field technician immediately picked up the source with his bare hands, inspected the capsule for damage (later estimating that he held it for no more than ten seconds), and



*Figure 2: Source rod, post-hammer. Note that the Cs-137 source is no longer present.*

placed it on the piece of heavy equipment previously used for leverage. The office technician located a spool of copper wire, and placed it over the source to provide at least some measure of shielding. The three individuals then stepped back approximately 15 feet from the source, while the RSO contacted the NRC.

Around 9:00 p.m., the RSO made contact with the NRC's Headquarters Operations Center (HOC). The Headquarters Operations Officer (HOO) on duty

connected the licensee with the NRC Region III Duty Officer (R3DO) and Region III DNMS management via conference call to discuss what could now be done considering the circumstances. The group discussed options for maintaining exposures ALARA and for transporting the gauge back to an authorized storage location.

Around 9:25 p.m., the field technician found and partially filled a small square cardboard box (approximately 12" cubed) with sand from the jobsite. The technician then quickly picked up the source from under the spool of copper wire, again with his bare hands (later estimating that he held it this second time for no more than ten seconds as well), then dropped it in the box, and filled the rest of the box with sand. The RSO then sealed the box, and placed it in the trunk of his car, along with the remnants of the gauge and its transport case. The RSO conducted additional surveys of the area where attempts had been made to straighten the source rod, where the source had been detached, and where it had been placed. The RSO found no readings in these areas that were distinguishable from background.

At approximately 10:00 p.m., the licensee's personnel left the jobsite. The RSO contacted the field technician's supervisor again and asked him to inform the State Police that their response would not be needed. At approximately 11:00 p.m., the RSO returned to the licensee's office in Grand Rapids and secured the gauge in the designated storage location.

The next day, the RSO conducted additional radiation surveys of the storage shed and of his vehicle. The RSO recorded readings of 0.40 mrem per hour at three feet from the box of sand containing the detached source while inside the shed, and 0.20 mrem per hour at the same distance from the box while outside the shed. The RSO found no readings in his vehicle that were distinguishable from background.

The RSO contacted and then visited a different portable gauge manufacturer than the one he spoke to the night before to arrange for transfer of the damaged gauge to their service center, also in Grand Rapids. The manufacturer provided him with leak test collection equipment, a lead pig, and instructions on how to remove the source rod shielding (and by extension, the source rod) from the gauge housing, so that the

components could again fit inside the transport case. The RSO brought these items [see Figure 3] back to the licensee's office, and proceeded to transfer the detached source from the box of sand to the lead pig using long-handled tools, collect leak tests of both sources, remove the source rod and its shielding from the gauge, and package all components in the transport case for transfer to the service center. The RSO placed the lead pig into the case as well, after sealing the top with duct tape to prevent the Cs-137 source from escaping the pig.



Figure 3: Gauge remnants, awaiting disposal at the service center

At approximately 3:30 p.m., the RSO transported the damaged gauge to the service center. The manufacturer collected their own leak tests and provided the licensee with documentation acknowledging receipt of the gauge the following day.

### C. Prohibited Activities Conducted during Response

From this review of the licensee's response to the damaged gauge, the inspector identified two apparent violations of regulatory requirements involving the conduct of prohibited activities.

Condition 14 of NRC Materials License No. 21-26580-01 states that sealed sources or source rods containing licensed material shall not be opened or sources removed from source holders or detached from source rods by the licensee, except as specifically authorized.

Due to the substantial potential for exposures or releases in excess of regulatory limits, the licensee's inadvertent detachment of the Cs-137 sealed source from the damaged gauge's source rod while attempting to retract it is an apparent violation of this License Condition.

Condition 20.A of the same license requires, in part, that the license shall conduct its program in accordance with the statements, representations, and procedures contained in the letter dated April 1, 2014 and its enclosures, and that the U.S. Nuclear Regulatory Commission's regulations shall govern unless the statements, representations, and procedures in the licensee's application and correspondence are more restrictive than the regulations.

In an enclosure to the April 1, 2014 letter, the licensee committed to implement and maintain the operating and emergency procedures in Appendix H of NUREG-1556, Vol. 1, Rev. 1, dated November 2001. The Operating Procedures contained in Appendix H of NUREG-1556 Vol. 1, Rev. 1 require, in part, that personnel do not touch the unshielded source rod with fingers, hands, or any part of the body.

Due also to the substantial potential for exposures or releases in excess of regulatory limits, the licensee's handling of an unshielded source rod and its contents, contrary to the prohibitions on such activities in the Operating and Emergency Procedures, is an apparent violation of this License Condition.

The inspector determined that the root cause of both violations appeared to be a lack of understanding of the scope of authorized activities. The licensee's staff appeared to believe that they could manipulate the source rod in order to retract the source into its shielding, given the circumstances. A contributing factor was the lack of any explicit guidance on how to properly resolve a situation involving a bent source rod.

As corrective action to address all deficiencies associated with the event and subsequent response, the licensee to date has committed to the following via its 30-day written report:

- Developing and providing annual refresher training to its gauge users to reinforce safety procedures and incident response;
- Developing a case study of this event for presentation to staff, incorporating what went well and what could have been done better;
- Determining the availability of Type A containers which can accommodate a damaged gauge no matter the condition of the gauge;
- Incorporating the availability of such containers into its emergency response plans and training; and,
- Developing an incident response team, comprised of additional staff with RSO training and experience, to provide timely support and coordination and to minimize uncertainty in responding to future events.

## 2.3 Conclusions

The inspector identified an apparent violation of Condition 14 of NRC Materials License No. 21-26580-01 for inadvertently detaching a cesium-137 sealed source from the source rod of the damaged portable gauge, and an apparent violation of Condition 20.A of the same license for handling, with bare hands, the unshielded source rod and its contents.

## 3 **Notification and Reporting**

### 3.1 Inspection Scope

The inspector discussed the applicable reporting requirements with the licensee's RSO and reviewed the initial notification and 30-day written report for this event to evaluate compliance with reporting requirements.

### 3.2 Observations and Findings

The gauge was damaged at approximately 5:45 p.m. Eastern Time on July 16, 2018. The licensee's RSO contacted the NRC's HOO at approximately 9:00 p.m. the same day. The notification resulted in Event Number (EN) 53507, reportable under 10 CFR Part 30.50(b)(2) as an event in which equipment is disabled or fails to function as designed when the equipment is required by regulation or license condition to prevent exposures to radiation and radioactive materials exceeding regulatory limits. The event was recorded in the Nuclear Materials Events Database (NMED) under Item No. 180340.

The licensee submitted its 30-day written report to the NRC on August 15, 2018. An electronic copy of the licensee's report can be found in the NRC's Agencywide Document Access and Management System (ADAMS), using Accession Number ML18243A479. The report included a thorough description of the event and details of the equipment and radioactive material involved therein. The report also included an

estimate of whole-body radiation exposure to individuals involved in the incident and the licensee's response, as well as corrective actions which appeared to address the probable root cause of the incident. The licensee also provided a copy of the sealed source leak test results taken by the licensee and those taken by the manufacturer upon receipt of the damaged gauge. Neither test found contamination indicative of any leakage.

### 3.3 Conclusions

The inspector determined that the licensee made all required notifications and reports within the required time periods, and that the licensee's written report included all required information.

## 4 **NRC Assessment of the Event**

### 4.1 Inspection Scope

The inspector toured the job site in Big Rapids where the incident occurred, interviewed licensee staff and gauge manufacturer representatives, reviewed the licensee's operating and emergency procedures and conducted independent radiation surveys and dose assessments to evaluate the consequences of the event and the licensee's response.

### 4.2 Observations and Findings

#### A. Root Cause and Contributing Factors

The inspector agreed that the damage to the gauge, which prevented the source rod from retracting the Cs-137 sealed source into its shielded position, met the criteria in 10 CFR 30.50(b)(2) for a reportable event. The inspector concluded that the root cause of the event was a lack of situational awareness by the McGuirk Sand and Gravel employee who operated the dozer. Contributing factors included the inability to communicate with the dozer operator, schedule pressures on the contractor, and the gauge user's momentary lack of immediate control of his gauge when he walked away to collect his clipboard.

From this assessment, the inspector identified one Severity Level IV violation of regulatory requirements for the failure to maintain immediate control of a portable gauge.

Title 10 CFR 20.1802 states that the licensee shall control and maintain constant surveillance of licensed material that is in a controlled or unrestricted area and that is not in storage.

Condition 20.A of NRC Materials License No. 21-26580-01 requires, in part, that the license shall conduct its program in accordance with the statements, representations, and procedures contained in the letter dated April 1, 2014 and its enclosures, and that the U.S. Nuclear Regulatory Commission's regulations shall govern unless the statements, representations, and procedures in the licensee's application and correspondence are more restrictive than the regulations.

In an enclosure to the April 1, 2014 letter, the licensee committed to implement and maintain the operating and emergency procedures in Appendix H of NUREG-1556, Vol. 1, Rev. 1, dated November 2001. The Operating and Emergency Procedures

contained in Appendix H of NUREG-1556 Vol. 1, Rev. 1 require, in part, that personnel always maintain constant surveillance and immediate control of the gauge when it is not in storage. At job sites, do not walk away from the gauge when it is left on the ground. Take action necessary to protect the gauge and yourself from danger of moving heavy equipment.

The failure to maintain control of licensed material, is a violation of 10 CFR 20.1802, and the failure to maintain immediate control of a portable gauge as specified in the licensee's Operating and Emergency procedures, is a violation of License Condition 20.A.

The NRC characterized these violations as a SLIV problem because the gauge user maintained surveillance of the gauge, and because he made an attempt to regain control without jeopardizing his own safety.

The inspector determined that the root cause of the violation appeared to be an oversight. The gauge user appeared to have been distracted by the need to record his measurements, and in the moment did not consider the need to ensure immediate control of it as he went to retrieve his clipboard.

As corrective action to address all deficiencies associated with the event and subsequent response, the licensee to date has committed to a series of measures, detailed earlier in Section 2.2 of this report.

## B. Independent Assessment of Contamination and Radiation Exposure

Using a Ludlum model 2403 survey meter (s/n 291539) with model 44-9 Geiger-Müller pancake probe (s/n 345324), last calibrated on January 26, 2018, the inspector conducted independent surveys of the jobsite in Big Rapids, including the area where the gauge was first damaged, the area where the licensee attempted to manipulate the source rod, and on contact with various surfaces of the dozer which had run over the gauge. The inspector found no evidence of residual contamination from any of these surveys.

Using the same survey meter and probe, the inspector also conducted independent surveys of the RSO's vehicle and the licensee's storage location in Grand Rapids. The inspector found no evidence of residual contamination here, either.

Using a Canberra UltraRadic meter with energy-compensated Geiger-Müller probe, last calibrated on April 24, 2018, the inspector also conducted independent surveys in the vicinity of the damaged gauge at the manufacturer's service center in Grand Rapids. The inspector found no evidence of residual contamination on the remnants of the source rod or other remnants of the gauge. In addition, the inspector measured the following approximate readings in the vicinity of the Cs-137 sealed source:

- 5,500 mrem per hour on contact (remotely measured);
- 95 mrem per hour at 4 inches;
- 20 mrem per hour at 8 inches;
- 10 mrem per hour at 1 foot;
- 5 mrem per hour at 2 feet; and,
- 3 mrem per hour at 3 feet.

Based on these readings, and based on estimated exposure times obtained from interviews with the technicians, the inspector estimated, with assistance from a Region III Certified Health Physicist using VARSKIN 6.0, that the field technician received around 122 mrem shallow-dose exposure to his hand while manipulating the source and source rod, and that the office technician received around 2 mrem to his hand while manipulating the source rod only.

Based on this information, the inspector generally agreed with the licensee's exposure assessment, and concluded that no personnel involved in this were likely to have received any exposures in excess of occupational dose limits. Moreover, the inspector concluded that no members of the public appear to have received any exposures in excess of public dose limits.

### C. Assessment of Radiation Safety Practices

The inspector noted that the licensee promptly and adequately restricted the area following the incident, and that the organization responded promptly to notification that it had occurred. The licensee's conduct of area surveys demonstrated adequate concern for and understanding of radioactive contamination. The licensee implemented some commendable ALARA practices, such as leaving the gauge in the ground whenever possible to maintain shielding from the exposed Cs-137 source, and maintaining distance from the gauge and detached source whenever possible.

However, the licensee did not adequately implement ALARA practices in some key respects, notably when handling the source rod and detached source directly. The inspector also noted that the licensee's decisionmaking in its response appeared to reflect an emphasis on compliance with regulations over the need to protect health and minimize danger to life or property.

#### 4.3 Conclusions

The inspector identified a SLIV violation of 10 CFR 20.1802 and a SLIV violation of Condition 20.A of NRC License No. 21-26580-01 for the failure to maintain control of licensed material.

## 5 **Implementation of Radiation Safety Program in Other Areas**

### 5.1 Inspection Scope

The inspector toured the office in Grand Rapids, interviewed staff, and reviewed a selection of records to evaluate the licensee's oversight of its radiation safety program.

### 5.2 Observations and Findings

The inspector toured the storage location at the licensee's office in Grand Rapids to evaluate the licensee's measures for materials security, hazard communication, and exposure control. The inspector noted that the licensee utilized at least two independent physical controls to secure material in storage, and conducted independent surveys

in the vicinity of the storage location using the Canberra UltraRadic described in Section 4.2. The inspector found no area exposures in excess of regulatory limits to members of the public as a result of these surveys.

The inspector discussed with the RSO the licensee's measures for material accountability, and reviewed a selection of leak test results for each of the licensee's gauges. The inspector also reviewed a selection of program audits, gauge user training records, and survey meter calibrations.

During the review of training records, the inspector identified a Severity Level IV violation for failure to provide recurrent training to hazmat employees at the required interval, after noting that two of the licensee's ten authorized gauge users had not received hazmat training at three-year intervals. One (the user involved in the event that prompted this inspection) had not received the training between March 2012 and July 2018, an interval of six years, four months. The other had not received it between March 2015 and May 2018, an interval of three years, two months.

Title 10 CFR Part 71.5(a) requires that each licensee who transports licensed material outside the site of usage, as specified in the NRC license, or where transport is on public highways, or who delivers licensed material to a carrier for transport, shall comply with the applicable requirements of the DOT regulations in 49 CFR parts 107, 171 through 180, and 390 through 397, appropriate to the mode of transport.

Title 49 CFR 172.702 requires that each hazmat employer shall ensure that each hazmat employee is trained and tested, and that no hazmat employee performs any function subject to the requirements of 49 CFR Parts 171-177 unless trained, in accordance with Subpart H of 49 CFR Part 172. The terms Hazmat Employer and Hazmat Employee are defined in 49 CFR 171.8.

Title 49 CFR 172.704(c)(2) requires, in part, that a hazmat employee receive the training required by this subpart at least once every three years.

The licensee's failure to provide recurrent training at least once every three years to all hazmat employees that satisfied the requirements in Subpart H of 49 CFR Part 172 is a violation of 10 CFR 71.5(a).

The root cause of the violation appears to be a lack of adequate oversight. The licensee maintained an excel spreadsheet to track periodic training requirements for employees, but in some instances did not update it, or did not take action on its notifications of expired training.

As corrective action, the licensee to date has committed to review on an annual basis all required staff training and maintain current certifications with respect to nuclear gauge handling and use.

### 5.3 Conclusions

The inspector identified a SLIV violation of 10 CFR 71.5(a) for the failure to provide hazardous materials transportation refresher training in accordance with 49 CFR 172.704(c)(2).

## 6 Exit Meeting Summary

The inspector presented preliminary inspection findings to the licensee on July 20, 2018, at the conclusion of the onsite inspection. The licensee acknowledged the findings presented. The inspector conducted a final inspection exit meeting with the licensee on September 24, 2018.

### **LIST OF PERSONNEL CONTACTED**

- ^ Paul Gelding, P.E. – Vice President
- Larry James, Ph.D – Corporate RSO [InstroTek]
- Michael Lockwood – Grand Rapids RSO [InstroTek]
- ^ Todd Richter – Construction Services Group Manager
- ^# Richard Thorne, P.E. – Radiation Safety Officer
  
- ^ Attended preliminary exit meeting on July 20, 2018.
- # Attended final exit meeting by telephone on September 24, 2018.

### **INSPECTION PROCEDURES USED**

- 87103: Inspection of Nuclear Material Licensees Involved in an Incident or Bankruptcy Filing
- 87124: Fixed and Portable Gauge Programs