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ES&H SECTION

Dear Mr. Weis,

SUBJECT: Crosswalk between O458.1 Requirements and Fermilab's Environment, Safety, and Health Program

Reference: DOE Order 458.1 Chg 2, June 6, 2011, "Radiation Protection of the Public and the Environment"

Chg 1 of DOE Order 458.1 was added to the DOE-FRA Contract as part of Modification M 090. The purpose of this letter is to provide you with a crosswalk between the current version of the referenced Order cited above and Fermilab's Environment, Safety, and Health program. Our conclusion is that Fermilab is in substantial compliance with this Order and is making plans to implement this Order using a graded approach. Your written concurrence/comments on this crosswalk and implementation plan would be greatly appreciated.

Questions on this subject should be addressed to Nancy L. Grossman, ES&H Director.

Sincerely,

Bruce L. Chrisman  
Chief Operating Officer

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Files: ESH File: Radiation Protection of the Environment (DOE O458.1) , w/att.  
ESH Docdb No. 1937, w/att.

## Crosswalk Between DOE O458.1 Requirements and the Fermilab ES&H Program

### GENERAL

DOE O458.1 Chg 1, 03-08-2011, referenced hereafter as O458.1, replaced DOE Order 5400.5, Change 2, January 7, 1993 (referenced hereafter as O5400.5) of the same title. More recently, Chg 2, 6-6-2011 was issued that completes this transition. Only portions of O5400.5, the Derived Concentration Guide Table and dose limits to the public (Chapter 2 Section 1; and Chapter 3), were previously incorporated into the DOE-FRA Contract as a Work Smart Standard. The administrative changes made to O458.1 on June 6, 2011 do not affect the conclusions of this document.

The approach here is to address specific sections of the Order in order of appearance and provide commentary concerning implementation features present in Fermilab's Environment, Safety, and Health program. This program explicitly includes the DOE-approved Fermilab Radiation Protection Program, most recently approved on August 20, 2010, and Fermilab's Environmental Management System, registered by the International Organization for Standardization (ISO) under the ISO 14001 Standard since August 2007.

In this new Order, DOE chose to institute a new DOE Standard, "Derived Concentration Technical Standard", DOE-STD-1196-2011, April 2011 (hereafter referred to as DCTS) as a document complementary to the Order that conveys much of the technical details including those pertinent to the changes to the radiation protection system being instituted. The DCTS specifies the Derived Concentrations Standards (DCSs) for individual radionuclides that replace the Derived Concentration Guides (DCGs) explicitly listed in O5400.5. The DCTS is now specifically referenced in DOE O458.1 Chg 2.

#### Status of implementation at Fermilab: Complete

Radiation protection of the public and the environment is addressed in the Fermilab Environment, Safety, and Health Manual (FESHM) including the Fermilab Radiological Control Manual (FRCM). Relevant chapters of these documents will be revised during CY 2012 to achieve consistency with DOE O458.1.

#### **O458.1 SECTION 1 – PURPOSE**

This simply states the expected goals of assuring proper protection of the public and the environment against risk from radiation associated with activities under the control of DOE.

There are no required contractor actions.

#### **O458.1 SECTION 2 – CANCELLATION**

This section is procedural and restates existing contractual obligations.

There are no required contractor actions.

#### **O458.1 SECTION 3 – APPLICABILITY**

This section makes it clear that the Order applies to all DOE elements that conduct radiological activities. It also invokes the requirements set forth in the associated Contractor Requirements Document (CRD) and requires the CRD to be included in all contracts where the contractor manages or conducts radiological activities at DOE sites.

The "usual" list of equivalencies is stated including activities regulated by the Nuclear Regulatory Commission (NRC) or an NRC Agreement State and the Naval Nuclear Propulsion Program.

There are no required contractor actions.

#### **O458.1 SECTION 4 – REQUIREMENTS**

- a. **Environmental Radiation Protection Program.** This section institutes a requirement for establishing a program to comply with the Order called the Environmental Radiological Protection Program (ERPP). This program can be a composite of plans, procedures, protocols, and other documents. It must be tailored to the hazard or risks of the radiological activities being conducted at the site. If a requirement of the Order is found to not be relevant, this program should document the basis for determining that fact.

Status of implementation at Fermilab: Complete

The Fermilab ERPP consists of Fermilab Environmental Management System (EMS) and the Fermilab Radiation Protection Program (RPP). Details of Fermilab's program to protect the public and the environment are found in the Fermilab ES&H Manual (FESHM) including the Fermilab Radiological Control Manual (FRCM).

- b. **Public Dose Limit.** Public dose limits are instituted in the context of the updated radiation protection system and terminology now also instituted in 10 CFR Part 835. In the newer system effective dose pertains to exposures of the whole body while equivalent dose is used for specific organs. These terms generally replace the term dose equivalent. Along with the definitions section given as Attachment 2 of the Order, important details are given in the DCTS.

Status of implementation at Fermilab: Update FESHM Chapters 8021, 8025, and 8080

The updated radiation protection system is now used in the entirety of the FRCM. The public dose limits of O458.1 as supported by the DCTS are explicitly applied to Fermilab operations in FRCM Chapter 11. Several of the 8000 series of Chapters in the FESHM will be revised during CY 2012 to incorporate the new radiation protection dosimetry system. Specific FESHM chapters to be addressed are 8021 "Chemical and Radioactive Waste Management", 8025 "Wastewater Discharge to Sanitary Sewers", and 8080 "Air Emissions Control Program".

- c. **Temporary Dose limits.** This section sets forth a process for authorizing a temporary public dose limit higher than 100 mrem in a year.

Status of implementation at Fermilab: Complete

There are no plans or credible circumstances where a request for such an authorization would be necessary. Should such an authorization be needed the provisions of O458.1 would be followed.

- d. **As Low as Reasonably Achievable.** This institutes the ALARA principle for environmental radiation protection and allows for its coordination, when appropriate with the 10 CFR 835 ALARA process.

Status of implementation at Fermilab: Complete

Fermilab has an established ALARA process set forth in general in the entirety of the FRCM and specifically in FRCM Chapter 3. The Fermilab ALARA program as set forth in the FRCM already incorporates protection of workers, members of the public, and the environment. The Radiation Safety Subcommittee of the Fermilab ES&H Committee (FESHCom) serves as the Laboratory's ALARA committee as specified in its Charter.

- e. **Demonstrating Compliance with the Public Dose Limit.** This section gives the acceptable methods for demonstrating compliance with the public dose limit set forth in the previous section and requires

the assessment of collective dose. The material is provided in considerable detail. It requires demonstration of compliance with exposure to radiation, airborne effluents, and liquid effluents of DOE origin and permits the selection of either a "representative person" or a "maximally exposed individual" (MEI). If it is suspected that any of the public dose limits expressed in section 4.b may be exceeded or the estimated total effective dose (TED) for members of the public exceeds 25 mrem (0.25 mSv) in a year, then the dose to the lens of the eye, skin, and extremities must be evaluated. A variety of analytical models to accomplish this objective are provided. Above the TED threshold of 25 mrem, the assessment of dose to members of the public must include major non-DOE sources of exposure. Assessment of collective dose to members of the public due to radiation emitted and radioactive materials not including radon released from DOE radiological activities only must be performed. Collective dose due to radon and its decay products produced by DOE radiological activities is to be calculated separately.

Status of implementation at Fermilab: Further revise FRCM Chapter 11

The methods of assessing dose to members of the public are described at many points in the FRCM and references cited therein. Chapters 8 and 11 contain explicit provisions set forth in this section of O458.1. The dose limits to members of the public have been incorporated into FRCM Chapter 11. Given the Fermilab Director's goal of limiting the annual dose at any point on the Fermilab site boundary to 10 mrem, an objective that has been in place since 1971, the TED threshold of 25 is not likely to be approached but this threshold is now explicitly stated in FRCM Chapter 11.

FRCM Chapter 11 will be revised during CY 2012 to clarify Fermilab's choice of "representative person" or "maximally exposed individual" and explicitly incorporate the provisions of this subsection of the Order pertaining to collective dose calculations. Heretofore, collective dose calculations have only been performed and reported for airborne radionuclide emissions under 40 CFR Part 61 Subpart H. The necessary modifications will be made to FRCM Chapter 11 and implemented for CY 2012 based on the detailed content of this subsection of O458.1 and applicable guidance documents referenced in O458.1. Fermilab does not produce radon and its decay products in its radiological activities with no collective dose attributable to that source.

As the Fermilab research program evolves and new on-site facilities are developed, the need for pre-operational monitoring plans will be developed consistent with this section of O458.1.

- f. **Airborne Radioactive Effluents.** This covers releases of radioactivity produced in the course of DOE activities and invokes 40 CFR Part 61, Subparts H, Q, and T, the U. S. Environmental Protection Agency's NESHAPS regulations.

Status of implementation at Fermilab: Complete

The longstanding implementation of NESHAPS requirements will continue. Concerning airborne radioactive effluents, only those of 40 CFR Part 61, Subpart H are applicable as Subparts Q and T deal with radon emissions from certain DOE operations (Subpart Q) and disposal of uranium mill tailings (Subpart T) that are not conducted at Fermilab. Compliance with the requirements of Subpart H, and hence with this subsection was assessed and found to be acceptable by the U. S. Environmental Protection Agency in May 2011.

- g. **Control and Management of Radionuclides from DOE activities in Liquid Discharges.** This section invokes many details pertaining to liquid discharge including specific activity limits for solids for alpha- and beta-emitters that can settle. It excludes the need to apply Best Available Technology (BAT) for tritium discharges. This section is where the first reference to the DCTS is made. It requires release of tritium in a manner established by the application of an ALARA process. It also invokes compliance with the drinking water maximum concentrations of 10 CFR Part 141, *National Primary*

*Drinking Water Regulations* for private or public drinking water systems. In this section it is made clear that when multiple radionuclides are encountered, the composite DCS is the sum of the fractional DCS values encountered.

Specific requirements pertaining to discharges into sanitary sewers are provided with some numerical limits, for example annual discharge limits of 5.0 Ci (185 GBq) for tritium and 1.0 Ci (37 GBq) for  $^{14}\text{C}$  are stated. There is also an annual discharge limit of 1.0 Ci (37 GBq) for all radionuclides aside from  $^3\text{H}$  and  $^{14}\text{C}$ . Except for tritium, implementation of BAT is required if the concentration of radionuclides discharged into a sanitary sewer is greater than five times the Derived Concentration Standard specified in the DCTS. Notification of operators of sewage treatment plants of DOE activities and practices is required. The DOE Field Element Manager, for Fermilab the DOE-FSO Manager, is now required to provide an annual report to local officials concerning discharges to sanitary sewers. Soil columns are explicitly prohibited.

Status of implementation at Fermilab: Develop protocols with DOE-FSO for notifying affected operators of sewage systems of DOE radiological discharges

Longstanding practices in place at Fermilab are in general in compliance with the provisions of this subsection. Extensive monitoring results exist that demonstrate that releases to surface waters are far below DCS values, or for multiple radionuclides the sum of fractional DCS values, as they were for the DCG values of 05400.5, and do not impact private or public drinking water systems in a way that causes such systems to exceed the maximum contamination limits of 40 CFR Part 141. The thresholds for applying BAT at the point of discharges expressed in subsection g. (5) are not exceeded.

Concerning the provisions pertaining to the discharges to sanitary sewers, extensive monitoring data exists that demonstrates that these provision are met. During CY 2012 Fermilab will coordinate with DOE-FSO the development of a protocol for notifying operators of sewage treatment facilities that receive Fermilab sanitary discharges to inform them of DOE practices and processes to monitor and control radiological discharges to sewers. Neither DOE nor Fermilab operate sewage treatment facilities on the Fermilab site.

As the Intensity Frontier research program in high energy physics develops at Fermilab, the production of radionuclides that are subject to liquid discharges, notably but not exclusively tritium, will increase. The Fermilab environmental monitoring program will continue to be refined to diligently monitor for radionuclides as the scientific research program of the Laboratory evolves.

- h. **Radioactive Waste and Spent Nuclear Fuel.** This section requires that management, storage, and disposal of radioactive waste be performed in a manner that keeps the total effective dose to members to the public from all pathways to be less than 25 mrem (0.25 mSv) in a year. Transportation of this waste is excluded from this requirement. This section also gives other provisions applicable to radioactive waste disposal site activities.

Status of implementation at Fermilab: Complete

It is not credible that the consequences of Fermilab radioactive waste management operations remotely approach the specified dose limit for members of the public. Fermilab does not manage any radioactive waste and spent nuclear fuel disposal facilities.

- i. **Protection of Drinking Water and Ground Water.** This section applies primarily to drinking water systems operated by DOE or a DOE contractor and requires equivalent protection to the community drinking water standards of 40 CFR Part 141. Neither Fermilab nor DOE-FSO operates any drinking water systems. Drinking water at Fermilab is purchased from the City of Warrenville. Fermilab has an established a Ground Water Protection Management Plan to address ground water protection

concerns. Ground water systems are to be protected from radiological contamination with several details listed.

Status of implementation at Fermilab: Complete

Fermilab has implemented all elements of this subsection. This documentation is found in the FESHM in the 8000 Chapter series.

- j. **Protection of biota.** This section addressed the assessment of doses to biota, especially when actions taken to protect humans from radiation and radioactive materials may not be adequate to protect biota. The use of the reference standard DOE-STD-1153-2002, *A Graded Approach for Evaluating Radiation Doses to Aquatic and Terrestrial Biota* is recommended.

Status of implementation at Fermilab: Develop a pathway analysis of impact on biota

Fermilab's program to protect humans from radiation and radioactive materials are generally deemed sufficient to protect biota. Assessments of the radiological impact on biota have been done. During CY 2012, a pathway analysis of the impact on biota will be performed and documented using DOE-STD-1153-2002 as a guide.

- k. **Release and Clearance of Property.** This section sets forth the procedures, dose constraints, and requirements needed to issue releases or clearances of property, both real and personal.

Status of implementation at Fermilab: Complete

Fermilab has already implemented release and clearance procedures in FRCM Article 411 that have been approved by DOE-FSO as a Work Smart Standard. These procedures assure that Fermilab does not release personal property that is also radioactive material or contaminated on the external surfaces with radioactive material. The values used for surface contamination are consistent with those of 10 CFR Part 835 and thus with those previously set forth in DOE O5400.5.

This section of O458.1 would also apply should Fermilab request release of metals encumbered by the metals recycling suspension of July 2000. Indeed, following these procedures would likely be the pathway followed to approve of such releases. At present such release of encumbered metals is dependent upon further actions of DOE Headquarters that include preparation and finalization of a National Environmental Policy Act document in accordance with the Memorandum for the Secretary entitled "Clearance for Recycle of Scrap Metal and Materials from Radiological Areas", EXEC-2011-009585, August 25, 2011. At present there are no plans for property releases affected by this subsection. Should such releases be planned in the future, the provisions of this subsection would be followed.

- l. **Records, Retention, and Reporting Requirements.** Much of this section contains requirements expected in a DOE Order of this type listed in order of appearance of in O458.1. This section in such reporting specifically requires the use of the special units of curie, rad, roentgen, rem and their submultiples while the SI units such as Becquerel (Bq), gray (Gy), and Sievert (Sv) may be provided parenthetically.

Status of implementation at Fermilab: Complete

Fermilab is in compliance with DOE records management requirements and continues to use the referenced system of units of measure in its Radiation Protection Program.

- m. **Implementation.** Full implementation is required within 18 months of the issue of this Order unless a different implementation schedule is approved by DOE-HQ. There is a provision for requesting alternative implementation schedules.

Status of implementation at Fermilab: Completion expected by end of CY 2012

All actions discussed in this crosswalk are scheduled for completion during CY 2012.

**O458.1 SECTION 5 – RESPONSIBILITIES**

This section is not discussed in detail here but it does restate the responsibilities of various DOE-entities mentioned elsewhere in the Order. There are no contractor-specific requirements in this section.

**O458.1 SECTION 6 – REFERENCES**

There are no contractor-specific requirements in this section.

**O458.1 CONTRACTOR REQUIREMENTS DOCUMENT (CRD) – ATTACHMENT 1 OF THE ORDER**

The requirements applicable to Fermilab have already been discussed.

**O458.1 CRD SECTION 1 – GENERAL REQUIREMENTS**

All actions discussed in this crosswalk are scheduled for completion during CY 2012.

**O458.1 CRD SECTION 2 – SPECIFIC REQUIREMENTS**

The requirements applicable to Fermilab have been discussed above.

**O458.1 DEFINITIONS – ATTACHMENT 2 OF THE ORDER**

The definitions will be most useful in developing the implementation of this Order. There is no further impact on implementation at Fermilab.

