



Tennessee Valley Authority, 1101 Market Street, Chattanooga, Tennessee 37402

July 11, 2013

U.S. Nuclear Regulatory Commission, Region I
ATTN: Blake D. Welling, Chief
Materials Security & Industrial Branch
Division of Nuclear Materials Safety
2100 Renaissance Blvd., Suite 100
King of Prussia, Pennsylvania 19406-2713

Tennessee Valley Authority

Material License Nos. 01-06113-04, 41-08165-08, ~~41-06832-06~~, ~~01-25207-01~~,
~~41-25219-01~~, ~~16-25243-01~~, 01-25284-01, and 41-08165-18
Docket Nos. 030-03572, 030-09944, 030-17797, 030-32822, 030-32925,
030-33122, 030-33440, and 030-35695

Subject: **Nuclear Regulatory Commission Request for Additional Information Dated June 5, 2013, Control Nos. 580457, 580463, 580461, 580466, 580467, 580460, 580458, and 580464**

- References:
1. Letter from TVA to NRC, "Tennessee Valley Authority's By-Product Material Licenses," dated April 11, 2013
 2. Letter from NRC to TVA, "Tennessee Valley Authority, Request for Additional Information Concerning Letter Dated April 11, 2013, Control Nos. 580457, 580458, 580460, 580461, 580463, 580466, 580467, and 580464," dated June 5, 2013

The purpose of this letter is to provide the information requested in the Nuclear Regulatory Commission's (NRC) letter dated June 5, 2013 (Reference 2). In Reference 2, the NRC requested that Tennessee Valley Authority (TVA) reply within 30 calendar days from the date of the letter. Although the NRC letter was dated June 5, 2013, it was postmarked June 20, 2013, and was received at TVA on June 24, 2013. In a telephone conversation on July 3, 2013, between Kathy Modes and Craig Gordon, NRC, and Jay Henson, TVA, it was agreed that the due date for the response would be extended to July 12, 2013.

Responses to the four items in Reference 2 for which additional information was requested are provided in the enclosure. As stated in the TVA letter dated April 11, 2013 (Reference 1), TVA will monitor individual external doses as required by 10 CFR 20.1502 with National Voluntary Laboratory Accreditation Program (NVLAP) accredited dosimeters (film badge, thermoluminescent dosimeter (TLD), optically stimulated luminescence (OSL) dosimeter, etc.)

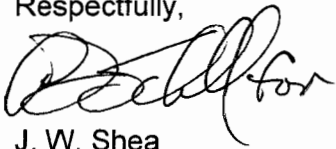
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that will be processed by a NVLAP-accredited entity. TVA is requesting that NRC authorize a semi-annual dosimeter exchange frequency for all monitored individuals except those individuals conducting radiography (e.g., radiographers and radiographer's assistants). Individuals conducting radiography will continue to exchange their OSL dosimeters on a quarterly basis.

Should you have any questions regarding this letter, please contact Lee Miller at (423) 751-3197.

Respectfully,

A handwritten signature in black ink, appearing to read "J. W. Shea", is written over the typed name.

J. W. Shea
Vice President, Nuclear Licensing

Enclosure: Response to Request for Additional Information

cc (Enclosure):

NRC Document Control Desk

ENCLOSURE

RESPONSE TO REQUEST FOR ADDITIONAL INFORMATION

NRC RAI Item 1

You indicated that the optically-stimulated luminescent (OSL) dosimeters will be used on a six-month exchange frequency. We note that dosimeters (including OSLs) may lose information over time, and would not find a six-month interval appropriate if such information loss results in reported doses being less than actual doses received. For the OSL dosimeters to be used, please confirm the NVLAP accreditation includes the proposed exchange interval, and ensures that reported doses are unaffected throughout the six-month reporting period.

TVA Response:

The National Voluntary Laboratory Accreditation Program (NVLAP) accredited OSL dosimeter supplier, Landauer, stated that their OSL dosimeters do not have an issue with loss of information over time (i.e., fade). In Attachment 1, Landauer referenced International Electrotechnical Commission (IEC) standard, IEC 62387, as providing a good technical basis and guidance for the appropriate level of fade over a monitoring period. Landauer stated that their $\text{Al}_2\text{O}_3:\text{C}$ (OSL) radiation detector complies with the IEC 62387 performance criteria as it relates to fade for weekly, monthly, quarterly, semi-annual, and annual frequencies.

NRC RAI Item 2

You state that the external dose monitoring results have demonstrated the effectiveness of the procedures in limiting occupational external doses. For the purpose of changing the monitoring frequency for the licenses authorizing use of fixed gauges and service provider activities, a prospective evaluation should be performed for each type of license on the doses workers could receive while engaged in licensed activities, including non-routine maintenance activities or activities where there is a potential for higher dose rates.

The guidance shown in Appendix J, NUREG-1556, Volume 4, "Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Fixed Gauge Licensees," and in Appendix L, NUREG-1556, Volume 18, "Consolidated Guidance About Materials Licenses: Program-Specific Guidance About Service Provider Licensees" may be helpful in determining the basis for the dosimetry program changes. The prospective evaluations should include a dosimetry evaluation (for fixed gauges, a dose calculation as shown in Table J.1 of the NUREG document), the highest annual whole body exposures for the past five years, and a trend analysis of actual exposures to those individuals involved in each activity. Please do not identify the person's name, only the year, the highest annual whole body exposure recorded, and the respective license number. For the trend analysis, you may provide a summary of the dose distribution for the number of monitored personnel.

TVA Response:

A table that provides the highest and average annual doses received by individuals who are monitored at seven of the TVA materials licensees is included as Attachment 2. Dosimetry results are not provided for the radiography license, License No. 41-06832-06, because TVA is not requesting a change in the exchange frequency for dosimeters worn by radiographers and radiographer assistants.

A prospective evaluation discussion for the doses individuals have received while performing licensed activities under the seven materials licenses follows:

NRC License No. 01-06113-04 Docket No. 030-03572

Western Area Radiological Laboratory, Muscle Shoals, AL

Service licensee: Instrument calibration and sample analysis

The Instrument Calibration Technicians work with the high dose rate calibration source contained in the well irradiator and other lower activity calibration sources. As listed in Attachment 2, the dosimetry results for these individuals have historically indicated no one has received an annual external dose greater than 37 millirem and the average dose has been less than 5 millirem. In some years they have received no dose. The doses received in 2009, 2010, and 2011 were most likely due to the performance of non-routine maintenance on the high dose rate calibrator. Non-routine maintenance required the workers to spend more time in the exposure room, with the source in the fully shielded position, than routinely required. Measured dose rates near the high dose rate calibration irradiator are 1.5 mrem/hour when the source is in the maximally shielded position. On occasion, non-routine maintenance requires the remote transfer of the high dose rate source from the well irradiator to a temporary storage pig. The maximum dose rate measured from the surface of the storage pig that could contribute to a whole body dose is 5 mrem/hour. Workers performing non-routine maintenance control their work activities to reduce the amount of time spent in close proximity to the well irradiator or the source pig. Workers who enter the exposure room for purposes other than non-routine maintenance are usually performing periodic surveys or similar activities and are only in the room for a few minutes.

Doses to workers performing non-routine maintenance in the high dose rate exposure room are maintained "As Low As Reasonably Achievable" (ALARA) by ensuring the high dose rate source is in its maximally shielded position before work begins, the use of area radiation monitors which alarm above a preset radiation level, the performance of radiation surveys in the room before the start and during the performance of non-routine maintenance to ensure dose rates are at expected levels, and the wearing of electronic alarming dosimeters by workers performing non-routine maintenance or present in the high dose rate exposure room during the conduct of non-routine maintenance.

Instrument Calibration Technicians spend up to 20 hours a week in the calibration room, which is outside of the shielded high dose rate exposure room. Dose rates in the calibration room may be as high as 0.2 mrem/hour. The exposure level depends on the individual's location in the room and the frequency of use of the high dose rate calibration source. A conservative estimate of the potential dose received in a year would be 208 mrem ($0.2 \text{ mrem/hour} \times 20 \text{ hours/week} \times 52 \text{ weeks/year}$). As shown by the dosimetry results for the last five years, worker doses have been well below 208 mrem/year.

The dosimetry results for the last five years for the Laboratory Technicians performing sample analysis have been 0 mrem/year. Dose rates in their work area may be as high as 0.1 mrem/hour. The exposure level depends on the individual's location in the room and the frequency of use of the calibration sources in the adjacent work areas. A conservative estimate of the potential dose received in a year would be 182 mrem ($0.1 \text{ mrem/hr} \times 35 \text{ hours/week} \times 52 \text{ weeks per year}$).

NRC License No. 01-25207-01 Docket No. 030-32822

Widows Creek Fossil Plant, Stevenson, AL

Fixed gauges

As listed in Attachment 2, the dosimetry results for the Instrument Technicians who perform routine operations and maintenance as well as non-routine maintenance routinely receive 0 mrem/year. In 2009, one individual had a reported dose of 11 millirem and the other forty-six monitored individuals had no dose reported for the year. The Radiation Safety Officer (RSO) noted that 16 fixed gauges were removed from service and most were reinstalled that year.

Instrument Technicians are trained to use ALARA principles (time, distance and shielding) when performing routine and non-routine operations and maintenance. The gauge shutter is closed when routine operations and maintenance are performed that could potentially result in exposure to increased levels of radiation (e.g., work near the detector or gauge). Non-routine operations and maintenance are not performed frequently (e.g., routinely one or two times per year). The RSO or a member of the radiation safety organization is present when non-routine operations and maintenance are performed. The RSO and radiation safety personnel ensure the shutter has been closed and locked and perform surveys of the gauge and work area to ensure doses are at expected levels before, during and after the work is completed. Instrument Technician handling of the gauges during non-routine operations and maintenance is limited by the use of chain fall hoists when removing and installing gauges. The time spent in close proximity (e.g., approximately one foot) to the gauge during non-routine operations and maintenance is a few minutes and depending on the gauge design and activity, the potential doses will vary. A conservative estimate of the potential yearly dose based on the highest dose measured around a gauge, a routine exposure time of 30 minutes to remove and re-install a gauge, and the conduct of this activity twice per year, is 6 millirem ($6 \text{ mrem/hour} \times 30 \text{ minutes}/60 \text{ minutes per hour} \times 2/\text{year}$).

NRC License No. 01-25284-01 Docket No. 030-33440

Mixed Waste Facility, Muscle Shoals, AL

Low level radioactive waste storage

As listed in Attachment 2, the dosimetry results for the Waste Handlers who receive, ship, and store the drums of mixed waste at the Mixed Waste Facility indicate the workers have received 0 mrem/year for the last five years. The measured dose rates on the drums are less than or equal to 0.1 mrem/hour and workers are in close proximity to each drum during handling for approximately two minutes. Generally, less than twenty mixed waste drums are received and stored each year. A conservative estimate of the potential annual dose a worker could receive handling 20 drums a year would be 0.067 mrem ($0.1 \text{ mrem/hour} \times 2 \text{ minutes}/60 \text{ minutes/hour} \times 20 \text{ drums/year}$).

NRC License No. 16-25243-01 Docket No. 030-33122

Paradise Fossil Plant, Drakesboro, KY

Fixed gauges

As listed in Attachment 2, the dosimetry results for the Instrument Technicians who perform routine operations and maintenance as well as non-routine maintenance routinely receive 0 mrem/year.

Instrument Technicians are trained to use ALARA principles (time, distance and shielding) when performing routine and non-routine operations and maintenance. The gauge shutter is closed when routine operations and maintenance are performed that could potentially result in exposure to increased levels of radiation (e.g., work near the detector or gauge). Non-routine operations and maintenance are not performed frequently (e.g., routinely one or two times per year). The RSO or a member of the radiation safety organization is present when non-routine operations and maintenance are performed. The RSO and radiation safety personnel ensure the shutter has been closed and locked and perform surveys of the gauge and work area to ensure doses are at expected levels before, during and after the work is completed. Instrument Technician handling of the gauges during non-routine operations and maintenance is limited by the use of chain fall hoists when removing and installing gauges. The time spent in close proximity (e.g., approximately one foot) to the gauge during non-routine operations and maintenance is a few minutes and depending on the gauge design and activity, the potential doses will vary. A conservative estimate of the potential yearly dose based on the highest dose measured around a gauge, a routine exposure time of 30 minutes to remove and re-install a gauge, and the conduct of this activity twice per year, is 1.5 millirem ($1.5 \text{ mrem/hour} \times 30 \text{ minutes}/60 \text{ minutes per hour} \times 2/\text{year}$).

NRC License No. 41-08165-08 Docket No. 030-09944

Power Services Shop and Bulk Material Storage Building, Muscle Shoals, AL

Repair, decontamination, testing and storage of contaminated reactor components

As listed in Attachment 2, the dosimetry results for the Equipment Technicians who perform repair, decontamination, testing and storage of contaminated reactor components routinely receive on average less than one millirem per year with a maximum less than 25 mrem/year.

Most components arrive at the site with minimal contamination and dose rates of approximately 0.1 mrem/hour from the package. Occasionally a component arrives with package dose rates between 5 and 10 mrem/hour. Workers on these components could potentially receive up to 25 mrem for the duration of the job. A more precise estimate of potential dose is difficult due to the variety of components, various levels of contamination, and the type of work performed on the components.

Individuals who work on contaminated equipment at the Power Services Shop (PSS) and the Bulk Material Storage Building (BMSB) work in contamination controlled zones (C-zone) or radiation controlled areas (RCA). C-zone work requires the donning of protective clothing and gloves to protect against worker contamination. The PSS occupational exposures are minimized by requiring the nuclear sites to decontaminate the equipment at their facility as much as practical before sending it to the PSS. Radiation safety personnel survey the components when they are received to ensure contamination and dose rates are at expected levels. Component surfaces are also surveyed as they are exposed during disassembly to ensure contamination and ALARA precautions are adequate. The PSS work practices and training supports adequate contamination control and the maintenance of worker dose at ALARA levels.

NRC License No. 41-08165-18 Docket No. 030-35695

Central Laboratory Services, Chattanooga, TN

Contaminated equipment repair, testing, inspection, and storage and liquid sample analysis

As listed in Attachment 2, dosimetry has not been issued to the Laboratory Technicians working under this NRC license. Based on surveys and an assessment of the work activities, the RSO has determined that monitoring of worker doses with whole body dosimeters is not required.

NRC License No. 41-25219-01 Docket No. 030-32925

Cumberland Fossil Plant, Cumberland City, TN

Fixed gauges

As listed in Attachment 2, dosimetry results for the Instrument Technicians who perform routine operations and maintenance as well as non-routine maintenance routinely receive 0 mrem/year.

Instrument Technicians are trained to use ALARA principles (time, distance and shielding) when performing routine and non-routine operations and maintenance. The gauge shutter is closed when routine operations and maintenance are performed that could potentially result in exposure to increased levels of radiation (e.g., work near the detector or gauge). Non-routine operations and maintenance are not performed frequently (e.g., routinely one or two times per year). The RSO or a member of the radiation safety organization is present when non-routine operations and maintenance are performed. The RSO and radiation safety personnel ensure the shutter has been closed and locked and perform surveys of the gauge and work area to ensure doses are at expected levels before, during and after the work is completed. Instrument Technician handling of the gauges during non-routine operations and maintenance is limited by the use of chain fall hoists when removing and installing gauges. The time spent in close proximity (e.g., approximately one foot) to the gauge during non-routine operations and maintenance is a few minutes and depending on the gauge design and activity, the potential doses will vary. A conservative estimate of the potential yearly dose based on the highest dose measured around a gauge, a routine exposure time of 30 minutes to remove and re-install a gauge, and the conduct of this activity twice per year, is 3 millirem (3 mrem/hour X 30 minutes/60 minutes per hour X 2/year).

NRC RAI Item 3

In addition, for each licensed activity please confirm that the six-month exchange frequency will be evaluated at the time of the annual program review in accordance with 10 CFR 20.1101(c), to ensure this practice is effective and personnel exposures are maintained ALARA.

TVA Response:

The dosimetry results obtained from a six-month exchange frequency will be reviewed and assessed during the annual program review as has been done in previous years for a three-month exchange frequency to continue to ensure that dosimeter use is effective and personnel exposures are maintained ALARA. During the annual review for each materials license, the RSO reviews and assesses the dosimetry results to identify any unexpected results or differences in the results from previous years to ensure dosimeter use has been effective and that personnel exposures are maintained ALARA. The RSO assesses the dosimetry results and other program information such as surveys and changes in work activities to determine the cause of any significant differences.

NRC RAI Item 4

Our records show the following mailing addresses for the licenses identified above.

For License No. 41-08165-08, the mailing address is listed as:
Tennessee Valley Authority
Chief Nuclear Officer and Executive Vice President
TVA Nuclear
1100 Market Street, LP 6A-C
Chattanooga, TN 37402-2801

For License No. 01-25284-01, the mailing address is listed as:
Tennessee Valley Authority
VP, Environmental Science & Resource
P.O. Box 1010
Muscle Shoals, AL 35662-1010

For License No. 01-06113-04, the mailing address is listed as:
Tennessee Valley Authority
TVA Nuclear
LP 3D-C
1101 Market Street
Chattanooga, TN 37402-2801

To allow proper receipt of NRC correspondence by you and the Radiation Safety Officers listed on the licenses, please let us know whether these addresses are correct or provide the most current address for each license.

TVA Response:

The correct mailing address for all TVA materials licenses is:

Tennessee Valley Authority
Vice President, Nuclear Licensing
LP 3D-C
1101 Market Street
Chattanooga, TN 37402-2801

TVA Corporate Nuclear Licensing personnel forward license documents and information to the RSO for each license.

Attachment 1

Landauer Letter Dated July 2, 2013

LANDAUER

July 2, 2013

Christopher N. Passmore
Vice President – Technical Services
Landauer, Inc.
2 Science Road
Glenwood, Illinois 60425-1586

Betsy Langille, CHP
Program Manager, Fleet RP Technical Programs
Nuclear Power Group Governance and Oversight
Tennessee Valley Authority
BR 3C-C
1101 Market St
Chattanooga, TN 37402-2801

Subject: $Al_2O_3:C$ Radiation Detector's Fade Characteristics

Dear Ms. Langille,

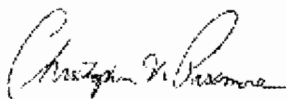
Landauer's $Al_2O_3:C$ radiation detector experiences minimal signal loss after irradiation. $Al_2O_3:C$ dosimetric traps retain the electrons in the dosimetric traps for much longer periods of time than compared to other radiation detectors (LiF:Mg, $CaSO_4:Tm$, or $Li_2B_4O_7:Cu$). This intrinsic property of $Al_2O_3:C$ means that the dosimeter can be worn for extended periods of time without the need to correct for the loss of signal over time due to fading.

$Al_2O_3:C$ fade has been measured to be approximately 4% 356 days post irradiation. In contrast, the fade for other commonly used radiation dosimeters are between 5 – 15% 90 days post irradiation (LiF:Mg 15%, $Li_2B_4O_7:Cu$ 10%, and $CaSO_4:Tm$ 5%).

The International Electrotechnical Commission (IEC), in standard IEC 62387, indicates acceptable relative response limit for fade over a wear period is within the interval from 0.91 to 1.11. Although this standard is not widely used in the United States it does provide a good technical basis and guidance for the appropriate level of fade over a monitoring period. Landauer's $Al_2O_3:C$ radiation detector complies with the IEC 62387 performance criteria as it relates to fade for weekly, monthly, quarterly, semi-annual, annual frequencies.

If you have any questions regarding this letter you can contact me at 708-441-8455 or by email at cpassmore@landauerinc.com.

Sincerely,



Christopher N. Passmore, CHP
Vice President, Dosimetry Services & Client Experience

Attachment 2

Dosimetry Results for TVA Materials Licensees

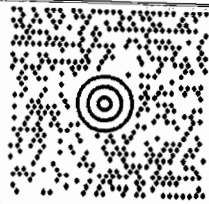
Dosimetry Results for TVA Materials Licensees

Licensee No./Docket No. Licensed Activity/Use	Worker Activity Group	Highest/Average Annual Dose (millirem) [Number Monitored]				
		2012	2011	2010	2009	2008
01-06113-04/030-03572 Service licensee: Instrument calibration and sample analysis	Instrument Calibration Tech	0/0 [24]	37/4.88 [16]	21/4.1 [10]	14/1.27 [11]	0/0 [10]
	Laboratory Technician	0/0 [4]	0/0 [4]	0/0 [5]	0/0 [5]	0/0 [6]
01-25207-01/030-32822 Fixed gauges	Instrument Technician	0/0 [31]	0/0 [40]	0/0 [41]	11/0.23 [47]	0/0 [28]
01-25284-01/030-33440 Low level radioactive waste storage	Waste Handlers	0/0 [3]	0/0 [4]	0/0 [6]	0/0 [5]	0/0 [5]
16-25243-01/030-33122 Fixed gauges	Instrument Technician	0/0 [9]	0/0 [7]	0/0 [7]	0/0 [7]	0/0 [15]
41-08165-08/030-09944 Repair, decontamination, testing and storage of contaminated reactor components	Equipment Technician	15/0.11 [134]	10/0.07 [149]	21/0.48 [142]	0/0 [82]	23/0.55 [73]
41-08165-18/030-35695 Contaminated equipment repair, testing, inspection, and storage and liquid sample analysis	Laboratory Technician	NA*	NA*	NA*	NA*	NA*
41-25219-01/030-32925 Fixed gauges	Instrument Technician	0/0 [9]	0/0 [7]	0/0 [12]	0/0 [12]	0/0 [14]

* Dosimeters are not required based on Radiation Safety Officer assessments of exposure levels and work activities.

SHIP TO:

BLAKE D. WELLING-CHIEF
USNRC- PRUSSIA-PA
MATERIALS SECURITY & IND. BRANCH
2100 RENAISSANCE BLVD
KING OF PRUSSIA PA 19406-2723



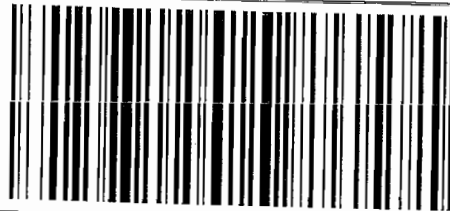
PA 193 9-02



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Short Code: 0002JQC

Reference # 2: LP3D JOE SHEA

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Joe Shea x4876
LP4B-C 0002JQC

Tennessee Valley Authority

1101 Market Street, Chattanooga, Tennessee 37402-2801

U.S. Nuclear Regulatory Commission, Region I

ATTN: Blake D. Welling, Chief

Materials Security & Industrial Branch

Division of Nuclear Materials Safety

2100 Renaissance Boulevard, Suite 100

King of Prussia, Pennsylvania 19406-2713

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2100 RENAISSANCE BLVD

KING OF PRUSSIA PA 19406-2723

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Express Envelope

This is to acknowledge the receipt of your letter/application dated

7/11/13, and to inform you that the initial processing which includes an administrative review has been performed.

New/Term/Amend (03038667, 03038668, 01-06113-04
☒ There were no administrative omissions. Your application was assigned to a technical reviewer. Please note that the technical review may identify additional omissions or require additional information. 01-25284-01, 41-08165-08
41-08165-8

☐ Please provide to this office within 30 days of your receipt of this card

A copy of your action has been forwarded to our License Fee & Accounts Receivable Branch, who will contact you separately if there is a fee issue involved.

581347, 581348, 581354, 581357
Your action has been assigned Mail Control Number 581345, 581346,

When calling to inquire about this action, please refer to this control number.

You may call us on (610) 337-5398, or 337-5260.