TRITIUM EXIT SIGN INVENTORY PROJECT (TESIP)

FINAL REPORT

January 29, 2009

Wal-Mart Stores, Inc.

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***** TES numbers are current as of January 26, 2009.

FINAL TESIP REPORT

I. Introduction

This report provides the final summary report for Wal-Mart's Tritium Exit Sign Inventory Project (TESIP). From 2000 to 2007, Wal-Mart Stores Inc. (Wal-Mart) possessed approximately 79,000[1] exit signs containing tritium (TES) for use in its approximately 4,500 facilities. Tritium, a radioactive isotope of hydrogen that emits a low level beta particle when combined with phosphor in gas tubes, creates enough energy to illuminate the phosphor. As used in TES, tritium does not present a significant risk to public health and safety because it does not have sufficient energy to penetrate the outer layer of human skin.[2] Tritium is used in exit signs because the resulting illumination is independent of electric or battery power. Despite the low level radiological risks associated with TES, the use of TES is regulated by the U.S. Nuclear Regulatory Commission (NRC) and NRC Agreement States because the signs contain a radioactive isotope. Accordingly, when Wal-Mart purchased TES for use in its facilities, it became a general licensee of the NRC under 10 C.F.R. § 31.5, and analogous provisions of Agreement State regulations.

For various reasons that are explained further in this report, Wal-Mart was unaware of its status as a general licensee and the associated resulting regulatory requirements until circa 2006. At that time, Wal-Mart began focusing on the status of its TES when two state regulatory agencies (Colorado and Nebraska) contacted Wal-Mart about its TES inventory in those respective states.

Wal-Mart responded to these states and based on its findings, expanded its TES inventory efforts in early 2007. In early 2008, Wal-Mart again expanded its efforts, this time to include an inventory of every domestic facility in the Wal-Mart chain, regardless of whether records indicated the presence of TES at that location. This nationwide TES inventory effort, the Tritium Exit Sign Inventory Project (TESIP), was designed to comprehensively assess and control all of Wal-Mart's TES and to ensure compliance with applicable regulations. During implementation of the TESIP, Wal-Mart also issued communications to all of its domestic facilities to alert them of this project and to provide

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[1] As further discussed herein, the 79,000 number used throughout this report reflects approximately 75,200 signs that records indicate Wal-Mart actually purchased plus approximately 3,800 signs that Wal-Mart appears to have acquired via store acquisitions or from other unknown sources.

[2] The radiation emitted from tritium is a health hazard to humans only when inhaled or absorbed through the skin in a chemically soluble form; that is, the radiation from a tritium atom is only hazardous when it is emitted inside the body. Even then, the dose consequences are usually small or negligible. For example, ANSI/HPS N13.12, "Surface and Volume Radioactivity Standards for Clearance," lists a surface screening clearance level of 600,000 dpm/100 cm^2 for tritium (reference Table 1, "Screening Levels for Clearance"), which is protective of 1 mrem/year; a dose considered below regulatory concern. In comparison, the average background level for the U.S. population is 300 mrem/year (NCRP 1987, Table 2.4). As another example, without exception, the NRC has characterized TES as containing less than Category 3 level of radioactive material. Sources that are "less than IAEA Category 3 sources," are either very unlikely to cause permanent injury to individuals or contain a very small amount of radioactive material that would not cause permanent injury.

direction regarding the proper handling of TES. Wal-mart's ultimate TESIP objective is to eliminate all TES from its facilities and replace them with non-tritium exit signs.[3]

Wal-Mart utilized a triage approach when addressing its TES issues with the following objectives:

- taking reasonable steps to promptly locate all TES at all of its domestic facilities;
- identifying, addressing and mitigating any potential adverse consequence to public and associate health and safety;
- resolving the preceding two items with timely, reliable and effective processes and programs that are documented and verifiable;
- preventing recurrence of similar circumstances in the future;
- preventing future potential non-compliance with state and/or federal regulatory requirements; and,
- removing TES from domestic facilities and replacing all of them with non-tritium exit signs by the end of 2008.

Wal-Mart engaged several companies, Shaw Environmental, Inc. (Shaw); Kroll, Inc. (Kroll); Dade Moeller & Associates, Inc. (Dade Moeller); and outside nuclear counsel Morgan, Lewis & Bockius LLP (Morgan Lewis) to assist regarding the various TESIP activities. The roles of these organizations are discussed throughout this report. A timeline of key activities is provided at Attachment A.

II. Regulatory Overview

A. NRC and Agreement States

The NRC directly regulates byproduct material in 15 states, the District of Columbia, Puerto Rico and other U.S. Territories. The remaining 35 states have entered into agreements with the NRC to conduct, in lieu of the NRC, several regulatory oversight activities, including the use of byproduct material, as authorized by Section 274 of the Atomic Energy Act of 1954 (AEA), as amended.

B. General Licensees of TES

1. General Requirements

TES users automatically become a general licensee upon purchase or receipt of TES from a specific licensee, and thereby become subject to the regulations at 10 C.F.R. § 31.5, and related Agreement State regulations. NRC and Agreement State regulations limit the general licensee's ability to transfer or dispose of the TES, and

[3] Although Wal-Mart attempted to locate all TES, a small number may still be found in Wal-Mart facilities. Accordingly, Wal-Mart has developed a long-term TES program (discussed in Section IX of this report) to respond to any TES located after December 31, 2008.

impose certain reporting requirements in the event of damage, loss, or transfer of the device.

2. Damaged TES

When a TES is damaged such that there is a loss of tritium gas containment, the general licensee must assess the importance of the breach on public health and safety, and dispose of the device with a specific licensee authorized to receive TES for disposal. In the majority of cases, the general licensee must report that damage to the appropriate regulator within 30 days. A report of damaged TES must include a brief description of the event, remedial action taken, and a plan for ensuring that the surrounding area is safe for unrestricted use.

3. Lost TES

The NRC and most Agreement States require that a general licensee report a lost or missing TES immediately by telephone. All jurisdictions require that the licensee submit a written report of the incident within 30 days. Reports of lost TES must contain a description of the licensed material involved, a statement of probable disposition of the TES, actions taken to recover the material, procedures adopted to prevent recurrence, and exposures to individuals, if any.

4. Transfer and Disposal of TES

For the most part, general licensees may not transfer TES, except to a specific licensee authorized to receive TES for disposal. A general licensee must report such transfer to the appropriate agency within 30 days of the action, and include in that report an identification of the device, the contact information for the recipient of the device, and the date of the transfer.

III. Inventory Program

A. Overview

Wal-Mart began to appreciate certain regulatory requirements associated with the ownership of TES in March 2006 when the Nebraska Radiation Control Program forwarded annual inventory forms to the company. Wal-Mart thereafter retained Shaw, a contractor with significant experience in handling and assessing radiological components, to inventory TES in Nebraska.

Shortly after the Nebraska notice, Wal-Mart began conducting inventories in Nebraska and Colorado in response to agency requests for annual fees associated with owning tritium exit signs. During these early inventory activities, Shaw conducted visual inspections for the purposes of responding to those agencies and enhancing Wal-Mart's ability to respond to future annual reporting requirements in those states. The preliminary findings from the inventories in Nebraska and Colorado did not provide a consistent representation nor a large enough sampling size of all Wal-Mart facilities to make an informed determination on how to best manage the installed TES.

Accordingly, in early 2007, due to the inventory results from Nebraska and Colorado, Wal-Mart determined that a broader TES inventory was necessary to better determine its scope of TES use. The objective at this time was to visit stores for which TES were purchased to gain a better understanding of TES use. In December, 2007, as the result of a meeting in which TES stakeholders at Wal-Mart realized the significance of the problem, Wal-Mart determined that a nationwide inventory of all of its facilities was required in order to account for all TES. Wal-Mart not only expanded the scope of its inventory, but also accelerated its program, moving up its target completion date to mid-2008. The all-store TES inventory actually was completed in July 2008.

Shaw led the physical inventory effort involving visits to each Wal-Mart store to identify those with TES. The physical inventory assessment included the entire population of domestic and Puerto Rican Wal-Mart-owned and leased facilities, including Supercenters, Division I stores,[4] Sam's Clubs, Neighborhood Markets, Distribution Centers and former Wal-Mart stores that are now sub-leased to other tenants.[5] Shaw also conducted inventory assessments at third-party-owned Return Centers, where merchandise is routinely returned for processing to manufacturers. TES were found in every facility type including distribution centers and facilities sold by Wal-Mart. Access to sold facilities was limited by the permissions of the new owners.[6]

Wal-Mart organized the 50 states and Puerto Rico into priority "tiers." These tiers were based in part on expected TES inventory in each state:

> ***Tier I***: California, Washington, Illinois, Pennsylvania, New Jersey and New York. Texas and Florida were later added.
>
> ***Tier II***: Colorado, Nebraska, Arkansas, Tennessee, Ohio, West Virginia, Virginia, Maryland, Delaware, Vermont, New Hampshire, Massachusetts, Connecticut, Rhode Island, & Maine.
>
> ***Tier III***: Oregon, Idaho, Nevada, Utah, Arizona, Louisiana, Mississippi, Missouri, Wisconsin, Indiana, Kentucky, and North Carolina.
>
> ***Tier IV***: Montana, Wyoming, New Mexico, South Dakota, North Dakota, Nebraska, Oklahoma, Minnesota, Iowa, Michigan, Alabama, Georgia, South Carolina, Alaska, Hawaii, and Puerto Rico.

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4 A Division 1 store is a traditional Wal-Mart store, as opposed to a Supercenter, which has a grocery section.

5 Attempts were made to visit all operating and formerly operating Wal-Mart facilities where access was allowed. Shaw did not visit stores that were constructed and began operation after January 2007 because Wal-Mart had stopped the purchase of TES by that date. Some sold facilities where TES were purchased were not visited as the new owners would not grant access.

6 Wal-Mart sought access to all facilities to which Wal-Mart's records show that TES were shipped, but the facility is no longer owned or occupied by Wal-Mart. Wal-Mart was able to gain access and inventory TES in all but 9 of those locations. Of those 9, 3 were demolished, 2 were destroyed by Hurricane Katrina, and access to 4 could not be obtained.

B. Procedures

Initially, Wal-Mart's objectives regarding the nationwide inventory were to visually identify all TES installed at its facilities and to ensure the return of any uninstalled signs back to the manufacturer. At that time, Wal-Mart contemplated using the inventory information collected in the field to determine the best approach to manage the installed TES based on quantities and typical installations. In 2007, Wal-Mart determined that it would discontinue the purchase of TES and use the Shaw inventory data to determine how many non-tritium exit signs needed to be purchased.

Shaw assembled a staff of over 100 field representatives to conduct the initial inventory. The Shaw representatives were assigned a list of facilities to visit, provided a handheld computer device for conducting the inventory, and trained prior to dispatch to the field. Shaw conducted training sessions that included a balance of safety, field data collection, and radiation awareness. TES inventory procedures evolved over the course of the project, as experience enabled Wal-Mart and its contractors to increase efficiency and better ensure public health and safety. The key elements of the baseline inventory are described below.

TES Identification – Each TES is marked with a serial number at the time of manufacturing. One objective of Shaw's inventory was to find the serial number for each TES and place an additional, unique identifier on the sign so that it may be identified as a TES found during the inventory process. The identifier was the four digit store number followed by sequential numbers, such as 1234-001. In addition to the unique identifier, Shaw also placed a "Property of Wal-Mart" label on each TES that could be accessed to prevent accidental transmittal. Examples of those labels are shown in the pictures below:

There were significant challenges during the inventory process in identifying serial numbers on TES. This phase of the TESIP was a visual process, and some serial numbers were covered by mounting brackets, too closely mounted to other devices to be read, covered by paint, or were faded from direct sunlight. Therefore, the TES was tracked by the unique identifier attached to the frame by the Shaw representative.

The serial number and unique identifier were entered into a handheld device and uploaded to Shaw's, and ultimately Wal-Mart's, database to establish a record for all identified Wal-Mart TES. Wal-Mart's comprehensive database (TES Management System) served as the ultimate repository for all information gathered during the TESIP. To enhance the completeness of Wal-Mart's records, the following additional information was also entered into the handheld device, whenever it was available and/or accessible:

- model number;
- manufacturer name;
- original curie content;
- sign expiration date;
- location of the sign;
- sign configuration (single-sided or double-sided);
- sign height greater or less than 7 feet;
- condition of the TES;
- general comments; and
- date the inventory visit was completed.

At the end of the inventory visit, the above information was uploaded from the handheld device to Wal-Mart's TES Management System.

TES Location – Shaw documented the location of all TES identified at a facility during the inventory process. The Shaw representative entered the TES location within the facility into the handheld device and prepared a hand-drawn map of each TES location for later reference. All hand-drawn maps were faxed to the Shaw Project Management Office for record keeping and were preserved in Wal-Mart's TES Management System.

TES Condition – Prior to conducting the TES inventory, Shaw trained its personnel to visually determine the operating condition of a TES. During the inventory, Shaw conducted tests, as further described below, to identify if there was any damage to the tritium-containing tubes. If Shaw identified damage to the TES, its personnel categorized the TES in a graded manner on the handheld device and subsequently in the Shaw daily damaged sign report (provided to Wal-Mart) using the terminology discussed below:

- *Critically damaged TES* – a classification for any sign in which the glass tubes were damaged, missing, did not glow, or the sign was crushed or punctured in a way that might cause the tubes to be broken, or the sign or contents were in imminent danger of falling. This term distinguished TES with compromised tritium-containing tubes, or those that were in imminent danger of becoming compromised. A further distinction was made for those TES that were damaged within the previous four months.

- *Non-critically damaged TES* – a classification for any damaged sign that was not critically damaged but had other damage such as broken or missing faceplates, frames, lens, etc.

- *Recent damage* – critical damage to a TES that had occurred within the last two days (in a retail area) or four days (in the store support areas (back hallways, warehouse, storage, etc.), and thereby necessitated an urgent response.

If any TES was identified as critically damaged, the Shaw representative did not proceed with the inventory process and proceeded with generating a Critically Damaged Exit Sign Report (CDESR) that the individual issued to the Wal-Mart Radiation Safety Officer (RSO). Wal-Mart and Shaw developed specific procedures for addressing the above three categories of TES. The procedures focused on limiting radiological exposure by preventing associates and customers from entering the area where the damage occurred until Dade Moeller representatives could determine the presence of any residual contamination and, if necessary, decontaminate the area to levels that were As Low As Reasonably Achievable (ALARA).

Uninstalled TES Returns – During the inventory, the Shaw representative conducted inspections of various areas within the store and interviewed store associates to find any TES that might be uninstalled. These TES could have been removed from service or could have been damaged at one point and stored somewhere within the store. Upon finding an uninstalled TES, the Shaw representative performed a "glow" test to determine if any of the tubes no longer illuminated in the dark. Shaw either placed the TES in a box or took it to a dark room to perform the glow test. If the Shaw representative determined that the TES was critically damaged, the CDESR was completed and provided to the Wal-Mart RSO for determining the required response. The Shaw representative also performed limited interviews of store associates and managers to determine how and when the damage occurred prior to completing the report.[7] Wal-Mart elected to conservatively declare signs "critically damaged" if Shaw could not determine the level of damage. All damaged signs (critical and non-critical) were reported to Wal-Mart on a daily basis. Shaw packaged all uninstalled TES in accordance with the manufacturer's specifications and in compliance with U.S. Department of Transportation (DOT) requirements for shipping back to the manufacturer for recycling.

Inventory Data Quality Control – Wal-Mart and Shaw had to make subjective determinations whenever data (*e.g.*, inventory, document, and database) appeared to be inconsistent. As such, Shaw implemented several inventory data quality control measures to better ensure the consistent treatment and accuracy of information that was later used during TES removal and replacement activities. The following checks were conducted and documented in the TES Management System:

[7] The Rapid Response Team (RRT), as further discussed herein, performed more in depth interviews of store personnel to determine the origins of the TES damage.

- **Valid Missing Sign Check:** If a TES record indicated "not found," but a location, unique identifier, and the "returned to manufacturer" date was populated, the record was changed to show that the TES was found.

- **Valid Sign Identified Check:** If a TES record indicated "found," but no location was entered; if the unique identifier could not be matched with the site map location; or if the comment indicated the sign was not installed, then the TES record was changed to indicate that it was found, but "not installed." If there was no unique identifier and no comment, however, then the record was changed to indicate it was "not found."

- **Valid Serial Number Check:** If the serial number on the manufacturer label was not legible, the serial number field could be left blank. Text in the serial number field such as "blank" or "unknown" was moved to the comments field.

- **Valid Unique Identifier Check:** All signs found during inventory should have a valid 7-digit unique identifier. The map and other fields for the record were checked to see if the unique identifier could be located or if there was an explanation as to why one was not recorded, such as that the Shaw representative could not reach the sign. If the unique identifier was found, it was entered in the unique identifier field. If the TES was not shipped to that store and if all the other fields were left blank, then that record was deleted from the database as it was determined to be a data entry error by the field staff.

- **Valid Tritium Sign Check:** Manufacturer names were made consistent across records found in the store. Variations such as "SLC" were changed to "Safety Light Corp.", and "Shield Source" was changed to "Isolite." Any records entered into the database for non-tritium exit signs were deleted.

- **Sign Not Installed Check:** Any time that "Sign Not Installed" was indicated for a TES found in the store, the "comments" field was checked to make sure that there was an explanation as to where the uninstalled sign was located.

- **Duplicate Sign Check:** In situations where two TES records with the same serial number, the same manufacturer, and the same location were indicated as "found" in the store, extraneous records were combined into a single record, preserving the data to show that a particular serial number had been shipped to the store. If comments indicated that there truly was a duplicate serial number, then both records were left in the database as found at the store but each TES is, nonetheless, marked with a unique identifier.

- **Extra Records Check:** For TES records that did not indicate a location, unique identifier, or comment and that were not shown as having been shipped to the store, but did in fact show up as found signs, the records are deleted because the record was most likely added by the Shaw staff by mistake.

- **Invalid Unique Identifier Check:** If a TES record had a unique identifier, but its record indicated it was not found in the store, then the map was consulted to confirm that the unique identifier was valid. If the store map indicated that the unique identifier was invalid, then the record was changed to show that the sign was not found in the store.

- **Valid Max Unique Identifier Check:** The highest unique identifier used should match the number of signs found at the store. The store map was consulted to resolve these issues.

- **Null Records Check:** All TES records for visited stores should indicate the TES as "found," "not found," or "found uninstalled." Any record without one of these three designations was researched further using the data checks identified above.

In some cases, data quality checks required phone calls back to the specific store or Shaw representatives to answer specific questions. In rare cases, second visits were conducted to confirm information.

IV. Remove & Replace Program

A. Overview

In April 2008, Wal-Mart decided that all TES should be removed and replaced (R&R). Once Wal-Mart and Shaw concluded that inventory activities had identified existing TES at a given store, they began implementing the TES removal and replacement program (R&R) to safely remove, replace and return all TES to the manufacturer. TES were replaced with non-tritium exit signs such as LED or phosphorescent signs.

B. Procedures

The TES R&R procedures evolved over the course of the TESIP due to increased and changing scope of field activities based on situations encountered during store visits. Revisions were consistent with maintaining public health and safety, and the proper handling of radioactive materials

Similar to the initial TES inventory, a field staff of over 100 trained professionals worked with Wal-Mart's electrical contractors to remove and replace TES. Before beginning the R&R, Wal-Mart reviewed local fire and building codes to ensure that approved devices were being installed in lieu of the existing TES.

Once at a facility, the first step in the process was to confirm that the TES targeted for removal was not critically damaged. The electrical contractor performed a TES glow test by placing a three-sided box with peep-holes over the sign for viewing. If any letters or arrows did not glow completely, or if other critical damage was found, the TES was left in place and a CDESR submitted to Wal-Mart. If the TES was not critically damaged, the TES was removed and the Shaw representative performed a second glow test to confirm. Prior to packaging, Shaw gathered the TES serial number and other information not obtained during the inventory. Because the electrical contractor removed TES mounting brackets and frames during this task, previously obscured or faded serial numbers sometimes became visible and were then recorded, as most signs were equipped with a second label inside the device.

One challenge during the removal involved many situations where the serial number on the TES frame did not match the serial number of the inner containment unit. This required significant data review to find the physical match for that frame's serial number to the appropriate inner unit. In some cases, the Shaw representative was able to reconcile this mismatch within TES units in the store. In other cases, the Shaw representative could not reconcile the mismatch and Shaw, Kroll, or Wal-Mart performed additional data searches within the TES Management System to attempt a match. In cases where no match was found, both the frame and the inner containment unit were returned to the manufacturer and noted separately on the shipping paperwork.

Once the TES was removed and all TES identification information was obtained, the Shaw representative boxed and labeled the non-critically damaged TES for shipment according to NRC and DOT regulations and guidance for transporting radioactive materials. Wal-Mart procedures required that no more than 99 curies could be placed in any one box and no more than 1,000 curies could be shipped from a single location in a single day, consistent with applicable regulations. The Shaw field representative updated the status of the TES and other data in the handheld device. Wal-Mart's procedures then required that the Shaw representative fax the required shipping paperwork to Isolite, a TES vendor and specific licensee with whom Wal-Mart had arranged transfer.[8] Once Isolite received the paperwork, Isolite would schedule UPS to pick up the boxes for shipment to Isolite's TES facility for recycling. Wal-Mart and Isolite reached an agreement that Isolite took possession (*e.g.*, the transfer of the TES occurred) at the Wal-Mart store location when Isolite issued a UPS shipping label for the return. While the boxes were awaiting shipment, Wal-Mart procedures required that the Shaw representative secure the boxes within the store to minimize the risk of accidental relocation or disposal.

To further ensure that boxes were picked up in a timely manner and delivered to Isolite, a process to track the shipments was developed. This process including the following:

- Logging the date Shaw faxed the paperwork to Isolite.
- Logging the date Isolite received the paperwork.
- Tracking the shipment status via the UPS tracking numbers provided by Isolite on a daily basis.
- Logging the date the boxes were received by Isolite.

If pick-up from the Wal-Mart facility did not occur within three days, Wal-Mart rescheduled pickups as necessary and contacted stores to ensure boxes were readily available. This protocol better ensured that all boxed TES were transferred to Isolite and not lost during the shipment process.

Sometimes, the replacement effort resulted in (1) the identification of additional TES that had not been located during the initial inventory or (2) discovery that certain TES

[8] Early in the R&R program and as a result of cooperation between the organizations, Wal-Mart reached agreement with Isolite that it would accept all Wal-Mart TES regardless of manufacturer.

had been lost during the period between inventory and R&R. In addition, sometimes TES damage was discovered when the device was removed during the replacement effort. These were TES that visually appeared operational (*i.e.* no visual signs of damage) during the initial inventory but subsequent glow testing added during R&R showed tubes that no longer illuminated. These TES were handled according to the Wal-Mart protocols for damaged TES.

C. <u>R&R Data Quality Control</u>

Shaw was able to collect additional data during R&R and track existing data using handheld devices, which contained the facility-specific inventory data. As each sign was removed from its installed location, the serial number of the sign was located in the handheld device and marked as “returned” along with the date it was boxed for shipment to the manufacturer. If a sign was found during the R&R activity that was not already in the handheld device, a record was added to the handheld device and populated with known information. No Shaw unique identifier was assigned to signs found during R&R that were not found during inventory because at that point in the project, Shaw was able to locate the manufacturer’s serial number.

At the end of the removal effort at a particular facility, the Shaw representative reviewed the information in the handheld device to verify that every sign found during inventory was found during the removal activity and boxed for shipment back to Isolite. After the Shaw representative removed and packaged the TES and uploaded the data, Shaw personnel performed additional data validation steps to confirm R&R data quality. Information in the database was compared to shipping paperwork to ensure accurate documentation. In some cases, information from Isolite was obtained to resolve discrepancies between the two data sources.

After all activities were completed, Shaw personnel performed a final review of the data collected to ensure that all TES which were found during the inventory had been returned. If a TES that Shaw initially found was not found during R&R, Shaw or Wal-Mart made follow-up calls to the store to confirm the TES was no longer located at the store. For the limited examples of this scenario, Wal-Mart and Shaw further investigated the ultimate disposition of the TES and if unsuccessful, changed the TES categorization to “lost” and reported this status to the appropriate regulatory authority.

During the R&R project, the data collected in the field underwent the following quality control steps:

- Step 1 – Reporting Quality Control and Resolution
- Step 2 – Database Quality Control and Resolution
- Step 3 – Dade Moeller Sign Returns

The activities included within each step are listed in the following sections.

Step 1 - Reporting Quality Control and Resolution

The first step in R&R data quality control was "reporting review," which included a comparison of serial numbers on the shipping paperwork given to Isolite against serial numbers indicated in the TES Management System as returned to manufacturer (excluding TES shipped by Dade Moeller, as explained below). The purpose of this process was to ensure that the reporting made to the NRC or applicable state agency was accurate regarding the TES returned to the manufacturer. If the serial numbers on the shipping paperwork matched the TES Management System, then the facility entered the second quality control step called "Database Quality Control and Resolution"; however, if they did not match, then the following rationale was used to resolve the issues.

If the shipping paperwork and the database did not match regarding the quantity of or serial numbers for the TES returned:

Shaw checked the manufacturer's information to confirm, when possible, that TES records indicated that the sign was shipped to the respective store. Shaw also checked for handwriting errors on the paperwork. Shaw also checked for possible matches between a serial number on the shipping paperwork that did not match any other returned serial numbers in the database, but was close to a serial number (*i.e.,* numbers transposed), that was marked as returned. Once resolved, the shipping paperwork and TES Management System were updated to match. In some situations the differences were serial numbers of frames with no matching containment unit.

If the shipping paperwork had the same serial number listed twice:

This was likely due to a handwriting error on the shipping paperwork. Shaw corrected these errors on the associated paperwork and in the TES Management System.

If the database had duplicate records for the same serial number:

Normally there should not be a duplicate serial number at a store as the manufacturers were to assign unique serial numbers to each sign.[9] However, when Shaw or other contractors identified a duplicate, Shaw checked the "comments" field for each record as sometimes the Shaw representative had previously indicated that there was truly a duplicate. The TES Management System was updated as necessary.

In cases where a serial number was listed in the TES Management System twice, but was only listed on the shipping paperwork once, the duplicate serial number in the database was likely incorrect. The paperwork and database were updated accordingly.

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[9] On rare occasions, Shaw identified duplicate serial numbers on two TES from the same manufacturer. In most cases, serial numbers were handwritten by the manufacturer on the label just prior to shipment to the store and therefore prone to error.

Step 2 - Database Quality Control and Resolution

Data filters were applied on the inventory and R&R data for each facility to look for anomalies that would identify a potential data problem that needed resolution. Shaw performed the following checks and evaluations in the TES Management System:

- **Duplicate Label Number:** This scenario typically occurred when the records are representing two different signs, as indicated by the location and the serial number fields differing between the two records, and when a "new" sign had to be added to the handheld device. If neither of those two scenarios existed, then the data was reviewed to see if the records represent the same sign, in which case the records would be combined.

- **Duplicate serial number:** Normally there should not be a duplicate serial number at a store as the TES manufacturer was supposed to assign unique serial numbers to each sign. However, in cases of duplicates, Shaw reviewed the comments field for each record as sometimes the field staff indicated that there was truly a duplicate.

In cases where a serial number was listed in Wal-Mart's TES Management System twice, the data for the store was reviewed and if both records had different label numbers and locations, then they were left as two distinct records; however, when the label numbers and locations matched, the records were combined (while preserving the record that indicated the serial number was shipped to the store).

- **Found Signs Not Returned:** For any records indicated as found at the store but missing return information, Wal-Mart's TES Management System was checked to determine if there was a record with the same serial number or label number that had return information and, as appropriate, Shaw removed the extra record that was marked found but had no return information (always preserving the record that indicated the serial number was shipped to the store).

- **Invalid Return Information:** All signs returned to the manufacturer were indicated as found at the store. The records were revised where appropriate.

- **Logical Return Date:** If the return date is invalid (*e.g.*, 4/1/2020, etc.) the shipping paperwork was consulted and the appropriate date was entered.

Step 3 – Dade Moeller Sign Returns

Where Dade Moeller was required to visit a store and return these TES to the manufacturer, as described below, this information was provided to Shaw for review. This information was reviewed along with existing information with the store to ensure no duplicate information was entered and the information met the same criteria as identified in Steps 1 and 2 listed above.

V. Response to Damaged TES

A. Overview

In early 2008, Wal-Mart contracted with Dade Moeller to provide health physics (HP) support and expertise in radiation protection, internal dosimetry, radiological laboratory analysis, and radiological instrumentation and characterization for TESIP in parallel with Shaw's ongoing inventory and R&R. There were more than thirty HPs involved in this effort, most of whom were Certified Health Physicists (CHPs). The Dade Moeller scope of work included full radiological support services for handling TES devices with broken tritium-containing tubes. Work elements included the following:

- characterization and survey of the radiological conditions associated with critically damaged TES;
- coordination with other contractors, *i.e.*, Shaw contractors and waste contractors, for damaged TES;
- disposition of the damaged TES(s) (package for return to Isolite);
- decontamination and disposition of radioactive waste, as needed, to meet regulatory standards;
- consultation, bioassay sampling, and assessment of potential employee exposures using the services of CHPs; and
- preparation of activity reports for each store visit, weekly shipment reports, and bioassay reports.

Dade Moeller designed its technical support to accommodate and complement the major activities already underway as part of TESIP. As Shaw identified damaged signs during inventory or R&R, Dade Moeller received direction from Wal-Mart to conduct store visits for radiological assessment, remediation (as necessary) and shipping of damaged signs. Consistent with Wal-Mart's direction, Dade Moeller scheduled its response to damaged sign reports according to the following categories:

- URGENT visit requests, where critical damage occurred and quick response was warranted because conditions exist where exposures could be incurred or contamination could be spread if not promptly addressed (these visits were staffed by CHPs);
- Rapid Response Team (RRT) visits, where critical damage occurred within the previous four months (these visits were staffed by CHPs and Morgan Lewis); and,
- Regular Visits, where critical damage occurred more than four months prior (these visits were staffed by qualified HPs and CHPs).

In addition, Dade Moeller conducted follow-up visits where necessary, and staffed those visits with HPs and CHPs.

1. <u>Store Visits</u>

Wal-Mart assigned higher priority to factors such as high regulatory concern or a higher-than-normal potential of developing a radiological situation (*e.g.*, TES in danger of falling from mounting). Accordingly, Dade Moeller conducted the following types of store visits:

HP-Only Visits

Scheduled visits were prioritized first by urgency and then by the date TES damage was reported. The objective was for Dade Moeller to visit a store within 21-28 days of its initial "reported" date. Each store was located and paired with nearby stores on the schedule for efficiency. An HP or CHP was scheduled for each location based on availability. During the store visit, Dade Moeller took smear samples that it sent to its licensed laboratory for analysis.

Follow-up visits by Dade Moeller were added to the schedule as Wal-Mart identified the need – sometimes as the result of elevated contamination levels detected during an initial visit. Dade Moeller primarily conducted follow-up visits to respond to identification of additional signs, decontaminate surfaces to ALARA levels, or to dispose of generated waste.

Dade Moeller and Wal-Mart typically confirmed the Dade Moeller schedule by Wednesday of each week so that Dade Moeller could obtain reciprocity for radiological licensing requirements with either the state or NRC, and so that Dade Moeller could send its materials to the store location for the following week's visit.[10]

RRT Visits

Dade Moeller typically conducted RRT visits at stores where critically damaged TES had been identified and damage was understood to have occurred within the previous four months. Based upon reasonable HP knowledge, Dade Moeller concluded that in such cases, a detectable uptake of tritium may be measured through bioassay monitoring. Uptakes that occurred prior to 4 months would be below the Lower Limit of Detection (LLD) for the analytical laboratory sampling equipment. Due to the sensitive nature of these visits, a CHP (rather than an HP) made RRT visits along with Morgan Lewis. Dade Moeller sought to schedule these visits within two weeks of discovery of the damage.

Other

Urgent visits to Wal-Mart facilities also included initial visits requested by Wal-Mart for incidents with higher potential risks of device containment loss (*e.g.*, TES in imminent

[10] Certain states required more than 3 days notice, which was considered when scheduling visits (*e.g.*, Kansas–5 days, New York–7 days, Illinois–10 days).

danger of falling from wall mounting), improper disposal risks (*e.g.*, TES accidentally placed into a trash compactor), or for critical damage within the previous several days. Urgent visits were scheduled as soon as possible based on availability of CHPs and outside counsel, and upon the granting of reciprocity for the radioactive materials license. Dade Moeller responded to these urgent visit requests (3 total) within 24 hours when possible, but at minimum, promptly after obtaining reciprocity from the subject state.

2. Standards for Contamination

During discussions with Agreement State regulators, it became apparent that there was no explicit or consistent standard for acceptable surface tritium contamination levels. NRC Regulatory Guide 1.86 values for beta-gamma emitting radionuclides were chosen as a conservative and acceptable basis for TESIP action levels. Some states recognize that Regulatory Guide 1.86 is conservative for tritium (and was not intended for tritium contamination) and allow higher levels. For example, the State of Texas (an Agreement State) allows averaging in their standards for removable contamination over an area of up to 1 square meter. Still, to better ensure that Wal-Mart's tritium cleanup activities were acceptable to all jurisdictions, Wal-Mart directed Dade Moeller to conservatively adopt the following action levels, based on Regulatory Guide 1.86:

Table 1 – TES Project Action Levels

Surface contamination levels (dpm/100 cm^2)		
1,000	On any single swipe	Removable tritium contamination[11]
15,000	For a single direct measurement	Total tritium contamination
5,000	Average for any square meter	Total tritium contamination

B. Procedures

Dade Moeller's HP activity procedures increased from one to four procedures to address the increased and changing scope of field activities based on situations encountered during store visits. The four procedures that Dade Moeller eventually adopted and continue to use for newly discovered TES are summarized below:

1. TES-001, "Damaged TES Survey and Disposition"

This procedure addresses the removal and shipping of damaged TES to a specific licensee, surveying and shipping samples to the laboratory, performing direct

[11] Removable contamination is contamination that can be removed from a surface by wiping the area with moderate pressure with a dry filter paper or absorbent paper. Fixed contamination is fixed to the surface and is not readily removed by wiping.

monitoring, shipping all equipment/materials to the return point, and collecting necessary information for reports.[12]

Dade Moeller uses two general methods to characterize radiological conditions: (1) indirect survey for removable contamination and (2) direct survey for total contamination.

Dade Moeller primarily uses an indirect method to quantify tritium levels with the use of swipe samples that are analyzed in Dade Moeller's analytical laboratory. Swipes were taken using a sample kit and then analyzed either using a portable Liquid Scintillation Counter (LSC) or in the analytical laboratory. If a portable LSC is available, the Dade Moeller HP estimates the removable activity on the swipes. All samples are retained for shipment to the analytical laboratory for quantitative analysis.

The HP takes a representative number of removable contamination swipes of the TES mounting area, floors, and walls, starting with the areas least likely to be contaminated. Additional direct measurements are sometimes necessary after the removable contamination survey. The CHP or HP compares results to the TESIP action levels (in dpm/ 100 cm^2). Next, a removable contamination swipe is taken on the outside of TES packaging and potential radioactive waste packaging to confirm compliance with DOT surface contamination limits for shipping.

For the TESIP, the direct survey method uses a windowless, gas-flow proportional counter. The primary instrumentation has been a Ludlum 2221 digital scaler/rate-meter and a Ludlum 44-110 Tritium probe, which is specifically designed for tritium contamination surveys. This instrument is the best available for such a field application, but does have several major limitations:

- It is cumbersome.
- Monitored surfaces must be smooth, flat, and consistent with the dimensions of the probe (*i.e.*, small items cannot be monitored).
- P-10 gas flow must be appropriate and time is needed to purge the probe volume for each measurement.
- The probe high voltage caused dust to accumulate on the active surfaces, thereby decreasing efficiency during use.
- Measurements in wind or air movement are difficult.
- The supply of these instruments was limited during the course of the Project.
- Monitoring of some surfaces, especially elevated surfaces, is difficult because of gas lines and electrical cables.

[12] Wal-Mart's protocols provided that Shaw shipped only those TES that were intact, not critically damaged, or uninstalled critically damaged, leaving installed critically damaged TES for disposition by Dade Moeller.

2. TES-002, "Decontamination of Tritium from Damaged TES"

This procedure provides guidance to HPs in the field for performing decontamination and determining suitable activity levels for removable and total contamination. The guidance includes decontamination methods and materials, survey methods for process effectiveness, a decision method for continuation or completion of decontamination efforts, and radioactive waste generation and disposition.

The approach and method of addressing potential tritium contamination and removing known tritium contamination at and around TES mounting locations evolved over the course of TESIP as tritium behavior characteristics became better understood and anticipated. Dade Moeller uses two primary methods for removing contamination: (1) removing the surface on which the contamination was located (typically a plywood header around a TES mounting location) and treating as low-level waste and (2) cleaning the surface with 91% isopropyl alcohol and paper towels.

Several enhancements of the techniques occurred as experience increased. Dade Moeller determined that a light spray of isopropyl alcohol immediately wiped off was more effective at removing surface contamination than a heavy spray and allowing the alcohol to remain on the surface. The procedure specifies multiple repetitions (12) of the spray-and-wipe technique. This cost-effective approach required relatively little time and yet was effective for removal. An evaluation of the effectiveness of the cleaning method showed a typical reduction of 98% in the amount of removable tritium contamination. Tritium contamination poses a challenge during remediation in that it can readily diffuse into the volume or matrix of materials. A matrixed material can be decontaminated but contamination can subsequently migrate to the surface at a later time. This necessitated removal of plywood headers when appropriate. These headers are then dispositioned appropriately by a licensed radiological waste vendor.

The final approach was to swipe the sign mounting area and the floor beneath and then to clean the mounting area and floor with isopropyl alcohol and paper towels. Post-cleaning swipes evaluated the effectiveness of the cleaning. The volume of cleanup material – latex gloves and paper towels – was minimal and could be placed in the TES shipping box.

3. TES-003, "Bioassay Evaluations for Response to Damaged TES"

This procedure provides guidance on determining if a bioassay is required and the necessary documentation, methods, shipping, and collection of information to perform a dose assessment.

Depending on the nature of the specific situation, Wal-Mart and its consultants determine when RRT visits and the services of a CHP are necessary. During RRT visits, the responding CHP is responsible for recommending to Wal-Mart when a bioassay should be offered to a Wal-Mart associate or other worker. TES-003 guides the CHP in this decision. CHPs use the following criteria for offering bioassay:

- Obtain samples from associates in the immediate area of the sign (within 1-2 m of the sign in an unconfined space such as a warehouse room, or inside the room for a room approximately 20 ft by 20 ft) during breakage if the breakage occurred within 4 months of the store visit.

- Consider associates with high occupancy of the nearby area during the breakage (~10 m in an unconfined space) for bioassay sampling when sign breakage occurred less than 30 days before the store visit.

- When the date and circumstances of sign breakage are not known, base the determination of the need for bioassay sampling on the results of the contamination monitoring performed under procedure TES-001.

A CHP's investigation is not limited to these criteria. The CHP is free to offer a bioassay for other reasons (*e.g.*, if an employee was concerned about a potential exposure). The offer of bioassay also is not limited to RRT visits, but may be offered during any CHP/HP visit when deemed appropriate and approved by Wal-Mart, based on information gathered at the store location. When a CHP offers a bioassay, a notice of that offer is provided to the Wal-Mart RSO.

Bioassay collection

Morgan Lewis and Dade Moeller CHPs/HPs manage bioassay collection. When applicable, the CHP discusses potential radiological exposure with the employee, describing the sample collection process, and offering a bioassay. The CHP also discusses the employee consent form in detail with the associate, and the individual's willingness to submit a sample, as indicated by signing a form. Employees are given the sampling vial, a bag marked "biohazard," and a set of instructions. The employee returns the sample to the CHP or places it in the bioassay kit for return to the laboratory. The CHP/HP typically mails the submitted samples to the Dade Moeller analytical laboratory. The CHP/HP records the sample date and the date of potential exposure in its records to facilitate the dose calculation.

Sample analysis and dose calculation process

The Dade Moeller analytical laboratory analyzes bioassay samples by liquid scintillation counting. A series of counting vials is prepared from each urine sample, each containing 1 milliliter of urine. The counts from these 10 vials are averaged for the final reported result.

Dade Moeller uses the International Commission on Radiological Protection (ICRP) Publication 68 two-compartment model to calculate tritium dose, along with the ICRP Publication 67 biokinetic model. This model assumes that 97% of the intake is consistent with an HTO (tritiated water) intake, and 3% is consistent with organically bound tritium. These components have 10- and 40-day retention half-times, respectively.

The CHP uses the laboratory results (in picocuries per milliliter) to back-calculate the total activity (converted to curies in the whole body) at exposure, A_o. The dose is calculated by multiplying the original concentration by the dose conversion factor supplied in ICRP Publication 68 of 66.7 rem/Ci. Attachment B contains an example of this calculation for a hypothetical employee.

4. TES-004, "Disposition of Potentially Contaminated TES-Related Waste"

Throughout the TES Project, TES activities generated very small amounts of tritium-containing radioactive waste. The subject procedure provides guidance on how Wal-Mart disposes of this contaminated or potentially contaminated TES waste.

Tritium-related waste typically consists of mounting surfaces under or adjacent to damaged TES, as well as materials used by Dade Moeller personnel in their response to TES issues. The mounting surface material consists of sections of plywood laminate, drywall, or both and any mounting hardware collected during removal. Other wastes include latex gloves, plastic bags (chemical management or liner bags), paper towels/wipes used for decontamination, and miscellaneous tools/hardware used to remove the TES or contaminated surfaces. This waste is generated either (1) during an initial store visit and as a result of direct contamination measurements or (2) on follow-up visits in response to removable contamination measurements that exceeded the Project action levels.

Dade Moeller uses its analytical laboratory to analyze swipe and bioassay samples, and the limited number of water samples taken. This functional laboratory has a written Quality Assurance Program and procedures and systems to ensure integrity of analytical results.

The Dade Moeller analytical laboratory is responsible for the preparation of sampling kits, distribution of the kits, and the analyses of all samples taken during the TESIP. The analytical laboratory is licensed by the State of Maryland (MD-31-244-01) to perform radioactive sample analysis. Quality assurance and quality control (QA/QC) information and Analytical Standard Operating Procedures specific to the analysis of TES (including associated surface) samples are maintained by Dade Moeller. These procedures contain detailed information on distribution and maintenance of the sampling kits, lists of instrumentation and counting protocols used to analyze the TES samples, explanations of the analytical procedures used during the Project, and QA/QC procedures for the analysis of TES samples and the generation of Sample Analysis Reports. The analytical laboratory retains all swipe samples and prepared bioassays collected through the end of the analytical portion of TESIP. Sample Analysis Reports (swipe, bioassay, and water) and accompanying analytical data are maintained in a secure location at the Dade Moeller Gaithersburg, Maryland, office and are subject to confidentiality restrictions, when required.

5. Visit Reports

Dade Moeller has generated a store report for each store visited. Dade Moeller uses those store reports to document the visit and provide information to Wal-Mart and its consultants to facilitate decisions regarding the need for follow-up actions.

The objective of these reports is to document that TESIP objectives are being completed at each location. Specifically, each report:

- documents the critically damaged (or other) TES at the store location;
- describes the disposition of each TES;
- includes information gained from associates, if available;
- provides a draft TES transfer letter;
- documents the survey performed to characterize the radiological conditions in the store and the results of that survey;
- documents the review of the circumstances considered and the evaluation for the offer of bioassay; and
- recommends additional actions, as necessary.

Dade Moeller's internal processes require a CHP peer review of all store reports before Dade Moeller's submittal to Wal-Mart.

Bioassay reports are prepared when individuals are monitored for exposure to tritium through the use of bioassay samples. These reports are peer reviewed, provided to the appropriate individual, and are maintained in a confidential manner by Dade Moeller.

Dade Moeller also submitted a weekly report to Wal-Mart identifying the signs shipped during the previous week. This report provided the manufacturer name, model type, serial number, maximum curie content, and date of shipment, to enable Wal-Mart to prepare its reports to the appropriate regulator.

C. Summary Findings

As of the date of this report, Dade Moeller has responded to 444 locations with reports of damaged TES and provided disposition for approximately 779 TES. Dade Moeller conducted 547 separate store visits in 45 states and Puerto Rico between February 18 and December 23, 2008. Of those, 118 were RRT visits and 3 were urgent visits. Dade Moeller did not conduct store visits in Alaska, Delaware, Idaho, Rhode Island, or Vermont because no critically damaged TES were reported for these states. Attachment C lists the stores visited, locations, number of visits, and indicates if the visit was RRT or urgent, rather than an HP-only visit.

- Out of the 547 store visits, 105 were repeat visits because:
    - store associates or the Shaw contractor found additional inventory or damaged TES after the initial visit (most common);
    - additional decontamination and disposal (D&D) was necessary after the quantitative results of tritium contamination levels returned from the Dade Moeller Analytical Laboratory; and

- o consultation was scheduled for associates who received bioassay.

During these visits, Dade Moeller used procedure TES-001 to package and ship damaged or broken signs to Isolite. There were 384 stores visits where signs were shipped by Dade Moeller's HPs or CHPs. The total number of signs that Dade Moeller shipped was approximately 779. Of those 779 TES, 55 TES that were shipped consisted of only the backplate or had no tritium-containing tubes, as indicated in Wal-Mart's damaged sign reports to regulators.

1. Contamination Encountered

Dade Moeller evaluated areas of the stores near damaged TES for residual tritium contamination and decontaminated such areas, as needed, to below Project action levels. When TESIP action levels were exceeded, remediation was performed to reduce contamination to ALARA levels. The objective is for as-left contamination levels to meet NRC and Agreement State requirements.

Dade Moeller's investigations of critically damaged signs at the stores found large variations in the amount of tritium contamination. The contamination levels in the store before any remediation ranged from 0 (not differentiable from background) to 3,700,000 dpm/100 cm^2 at the TES mounting location. This variation was primarily a function of the:

- amount of damage to the sign;
- length of time since the damage occurred; or
- type of material where the TES was mounted (plywood, drywall, etc.).

The average "as-found" removable tritium contamination level found to date is 3,800 dpm/100 cm^2. This average is significantly influenced by a few locations with high as-found removable tritium contamination values. The median as-found removable tritium contamination value to date of 6 dpm/100 cm^2, is more representative.

When damaged sign removal and follow-up activities were complete, all stores, with the exception of two instances, had removable and fixed tritium contamination below Project action levels. Further remediation of tritium contamination in these two stores was unnecessary because the levels do not present a hazard and further remediation could not be justified by ALARA principles.

2. Dispositioned Waste

Tritium-contaminated waste was generated, transported, and disposed of from 109 store locations, representing more than 100 individual packages and 194 cubic feet of potentially contaminated TES waste. Those store locations are listed in Attachment D. Wal-Mart and Dade Moeller interfaced with Agreement State and NRC personnel when appropriate. As described in Section V.B.4, waste generally consisted of mounting surfaces under or adjacent to damaged TES, as well as materials used by Dade Moeller personnel in the course of tritium decontamination. All waste packages contained DOT exempt quantities of tritium.

3. Bioassays

Dade Moeller advises Wal-Mart regarding who should be offered a bioassay after potential exposure to tritium from a TES. Dade Moeller invited associates who had the potential for an intake of tritium to provide bioassay samples consistent with Section V.B.3. Dade Moeller offered bioassay samples during store visits and, for electrical subcontractor employees, by telephone. At least 82 persons were offered bioassay sampling by Dade Moeller.[13] Seventy-four of these individuals were Wal-Mart employees and 8 were employees of subcontractors.

Of those offered bioassay by Dade Moeller, 40 accepted, and Dade Moeller analyzed all 40 samples. Of these, 14 samples (35% of the number of bioassay samples provided) were above the minimum detectable activity ("MDA") for the urinalysis. Doses were calculated for each positive sample as described in Section V.B.3 and in Attachment B. The results in Attachment E (Table 1), "Bioassays Administered by Dade Moeller" are based on the positive bioassay samples analyzed by Dade Moeller. Bioassay results less than the MDA are not included in this listing.

In addition, Shaw performed bioassay for its employees, Wal-Mart employees, and contractor employees at one location early in the project before Wal-Mart engaged Dade Moeller as radiological consultant. Shaw also continued to offer bioassay to its employees and subcontractor employees throughout the project. Shaw's results are provided in Tables 2 and 3 of Attachment E and appear to be consistent with Dade Moeller's results for similar circumstances.

Communications of Results

After calculating doses, Dade Moeller conducted face-to-face consultations with Wal-Mart associates who submitted bioassay samples, regardless of the results. The dose was reported in a letter to the employee that was hand-delivered by a Dade Moeller CHP. Consultations for subcontractor employees took place only if bioassay results were positive, although results were reported to all individuals sampled.

Conclusions

Of the 40 bioassay samples analyzed by Dade Moeller; 14 were above the MDA for the urinalysis. Most bioassay results were below the Lower Limit of Detection.[14] Calculated doses for all personnel who were sampled were 1 millirem or less, except for three instances, which resulted in doses of 7.0, 1.5, and 5.6 millirem. These doses are low compared with the average annual background radiation in the United States, 300 millirem, and are comparable with the 4 - 15 millirem received during a dental X-ray or the 10 millirem resulting from a chest X-ray. The three highest doses involved the

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[13] Early in the project, persons who declined bioassay were not necessarily reported.

[14] Lower Limit of Detection (LLD) refers to the lowest amount (counts) of radioactive material that can be detected during a particular count time above background.

breakage of multiple tubes and individuals who were in close proximity to the sign(s) during breakage. All calculated exposures were almost 2 orders of magnitude below the annual dose standard of 100 millirem for a member of the public by a facility operating under a specific license (10 C.F.R. § 20.1301) and well below the cleanup standard of 25 millirem applicable to exposures associated with termination of a specific facility license (10 C.F.R. § 20.1402). Although these dose criteria are not applicable to the TES Project because the TES materials are generally licensed, these references are provided for comparison.

Considering all bioassay results obtained in this project (by Shaw and Dade Moeller), positive bioassay results appeared to be associated with:

- immediate presence of an individual in the area of TES breakage ;
- involvement with cleaning up TES debris; or
- working in the immediate area of a TES that was recently broken, when a large amount of contamination was found in the work area.

For example, at one store a TES was broken during its removal by an electrical subcontractor employee when dropped from a height of approximately 8 feet. The subcontractor employee picked the damaged TES up from the floor and subsequently handed it to a Shaw contractor employee. Both individuals submitted bioassay samples. The higher dose – 0.5 millirem – was to the electrical subcontractor employee; the Shaw contractor employee received 0.2 millirem.

A large proportion of the samples processed by Dade Moeller – 65% – were negative (below the MDA). The proportion of the samples processed by Shaw was similar, 64% were negative. Submission of samples by Wal-Mart Associates was purely voluntary, and not all individuals offered bioassay by Dade Moeller submitted samples. Of all individuals offered bioassay, only 17% were positive (above the MDA). These proportions suggest that the bioassay sampling criteria used were conservative.

D. Health and Safety Assessment of Damaged TES

The final response to damaged TES was to assess the potential health and safety impacts to store associates and members of the public from possible exposure to tritium released from damaged exit signs. Damaged TES can pose a potential risk to these individuals if they are exposed by handling the signs or if they are in the vicinity when a tritium-containing tube in the sign is broken and the tritium gas released. Intact TES present no radiation hazard to members of the public. This health and safety assessment looks at the potential radiation dose to individuals from likely exposure scenarios involving damaged TES. Knowledge of potential exposures and the resultant doses gained during the project were a key aspect of preparing scenarios and estimating impacts. Generic groundwater modeling was conducted to estimate impacts from groundwater transport and ingestion. 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.

As noted above, this assessment looks at potential radiation doses to individuals. The fact that approximately 15,000 - 16,000 TES may be lost, missing or otherwise unaccounted for has little implication for individual exposure. These lost or missing signs have been widely distributed in time (over the past 7 years) and in space (across most of the United States and Puerto Rico). There is no reasonable possibility that an individual or localized group of individuals – such as a town or neighborhood – may have been exposed to all or even a significant number of these signs. Therefore, this assessment examines realistic exposure scenarios involving a realistic or reasonable maximum number of damaged TES that could result in radiation dose to an individual.

1. <u>Perspective on Radiation Dose</u>

Estimates of impacts to human health and safety in this assessment are presented in terms of radiation dose. Often simply called dose, it is a fundamental concept in measuring and quantifying the effects of exposure to ionizing radiation. In this assessment the estimated radiation dose is presented in units of millirem (mrem). The annual limit in the United States for radiation dose to a member of the public – radiation dose <u>above</u> background levels (discussed below) – is 100 mrem per year from all sources. Some specific exposure pathways, like the drinking water pathway have lower, individual limits.

Everyone receives radiation dose from natural background radiation. The average person in the United States receives about **300 mrem per year** from natural background radiation, which comes from cosmic radiation (external radiation from outer space), naturally occurring radioactive elements in the soil (also external radiation), naturally occurring radioactive elements in our bodies (from ingestion), and the naturally-occurring radioactive element radon (inhalation of radon gas and decay chain radionuclides).

The average individual receives another **60 mrem per year** from manmade sources of radiation, mainly medical sources like x-rays and nuclear medicine used for medical diagnosis and therapy. What might be thought to be a big contributor to manmade radiation exposure, nuclear power, is actually very small, contributing much less than 1 mrem per year. Consumer products, like tritium exit signs, are also very small contributors. Other common exposures to radiation and the radiation dose received include the following:

A roundtrip airline flight from LA to New York (cosmic radiation):	3 mrem
Medical exposures	
Dental X-ray	4 -15 mrem
Chest x-ray	10 mrem
CAT scan	150 -1,300+ mrem

Potential radiation exposures from tritium exit signs should be evaluated in the context of the annual dose limit, the average annual background dose rate, and doses from other common exposures.

2. Shopper or Non-involved Associate Near Damaged TES

In this scenario, a member of the public is assumed to be shopping in a store near a damaged, double TES. The TES remained in place after the initial damage event, the shopper does not touch it and was not present when the sign was broken. This scenario also applies to a store associate who is not involved in the event causing damage to the sign but later works in the store in the general vicinity of 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 during the TESIP. No modeling was conducted. During the TESIP, several individuals were identified with similar exposure conditions to those defined by this scenario. From the multiple negative bioassay results obtained from associates 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

3. Associate Involved with Mechanical Impact to TES and Clean-up

This scenario is described as an associate driving a walking stacker or forklift that accidentally strikes a wall-mounted single TES. Project experience indicates that single TES are found in locations that are most susceptible to damage under this scenario. The single TES is knocked from the wall down to the floor below, approximately 10 feet. The associate is not in the immediate vicinity of sign when it strikes the floor but rather is on the forklift or stacker. The associate completes the moving or stacking activity then cleans 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 during the TESIP (see attachments B and E of this report). No modeling was conducted. An evaluation of the bioassay results for the Plymouth, IN, store, which are also supported by the results from the Broken Arrow, OK and Palmdale, CA stores, concludes that only limited exposures and doses would occur.

Estimated Dose:	Most likely:	0.1 mrem or less
	Reasonable maximum:	1 mrem

4. Associate Directly and Immediately Involved in TES Damage

In this scenario an associate is directly involved in breaking or damaging a TES. The individual is either within arm's length of a single TES or is standing over a double or single TES when it is broken. This scenario is based on incidents of a TES breaking during a difficult removal from a wall mounting location and one where an associate 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 during the TESIP. The basis for this evaluation is the Palmdale, CA and Shakopee, MN store exposures and bioassay results. Project experience showed this to be the scenario where an involved associate could receive the highest potential dose.

Estimated Dose:	Most likely:	5 mrem
	Reasonable maximum:	10 mrem

5. TES Placed in a Store Compactor

For this scenario, several intact TES are inadvertently placed in a store trash compactor. The compactor containing the TES is operated multiple times as new trash is added. Finally, the compactor is filled to capacity with metal, wood, cardboard, and miscellaneous materials. Up to 5 TES are assumed to be in 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 were damaged by the compactors. It is possible a TES could be damaged in a compactor; however, an associate 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 employee in the general vicinity of compactor when a sign is broken is likely similar to an employee involved in mechanical breakage of a TES (scenario 3) but without the associated clean-up activities. The compactor would provide additional isolation from the damaged TES. Therefore, the most likely dose from scenario 3 (mechanical breakage) is considered representative of the reasonable maximum dose for this scenario. The basis for this evaluation are the intact, undamaged TES retrieved from compactors in Cincinnati, OH and Colonial Heights, VA; also considered are Plymouth, IN exposures and bioassay results.

Estimated Dose:	Most likely:	0 mrem
	Reasonable maximum:	0.1 mrem or less

6. Inadvertent Disposal of Multiple TES in a Municipal Landfill

This is the only scenario that used modeling rather than project experience. One hundred intact tritium exit signs[15] are assumed to be inadvertently discarded from one store at the same time and disposed in a municipal landfill. The average activity per TES is assumed to be 10 curies, for a total disposed activity of 1,000 curies. The individual sign activity considers radioactive decay of the tritium while the signs were in stores and manufacturer differences in the initial sign activity. All of the TES are assumed to remain intact until the landfill daily soil cover is added and compaction occurs[16]; any tritium gas released from the damaged signs is assumed to be captured in the soil and fully converted to tritiated water (HTO) and available for transfer to groundwater. During compaction of the waste and soil cover an estimated 40% (0.4) of the signs are damaged; in these damaged signs 40% (0.4) of the tritium-bearing tubes are broken and release tritium gas, which is captured in the soil matrix and fully oxidized to HTO. These damaged fraction estimates of signs and tubes are based upon the assumption of signs with frames and faceplates intact being discarded (all tritium available for transfer to a landfill) and project knowledge of observed damage to signs[17]. The activity of tritium available for transfer to groundwater for this scenario is 160 Ci out of a total of 1,000 Ci present in the disposed TES.

Modern municipal landfills are carefully located, scientifically engineered facilities built into or on the ground that are designed to isolate waste from the environment. Such facilities typically include a series of disposal units known as cells. Operation of municipal landfills is regulated by the U.S. Environmental Protection Agency (EPA) through its Resource Conservation and Recovery Act (RCRA) Subtitle D regulations (40 CFR Part 258, 2008). Waste is isolated from the environment using engineered barriers, such as synthetic or clay liners, placed at the bottom of a landfill cell and in the cap used to cover waste when a cell is full. The cell liner is designed to collect any water (from rainfall or snowfall) that might pass through the waste during and after landfill operations. Water in a landfill cell, known as leachate, will contain soluble or suspended materials from the waste, which could contaminate ground water resources. Modern landfills have leachate collection systems that are designed to collect and remove leachate water from a waste cell, further limiting the potential for ground water contamination. The closure cap is designed to prevent infiltration of water after disposal operations cease.

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15 100 tritium exit signs represents about 0.6% of the total signs unaccounted for and greater than the 99th percentile for the number of signs unaccounted for at any one store. This is, at minimum, a reasonably conservative estimate and probably a bounding estimate.

16 Any dose to a disposal truck driver or municipal landfill worker would be very small and conservatively characterized by the TES in store compactor scenario, with a likely dose of zero mrem and a reasonable maximum dose of 0.1 mrem or less.

17 The project observed a damage fraction of less than 0.1 for person-caused damage in dumpsters, and a damage fraction of zero for repeated compaction of signs in a hydraulic compactor. Intact signs in a flat position are reasonably robust; only direct impact to the face of the sign inside the frame is likely to cause damage. Considering activities and compaction likely to occur in a landfill, the damage estimates used in the assessment are considered reasonably conservative compared with actual experience.

By minimizing the water entering a closed landfill cell, the potential for ground water contamination from leachate water is also limited. In addition, gas collection systems are often installed to collect any gas generated by the decomposition of waste. The gas may be high in methane from degrading organic waste, and is sometimes used as a combustion source for power generation. The operational and post-closure performance of landfills in protecting environmental releases is monitored through a series of ground water monitoring wells located in a buffer zone between the landfill cells and the site boundary. Samples from the monitoring wells would indicate if the liner systems fail and if corrective actions are required to prevent contamination of ground water beyond the site boundary. Each landfill operator is required to provide financial assurance monies that are available to properly close and care for the landfill after closure (NSMWA, 2005).

Because of the regulated nature of modern municipal landfills, exposure to members of the public through ground water consumption following disposal of tritium signs would seem to be a remote possibility and the most likely dose to a member of the public would be zero. However, a reasonable maximum dose scenario is also developed and is based on a generic modeling approach. It is assumed that the liner systems fail and tritium is transported to a shallow nearby aquifer. This assumption would also be consistent with disposal at small municipal landfills that fall below the EPA regulations. The scenario selected is a drinking water scenario, where the dose to members of the public results from drinking ground water containing tritium leached from a landfill cell. This scenario has been described and documented in a report prepared for the U.S. Nuclear Regulatory Commission (NRC) supporting its license termination proceeding (Kennedy and Strenge, 1992) and is consistent with the basis the EPA used to derive the tritium drinking water standard (EPA, 2000).

The primary mechanisms controlling potential ground water contamination include infiltration and leaching, transport through the unsaturated zone, and transport through the saturated zone. Many additional characteristics of a specific site would influence these mechanisms, including precipitation rates, the effectiveness of the disposal cell design in preventing releases, the size of the disposal cell, land surface usage, and aquifer usage and conditions. Because of the wide variability of physical and chemical conditions, a generic representation of the drinking water scenario is considered to serve as a representation of a reasonable maximum dose. This scenario assumes one year's precipitation interacts with the tritium in the landfill, which is then transported to offsite ground water used as a drinking water source, without further dilution. The following assumptions are made for the calculation:

- The disposal cell is assumed to be 100 meters (328 feet) by 50 meters (164 feet), to a depth of 10 meters (32.8 feet). Although these dimensions could vary, a single cell of these dimensions would represent about 50,000 tons of waste which is representative of a smaller landfill (NSMWA, 2005).

- All of the tritium is assumed to be in the form of HTO and none is released as gas either during or after disposal. There is no retardation of tritium in the waste or in the aquifer (Kennedy and Strenge, 1992).

- The release is assumed to be to a shallow aquifer and there is a dilution factor of 10% (0.1) of the released leachate water as it infiltrates the aquifer.

- Drinking water is obtained from ground water at the rate of 2 liters per day (L/d), or 730 L/year (Kennedy and Strenge, 1992), consistent with adult water consumption.

- The transport time from the leachate water to the well is one half-life of tritium, or 12.33 years. Although this value is low (non-conservative) compared with most ground water systems when a buffer zone is considered, it should provide a conservative basis for the maximum reasonable dose from drinking water pathway analysis.

- The assumed annual precipitation is 0.5 meters (about 20 inches) per year. This value was selected since it is on the low side of average rainfall for most states.

From these assumptions, the total leachate released in a year is 2,500 cubic meters, or 2.5×10^9 liters. Assuming 160 curies released, with a transport time of 12.33 years, and 10% dilution in the aquifer, the drinking water concentration is 3,200 picocuries per liter (pCi/L). This concentration is 16% of the EPA drinking water standard for tritium (20,000 pCi/L).

The dose to the individual consuming well water for the baseline evaluation is:

$$H = Q * DF * C * I$$

Where H is the committed dose equivalent in mrem, Q is the quality factor (set to 1.0 for beta radiation), DF is the dose conversion factor in mrem/pCi ingested, and I is the intake of 730 L/year. The dose conversion factor for ingestion of tritium from Federal Guidance Report No. 11 (Eckerman, et al., 1988), published by the EPA for an adult, is 6.41×10^{-8} mrem/pCi. These values are based on the recommendations of the International Commission on Radiological Protection (ICRP) in their Publications No. 26 and 30 (ICRP 1977; 1979-1988). By substitution:

$$H = 1.0 * (6.41 \times 10^{-8} \text{ mrem/pCi}) * (3{,}200 \text{ pCi/L}) * 730 \text{ L/year}$$

or,

H = 0.15 mrem/year, about 4% of the EPA 4 mrem/year drinking water standard.

The most restrictive tritium ingestion dose conversion factor from Regulatory Guide 1.109 (NRC 1977) is for an infant, with a value of 3.08×10^{-7} mrem/pCi ingested; however the water ingestion rate is much lower and mainly offsets this higher factor. Dose to an infant – if drinking water were to be taken directly from such a well – could be somewhat higher than this estimated dose but still well below the EPA drinking water dose limit.

Estimated Dose:	Most likely:	0 mrem
	Reasonable maximum:	0.2 mrem

Comparison of modeling to measured tritium leachate data. The assumptions of this scenario would result in a tritium concentration of 64,000 pCi/L in the untreated leachate of the landfill. In order to evaluate the reasonableness of the scenario estimate it was compared to results of a project sponsored by the Pennsylvania Department of Environmental Protection, Bureau of Radiation Protection and the Bureau of Waste Management to investigate radioactive material potentially present in untreated landfill leachate (CEC, 2006). The project included all active and permitted landfills in the Commonwealth of Pennsylvania having a leachate collection system. A total of 54 of the 108 solid waste landfills in Pennsylvania (or half of the total) met this criterion in 2004. Samples of raw, untreated leachate were collected from these landfills, along with five quality control samples. The tritium data for the fall of 2004 indicated positive tritium results in 57 of the 59 samples analyzed. The results ranged from 6.86 to 94,400 pCi/L, with a mean concentration of 25,200 pCi/L. There were 31 samples (or 53% of the total number of samples) with tritium concentrations above the EPA drinking water standard of 20,000 pCi/L. The fall 2005 results showed positive tritium results in 55 of 59 samples analyzed. The results ranged from -62 to 181,700 pCi/L, with a mean concentration of 20,900 pCi/L. There were 16 samples (or 27% of the total number of samples) with tritium concentrations above the EPA drinking water standard of 20,000 pCi/L (CEC, 2006).

The Commonwealth of Pennsylvania considers the EPA drinking water standard of 20,000 picocuries per liter as an applicable or relevant and appropriate requirement (ARAR) standard for leachates and any other waters at the point of intake to a drinking water supply. However, the Commonwealth concluded that, considering the treatment and discharge processes that leachate is subject to, and the dilution factors associated with human exposure scenarios involving drinking water, none of the fall 2004 or 2005 tritium sampling results would exceed the EPA criteria at the point of intake (CEC, 2006). Considering the highest sample concentration recorded (181,700 pCi/L), this would imply a dilution factor of at least (181,700/20,000), or about ten. Therefore, the untreated leachate concentration developed as part of this scenario is conservative, and the dilution factor assumed is appropriate for the estimation of a reasonable maximum dose.

7. Conclusions and Summary

Evaluation of the exposure scenarios described above shows that in all cases exposure to tritium from damaged tritium exit signs results in negligible or very low doses to members of the public. In all evaluated cases, the estimated dose is well below background radiation doses, the applicable dose limit of 100 mrem/year, and well below the drinking water standard of 4 mrem/year from the potential release of tritium to groundwater. 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 based on TESIP experience provide support for NRC’s general licensing approach to tritium exit signs. Table 2 summarizes the scenarios and the estimated most likely and reasonable maximum doses from potential exposure to damaged tritium exit signs.

The magnitude of the number of lost or missing signs has little implication for individual exposure. These lost or missing signs have been widely distributed in time (over the past 7 years) and in space (across most of the United States and Puerto Rico). There is no possibility that an individual or localized group of individuals – such as a town or neighborhood – may have been exposed to all or even a significant number of these signs. The individual exposure scenarios presented in this assessment represent the best way to evaluate the potential health impact of damaged or discarded tritium exit signs.

Table 2 – Summary of Estimated Doses from TES Exposure Scenarios.

Exposure Scenario	**# of TES**	**Estimated Dose (mrem)**		**Basis for Estimate**
		Most Likely	Reasonable Maximum	
1. Shopper or uninvolved associate in store	1 – 2	0	0	Project experience
2. Associate involved in TES mechanical breakage, clean-up	1	0.1	1	Project experience
3. Associate directly and immediately involved in TES breakage	1 – 2	5	10	Project experience
4. TES placed in store compactor	≤ 5	0	0.1	Project experience
5. TES disposed in landfill	100	0	0.2	Generic modeling

8. References

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VI. TES Data Collection

In January 2008, Wal-Mart engaged Kroll, an organization with previous experience in large-scale investigations, to perform an investigation of the status of TES purchased by Wal-Mart. Kroll focused on identifying likely TES locations primarily by reviewing associated documents and files. For those TES that were no longer present at their original location, Kroll determined the method of likely disposal or transfer, as applicable.

The primary purpose of Kroll's inventory was to establish the base number of TES that Wal-Mart purchased and to confirm the status of each TES. The baseline inventory assessment was divided into four priority-based tiers as discussed in Section III.A. Wal-Mart's June 5, 2008 interim report to the NRC provided preliminary results regarding Tiers I, II and III. Subsequent to that report, Kroll completed its analysis of Tier IV. However, because of the focus of this report, all tier results have been merged into the state-by-state results provided in Attachment F.

A. Document Review

The preliminary phase of Kroll's investigative effort conducted from approximately January, 2008 to May, 2008, focused on Tier I states. Wal-Mart provided Kroll with access to relevant Wal-Mart databases and documents in support of this effort. Kroll's investigative protocol consisted of on-site and remote review of relevant Wal-Mart database documents, e-mail, informational interviews of Wal-Mart associates, and interviews of Wal-Mart vendors and contractors. As part of its investigative activities, Kroll reviewed data and information primarily from the following sources:

Isolite

- Invoices provided by Isolite that identified Wal-Mart as the "End-User" of TES.
- All available invoices maintained in Wal-Mart's Accounts Payable Notes and microfiche archives.
- Return Merchandise Authorizations.
- Credit documentation.
- Shipment information submitted to Wal-Mart.
- Shipment information submitted to the NRC.

SRB Technologies (SRB):

- Available invoices including those obtained from Wal-Mart's Accounts Payable Notes and microfiche archives.
- Shipment information submitted to Wal-Mart.

Wal-Mart's Real Estate Library (REL):

- Change Orders (COs).
- E-mail correspondence.
- All related construction documentation, including, but not limited to, Warranty Inspection Reports, Maintenance Data Sheets and store "closeout" files.

Wal-Mart's Electronic Document Delivery System (EDDS):

- Construction Change Directives (CCDs).

Interviews of Key Wal-Mart Associates

- At the outset of this investigation, Kroll conducted informational interviews with nine Wal-Mart associates who Wal-Mart identified as having knowledge of the decision to implement, purchase, install or remove TES at Wal-Mart's stores.

These associates worked in a variety of functions at the company, including, but not limited to, Construction, Design, Fire Safety and Procurement.

E-mail Review of Key Wal-Mart Associates

- **E-mail records:** Kroll secured and reviewed e-mail correspondence for the above-mentioned Wal-Mart Real Estate associates.

B. General Contractor Assessment

Kroll and Morgan Lewis contacted a sampling (36) of general contractors (GCs) in six Tier I states for stores known to have received TES.[18] Kroll contacted 32 of the 36 GCs and interviewed 22 contractors. The GCs interviewed checked their records and conferred with their project superintendents and/or electrical subcontractors regarding their recollection of TES practices. Nearly every GC contacted by Kroll had limited knowledge about TES, including how signs were to be handled and final disposition of any excess or removed signs at a particular store.[19]

The remaining 10 GCs indicated that they would check their available records and/or contact electrical subcontractors and project managers to obtain additional information about the signs. To facilitate this research, Kroll also sent a Request for Information (RFI) to GCs asking for the names of Wal-Mart associates with whom the GC dealt, the names of parties who handled TES, the stores the GC worked on, the names and contact information of electrical subcontractors, a description of any issues related to TES and how excess material or signage was handled.[20] Following Kroll's initial GC contact and interview, most of these GCs responded, albeit with very limited and marginally useful information.

Kroll obtained the following information from interviews with general contractors:

- Electrical subcontractors were typically responsible for handling the signs. In some cases, the GC would accept delivery of the signs, but then transfer the signs to the electrical subcontractors for installation. Some GCs indicated that they would allow the electrical subcontractors to use a trailer or storage area while they were on the job site.

- The majority of GCs explained that excess owner-supplied material – *i.e.*, the material purchased by Wal-Mart – would have been left at the store, or the GC may have received directions to return the material to Wal-Mart. Several GCs speculated, but did not specifically recall, that excess material left at the store or attic stock would eventually be thrown away.

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18 Pennsylvania, Washington, New Jersey, New York, California and Illinois

19 Kroll made multiple attempts to discuss TES with all contacted GCs, but some were uncooperative.

20 All of the GCs contacted by Kroll either directed Kroll's inquiry to another more knowledgeable person at the company and/or agreed to search their records. Nearly every GC contacted by Kroll had only limited knowledge about TES installed in the stores.

- Some GCs indicated that they sometimes returned excess materials to the vendor.

- Some GCs specifically recalled that excess TES were placed on a pallet and left with the store. The GCs indicated it was up to the store manager whether to keep, return or dispose of the excess TES.

- The GCs had a very limited understanding of the signs. None recalled receiving any warnings, instructions or special handling directions with the signs. Several GCs, even some who referred to them as “nuclear signs” and therefore seemed to recognize the special nature of the TES, were not aware that they required special handling.

- Many GCs stated that they had no relevant documentation to provide. For example, one GC stated that all shipping documents for a store are destroyed after the store’s completion and the store’s closeout is turned over to Wal-Mart.[21] Thus, the GC would not have any additional records beyond what is in Wal-Mart’s possession.

- Several GCs indicated that the electrical subcontractors with whom they worked were no longer in business and/or the project manager or superintendent who worked on the store was no longer employed by the GC.

Although Kroll was unable to identify the likely disposition of many missing TES, Kroll’s review of available documentation and data revealed the following most likely disposition of TES. The missing TES were likely to have been:

1. Shipped back to either Isolite or SRB

2. Transferred by a general contractor or electrical contractor to a non Wal-Mart facility

3. Placed in storage at the indicated Wal-Mart store

4. Never installed at a store because local building authorities and/or fire marshals refused to allow the installation of TES

5. Discarded once damaged or unused for a significant period of time

C. Reconciliation of TES Data

Wal-Mart primarily purchased signs from SRB and Isolite. Shaw obtained TES purchase and shipment records from SRB and Isolite including all purchases by Wal-Mart from late 2000 through January 2007. Kroll obtained an “End-User” report from Isolite documenting its record of shipments where Wal-Mart was the end-user of TES but not always the purchasing customer, *i.e.*, where a contractor purchased the TES for Wal-Mart. Isolite also provided Kroll with a TES status report that it submitted to the

21 Records indicate that this GC worked on 36 stores.

NRC. This report documented all of the TES orders that it shipped to Wal-Mart from its facility in Pennsylvania (NRC Report).[22] Although SRB did not provide Wal-Mart with its Wal-Mart-related TES purchase information, Kroll was able to locate some shipment data during its search of Wal-Mart records.

In an effort to reconcile and combine the above data, Kroll conducted a line-by-line comparison of: (1) Isolite's NRC Report, (2) the data contained in Isolite's End User Report, and (3) the data from Isolite's TES purchase/shipment information provided to Shaw. Kroll identified inconsistencies between these three data sources (*i.e.*, the number of reported TES not matching the number reflected by serial numbers) and working with Shaw and Morgan Lewis, reconciled the data based on available records, knowledge and patterns. The types of issues faced during data reconciliation included:

- Kroll's review of vendor invoices identified various anomalies between the count on the vendor invoice and the quantity specified in the range of serial numbers. In some cases, more signs were identified on the invoice than in the range of serial numbers. In other cases, more signs were reflected in the serial number sequence than in the total number of signs shipped on a particular invoice. Many of these cases appear to be keystroke errors by the vendor. As a result, Kroll and Shaw reviewed the available information and made a determination on a case-by-case basis. These decisions were based on documentation identified in Wal-Mart's records and the results of Shaw's store surveys.

- Kroll's review identified invoices with partial or incomplete store addresses. In these cases, given Shaw's survey of all Wal-Mart stores around the country, Kroll worked with Shaw to determine the best possible address match based on the partial information.

- Where there have been questions about the number of signs that were expected at a particular store, Shaw has used the total sign count calculated from Kroll's manual review of invoices from both vendors, NRC reports previously submitted by the vendors, various shipment summary reports and other documentation reviewed by Kroll.

Additional factors have an undefined impact on the reliability of data reconciliation efforts. Key factors are:

- SRB, declined to provide information or access to its records in response to Wal-Mart's requests.

- Typographical errors in TES vendor records.

- Inconsistencies or limited information in TES vendor records sent to the NRC.

Additional unexpected information and inconsistencies were evaluated by data reconciliation participants with the following resolution approaches:

[22] Isolite has not yet provided information on orders that were shipped from its facility in California despite numerous requests.

- **Inconsistent store address information:** Kroll's and Shaw's research revealed several address inconsistencies for Wal-Mart stores in the United States. In the majority of instances, addresses found in Shaw's data did not match addresses that Kroll identified either in the vendor's shipping records or on the vendor's invoice. That discrepancy occurred because many times, the store under construction did not have a physical address when the TES were purchased and shipped, so the TES were shipped to temporary or alternative addresses. In these instances, Kroll and Shaw determined that Shaw possessed the most accurate address information because they had more recently received store address data from Wal-Mart.

- **Duplicate serial numbers in available records:** Shaw's inventory revealed several instances where the same serial number appeared on signs at more than one location. This issue pertained to both Isolite and SRB. As a result of Kroll's and Shaw's research, it appears as though the signs may have been sent to one store, later returned to the manufacturer and then shipped to a second store. Regarding Isolite's signs, reconciliation participants agreed that if return information from the vendor verified that the signs had been returned**,** then Shaw would associate the duplicate serial numbers with both addresses. Additionally, if Isolite return data was not available, then the serial numbers were only associated with the location at which they were found. In the absence of SRB return data, serial numbers on signs from SRB were allocated to the store at which they were found. All of these determinations were made under the assumption that typographical errors existed in the vendor's records.

- **Missing serial numbers in Isolite return data:** Kroll's and Shaw's review of available Isolite return data revealed 25 records that did not include serial numbers for the returned signs. In these instances, the number of returned signs was deducted from the total number of "expected" signs at the store.[23]

VII. Final Project Results

A. TES By the Numbers

Attachment F provides a state-by-state list of TESIP results. The list notes the number of stores visited, the number of stores where TES were found, the number of stores where TES were expected to be found, the number of TES shipped to the stores within a state, the number of TES that were found at stores within the state, the number of TES unaccounted for, and the number of TES returned to the manufacturer.

According to the data review conducted by Kroll, 75,286 TES were shipped to 1,426 facilities. At the conclusion of the inventory, a total of 63,409 TES were found at 1,543 facilities. This number of TES includes the number of TES shipped to the stores that were found and also "new signs." New signs are those that based on inventory and shipment records, Wal-Mart did not purchase corporately and, therefore, did not expect

[23] Note that the signs in question were only deducted from the "expected" total at a particular store if they were not considered "expected" at another location.

to find. Additionally, a “new sign” was a TES were a serial number could not be found and therefore Wal-Mart was not able to match it to an expected sign.

Kroll’s analysis of the information collected to date by Shaw, combined with a review of Wal-Mart’s records and information provided by Isolite, SRB, general contractors, and the NRC indicates that at this time, there are approximately 15,858 TES that are currently unaccounted for from Wal-Mart’s facilities in the United States and Puerto Rico. Wal-Mart continues to process information regarding the number of signs returned to vendors. This data represents a current “unaccounted for” rate of approximately 20 % of the purchased TES. It is important to note that, because serial numbers were not available for some lost TES or for some “new” TES,[24] the actual number of lost TES could be dramatically lower. Put another way, the “new” TES found at some locations could in fact be the same signs that were lost from another location.

Kroll’s 50-state data review identified evidence supporting several primary causes for missing TES. In several states, inspections by city/town-level or state-level building inspectors or fire marshals led to a change order to remove all TES from the store. In most cases, the TES were replaced with powered LED exit signs. Inspectors or fire marshals often cited the requirement for “illuminated” or “lighted” exit signs or cited violation of state building codes. Many stores were issued change orders, as a result of fire inspector or building inspector directions to remove TES, but often no reason for the removal was cited in documentation reviewed by Kroll. In the majority of these cases, Kroll identified little if any information indicating where TES were sent once they were removed.

In some cases, damage, theft or missing signs were cited in internal paperwork as the reason for a new order of signs from a vendor. In one store, for example, Kroll found documentation indicating that signs had been stolen and an order for replacements was placed. In other cases, it appears that TES may have been misplaced. For example, Kroll identified e-mails and Shaw spoke with contractors where some TES allocated for a store were found in the office of the general contractor.

Shaw also identified that there were 3,010 “transfers” between stores. A “transfer” was one where a TES was expected at one location based on purchase records but was found at another location. “Transfers” were found between stores located within the same state and between stores in two different states.

The following are some statistics from the TESIP.

- Number of Wal-Mart facilities visited = 4,545
    - Supercenters = 2,393
    - Wal-Marts[25] = 969
    - Neighborhood Markets = 120

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[24] A “new” TES is one that was not expected but was nonetheless found.

[25] This total number includes Amigos grocery stores located in Puerto Rico.

- Sam's Clubs = 592
- Distribution Centers = 157
- Formerly Occupied Stores = 307
- Home Office Facilities[26] = 7

- Number of Wal-Mart facilities with TES = 1,543
  - Supercenters = 1,064
  - Wal-Marts = 221
  - Neighborhood Markets = 75
  - Sam's Clubs = 163
  - Distribution Centers = 5
  - Formerly Occupied Stores = 14
  - Home Office Facilities = 1[27]
- Number of Expected TES = 75,286
- Number of "New" TES Found: 3,765
- Total Number of TES at Stores = 79,051
- Number of TES Inventoried = 63,409
- Number of TES Returned = 63,192
- Number of TES Lost = 15,858
- Number of critically damaged TES = 779
- Number of stores containing critically damaged TES = 444
- Maximum number of TES found at one store = 135
- Minimum number of TES found at one store = 1 TES
- Number of TES at a typical store = 50-60 TES

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[26] The Wal-Mart "Home Office" actually contains over 40 buildings. All were visited but were tracked by their seven separate addresses.

[27] Sample sign (not installed for use) provided by vendor for Wal-Mart's evaluation.

B. Reporting Summary

Over the course of its inventory and replacement program, Wal-Mart submitted reports of damaged, lost, and transferred TES to the NRC or Agreement States, as appropriate. At a minimum, NRC and Agreement States require a written report of any loss, damage, or transfer of a TES within 30 days of the date of that event. With only few exceptions, Wal-Mart submitted these reports in a timely manner. In some cases, however, information of the transfer of a TES, or on rare occasion, damage to a TES, was delayed. In those instances, Wal-Mart drafted and submitted a report to the appropriate regulator as soon as possible after receipt of the information.

For lost TES, the NRC and most Agreement States require that the licensee report the loss in two ways: immediately by telephone, and again by a written report within 30 days. For the most part these reports, and the subsequent written reports required in all jurisdictions, were completed after Wal-Mart, Shaw, and often Dade Moeller conducted physical and database searches for the TES. Because of the quantity of data available, these searches were best conducted towards the end of the Project and after Shaw completed its inventory. Accordingly, although some TES may have been "unaccounted for" earlier in the Project, they were not reportable as "lost" until the database review and nationwide inventory was nearly completed and the TES were thereafter confirmed to be missing.

A table showing all stores for which lost or damaged TES were reported to the NRC is available at Attachment G. A list of the stores in Agreement States for which reports of damaged or lost TES were submitted is attached at Attachment H. Note that, for many stores, Wal-Mart submitted more than one report. For example, in the case of a damaged TES, Wal-Mart would provide the initial report of damage, a transfer report when the damaged TES was transferred, and supplemental reports within 30 days of learning any additional information about the damaged TES. A complete matrix documenting all reports submitted is available at Attachment I and copies of all reports are available in the appropriate store folders in Wal-Mart's TES Management System.

VIII. Apparent Cause Determination

As discussed in the Introduction to this report, Wal-Mart did not immediately recognize its obligations as a general licensee upon its purchase of TES. Accordingly, an Apparent Cause Review was initiated by Wal-Mart to identify why Wal-Mart failed to recognize TES-related requirements and to identify contributing factors to 15,858 unaccounted for Wal-Mart purchased TES. To perform this review, Wal-Mart established an Apparent Cause Review Team comprised of representatives from Kroll and Morgan Lewis.

A. Scope

The Apparent Cause Review assessed the 2000 – 2007 timeframe. This encompasses Wal-Mart's initial purchase and use of TES in Wal-Mart facilities through implementation of Wal-Mart's removal and replacement thereof.

1. Apparent Cause

Wal-Mart concluded that following is the apparent cause related to the above Problem Statement:

> *Insufficient knowledge regarding the nuclear regulatory process and related responsibilities: More specifically, Wal-Mart did not recognize and fully understand that, irrespective of the fact that the TES were sold without a specific license or registration requirement, and with only minimal use requirements, because they contained radioactive material, they were subject to significant regulatory reporting, inventory and disposal obligations to federal and state regulators.*

a. Contributing Causes

Contributing Cause 1:

> *Inadequate understanding of applicable regulatory requirements including the associated accountabilities, applicability, and scope of the requirements.*

Contributing Cause 2:

> *Over-reliance on and/or misunderstanding of vendor statements indicating or implying that the vendor would address regulatory requirements associated with the TES including reporting and ultimate disposal.*

Contributing Cause 3:

> *Inadequate communications and understanding between Wal-Mart departments regarding TES responsibilities.*

Contributing Cause 4:

> *Inadequate tracking of TES by Wal-Mart after purchase and delivery to construction project sites, and ineffective communications regarding TES regulatory requirements to Wal-Mart's construction and remodel general contractors in the field.*

Contributing Cause 5:

> *Failure of regulatory indicators to alert Wal-Mart, an entity unfamiliar with the nuclear industry, that it had direct regulatory obligations regarding rigorous management, oversight and disposition of TES.*

B. Detailed Discussion

Provided below is a more detailed discussion of the apparent and contributing causes and the key bases for Wal-Mart's conclusions.

Apparent Cause:

> *Insufficient knowledge regarding the nuclear regulatory process and related responsibilities: More specifically, Wal-Mart did not recognize and fully understand that, irrespective of the fact that the TES were sold without a specific license or registration requirement, and with only minimal use requirements, because they contained radioactive material, they were subject to significant regulatory reporting, inventory and disposal obligations to federal and state regulators.*

Wal-Mart concludes that inadequate knowledge of the TES themselves, and of associated regulatory obligations are key factors that resulted in its corporate associates not developing a comprehensive and integrated plan for inventory management, reporting, proper handling of, and ultimate disposition of TES. This conclusion is supported by the fact that once senior management clearly understood TES regulatory requirements, Wal-Mart promptly designed, developed, and implemented a robust program to address these matters.

It is clear both from interviews of Wal-Mart corporate employees and reviews of numerous relevant internal documents that some Wal-Mart associates had, at most, only limited knowledge or understanding of potential regulatory implications of using TES. However, it is equally clear that this awareness was not widespread or very deep. Though the issues of additional obligations related to the handling, inventory and disposal of TES did arise, Wal-Mart associates did not recognize the regulatory significance of these issues. In addition, as further discussed below, concerns regarding regulatory significance appear to have been allayed by perceived assurances provided by or believed to have been provided by TES vendors, Isolite and SRB.

Although Wal-Mart possessed approximately 79,000 TES over the period commencing in 2000, it did not recognize the need to appoint a single point of contact—an RSO—until January 2008. It appears from a review of TES-related e-mails and interviews of Wal-Mart associates responsible for related aspects of Wal-Mart's purchase of TES, distribution, use or disposition of TES that each organizational unit within Wal-Mart was working independently. Roles and responsibilities regarding TES were narrowly defined and were not integrated among other Wal-Mart organizations also involved in the purchase or use of TES. As such, the lack of a single point of contact in an RSO had a significant impact on Wal-Mart's ability to manage TES, since this function was not assigned to any specific department.

Contributing Cause 1:

> *Inadequate understanding of applicable regulatory requirements including the associated accountabilities, applicability, and scope of the requirements.*

As previously noted, the fact that Wal-Mart did not have an in-house single point of contact (e.g., RSO) regarding TES contributed to an inadequate understanding, in general, by Wal-Mart regarding applicable regulatory requirements. One example of this contributing cause is an April 21, 2004, meeting at the Wal-Mart home office during which Isolite provided Wal-Mart with relevant sections of NUREG-1556, an NRC document that provides guidance related to the use of generally licensed materials and summarizes the NRC's TES-related guidance and expectations.[28] One attendee of the meeting interviewed by the Apparent Cause Review Team sent a follow-up e-mail to his peers questioning whether TES should be used. This person did not, however, fully understand the substance of the NUREG since his focus was on the business decision to use TES and not on regulatory-related concerns. Other associates told the Apparent Cause Review Team that they may have heard about or discussed possible regulatory requirements associated with using TES, but did not perform any follow-up to determine whether Wal-Mart had any actual regulatory obligations that were not being met.

Some Wal-Mart associates recalled raising questions regarding the use of TES because they contained a radioactive isotope and associates might be exposed to radiation if a sign were broken. It does not appear that these questions were subsequently addressed by any Wal-Mart associates. Because the signs could be purchased from a vendor without any specific license or other regulatory prerequisites, Wal-Mart associates, as a general matter, had minimal understanding regarding adverse effects on its associates or members of the public. None of the radiological-based concerns was considered or evaluated further because the Wal-Mart associates making the decision to specify or purchase the TES did not have a level of training or expertise to recognize and appreciate applicable federal and state radiological regulatory requirements and associated required actions.

<u>Contributing Cause 2:</u>

> *Over-reliance on and/or misunderstanding of vendor statements indicating or implying that the vendor would address regulatory requirements associated with the TES including reporting and ultimate disposal.*

The Apparent Cause Review Team interviewed several Wal-Mart associates who were involved with the purchase or use of TES, and who recalled vendor statements (*e.g.*, during the April 21, 2004 meeting with Isolite, and during one-on-one conversations with each other) that the vendor would take responsibility for regulatory obligations regarding the return of TES on Wal-Mart's behalf. It appears that Wal-Mart associates who heard these statements consistently believed that after the TES was purchased by Wal-Mart, Wal-Mart had no other obligations except to return the signs to the vendor at the end of the sign's use. No Wal-Mart associates were assigned or took responsibility for ensuring that the vendor followed through, or that processes and procedures were developed to cause the vendor to follow through on any such representations.

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28 NUREG-1556, Volume 16, "Consolidated Guidance About Materials Licensees, Program-Specific Guidance About Licenses Authorizing Distribution to General Licensees," December 2000. Appendices K and L of NUREG-1556 provide guidance specific to general licenses under 10 CFR § 31.5, and self-luminous exit signs, respectively.

Contributing Cause 3:

> *Inadequate communications and understanding between Wal-Mart departments regarding TES responsibilities due, in part, to decentralized compliance functions.*

When the decision was made to specify TES for inclusion in Wal-Mart construction, responsibility for compliance was decentralized throughout the design, construction, purchasing, and operations organizations, with no one organization specifically responsible for compliance issues which spanned all four disciplines. The Apparent Cause Review establishes, based on a review of a number of Wal-Mart internal e-mails, that Wal-Mart associates had an inconsistent understanding and expectations of each other regarding TES, and that no team was assigned or assumed responsibility for ensuring those questions were fully addressed and resolved.

Wal-Mart had a compliance department that provided advice regarding environmental obligations only when requested. As discussed in Contributing Cause 2, while some Wal-Mart associates may have been aware of the possibility that using TES also meant that the general licensee had to satisfy certain regulations, no centralized organization, including the Environmental Services department, appears to have been accountable or responsible for ensuring that these additional activities were identified or carried out.

Further, purchasing associates would not have seen regulatory guidance intended to provide notice of requirements related to TES because all purchasing was conducted by the Home Office, while the TES were delivered to decentralized project sites. And, while field associates may have seen the labels below, as a result of no team owning specific responsibility for managing obligations related to TES, no training or explanation was provided to field associates concerning the requirements or regulatory implications set out in the label.

Contributing Cause 4:

Inadequate tracking of TES by Wal-Mart after purchase and delivery to construction project sites, and ineffective communications regarding TES regulatory requirements to Wal-Mart's construction and remodel general contractors in the field.

Wal-Mart procurement associates who may have received regulatory obligation information from TES suppliers did not understand the significance of the communications. Wal-Mart essentially had a customer/supplier relationship with TES vendors and most communication from and to these suppliers was conducted through the procurement department. When either vendor (SRB or Isolite) provided TES regulatory information to Wal-Mart, the procurement team did not seem to recognize that the information was transmitted to broadly inform Wal-Mart of its obligations with regard to the use and disposition of TES, or of the tasks the vendor would complete from a regulatory perspective.

The Apparent Cause Review Team understands, based on discussions with TES vendors, that although TES were procured by the centralized corporate procurement team, the TES were delivered to local construction project sites. TES handling and return information was supposed to be included in each box or group of boxes containing new TES. However, GCs responsible for those projects, who were interviewed, did not recall seeing such information and, generally, only recalled that they had received some “atomic” or “nuclear” signs. Further, in several instances, it is not clear what became of surplus TES at the end of a construction project. No direction was provided to GCs regarding handling of these surplus TES. It was Wal-Mart's and the GCs' practice to treat excess materials at a store location as “surplus.” Neither Wal-Mart nor GC personnel recalled any exception being made if the “surplus” happened to be TES. The Apparent Cause Review Team believes that this contributing cause likely resulted in many of the TES being dispositioned without sufficient awareness and control.

Wal-Mart concludes that the above TES disposition possibilities are reasonable based on its document reviews, General Contractor interviews and interviews of its personnel. However, one of the options, "Unauthorized removal by a 'person' " may represent the most likely disposition due to the number of signs that Wal-Mart cannot locate. Wal-Mart believes that it is inevitable that some TES may have been disposed of in facility trash or inadvertently destroyed. It is likely that store personnel would have noticed or recalled noticing bulk disposal in trash. However, for those locations where large numbers of signs cannot be located, and considering the size of the Wal-Mart retail operation, the inadvertent disposal in trash option becomes less plausible. Since this apparent cause investigation did not identify any Wal-Mart associate or manager who recalled bulk trash disposal of TES, it becomes more likely that large numbers of the signs were taken from the facility without Wal-Mart's knowledge or permission.

Contributing Cause 5:

> *Failure of regulatory indicators to alert Wal-Mart, an entity unfamiliar with the nuclear industry, that it had direct regulatory obligations regarding rigorous management, oversight and disposition of TES.*

On December 18, 2000, the NRC issued, as a final rule, "Requirements for Certain Generally Licensed Industrial Devices Containing Byproduct Material." This rulemaking amended 10 C.F.R. Parts 30, 31 and 32 regulations governing the use of byproduct material in certain detecting, measuring, gauging, or controlling devices, and devices to produce light or an ionized atmosphere. TES were within the scope of the rulemaking. The amendments to 10 C.F.R. Part 31 include explicit provisions for a registration process, appointment of a contact point, requirements regarding transfer and reporting requirements, some of which pertain to the use of TES.[29] Issuance of the revised rule occurred at approximately the same time as Wal-Mart's decision to begin using TES.

On December 7, 2006, the NRC issued Regulatory Information Summary (RIS) 2006-25, which was issued to "All U.S. Nuclear Regulatory Commission (NRC) licensees distributing tritium exit signs and those possessing a tritium exit sign under a general license."[30] This document was in response to concerns expressed by the State of New Jersey and Commonwealth of Pennsylvania regarding possible improper disposal of TES. The stated purpose of the RIS was "to reiterate the requirements in 10 CFR § 32.51a that distributors of tritium exit signs must follow when transferring them to general licensees." It was also "intended to reiterate the requirements in 10 CFR § 31.5 for general licensees regarding transfer and disposal of the tritium exit signs."

While, in other situations, receipt of the RIS (in 2006) might have served as a "wake-up call" to inform a general licensee of it obligations and of the NRC's guidance, here, the inability to confirm distribution of the RIS challenges whether the NRC achieved its objective. Wal-Mart personnel do not recall receiving this RIS when issued. Because of Wal-Mart's mistaken belief that it had very limited responsibilities regarding TES and its resulting failure to develop appropriate organization-wide procedures, Wal-Mart did not know to inform store associates, GCs or electrical contractors of the applicable requirements or guidance.

The only regulatory documents any Wal-Mart associates recall receiving (although apparently, it was not reviewed) was the NRC's guidance to general licensees of TES, Volume 16 of NUREG-1556, Consolidated Guidance About Materials Licensees, Appendix L: Guidance on Self-Luminous Exits (Q&As), which was provided by Isolite during the April 21, 2004 meeting.

Because of the nature of regulatory programs associated with generally-licensed devices such as TES, there was no external regulatory mechanism to ensure that Wal-

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29 *See* Requirements for Certain Generally Licensed Industrial Devices Containing Byproduct Material, 65 Fed. Reg. 79162 (Dec. 18, 2000).

30 NRC Regulatory Issue Summary 2006-25, "Requirements for the Distribution and Possession of Tritium Exit Signs and the Requirements in 10 CFR 31.5 and 32.51a," December 7, 2006.

Mart timely developed a centralized corporate recognition of its obligations as a general licensee when it first embarked on its program to use TES.

General Observations:

Wal-Mart believes that, as a general matter, a large corporate entity considering using TES during the same time frame as issuance of a new rule governing TES would not necessarily understand the need to consult the then-new regulation or other regulatory guidance, or appreciate the potential consequences of failing to do so. From a quick review of the websites of several TES vendors, it appears that essentially no information is provided advising a prospective purchaser that it will become a general licensee of the NRC or, significantly, of the obligations the purchaser will assume. Subsequently, even when TES use was more commonplace at Wal-Mart, because of the way in which new-store and store-renovation procurement was handled, nothing would have directed Wal-Mart's corporate attention, as a novice general licensee, to Title 10 of the Code of Federal Regulations. Moreover, the NRC's general license program, at least with respect to TES, seems to be largely dependent on specific licensee manufacturers and distributors of TES (under 10 C.F.R. § 32.52) to inform the NRC of TES general licensee users to whom TES have been sold and transferred.

The Apparent Cause Review Team understands that the NRC's database of TES users, which is derived from that information, is, in turn, used to develop the address list used for dissemination of information to TES general licensee users. In the case of Wal-Mart, or other large general licensees who procure large numbers of TES for use at many local sites, it is the address of the local site, as the end-user, that is reported to the NRC. Thus, unless the corporate headquarters of a large organization such as Wal-Mart is itself an end-user whose name has been reported to the NRC,[31] it will not be an addressee of NRC information.[32] Consequently, it is critical that local store management be made aware that it may, from time-to-time, receive information from the

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[31] Although records reflect that one sample TES was sent to Wal-Mart Headquarters for the apparent purpose of evaluation by Wal-Mart for possible use of a new vendor's product, we were unable to determine if the vendor reported that to the NRC as a transfer and, therefore, the Headquarters' address was apparently not included in the NRC's database. Consistent with other information developed, it appears that the individual who obtained the sample, considered only whether the TES was suitable for purposes of complying with fire-code requirements, with no thought given to other regulatory implications

[32] While not likely affecting the outcome here, the completeness of the NRC's database is uncertain. For example, upon review of the NRC's database of TES specific licensees and the locations of signs as of mid-2008, it does not appear that the NRC's records of TES and associated general licensees are complete. (The NRC database of TES users (general licensees) was obtained in response to Freedom of Information (FOIA) Request 2008-0260, dated July 22, 2008. Information regarding Wal-Mart electrical subcontractors was obtained in response to FOIA 2008-0253.) Wal-Mart confirmed that the NRC's list on July 22, 2008 (the date of issuance in the FOIA response) contained fewer than 220 Wal-Mart and Sam's Club locations nationwide (out of over 1500 locations at which TES were located during Wal-Mart's current inventory effort). The list also does not include an address for Wal-Mart corporate offices in Bentonville, Arkansas, which would be responsible for disseminating TES information to all of its stores. Moreover, while NRC records of general licensees include the names of a number of electrical subcontractors that worked on Sam's Club stores, the database did not allow the Apparent Cause Review Team to determine whether any subcontractor actually received the RIS from the NRC.

NRC, and must be informed of what action is expected of them. In the case of Wal-Mart, for reasons discussed above, that did not occur until 2008.

In December 2008, the NRC published a Data Sheet regarding TES on the front page of its website in order to advise users of TES of the proper handling of those devices and applicable regulations. Although the NRC Data Sheet contains information useful to general licensees of TES, general licensees that are otherwise unaware of applicable regulations are not likely to monitor the NRC's website and therefore likely did not know that the Data Sheet had been issued and as a result, have not changed their TES-related practices.

NRC and state regulatory guidance regarding the use of TES does not appear to contemplate or address the acquisition and use of TES to the extent that existed at Wal-Mart — in terms of both absolute numbers of devices acquired and their geographic dispersal. While the provisions of 10 C.F.R. § 31.5 and the guidance in NUREG-1556 (and the analogous state provisions) can, perhaps, be readily implemented by general licensees who acquire just a few devices for use in perhaps just a few locations, the acquisition and use of over 79,000 TES in several thousand locations nationwide present special challenges that do not appear to have been anticipated by the NRC.

IX. Conclusion and Path Forward

Wal-Mart has undertaken a comprehensive and robust program to safely inventory and remove TES from all of its facilities in the United States and Puerto Rico and ensure compliance with all applicable regulatory requirements. As a part of that program, Wal-Mart ceased purchasing TES in 2007. In 2008, Wal-Mart revised its design guidelines and construction documents to prohibit the use of TES in any Wal-Mart facility. However, given the number of TES purchased between 2000 and 2007, and the size, varied layouts, and number of Wal-Mart properties, it is possible that a very small number of TES remain in Wal-Mart facilities. Therefore, Wal-Mart has developed a long-term TES management strategy comprised of continued communication, identification, tracking, reporting, and disposition and remediation, as necessary. The key components of this strategy are discussed below.

Communication & Identification

Over the next several years, it is important that Wal-Mart regularly communicate to its facilities that TES may still be in place, and what actions associates who discover TES must take. To that end, Wal-Mart had previously developed and issued a fact sheet on TES that shows what the signs generally look like, some key identifying features, and a number to call should TES be discovered. Additionally, the fact sheet describes a clean-up procedure should TES be broken in the immediate vicinity of associates.

To ensure that the information in this fact sheet is communicated regularly to all facilities, Wal-Mart will establish in its Environmental Management program as a twice-yearly task to automatically assign the RSO with direction to issue the communication by a specified date, with prescribed escalation to senior management should the RSO not complete the task. Wal-Mart will provide this communication over the next two years, and re-evaluate its need after that time. In order to determine effectiveness of this effort, the RSO will review latent TES identifications every six months to determine whether findings warrant adjustment of this approach.

As an additional identification effort, Wal-Mart will utilize Regional Compliance Managers who regularly conduct field compliance inspections to look for TES. At least twice a year, as these associates tour facilities on compliance assessment visits, they will have specific questions to answer on whether TES are present. These assessment visits, with the specific questions, will be yet another way to identify TES that may have been overlooked in the initial inventory and remove/replace effort.

Tracking & Reporting

As discussed and described earlier in this report, Wal-Mart developed and implemented the TES Management System, a robust database referenced throughout this report, for managing its TES project. This system will remain live for at least the next two years, allowing Wal-Mart to track and report on found, missing, and damaged TES over that period. This system will ensure that all applicable reporting requirements are identified, and appropriate notifications made. Wal-Mart will assess the need to continue this effort beyond two years at a later time.

Disposition & Remediation

In the event that additional TES are discovered, Wal-Mart will need to return the TES to Isolite. Additionally, if TES are critically damaged such that containment is breached, there will be a need to survey for potential contamination, remediate as necessary, and provide the opportunity for bioassays for potentially exposed individuals. To this end, Wal-Mart will retain the services of its key RRT organizations (*e.g.*, environmental, health physics and legal) to provide support in this area. For example, Wal-Mart recently discovered additional TES after the close of the inventory and R&R phases of TESIP. Wal-Mart directed Shaw to package and ship the TES to Isolite, and Dade Moeller to disposition the damaged TES, consistent with existing TESIP protocols. Wal-Mart anticipates responding to future discoveries of TES in a similar manner.

Finally, in an effort to keep TES from being used in future projects and introduced into our facilities, our design guidelines and construction documents now prohibit the use of TES. The above processes will ensure that Wal-Mart has the appropriate systems and people in place to properly manage TES over the next several years, until any remaining TES are located and dispositioned.