



U.S. DEPARTMENT OF
ENERGY

Nuclear Energy

Dosimetry DOELAP Assessor Training

Review of Findings

Salt Lake City, UT
September 24, 2012

■ Twelve Main Requirement Sections

- General – 5
- Personnel – 20
- Equipment and Facility – 13
- Quality Assurance – 9
- Dosimeters – 17
- Luminescent Dosimeter – 16
- Track Etch Dosimeter – 17
- OSL Dosimeter – 19
- Calibration – 4
- Processing – 15
- Reports – 2
- Testing - 2

Perform the Assessment Day 1 Evening Activities

■ Assessment Team

- Discusses findings
- Agree on priority of findings (Deficiency, Concern, Observation or Noteworthy Practice)
- Draft report
- Identify areas for verification of factual accuracy, follow-up and further investigation (might want to prepare informal plan)

■ Deficiency

- This is reserved for any aspect of the DOELAP program that an assessment team believes prevents the program from functioning competently. A deficiency will either suspend or revoke a current accreditation or suspend a new application for accreditation until the deficiency has been remediated.
- Failing proficiency testing in two consecutive sessions
- A remedial action plan is required
- A remedial action plan is required within 45 days of closeout meeting and should be corrected within 60 days of the closeout meeting.
- Remediation may be confirmed by an assessment team



Perform the Assessment Finding Categorization (continued)

■ Concern

- Deviation from DOELAP standard requirements that does not adversely affect the quality of the program. One or more concerns will not affect a program's accreditation; however, any concern not remediated by a program's next accreditation cycle will automatically be elevated to a deficiency thereby preventing the renewal of accreditation.
- Multiple concerns may be combined and elevated to a deficiency
- A remedial action plan is required within 45 days of closeout meeting

Perform the Assessment Finding Categorization (continued)

■ Observation

- This is either a suggested improvement that a DOELAP program may incorporate at its own discretion or the highlighting of a noteworthy practice. The suggestion is offered to help “fine tune” a program.
- No written response is required.

Perform the Assessment Upgrading Previous Concerns

■ Evaluate whether to:

- 1) upgrade an unresolved concern to a deficiency, or
- 2) identify a new concern through an explanation of extenuating circumstances.

■ The Oversight Board has the discretion to recommend a concern be elevated to a deficiency.

■ Assessment Findings, Categorization, and Corrective Actions

- Your Responsibility:
 - Given a finding, categorize it as an observation, concern, or deficiency
 - If a concern or deficiency, tie the finding to a requirement in the assessors checklist
 - Determine if site corrective action plan/response is adequate to close the finding
- What would you look for during the site assessment

Writing Tips

- Each finding should stand on its own merits.
- Put the major issue up front.
- Do not worry about upsetting the participant. Don't write the excuses for a finding.
- Ensure the write-up is complete and that a person who is not involved with the assessment (i.e. STM) can understand the issue from the write-up.

Finding #1

- The reassignment of the Dosimetry technician has resulted in a shortage of staff within the PARTICIPANT's external dosimetry program. The duties of the Dosimetry Technician have been assumed by the External Dosimetrist with limited support from the Internal Dosimetrist and Technical Advisor (IDHP). In addition to limited support provided to the external dosimetry program, the IDHP is responsible for the bioassay program. This has resulted in the External Dosimetrist creating the required documentation and in some cases performing the peer review. This is not in accordance with the requirements of the Quality Assurance Plan and implementing procedures.

Finding #1, Continued

- This allocation of the professional resources creates an error likely condition with the implementation of the dosimetry and quality program. It also creates a program implementation vulnerability should the External Dosimetrist become unavailable as routine or non-routine operations could not be performed. This issue was identified at the concern level in 2008 and 2010 DOELAP assessments. The PARTICIPANT corrected the concerns identified in the previous DOELAP assessments per the approved corrective action plans. However, the recurring nature of staffing resource allocation, and the subsequent impact on the program, is significant enough to warrant a deficiency.



Finding #1, Criteria:

■ Category – DEFICIENCY

- P.4: The individual who has technical responsibility must ensure all dosimetry data are approved.
- P.7: All personnel dosimetry program staff members must be familiar with and implement the documented quality control program.

Finding #1 Response:

The Prime Contractor recognizes the recurring concern and need for support of the external dosimetry program. The qualified and trained Dosimetry Technician currently is temporarily assigned to lead the ISMS (Integrated Safety Management System) certification process.

Action: The qualified and trained Dosimetry Technician will be reassigned to the Dosimetry Office. In addition to the reassignment of the Dosimetry Technician back to the Dosimetry Lab, three other individuals within the Radiological Controls Department will be trained to a lower level to assist and support in situations when staffing may be inadequate due to unexpected circumstances. Having other personnel trained will allow the Dosimetry Program to function without violating the Quality Assurance Plan or operating procedures.

■ Finding #2

- The 2009 DOELAP onsite assessment identified a concern related to the PARTICIPANT's dosimeter card configuration that uses a 0.015-inch TLD-700 element in position 3 under the Mylar filter. The Harshaw 8825 algorithm was developed for a thinner 0.006-inch element in this position. Using the Harshaw 8825 algorithm with the PARTICIPANT's card configuration introduces a large negative bias into the shallow dose equivalent calculated for low energy beta radiation fields. PARTICIPANT's corrective action was to pursue algorithm modifications with the vendor that would develop new fundamental data and equations to properly calculate doses for the dosimeter configuration being used. Technical discussions with the dosimetry vendor were held, but the vendor eventually declined to make the changes to the algorithm. While the PARTICIPANT's DTL has made some changes to the dose calculation algorithm to better handle the 85Kr test radiation field, and these changes were used to report DOELAP performance test results, the process is neither formally documented nor under configuration control. The changes must be reviewed, documented and incorporated into implementing procedures. (CA, PR6, PR7, T.1)



■ Finding #2:

- Category - DEFICIENCY

■ CA:

- 1) Calibration and verification for dosimetry systems must be outlined in the QA manual. The manual must identify the calibration services, reference materials, and measurement assurance programs used.
- 2) Dosimetry systems must be calibrated to known doses from radioactive sources or radiation-generating machines. The calibration facility radiation fields must be measured with calibrated instruments. Instrument calibrations must be traceable to national standards or based on the measurement of activity of a source. In the latter case, the source must be traceable to primary radiation standards. Care must be taken to maintain a standard source geometry.
- 3) Calibration protocols used must be appropriate for the sources of radiation at the facility and the potential exposure levels.
- 4) The energy response of each type or model of dosimeter must be characterized by calibrating each model for all appropriate radiation categories. The dosimeter response must be determined over the exposure range for which it is to be used.



■ Finding #2: Criteria continued:

- Category - **DEFICIENCY**
- PR6: The algorithm must be satisfactorily documented to indicate its validity for dose interpretation. Documentation must indicate:
 - The algorithm was created and tested using fundamental data that are retrievable.
 - The uncertainty analysis of the algorithm characterizes the precision and accuracy of the dose interpretation to the dosimeter.
 - Process controls were considered and documented when the algorithm was developed.
 - The attributes and limitations of the algorithm are documented.

Finding #2: Criteria continued:

- Category – **DEFICIENCY**
- PR7: Computational models or algorithms for calculating dose from raw data must be adequate for the processor's dosimetry system.
- T.1 : Protocols for proficiency testing in accordance with the DOE Standard must be defined. They must be consistent with routine processing procedures.

Finding #2 Response:

The PARTICIPANT dosimetry documented the dose calculation methodology calculating doses resulting from exposure in a mixed photon and low energy beta field into an approved document titled Documentation of Shallow Dose calculation in a Mixed Photon Beta Radiation Field using the PARTICIPANT Harshaw 8825 Dosimeter. The document is attached. The current dose calculation procedure, PARTICIPANT 12-051339 was revised to include the steps necessary to calculate doses from a mixed photon and low energy beta field as outlined in the documentation. The revised procedure is attached.

Finding #3:

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After processing the dosimeters, Landauer will be sending the PARTICIPANT a file with the dose results and associated dose calculation parameters. While Landauer was able to provide dose files containing beta/gamma doses, files containing neutron doses, CR-39 and OSLN, were not available for review. Since the PARTICIPANT also retains the option to request specific background subtractions for off-cycle dosimeters, and Facility Neutron Correction Factors be applied for specific groups or individuals, this is a particularly important step and needs to be tested and verified before actual field dosimeters are processed. (P.3) (D14).



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- Category - **DEFICIENCY**
- P.3: The individual who has technical responsibility must generally exhibit adequate technical knowledge and management control for personnel dosimetry.
- D.14: Information available concerning processed dosimeters should include:
 - Radiation type
 - Dose definition (terminology)
 - Responsibility for handling the dose of record
 - Calibration procedures used in dose determination
 - Quality control
 - Special processing procedures to be used as part of the dosimetry service
 - Directions for handling and using background control dosimeters
 - Identifying anomalies noted during processing



Finding #3 Response:

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- The file transfer interface between PARTICIPANT and Landauer is divided into to 3 sections:
 - An Active Dosimetry User file is sent to Landauer for dosimeter assignment and labeling.
 - An Assignment {Packing list) file is returned to PARTICIPANT from Landauer for creating issue records in the Doc2.0 database.
 - Dose (DCI) file is returned to PARTICIPANT from Landauer for dose assignment. This file completes the issue record by populating the dose fields and closes the completed record.
 - a. The Active Dosimetry User File sent by PARTICIPANT to Landauer has already been demonstrated and the interface is working correctly:
 - b. The Assignment {Packing list) file will be provided by Landauer in the proper format per the Argonne File Layouts document version 1.10, tested by PARTICIPANT before June 22, 2012, and documentation forwarded to the STM by June 29, 2012.



Finding #3 Response continued:

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- c. The Dose {DCI) file will be provided by Landauer in the proper format per the Argonne File Layouts document version 1.10, tested by PARTICIPANT before June 22, 2012, and documentation forwarded to the PEPA by June 29, 2012.
- Dose file from Landauer will be transferred using the routine file transfer process. Landauer to provide document stating doses have been reviewed.
 - Dose file will be reviewed, posted to the Doc2.0 database and approved per procedure EDG-206, Dose Assignment & Posting.
- Periodic testing of the interface between Argonne and Landauer will continue until DOELAP Accreditation is approved.

Finding #4:

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- A list of equipment and facilities is required to be made available for review at the time of the assessment. The complete list of equipment is currently under negotiation by both the head contractor and the PARTICIPANT with a current scheduled completion date of 9/30/20xx. Although the majority of the equipment being transferred is known, the final list has not been documented and transfer has not been formally completed. Failure to provide a complete equipment list is considered deficient.

Finding #4: Criteria

- Category - **DEFICIENCY**
- E.1: A list and description of the facilities and equipment used in all the processing protocols for which accreditation is requested must be available in the laboratory. The list allows the facilities and equipment to be correlated with calibration records.

Finding #4 Response:

As stated in the report, the equipment list was scheduled for completion on September 30, 20xx. At the conclusion of the onsite assessment, head contractor and the PARTICIPANT accelerated completion of the equipment list. The list of equipment to be transferred to the PARTICIPANT from the head contractor as agreed to by the head contractor is now finalized and provided in Appendix B as objective evidence that deficiency #2 has been resolved. All equipment and instrumentation will be managed in accordance with Property Management Processes, MSC-PRO- 13 3, that describes the proper transfer and management of government owned property.

Finding #5: Observation

- An excellent and comprehensive study of neutron spectra for a variety of californium source configurations in the modified low scatter room of the Radiation Calibration Laboratory was performed following the failure of the Panasonic UD-810 in DOELAP performance testing. As a result, the room is now very well characterized. The response to the performance test failure demonstrates the PARTICIPANT's management's commitment to the external dosimetry program, and is a noteworthy practice.



Finding #6:

Nuclear Energy

- The management system for resolving QA concerns identified through internal audits and internal dosimeter performance testing appears to be ineffective (Q3). During 2010 and 2011, the existing Harshaw LiF:Mg,Ti TLD chip population used for the Landauer U-Ring was gradually replaced with new chips manufactured by TLD Poland. Although procurement specifications attempted to match the sensitivity of the existing Harshaw material, the characterization testing of the new material performed by Landauer before release of the new chips for production use failed to detect a significant difference in sensitivity chips for production use failed to detect a significant difference in sensitivity from the existing Harshaw population.



Finding #6: Continued.

- The difference became evident as a 20% low bias in QA dosimeter performance with both LDR and PNNL irradiated ring audit dosimeters and is also evident in DOELAP performance test results. The decision to begin using the Poland material for production use was based on an inadequate testing to characterize the new material's response. The need to better characterize the material was identified in internal assessments performed in 3/17/2009, 11/11/2010 and 10/4/2011 yet no action was taken. The management process for resolving QA concerns identified through audits and performance testing appears to be ineffective. To correct the problem with having introduced new material of differing sensitivity, significant time and money was spent to accelerate the complete replacement of the older material with new and thereby to return the population to a single uniform sensitivity.

Finding #6: Criteria

- Category - **Concern**
- Q.3: The supervisor must examine audit results. Action must be taken to correct any deficiencies.

Finding #6 Response:

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- Landauer will take the following actions to improve the management system for resolving QA concerns identified through internal audits and internal dosimeter performance testing.
 - a. Landauer has purchased the ION Quality Management System to assist with managing the quality program. The system should be fully functional by January 1, 2013. ION is a fully integrated web based management system that will provide Landauer the tools to track the status of open action items and provide periodic alerts to management when action items are overdue.
 - b. Landauer will implement an escalation system for overdue internal audit findings within the ION Quality Management System. The escalation levels will be direct manager, QA Manager, and finally the President / Chief Executive Officer (CEO). The escalation system will be in place by January 1, 2013.
 - c. Landauer will also send a quarterly report summarizing overdue action items to the Operating Management Team and members of the Quality Management Team. The first report will be sent out by April 30, 2012.

Finding #7

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With the introduction of the automated Training Program Software (TPS) system in December 2009, training materials and records for most of the GDS personnel were maintained and documented electronically by the TPS. However, the TPS system only maintains the current training records and has no provision to generate employee historical training records for compliance reviews.

Finding #7: Criteria

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- Category - Concern
- P-17: A record of the dates and findings of competency reviews must be available for review.
- P-20: A record of training courses completed by each staff member must be available for review.

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- An upgrade to the Training Program Software (TPS) to a training history feature is being developed. Discussions will be had with the programmers to determine how this might be incorporated into the current database structure and the extent of modifications required for incorporation of this feature. The modifications and thus completion date are yet to be determined. Until the modifications for the training history feature have been completed, included, and tested satisfactory a hard copy of each employee's training history will be retained.

Finding #8: Observation

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- The dosimeters used for DOELAP Performance Testing may not be identical to those used for field dosimetry. This should not impact the performance of either dosimeter, but is not in precise compliance with the procedure. (T.1)
 - (T.1) Protocols for proficiency testing in accordance with the DOE Standard must be defined. They must be consistent with routine processing procedures.

Finding #9:

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- Each of the locations that dosimeters are staged or stored should be labeled accordingly.

Finding #9: Criteria

- Category – Concern
- D.2: A positive system for identifying and tracking all dosimeters must be in use.
- D.16: The location of dosimeters within the laboratory must be documented.

Finding #9 Response

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- Dosimeter media staging and storage locations will be labeled accordingly.

Finding #10: Observation

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- Dose processing reports for the PARTICIPANT and SUB-PARTICIPANT were reviewed and found to be appropriate.



Finding #11:

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Procedure DG#006 Measurement Quality Assurance (MQA) Testing establishes guidelines to perform more detailed analysis for annual comprehensive QC dosimeters when the performance bias ($|B|$) is greater than 0.2. During this assessment, MOA documents for year 2009 and 2010 were reviewed. On one occasion, the performance bias was greater than 0.3 for the low-energy photon irradiation category for both shallow and deep dose results, and the analysis to address this bias issue was not included in the MOA memorandum (reference: RP-DREP-201 00820-MEM-01). During 2008 and 2009 dosimeter algorithm has been modified due to DOELAP performance testing results in the III+IV shallow dose category. Considerations should also be given to evaluating the impact on the PARTICIPANT dosimetry program from this recent algorithm modification. (P.7, Q.1,Q.8)



Finding #11: Criteria

- Category – Concern
- P.7: All personnel dosimetry program staff members must be familiar with and implement the documented quality control program.
- Q.1: Technicians must be familiar with and implement the documented quality control program.
- Q.8: The QA program must incorporate external checks, including:
 - Processing controls (e.g., light source readings, microprocessor controls)
 - Blind-audit dosimeters
 - Unexposed dosimeters



Finding #11 Response:

1. Procedure DG #006 (Measurement Quality Assurance MQA) will be revised to incorporate:
 - The Excel template for evaluating the MQA results will be modified to add automatic notification trigger when the performance bias ($|B|$) is greater than 0.2.
 - A paragraph will be add to the MQA report template to identify and discuss any QC dosimeter readings with performance bias ($|B|$) greater than 0.2.
 - PARTICIPANT will work with Landauer to analyze and resolve the high biases identified in the RP-DREP-20100820-MEM-01. The above memo will also be revised to document the analysis.
2. PARTICIPANT will evaluate the impact on the PARTICIPANT dosimetry program with respect to the recent change in dose algorithm associated with the III+IV shallow dose category. The results of the evaluation will be documented in a memo to file.

Finding #12: Observations

- Worker training records were reviewed. The "require requalification" column for more recent records was found incomplete. The use of the new training record data entry system and changing practices for documenting training due to reorganization and procedure/training consolidation may have contributed to incomplete records.

Finding #13

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- All procedures and processes currently can be performed by at least one trained person. However, there are some critical processes including cleaning and calibration of Panasonic readers that only one person is trained to perform. Cross training of personnel to provide adequate backup should be conducted. The external dosimetry group has a draft procedure for cross training

Finding #13: Criteria

- Category - Concern
- P.19: "Training consistent with assigned responsibilities"

Finding #13 Response:

Nuclear Energy

- The Lab X External Dosimetry Group (EDG) completed its procedure for cross training (Reference 2) and issued it on September 8, 2008. The procedure requires the EDG to have at least two full-time employees qualified to perform each EDG processing procedure. If there is only one qualified employee able to perform a particular processing procedure, Reference requires that another full-time employee become qualified to perform it within 12 months.
For each processing procedure for which only one full-time employee is currently qualified, the EDG will qualify another full-time employee before September 8, 2009.

Finding #14:

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- Dose calculation methodologies for Harshaw dosimeters do not clearly establish the relationship between TL light emission and dose equivalent. In the case of Harshaw dosimeters, reader calibration exposures to Cs-137 are performed using bare cards irradiated face-on inside a plastic sleeve; this is a local geometry convenient for high volume irradiations. However, there is no further correction from this geometry to a referenceable geometry for extremity dose equivalent when calculating dose for personnel dosimeters, although such a correction is made for DOELAP performance testing. (TL-5)

Finding #14: Criteria

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- Category - Concern
- TD.5: Sufficient measurements to establish relationship between TL/OSL emission – dose characteristics and conversion factor. The conversion factor is used to convert instrument reading to dose equivalent.

Finding #14 Response

- The PARTICIPANT is in the process of migrating to a new version of its TLD processing database system, with full system installation expected within the next 60 days. Upon installation of the new system, the Harshaw dose calculation algorithm will be modified to employ lookup functions in order to apply correction factors appropriate to the exposure geometry to the reader system output. In addition, the External Dosimetry Technical Basis Document will be updated to reflect the dose calculation methodology for Harshaw extremity dosimeters. The PARTICIPANT anticipates that this modification will be fully implemented.



Finding #15:

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- There is an absence of formal, documented review and approval by SST personnel of dose data received from the vendor. SST work instructions do not describe how the vendor-determined doses are received (by hardcopy report) nor do they define a process for review of reported doses or approval of doses for assignment in SST records. In practice, the process for data receipt and entry into the dosimetry database appears to work effectively, but is undocumented. Further, appropriate data reviews have been done including annotating the vendor's reports with appropriate notes regarding data subjected to scrutiny, but no documented approval is given, nor do the records identify the person or persons conducting the reviews.

Finding #15: Criteria

■ Finding #15:

- Category – Concern
- P.3: The individual who has technical responsibility must generally exhibit adequate technical knowledge and management control for personnel dosimetry.
- PR.5: The individual technically responsible for dosimetry processing or his/her assigned representative must give final approval of dosimetry data. This person must also make decisions regarding questionable data.

Finding #15, Response:

Create a form called Quarterly Dose Report Receipt Inspection. Insert Directions and description into procedures and work instructions.