

February 14, 2011

U.S. Nuclear Regulatory Commission, Region III
Attn: Regional Administrator
2443 Warrenville Road, Suite 210
Lisle, IL 60532-4352

RE: NRC Event Number 46547

On January 17, 2011, Eli Lilly and Company (Lilly) reported the loss of eight tritium exit signs to the NRC Operations Center by telephone per the expectations of the January 16, 2009 Demand for Information from the U.S. Nuclear Regulatory Commission. Upon investigation, it was determined that there were an additional eight signs lost. Event number 46547 was amended on February 8, 2011, to indicate a total of sixteen signs were lost. The signs were lost from Lilly offices located at 639 S. Delaware Street, Indianapolis, IN, 46225.

Item 1. 10 CFR 20.2201(b)(1)(i): A description of the licensed material involved, including kind, quantity and chemical and physical form.

Response: Sixteen tritium exit signs of the following design:

Manufacturer	Model Number	Serial Number
Evenlite	201	57281
Evenlite	201	59311
SRBT	BX	C035796
SRBT	BX	C035795
Evenlite	201	57381
SRBT	BX	C035790
SRBT	BX	C035789
Evenlite	201	57381
Evenlite	201	5989I
Evenlite	201	5897I
Evenlite	201	5885I
Evenlite	201	5886I
Evenlite	201	5899I
Evenlite	201	5900I
Evenlite	201	5819I
Evenlite	201	5887I

Item 2. 10 CFR 20.2201(b)(1)(ii): A description of the circumstances under which the loss or theft occurred.

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Response: Two floors of Lilly building 22 and three floor of Lilly building 31 were undergoing total renovation. The onsite contractors responsible for facilities maintenance were trained in the proper procedures for tritium exit sign disposal. The contractors hired to perform the demolition were instructed on the proper procedure for exit sign removal, however only half of the signs from the two projects were properly returned to Lilly Radiation Safety.

Item 3. 10 CFR 20.2201(b)(1)(iii): A statement of disposition, or probable disposition, of the licensed material involved.

Response: It is believed that the signs were placed into a number of possible general demolition debris dumpsters, and disposed of by the local waste disposal company by method of landfill.

Item 4. 10 CFR 20.2201(b)(1)(iv): Exposures of individuals to radiation, circumstances under which the exposures occurred, and the possible total effective dose equivalent to persons in unrestricted areas.

Response: To our knowledge, there have been no known exposures to any radiation from these signs. Wipe tests of the remodeled areas, dock and dumpster areas were free of radioactive contamination. The consulting firm of Dade Moeller & Associates, Richland, Washington, was hired to evaluate the potential health and safety impact of exposure to the missing signs. Their evaluation is enclosed.

Item 5. 10 CFR 20.2201(b)(1)(v): Actions that have been taken, or will be taken, to recover the material.

Response: A thorough search of Lilly facilities, including other waste areas, was conducted, and the missing signs were not located. The demolition contractor was interviewed, and stated that the signs were most likely disposed with normal demolition waste. Due to the time lapse between the demolition work, and the discovery of the lost signs, recovery prior to landfill was not possible.

Item 6. 10 CFR 20.2201(b)(1)(vi): Procedures or measure that have been, or will be, adopted to ensure against a recurrence of the loss or theft of licensed material.

Response: The on-site contractor has developed a standard operating procedure whereby they will be taking direct responsibility for the removal of all tritium exit signs within their project scope. The on-site contractor building engineer, or his designate, will log and record all tritium signs present and compare with the inventory maintained by Lilly Radiation Safety prior to the commencement of project work. Sign removal will be performed by the on-site contractor building engineer, or his designee, prior to the demolition contractor's arrival. On a broader scale, Lilly Radiation Safety will be working in a joint effort with corporate environmental and safety groups to reach out to all maintenance organizations across Indianapolis facilities, to communicate the learning, and encourage similar processes be developed within all organizations.

If you have any questions regarding this report, please contact me at (317) 276-7862

Sincerely,

A handwritten signature in black ink, appearing to read 'S.D. Hampton', with a long horizontal flourish extending to the right.

Stanley D. Hampton, M.S.
Corporate Radiation Safety Officer
Eli Lilly and Company

Enclosure

Health and Safety Assessment of Lost or Damaged Tritium Exit Signs

The potential health and safety impacts have been evaluated for exposure to self-luminescent tritium exit signs (TES) removed from locations within the Eli Lilly facility. A total of 16 TES have been misplaced and are considered to be potentially lost as the result of a recent remodeling effort at the facility. Eli Lilly employees, contractors, and sub-contractors could have been in the vicinity of these signs and potentially exposed. All potentially exposed individuals are considered to be members of the public, and subject to an annual radiation dose limit of 100 mrem per year. This assessment considers the possibility that the misplaced TES have been damaged. Damaged TES can pose a potential risk if they are handled or if individuals are in the immediate vicinity when tritium-containing tubes in the sign are broken and the tritium gas released. Intact TES present no radiation hazard to nearby individuals.

This assessment is necessarily qualitative since no direct information is available about the TES other than the number of signs and approximate amount of tritium activity per sign. Exposure scenarios have been prepared and potential impacts estimated based on Dade Moeller's previous experience with removal and assessment of damaged TES and the knowledge of potential exposure pathways and the resultant doses, and applied to the Eli Lilly facility. The assessment develops and evaluates realistic exposure scenarios involving a realistic or reasonable maximum number of damaged TES that could result in radiation dose to an individual. Assessment endpoints are estimates of the most likely dose received (average or median estimate) and a reasonable maximum dose (approximately a 95th percentile dose, but not a bounding estimate) for each scenario.

1. Contractor Removes and Handles 16 Undamaged TES

In this scenario a sub-contractor carefully removes 16 intact TES; none of the TES are damaged during the removal process. Intact TES present no radiation hazard to an individual handling the signs or to nearby individuals, even though minor amounts of tritium contamination may sometimes be found on intact TES. No radiation dose would be received.

Estimated Dose:	Most Likely:	0 mrem
	Reasonable Maximum:	0 mrem

2. Employee or Contractor Works Near 16 Undamaged TES

In this scenario an employee or sub-contractor works in the general vicinity of 16 intact TES, all of which are undamaged. Intact TES present no radiation hazard nearby individuals, and no radiation dose would be received.

Estimated Dose:	Most Likely:	0 mrem
	Reasonable Maximum:	0 mrem

3. Contractor Directly and Immediately Involved in TES Damage

In this scenario a sub-contractor is directly involved in breaking or damaging a TES. The individual is either within arm's length of a single TES (< 1 m) or is standing over a TES (< 2 m) when it is broken. This scenario is based on prior experience with incidents of a TES breaking during a difficult removal from a wall mounting location and one where an individual was in a dumpster and damaged signs in the dumpster by jumping on them in an attempt to compact trash. In the dumpster incident only 2 of nearly 30 TES present (a damage fraction of less than 0.1) were damaged. Potential exposure to tritium in this scenario is based on knowledge of actual exposure to damaged TES and follow-up tritium bioassay results. Experience has shown this to be the scenario where an involved individual could receive the highest potential dose.

Estimated Dose:	Most Likely:	5 mrem
	Reasonable Maximum:	10 mrem

4. Employee or Contractor Works Near a Damaged TES

In this scenario an individual works in the general vicinity of a damaged TES which had been removed from the facility. There is no special packaging of the TES, and other intact TES may or may not be present. This individual was not in the immediate area when the TES was damaged, and does not handle the damaged TES. Estimates of the most likely and reasonable maximum doses from exposure to tritium in this scenario are based on knowledge of actual exposures to damaged TES and follow-up tritium bioassay results. No modeling was conducted. In earlier, unrelated events involving damaged TES, several individuals were identified with similar exposure conditions to those defined by this scenario. From the multiple negative bioassay results obtained from individuals working in or near an area where a damaged sign was found, no exposure (or intake) would occur for this scenario.

Estimated Dose:	Most Likely:	0 mrem
	Reasonable Maximum:	0 mrem

5. Contractor Involved with Physical Impact to a TES and Clean-up

This scenario represents a situation where a contractor accidentally strikes and breaks a wall-mounted single TES from a distance of 5 to 10 feet, using building material like conduit, pipe, or a 2" x 4". This type of damage could occur during preparatory or remodeling activities. The TES is assumed to be knocked from the wall down to the floor below, approximately 10 feet. The contractor is not in the immediate vicinity of sign when it strikes the floor but rather is at the distance noted above. The individual is assumed to complete the immediate task at hand, then clean up the sign debris.

Estimates of the most likely and reasonable maximum doses from potential exposure to tritium in this scenario are based on knowledge of actual exposure to damaged TES and follow-up tritium bioassay results from similar scenarios involving mechanical impact using a forklift or stacking implement and from clean-up activities.. No modeling was conducted. Multiple incidents have indicated that only limited exposures and doses would occur.

Estimated Dose:	Most Likely:	0.1 mrem or less
	Reasonable Maximum:	1 mrem

6. TES Disposed and Placed in a Compactor

For this scenario, the contractor was assumed to remove 16 intact TES from the Eli Lilly facility and later toss them into an industrial trash compactor at a remote site. The compactor containing the TES is operated multiple times as new trash is added and the compactor is filled to capacity with metal, wood, cardboard, and miscellaneous materials. The potentially exposed individual is a hypothetical unknowing member of the public near the compactor.

Potential exposure to tritium in this scenario is based on knowledge of actual incidents involving compactors. No modeling was conducted. In all incidents encountered for this project, no intact TES (up to 5 disposed) were damaged even after numerous compactions. It is possible a TES could be damaged in a compactor; however, an individual could not be immediately adjacent to a sign damaged (i.e., in the compactor), which reduces the potential for exposures. The reasonable maximum dose to an individual in the general vicinity of compactor when a sign is broken is likely similar to an employee involved in physical breakage of a TES (scenario 5) but without the associated clean-up activities. The compactor would provide additional isolation from the damaged TES. Therefore, the most likely dose from scenario 5 (physical impact and breakage) is considered representative of the reasonable maximum dose for this scenario. The basis for this evaluation was experience with intact, undamaged TES retrieved from other compactors as well as potential exposures and bioassay results for compactor disposal incidents.

Estimated Dose:	Most Likely:	0 mrem
	Reasonable Maximum:	0.1 mrem

Conclusions and Summary

Evaluation of the exposure scenarios described above shows that in all cases handling of intact tritium exit signs results in no radiation dose, while exposure to tritium from damaged tritium exit signs results in negligible or very low doses to potentially exposed employees, contractors, or sub-contractors. In all cases the estimated dose is well below the applicable dose limit of 100 mrem per year. Only when an individual is in the immediate vicinity (0-2 meters) at the time the TES is broken does it appear likely that the reasonable maximum dose would exceed 1 mrem. These scenarios are based on previous experience with removal and disposition of intact and damaged tritium exit signs. Table 1 summarizes the scenarios and the estimated most likely and reasonable maximum doses from potential exposure to damaged tritium exit signs.

Table 1 – Summary of TES Exposure Scenarios and Estimated Doses.^a

Exposure Scenario Exposed individual Condition of TES	Number of TES	Estimated Dose (mrem)	
		Most Likely	Reasonable Maximum
1. Removal of TES from wall; involved sub-contractor; intact TES	16	0	0
2. Staging of TES; nearby employees, individuals; intact TES	16	0	0
3. TES broken during removal; involved sub-contractor; damaged TES	1 – 2	5	10
4. Staging of damaged TES; nearby employees, individuals; damaged TES	1	0	0
5. TES broken from a distance and cleaned up; involved sub-contractor damaged TES	1	0.1	1
6. TES placed in compactor at remote location; member of the public; damaged TES	up to 16	0	0.1

a. Scenarios and estimated doses are based on prior TES experience.