

**RADIATION PROTECTION PROGRAM INTERNAL ASSESSMENT SUMMARY FOR THE CY 2005 -
CY 2007 TRIENNIUM
FERMILAB RADIATION PROTECTION GROUP
FEBRUARY 28, 2008**

EXECUTIVE SUMMARY

During the CY2005-CY2007 triennium, the internal audits of all program elements and of the Fermilab line organizations were conducted as required by 10 CFR 835.102. The assessment consisted of a review of corrective actions implemented in response to the audits conducted during the last triennium, a comprehensive Peer Review of the Fermilab Radiation Protection led by a subject matter expert from Argonne National Laboratory, and individual assessments of each of the Fermilab line organizations.

The peer review resulted in an in-depth identification of both program strengths and opportunities for improvement. The assessments of the line organizations found that, overall, each of the divisions and sections continue to effectively implement the Laboratory-wide program and best management practices in radiation protection. It is observed that most of the personnel who lead radiation protection activities throughout Fermilab are dedicated professionals who put in the extra effort needed to ensure that people are safe, the environment is protected, and the Fermilab high energy physics program is supported in a manner that keeps radiation doses as low as reasonably achievable (ALARA). The radiation protection program also benefits from a high level of management support implemented Laboratory-wide in all divisions and sections, large and small.

As an additional component of the assessment this triennium, the amendments to 10 CFR 835 finalized in July 2007 resulted in a comprehensive revision of the Radiation Protection Program (RPP) for Fermilab and a companion complete revision of the Fermilab Radiological Control Manual (FRCM). While the RPP is presently under review by the Department of Energy, the FRCM revision was conducted in a manner that should result in a number of minor, and some major, programmatic improvements that are not directly tied to the 10 CFR 835 amendments.

METHODOLOGY

A triennial assessment of the Fermilab Occupational Radiation Protection Program was conducted as required by the Fermilab Radiation Protection Plan (RPP) and 10 CFR 835, "Occupational Radiation Protection" as specified at §835.102:

Internal audits of the radiation protection program, including examination of program content and implementation, shall be conducted through a process that ensures that all functional elements are reviewed no less frequently than every 36 months.

Although extensive and significant revisions to 10 CFR 835 were finalized by DOE in June 2007, the triennial assessment discussed here was solely performed under the existing RPP submitted to DOE on November 2006. The RPP revision of November 2006 was a rather minor revision of the March 2001 version of the Fermilab RPP needed to reflect the transfer of the

Fermilab Management and Operating Contract from Universities Research Association to Fermi Research Alliance, LLC.

The conduct of these triennial assessments was performed in accordance with Article 122 of the Fermilab Radiological Control Manual (FRCM). This internal audit program is an ongoing process carried out by means of formal reviews conducted in accordance with the general requirements specified by Fermilab Environment, Safety, and Health Manual (FESHM) Chapter 1040.1. This report summarizes the audit activities conducted during the past 36-month period. All component assessments are documented in the Fermilab ESHTRK database.

TABLE 1 provides a mapping of the functional elements of 10 CFR 835 to how they were addressed in this assessment. The Functional Areas were taken from the DOE guidance document, "Radiation Protection Programs Guide", DOE G 441.1-1B, March 1, 2007.]

TABLE 2 lists the individual component assessments and their completion dates, exclusive of report writing time, along with ESHTRK Report Number. For convenience, below each assessment are given the internet links to the ESHTRK entry. For the divisions and sections more heavily involved in radiological work, a link to the separate, detailed report is also provided. For those with minor radiological program involvement, the full report is provided. The external radiation dosimetry program continued to be accredited by the Department of Energy Laboratory Accreditation Program (DOELAP) throughout this triennium.

Each of the reviews of the divisions and section within Fermilab were conducted with the awareness of the management of the organization and with involvement of the line organization staff associated with environment, safety, and health efforts of that organization. For the organizations with intensive activities in radiation protection, the assessment teams primarily interacted with the full-time radiation protection personnel on staff. The effort spent on the conduct of the individual assessments was scaled to the level of occupational radiological work performed in a given organization. Most, by far, of the radiological work conducted at Fermilab is done within the Accelerator Division (AD). The scope of radiological work in the Particle Physics Division (PD) and the Technical Division (TD) is smaller in scope than that in AD but still significant. Smaller scale radiological work activities occur in the Facilities Engineering Services Section (FE) and the Business Services Section (BS) and to less degree in the Computing Division (CD). The Finance Section (FI), established during the last year of the triennium, and the Workforce Development and Resources Section (WR) conduct no radiological activities. The medium-scope radiological work activities of the Environment, Safety, and Health Section (ES) were primarily assessed during this triennium by means of the Peer Review of the Radiation Protection Program.

TABLE 1 10 CFR TRIENNIAL ASSESSMENT PLAN FOR CY 2005 - CY 2007

FUNCTIONAL ELEMENT	METHODOLOGY	DOCUMENTATION
1. ORGANIZATION AND ADMINISTRATION 10 CFR 835, Subpart B	Peer Review	Peer Review Report
2. ALARA PROGRAM 10 CFR 835.101(c), Subpart K	Peer Review RPG Audits of Divisions/Sections	Peer Review Report ESHTRK Reports
3. EXTERNAL DOSIMETRY PROGRAM 10 CFR 835.401 (a), 402(a),(b)	Peer Review DOELAP Onsite Assessment Dosimetry Program Audit	Peer Review Report ESHTRK Reports
4. INTERNAL DOSIMETRY PROGRAM 10 CFR 835.401(a), 402(c),(d)	Peer Review, RPG Audits of AD, TD, ES	Peer Review Report ESHTRK Reports
5. AREA MONITORING AND CONTROL		
a. <u>Area Radiation Monitoring</u> 10 CFR 835.401(a)	Peer Review, RPG Audits of Divisions/Sections	Peer Review Report ESHTRK Reports
b. <u>Airborne Radioactivity Monitoring</u> 10 CFR 835.209, 401(a), 403	Peer Review, RPG Audits of AD only	Peer Review Report, ESHTRK Reports
c. <u>Contamination Monitoring and Control</u> 10 CFR 835.401(a), Subpart L	Peer Review, RPG Audits of ES, AD, TD, PPD	Peer Review Report, ESHTRK Reports
d. <u>Instrument Calibration and Maintenance</u> 10 CFR 835.401(b)	Peer Review	Peer Review Report
6. RADIOLOGICAL CONTROLS		
a. <u>Radiological Work Planning</u> 10 CFR 835.501(d), 1001(b), 1003	Peer Review, RPG Audits of Divisions/Sections	Peer Review Report, ESHTRK Reports
b. <u>Entry and Exit Controls</u> 10 CFR 835, Subpart F	Peer Review, RPG Audits of Divisions/Sections	Peer Review Report, ESHTRK Reports
c. <u>Radiological Work Controls</u> 10 CFR 835, Subpart F, 1003	Peer Review, RPG Audits of Division/Sections	Peer Review Report, ESHTRK Reports
d. <u>Posting and Labeling</u> 10 CFR 835, Subpart G	Peer Review, RPG Audits of Divisions/Sections	Peer Review Report, ESHTRK Reports
e. <u>Release of Materials and Equipment</u> 10 CFR 835.1101	Peer Review, RPG Audits of Divisions/Sections	Peer Review Report, ESHTRK Reports
f. <u>Sealed Radioactive Sources Accountability and Control</u> 10 CFR 835, Subpart M	Peer Review, RPG Audits of Divisions/Sections	Peer Review Report, ESHTRK Reports
7. EMERGENCY EXPOSURE SITUATIONS 10 CFR 835.1301, 1302	Peer Review	Peer Review Report
8. NUCLEAR ACCIDENT DOSIMETRY 10 CFR 835.1304	Not Applicable per RPP	Not Applicable
9. RECORDS 10 CFR 835 Subpart H	Peer Review DOELAP Onsite Assessment Dosimetry Program Audit	Peer Review Report ESHTRK Reports
10. REPORTS TO INDIVIDUALS 10 CFR 835 Subpart I	DOELAP Onsite Assessment Dosimetry Program Audit	Peer Review Report ESHTRK Reports
11. RADIATION SAFETY TRAINING 10 CFR 835 Subpart J	Peer Review, RPG Audits of Divisions/Sections	Peer Review Report ESHTRK Reports
12. LIMITS FOR THE EMBRYO/FETUS 10 CFR 835 Subpart C	Peer Review	Peer Review Report

TABLE 2 COMPONENT ASSESSMENTS FOR THE TRIENNIUM CY 2005 - CY2007

Component Assessment	Leader/Team Members	Date of Completion	ESHTRK Report No.
DOELAP Onsite Review	Michael Souleyrette (Y-12), Gloria Mei (ORNL) for DOELAP	7/26/2006	27957
https://www-esh.fnal.gov/pls/fnal_user/eshtrk_common.audit_details?rid=27957 Report: http://www-esh.fnal.gov:8001/ESHTRK/20070726_DOELAP.pdf			
Dosimetry Program Audit	Timothy Miller, David Baird	8/4/2005	27453
https://www-esh.fnal.gov/pls/fnal_user/eshtrk_common.audit_details?rid=27453			
Peer Review of Fermilab Radiation Protection Program	Gary Zeman (ANL)/Steve Butala (ANL), Al Maysam (FNAL), Rick Ford (FNAL), David Boehnlein (FNAL)	4/26/2007	28182
https://www-esh.fnal.gov/pls/fnal_user/eshtrk_common.audit_details?rid=28182 Report: http://www-esh.fnal.gov:8001/Assessments/2007_rad_peer.pdf			
Facilities Engineering Services Section	Vernon Cupps,/Kathy Graden, Susan McGimpsey	12/5/2007	28722
https://www-esh.fnal.gov/pls/cert/eshtrk_common.audit_details?rid=28722 Report: http://www-esh.fnal.gov:8001/Assessments/FESS_TriennialRadiationProtectionAudit_2007.pdf			
Business Services Section	Vernon Cupps/Kathy Graden, Susan McGimpsey	12/19/2007	28723
https://www-esh.fnal.gov/pls/cert/eshtrk_common.audit_details?rid=28723 Report: http://www-esh.fnal.gov:8001/Assessments/BSSRadiationProtectionAudit_2007.pdf			
Computing Division	Don Cossairt/Susan McGimpsey	2/1/2007	28020
https://www-esh.fnal.gov/pls/fnal_user/eshtrk_common.audit_details?rid=28020			
Finance Section	Don Cossairt/Susan McGimpsey	2/21/07	28018
https://www-esh.fnal.gov/pls/fnal_user/eshtrk_common.audit_details?rid=28018			
Workforce Resource & Development Section	Don Cossairt	2/21/2007	28019
https://www-esh.fnal.gov/pls/fnal_user/eshtrk_common.audit_details?rid=28019			
Accelerator Division	Susan McGimpsey/Kathy Graden, Don Cossairt, Kamran Vaziri, Vernon Cupps	9/28/2007	28726
https://www-esh.fnal.gov/pls/cert/eshtrk_common.audit_details?rid=28726 Report: http://www-esh.fnal.gov:8001/Assessments/ADRadiationProtectionAudit_2007.pdf			
Particle Physics Division	Kamran Vaziri/Susan McGimpsey, Kathy Graden	12/20/2007	26840
https://www-esh.fnal.gov/pls/cert/eshtrk_common.audit_details?rid=28640 Report: http://www-esh.fnal.gov:8001/Assessments/PPD_RPP_Audit_2007.pdf			
Technical Division	Kathy Graden/Vernon Cupps, Susan McGimpsey	4/30/07	28078
https://www-esh.fnal.gov/pls/fnal_user/eshtrk_common.audit_details?rid=28078 Report: http://www-esh.fnal.gov:8001/Assessments/TD_10CFR835_Triennial_Assessment_2007.pdf			

RESULTS OF ASSESSMENTS OF DIVISIONS AND SECTIONS

It is concluded that this triennial assessment, while acknowledged to be a requirement under 10 CFR 835.102, continues to be a valuable and timely forum for conducting a laboratory-wide program review. While occupational radiological protection program assessments of those line organizations with no significant involvement with the radiation protection program (WR, FI, and CD) might appear to be superfluous, it was concluded that those assessments continue to be of value as a forum for communication about the radiation protection program. It also afforded an opportunity to assess the continued maintenance of current General Employee Radiological Training (GERT) for all Fermilab employees.

During the assessment of the divisions and sections no programmatic issues meeting the criteria of NTS reportability or of significant safety significance were identified. In fact, steady improvements in program implementation and performance were seen when measuring current conditions and levels of program implementation against those seen in previous assessments. This led to the identification of a number of noteworthy practices. The audit teams were able to identify several recommendations made with a view toward future improvements, and several findings were developed. Corrective actions to the findings and responses to the recommendations are underway.

RESULTS OF THE PEER REVIEW OF THE FERMILAB RADIATION PROTECTION PROGRAM

The Peer Review served as the centerpiece of the assessment for this triennium. The assessment categorized its specific results according to the following definitions:

Finding - is a violation of requirement of a published standard. Published standards are Fermilab's Radiation Protection Program Plan (RPP), the Fermilab ES&H Manual (FESHM), the Fermilab Radiological Control Manual (FRCM), and the Fermilab Work Smart Standard (WSS) set and applicable DOE and Executive Orders.

Recommendation - is the identification of a condition that affords an opportunity for improvement but does not constitute a specific violation as would a Finding.

Noteworthy Practice - is a work process that is shrouded in safe work practices, improves productivity and exceeds the spirit and intent of the applicable regulations and standards. Noteworthy practices may include best management practices.

Observations - pertain to conditions observed by the review team that, following subsequent review and analysis support a Finding, Recommendation, or Noteworthy Practice. Observations can also be used to capture the "working notes" of the assessment team.

Findings, Recommendations, and Observations

Despite the importance hierarchy of results as defined above for use in the Peer Review, the ESHTRK database only permits one type of entry, the “finding”, for tracking purposes. In order to take advantage of the tracking features of ESHTRK, Findings, Recommendations, and Observations were all entered as “findings”. These results of the Peer Review are discussed below along with a summary description of follow-up actions taken, and status as of December 31, 2007

ESHTRK ID 76691

Professional Staff Level-Observation No. 1

Shielding for new facilities is designed by those working on the project, but the design reviews must be done by the ES&H Section. The design reviews should be done by experts independent of those that do the original designs. Effectively, this means the task falls upon one or two individuals. The ES&H organization does not seem to be adequately staffed to perform and/or provide independent review of shielding designs for new facilities being planned or designed at Fermilab.

This has been the subject of previous discussions among the ES&H Section Management Team and was reviewed in a meeting of this team held on July 18, 2007. It is recognized that dependent upon the direction of the program of the Laboratory it is plausible that more staffing in this area could be needed and then added. In the interim, should such expertise be needed on short notice, there are several individuals on the Fermilab staff who possess the needed expertise who could be called upon on a temporary basis. This Observation is considered **closed**.

ESHTRK ID 76692

Review and Revise the RPP-Observation No. 2

Although the RPP underwent a minor revision when FRA assumed management of Fermilab, there has not been a substantive revision of the RPP since 2000. The RPP should be reviewed to determine whether an update is necessary as per 10 CFR 835.101(g). If such an update is necessary, then the RPP should be revised. This could possibly be linked to an ongoing Notice of Proposed Rulemaking on 10 CFR 835.

10 CFR 835 was amended effective July 9, 2007. The nature of the amendments requires a revision to the Radiation Protection Plan (RPP) to be submitted to DOE by January 4, 2008. The nature of the amendments requires this revision to be an extensive one. The revised RPP was submitted to DOE on December 19, 2007. This Observation is considered **closed**.

ESHTRK ID 76693

Reporting Chain for RSOs-Recommendation No. 1

The committee makes one recommendation regarding the matrix management arrangement of divisional Radiation Safety Officers (RSOs). Currently there is no formal tie between the divisional RSOs and the central radiation safety organization. Field RSOs report directly to line division management, not to the Senior RSO. The radiation safety organization should have some formal input to the RSOs' performance appraisals.

This was reviewed in a meeting of the ES&H Section Management Team on July 18, 2007. It was concluded that there is no need to provide the suggested input formally as the ES&H Director as well as the Associate Head for Radiation Protection have continual, ongoing, productive relationships with Division/Section Heads, Senior Safety Officers, and Radiation Safety Officers that affords sufficient opportunity to offer comments on performance. This Recommendation is considered **closed**.

ESHTRK ID 76694

Neutron Dosimetry-Observation No. 3

Laboratory operations have changed significantly since the technical basis for dosimetry was developed. At that time, the Laboratory still had an active experimental program in the fixed-target areas, the Main Injector was not operational and the current neutrino program had yet to begin. Personnel neutron monitoring by CR39 is a good practice, but the review team did not see evidence that radiation fields had been characterized to rule out lower energy neutrons than would be detected by CR39.

Radiation Physics Note No. 124, "Technical Basis for External Dosimetry at Fermilab", was originally issued in August 1996 and was revised June 2006. No changes in Fermilab operations have resulted in significant modifications to the neutron radiation fields present. While neutron exposures at Fermilab are rare, in the event of a confirmed neutron exposure above 30 mrem, an exposure investigation will be initiated and will take into account the characteristic neutron fields around the accelerator complex. The requirement for this investigation is specified in the External Dosimetry Program Document, most recently revised as of December 2005. These documents were reviewed during the most recent on-site DOELAP assessment of July 2006. The revisions to 10 CFR 835 that have just been finalized (see corrective action to Finding 76692) explicit requires reconsideration of neutron dosimetry that will be done in the course of continued DOELAP accreditation and in accordance with the revised RPP submitted on December 19, 2007 or modifications made to the RPP as suggested/directed by DOE. This Observation is considered **closed**.

ESHTRK ID 76695

RCT Staffing Level - Recommendation No. 2

The committee noted that monitoring and waste-handling activities for the NuMI beamline have impacted routine surveillances in other areas. A workload analysis of the RCTs should be performed to determine whether adequate staffing is available to meet all of the operational requirements of the accelerator complex and experimental areas.

The RCTs affected by NuMI operations are those of the ES&H Section (waste-handling tasks) and those of the Accelerator Division (primarily job-coverage and tritiated water handling tasks). Neither organization has experienced significant overtime costs for non-exempt technicians or identified other activities as being given insufficient attention. The addition of more dehumidification capacity to the NuMI tunnel during the August-September 2007 shutdown should provide considerable relief of some of the higher-impact tritiated water handling tasks.

RCT staffing needs is subject to ongoing review as a part of the normal performance appraisal system. This Recommendation is considered **closed**.

ESHTRK ID 76696

Documentation of Written Authorizations to Enter Radiological Areas-Observation No. 4

The review team expressed some interest as to whether the memorandum issued as written authorization for access to the CDF and D0 experimental areas allows for adequate personnel entry control as per 835.501(a). The interest arose because the memorandum does not include a list of names. Given the size of the experimental collaborations, the memo potentially applies to approximately 1000 people, so a written list seems impractical. The team was shown the procedures for allowing access, which include a check of an individual's name & ID # in the training database as a requirement for checking out a key, along with a signature in a logbook when receiving the key. The signature is an acknowledgement that the signer has read the memo and is aware of the radiological restrictions. In the review team's opinion, this is a more effective procedure for maintaining access control than a written list would be and it appears to satisfy the intent of the regulation. However, the committee did not have time to perform an in-depth audit of the access records and suggest that Fermilab conduct an assessment to ensure that these records are maintained in accordance with 835.701(a).

A discussion among RSOs representing AD, TD, PD, FE, and ES&H Section Radiation Physics Staff on July 11, 2007 concurred that the use of the database provides a compliant, adequate, and indeed superior method of assuring that personnel allowed entry to the CDF and D0 experimental halls have been provided with a written authorization. The more conventional use of a printed list of names would be inferior as it would be promptly obsolete referenced to the database used. This Observation is considered **closed**.

ESHTRK ID 76697

Record Assessments-Recommendation No. 3

Radiation Work Permits and other written authorizations, records of radiological surveys, and administrative records are maintained by division and section line organizations, rather than in a central file. This is a logical approach, given the structure of the radiological control organization at Fermilab. However, the committee believes that a degree of central oversight will help ensure compliance with 835.701(a). Periodic records assessments should be carried out by FNAL.

Records assessments of the documentation listed continue to be an ongoing part of the triennial radiation protection program assessments of the divisions and sections. A discussion among RSOs representing AD, TD, PD, FE, and ES&H Section Radiation Physics staff on July 11, 2007 verified that these records are also being archived in accordance with the cited requirements of 10 CFR 835 and the FRCM. This Recommendation is considered **closed**.

ESHTRK ID 76698

Documentation of Survey Data-Finding No. 1

There is no documentation of survey data for articles cleared from potential contamination areas by radiation workers. 10 CFR 835.701(a).

A discussion among RSOs representing AD, TD, PD, FE, and ES&H Section Radiation Physics Staff on July 11, 2007 concluded that articles are not removed from contamination areas or potential contaminated areas by radiation workers without being decontaminated prior to removal. This is done for operational reasons inclusive of compliance with 10 CFR 835.1101 and 10 CFR 835.1102. If such items must be removed from contamination areas but cannot be decontaminated, then the provisions of 10 CFR 834.701(a), 10 CFR 835.1101, and 10 CFR 835.1102 are followed. Compliance with the requirement is an ongoing topic of the triennial radiation protection program triennial assessments of the divisions and sections. This Finding is considered **closed**.

ESHTRK ID 76699

Training for Radiological Control Technicians-Recommendation No. 4

The RCT training course shown to the committee amounted to only 4 hours of training every two years. This hardly seems adequate to ensure coverage of the full array of knowledge needed by an RCT. However, other records seem to show that the RCTs receive considerable training in addition to this, but that the laboratory is not taking credit for all that they receive. Documented continuing education for biennial recertification of RCTs is too brief and should be expanded to ensure coverage of all important elements. Retraining should be conducted on a 24-month basis as is the standard for other DOE radiological safety training. RCT skills-based performance, e.g. performing a radiological survey, should be evaluated and documented by use of a criterion referenced checklist.

10 CFR 835 does not specify details of RCT training aside from the 24 month renewal interval of 10 CFR 835.901(e) that is not in question here. A document is being prepared that will provide a tool for collecting information concerning RCT training and retraining actions and status for comparison against requirements of the FRCM. A new training program has been approved and will be implemented during CY 2008. This Recommendation is considered **closed**.

ESHTRK ID 76700

Accessibility of Radiological Areas and Radioactive Material-Finding No. 2

This finding is prompted by a situation encountered during a tour of the accelerator building. It encompasses several concerns, but the most directly applicable portion of the regulation is 835.901, Radiation Safety Training, hence we include it here. An accelerator footprint area door, posted as a Radioactive Materials Area, was unlocked and could allow unrestricted access to passers-by (We noted that a group of high school students was touring the building at the same time we were.) An open bag labeled Contaminated Material was just outside the door and was accessible. The committee member who spotted this chose not to inspect the bag to see if it actually contained contaminated material, but we must assume that it could have. We cannot know, on the basis of a brief tour, whether this situation was unique. Since the charge to the committee is to perform a programmatic review, not a walk-through audit, we express our finding in broad terms. Fermilab should investigate the extent to which radiological areas and/or radioactive materials are accessible to persons who are not adequately trained to deal with them and correct this situation where it exists. 10 CFR 835.901(a)

This was discussed by the ES&H Section Management Team on July 18, 2007. This is a vulnerability well-known to senior Laboratory management that is largely a legacy of the facility as designed. It is also not possible to always keep all the doors locked due to temporary conditions that arise in the course of facility operation. A very high percentage, approaching 100 %, of the Laboratory population including employees, users, and subcontractors have current GERT training, the minimum level of training by policy required to enter such areas. The hazards in question pose only very small radiological risks that are well-understood. Specifically, as verified by the Accelerator Division Radiation Safety Officer the accessible areas in Accelerator Footprint Area only do not contain any radiation areas, contamination areas, or airborne radioactivity areas (as defined by 10 CFR 8350 so that the radiological hazards are limited to low level radioactive materials. This Finding is considered **closed**.

ESHTRK ID 76701

Design and Review Process-Recommendation No. 5

This recommendation prompted considerable discussion during the review. We therefore feel it merits a detailed explanation here. A significant fraction of RCT and waste-handling effort are presently dedicated to controlling tritium produced in the NuMI beamline. The extent of the tritium problem was not known until routine environmental sampling found tritium in water flowing offsite, a situation unprecedented at Fermilab. Despite the fact that the NuMI Project underwent numerous technical and safety reviews, the situation with the tritium was not foreseen. The committee wishes to emphasize that this is not a recommendation on NuMI operations or on the efforts to mitigate the tritium produced at NuMI, which we did not review in detail. Rather, this recommendation is aimed at the design and review process itself. The Laboratory should understand why the tritium situation was not identified in the design or commissioning stage. During our interviews, the committee was told by several people that they don't know what could have been done differently. And that is precisely our point. The design and review process should be subjected to a root cause analysis and corrective actions in response to the unforeseen appearance off-site of tritium from the NuMI tunnel and the unanticipated level of effort required mitigating it.

This was discussed by the ES&H Management Team on July 18, 2007. This topic has been one of the major subjects of the Surface Water Task Force chaired by the Associate Director for Accelerators since 2005. Extensive documentation of this matter was also collected and transmitted to IEPA in response to the IEPA Notice of Violation issued in March 2006. The production of tritium was recognized during the project design phase. In fact, the rather late change to discharge of the NuMI sump to the Industrial Cooling System rather than to the Indian Creek watershed was partially done to avoid the potential for a measurable offsite discharge. Also, the evaluation of how this occurred remains the subject of ongoing investigation. This Recommendation is considered **closed**.

ESHTRK ID 76702

Tracking of Generally-Licensed Sources-Observation No. 5

Generally licensed sources in gauges and measuring instruments, e.g. Ni-63 source in GC/MS, should be tracked since USNRC requires [cf. 10 CFR 31.5] that these be leak tested

semiannually. At the time of the review, it was unclear [to the audit team] whether this was being done.

The tracking of sealed sources of this type is routinely done and results are documented in the Fermilab Sealed Source Program as with any other sealed source on site. This Observation is considered **closed**.

ESHTRK ID 76703

Quality Assurance-Recommendation No. 6

The applicability of DOE QA Order 414.1C, and of the QA requirements of 10 CFR 830 Subpart A to non-accelerator facilities like the rad calibration shop and the waste facility, should be reviewed.

Currently Fermilab facilities such as those cited as examples are believed to be in full compliance with the Director's Policy on Quality Assurance (Director's Policy No. 10), an internal directive consistent with DOE Order 414.1C. Concerning 10 CFR 830, the definitions clearly exclude from its applicability, "...accelerators and their operations and ...activities involving only incidental use and generation of radioactive materials or radiation such as check and calibration sources". 10 CFR 830.120 defines the scope of Subpart A, "Quality Assurance" requirements as "...activities, including providing items or services, that affect or may affect, nuclear safety of DOE nuclear facilities". While 10 CFR 830 unfortunately does not provide a definition of "nuclear safety", in DOE Order 410.1B "Facility Safety", the term "nuclear safety" in paragraph 1.c(1) is kept separate from radiation protection and in Chapter I is only connect with DOE hazard category 1, 2, and 3 nonreactor nuclear facilities and DOE nuclear reactors. Finally, the Office of Enforcement in Enforcement Guidance Supplement 99-01 (July 1999) makes it clear that that 10 CFR 830 applies only to nonreactor nuclear facilities that pose a nuclear hazard and does not applies to those explicitly excluded by the Rule as quoted above. Since Fermilab only produces radioactive materials or radiation incidentally (e.g. check and calibration sources and waste) and do not pose a nuclear safety issue, 10 CFR 830 is not deemed to be applicable. This matter was discussed by D. Cossairt with D. Parczyk of the Fermi Site Office on 8/15/07 who concurred with the above assessment. Improvements to the Fermilab Program in Quality are under discussions and will be implemented in CY 2008. These will include the radiation protection program. This Recommendation is considered **closed**.

ESHTRK ID 76704

Accelerator Safety Order-Recommendation No. 7

A gap analysis should be done to determine if any elements of DOE 420.2B that are not being addressed would add value to the RPP program.

Such a gap analysis has been performed and documented. The results were discussed by D. Cossairt with D. Parczyk of the Fermi Site Office on 8/15/07 who concurred with the results. Two follow-up items were found that will be implemented in the course of the extensive modifications to policies in radiation protection associated with the revision to 10 CFR 835 that must be done (see corrective action for Finding 76692). First, FRCM Article 362 should be rewritten to tie directly to the "exclusions" statements in DOE 420.2B (Section 3.c under

“Applicability”). Second, FESHM 2010 should be rewritten to specifically include “Unreviewed Safety Issues” as discussed in DOE 420.2B (Section 4.c under “Requirements”). Since the gap analysis is complete, this Recommendation is considered **closed**.

NOTEWORTHY PRACTICES

The Peer Review report also identified 17 Noteworthy Practices listed here:

NP 1: Definition of a Radioactive Material Area

Fermilab has defined a Radioactive Material Area (RMA) so as to include all areas with radioactive material, rather than applying the less restrictive criteria of 10 CFR 835 Appendix E.

NP 2: Definition of Radioactive Material

Radioactive material is not defined in 10 CFR 835, however Fermilab has developed a practical and measurable definition that is implemented effectively throughout the laboratory.

NP 3: Laboratory Organization

The Laboratory has recently undergone a reorganization in conjunction with a new contract award to the Fermi Research Alliance. In the new management structure, the Senior Radiation Safety Officer (SRSO) reports directly to the Lab Director. This structure provides the SRSO with the authority to define the Radiation Protection Plan and implement radiation safety policy uniformly throughout the lab. Furthermore, it places an emphasis on radiological safety at the highest level of Laboratory management.

NP 4: Fermilab Radiological Control Manual (FRCM)

The FRCM is a mature document that appears to be complete and well-understood by the radiation protection staff.

NP 5: ALARA Program

The ALARA program is strong and has been effectively implemented to manage worker radiation dose.

NP 6: Participation in DOELAP

As a DOELAP assessor, the dosimetry program manager adds strength to the program.

NP 7: Area Monitoring Program

The area monitoring program is well developed and comprehensive, and covers both active and passive rad levels and air monitoring, with central collection and tracking of data.

NP 8: Posting for Beam-off Conditions

FNAL has a well developed policy for posting interlocked accelerator areas for the beam-OFF (not the beam-ON) conditions that would be encountered by workers, and this policy has been approved by DOE in the RPP.

NP 9: Records for Radioactive Sources

Not only is the source inventory carefully tracked, but lists of authorized users and monitors for each source are maintained. Records of sealed sources are maintained by the RSO group. Documents requested by the Review Team were readily accessible.

NP 10: Dosimetry Reports

The web-based application for issuance of dosimeter badges is a best practice to ensure the completeness of dosimetry records and reports.

NP 11: Radiation Worker Training Required for Dosimeter

All those issued a dosimeter badge are required to have Radiological Worker (RW) training; and anyone authorized controlled access to accelerator areas is checked to ensure RW training is up to date.

NP 12: Training for Visiting Scientists

For visiting scientists, the access controls assured that required RW training is completed prior to performing radiological work.

NP 13: Review of DOE Directives

The ES&H organization reviews every directive from the Fermi Site Office (FSO) that comes to the Lab, to ensure radiation safety aspects are addressed early and throughout the planning and design stages.

NP 14: Frisking on Exit from Radiological Areas

All radiation workers are taught in RW training to self frisk upon exit from radiological areas, and to survey removed articles for radioactivity and for contamination.

NP 15: Tracking of sealed sources

All sealed sources are in the system, not just those above Appendix E levels.

NP 16: Special Form Certificates

Special form certificates were available for all high activity sources.

NP 17: Emergency Facilities and Training

The BODA facility and the training of Fire Department staff in emergency rad response are best practices.