		ES&H Section Procedures	
Procedure Number/Name ESH-RPO-SOURCE-04 DOE STD 1027-92 Summation of Accountable Radioactive Source and Nuclear Material Activity Totals By Facility Spreadsheet Instructions		Effective Date: 2/02/2021	
Written by: Kathy Graden	Reviewed and Updated By: Kathy Graden	Revision: 6	

DOE STD 1027-92 Summation of Accountable Radioactive Source and Nuclear Material Activity Totals Spreadsheet Instructions

Approvals

Written By:

Kathy Graden, ESH Radiation Physics Operations (RPO) Program Coordinator/Source Physicist

Reviewed By:

Sue McGimpsey, Radiation Safety Officer/Source Physicist Backup

Approved By:

Maddie Schoell, RPO Department Head

Revision History

Author	Description of Change	Revision Number	Revision Date
K. Graden	Editorial changes	0	7/22/2015
K. Graden	Editorial changes	1	6/15/2016
K. Graden	Changes include incorporation of ESH&Q Section procedure template, new numbering system, and editorial changes	2	1/10/2017
K. Graden	Changes to include additional steps for clarification.	3	9/11/2018
K. Graden	Changed ESH&Q Section to ES&H Section. Editorial Changes.	4	4/30/2019
K. Graden	Change in procedure to access, copy, and paste ES&H Section webpage "Radiation Sources Isotope Report" into Excel spreadsheet. Editorial changes.	5	4/13/2020
K. Graden	Incorporation of procedure into ESH RPO template. Update information for Oracle APEX radioactive source database	6	2/2/2021

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Procedure

1.0 Purpose

DOE Standard 1027-92, Hazard Categories of DOE Nuclear Facilities provides requirements and guidance for determining if a Department of Energy (DOE) nuclear facility is a Hazard Category (HC) 1, 2, 3, or Below HC-3 nuclear facility, as required by Title 10 of the Code of Federal Regulations (CFR) Part 830, Nuclear Safety Management. In establishing the safety basis for a hazard category 1, 2, or 3 DOE nuclear facility, Fermilab is responsible to categorize accountable radioactive sources and nuclear materials consistent with this DOE Standard.

This Standard does not apply to certain facilities or activities, irrespective of radioactive material quantities, that are not required to follow 10 CFR Part 830, Subpart B. Activities not required to comply with the provisions of 10 CFR Part 830, Subpart B, are those outside the scope of the regulation, as provided in 10 CFR Section 830.1, explicitly excluded by 10 CFR Section 830.2, Exclusions, or classified as Below Hazard Category 3. "Accelerators and their operations," and "activities involving only incidental use and generation of radioactive materials or radiation such as check and calibration sources, use of radioactive sources in research and experimental and analytical laboratory activities, electron microscopes, and X-ray machines" are outside the scope of 10 CFR Part 830 because they are excluded from the regulation's definition of "nuclear facility."

The following procedure provides step-by-step instructions for updating the Fermilab Activity Summation of Radioactive Source and Nuclear Materials Inventory List in accordance with DOE STD 1027-92 to ensure minimum category threshold values are not exceeded.

2.0 Scope

This procedure is limited to Activity Summation of Radioactive Source and Nuclear Materials Inventory Excel spreadsheet as it supports hazard categorization of accountable radioactive sources and nuclear materials at Fermilab.

3.0 Summary

N/A

4.0 Definitions

See DOE Standard 1027-92 for definitions.

5.0 Responsibilities

Fermilab ES&H Section Radiation Physics Operations Department Program Coordinator/Source Physicist is responsible to complete the Fermilab Activity Summation of Radioactive Source and Nuclear Materials Inventory List in accordance with DOE STD 1027-92.

6.0 Health and Safety Warnings

N/A. This is a database procedure.

7.0 Material, Equipment & Training Needed

7.1 Material & Equipment Required

- Computer

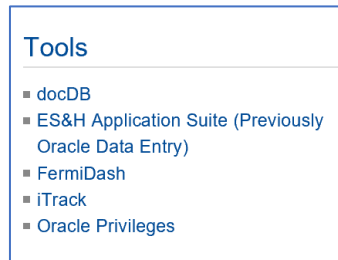
7.2 Training Required

N/A. There is no TRAIN course associated with this procedure.

8.0 Procedural Steps

8.1 Logon to Oracle APEX Radioactive Sources database

- 8.1.1 Go to ES&H Section webpage, *Tools* section on left side of page. Click *ESH Application Suite*.



- 8.1.2 Please note that only the Source Physicist and the Source Physicist Backup have access to this database. If you need access, contact Core Computing Division Business Applications Group Leader to request access. Logon in by clicking *Continue* when Fermilab authentication system page appears as shown below:

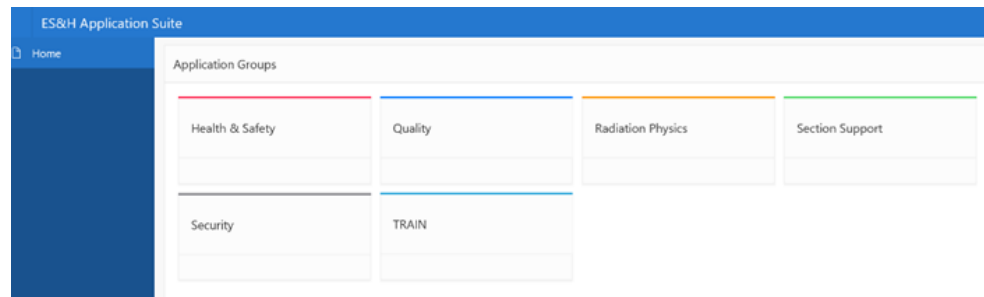


8.1.3 Click *Sign On* as shown below:



The image shows the Fermilab login interface. At the top left is the Fermilab logo. Below it, the text reads "Please enter your SERVICES user name and password." There are two input fields: "USERNAME" with the text "lgraden" and "PASSWORD" with masked characters "*****". A blue "Sign On" button is located at the bottom right of the form.

8.1.4 Click on *Radiation Physics* application. The following screen will appear.



8.1.5 Click on *Radioactive Sources*.

8.1.6 Click on *Reports* on the left-hand margin.

8.2 Generation of Accountable Isotope Inventory List

8.2.1 To generate the *Accountable Source Inventory* report, click on *Radioactive Sources-Accountable* report.

- Go to *Actions* tab and Click on *Download*
- Click on 'CSV'
- Click on the Excel icon on the bottom left of the webpage
- This will download the Oracle APEX data into an Excel spreadsheet that can be formatted
- Click on 'Save As.' Save file as 'Month Year Radioactive Source Accountable Inventory by Isotope' and change file extension to 'xlsx'
- Format the spreadsheet so that data in fields are visible. Orientation should be *Landscape*. Go to *Page Layout, Sheet*, and Enter *Rows to Repeat at Top* and *Print Area*. Title Header *Radioactive Source Accountable Inventory by Isotope as of &[Date]*

8.2.2 Sort the inventory list by *Isotope*. Be sure to click "My data has headers."

- 8.2.3 Insert a column between Decayed MicroCuries and Manufacturer. Name blank column "Decayed Curies." Convert microCuries to Curies from Decayed MicroCuries values. The formula is =D2/1000000 or =D3/1000000 (6 zero's) depending on header row. Copy cell and highlight entire column, then paste special – "All."
- 8.2.4 Format under *Scientific* with 2 decimals. *Alignment* should be right and bottom.
- 8.2.5 Insert column between Decayed Curies and Manufacturer. Name new column "Decayed Curies Values." Copy "Decayed Curies" into "Decayed Curies Values" column. Only paste values, not formula. This is the column that will be used to copy and paste updated decayed activities into "Month Year Accountable Radioactive Source and Nuclear Material Activity Totals By Facility" spreadsheet.

8.3 Generation of Radioactive Source and Nuclear Material Activity Totals by Facility Inventory List

- 8.3.1 Go to the most recent "Month Year Accountable Radioactive Source and Nuclear Material Activity Totals By Facility" spreadsheet and Save As current month and year. It is located on DocDB here: <https://esh-docdb.fnal.gov/cgi-bin/sso/ShowDocument?docid=151> (right click to open hyperlink).
- 8.3.2 Update the Decayed Curies date on the header to the date of the decayed microCuries on the Accountable Isotope Inventory spreadsheet.
- 8.3.3 Delete all the Decayed Curies Values in Column G of the "Month Year Accountable Radioactive Source and Nuclear Material Activity Totals By Facility" spreadsheet. **DON'T DELETE ANY NUCLEAR MATERIALS DATA FOR U-235 AND U-238. THIS DATA DOESN'T CHANGE BECAUSE HALF LIFE IS SO LONG.**
- 8.3.4 Print both spreadsheets and do a one to one cross check. Each source in the "Accountable Isotope Inventory" spreadsheet must match the "Accountable Radioactive Source and Nuclear Material Activity Totals By Facility" spreadsheet. Some sources may be in different locations or new sources may need to be added. Whatever the case, the Accountable Radioactive Source and Nuclear Material Activity Totals By Facility spreadsheet must have the exact sources as the "Accountable Isotope Inventory" spreadsheet.
- 8.3.5 ALL accountable sources that are issued to various field locations should be listed in the Site 40 Large Safe section of the "Accountable Radioactive Source and Nuclear Material Activity Totals By Facility" spreadsheet. Look in the various field locations to match up the sources located in various field locations for entry into the Large Safe section of the "Accountable Radioactive Source and Nuclear Material Activity Totals By Facility" spreadsheet.
- 8.3.6 Copy "Values" (not formula data) into Decayed Curies Column G. Highlight accountable inventory decayed microCurie values yellow after you finish pasting each value into Activity Totals spreadsheet to keep track of what has been copied. When copying values into Boneyard To Be Disposed, sort Accountable Inventory by Area, then Isotope, then Source ID.

- 8.3.7 Format Decayed Values to correspond with other numerical values – Scientific with 2 decimals.
- 8.3.8 For Curie values for U-235 and U-238 for the depleted uranium, use the Rad Pro calculator to convert kg to Curies.
<http://www.radprocalculator.com/Gamma.aspx>
- For example, the total U-238 (element weight) for the DZero Detector is 237,792 kg or 237,792,000 grams. Use the converter to obtain Curies which is 79.898 Ci. For U-235 (isotope weight) for the DZero Detector, U-235 isotope weight is 476 kg or 476,000 grams. Use the converter to calculate 1.02 Curies of U-235 for the DZero Detector. Do this for each of the locations where DU is stored
 - For ME7 North, add all element weights and then add all isotope weights together. Then use the Rad Pro calculator to convert the total U-235 and U-238 amounts to Curies. For example, The DU canister is 98 kg and the CCEM module is 529 kg for a total of 627 kg. Use the 627 (U-238/element weight) value to convert to Curies. Use 1 kg for U-235(isotope weight) calculation
- 8.3.9 Check the expiration dates for all Special Form Certificates listed in spreadsheet. Update accordingly. Special Form Certificates are located on DocDB here: <https://esh-docdb.fnal.gov/cgi-bin/sso/ShowDocument?docid=148> (right click to open hyperlink).
- 8.3.10 Verify that the Summations are correct in Column H. Example for Booster Neutrino Beamline Muon Alcoves sum is =SUM(G6:G8).
- 8.3.11 Verify that formulas in each of the turquoise subtotal rows in Columns I and J. For example, the formula for Column I should be H row number/M row number (H287/M287). Column J should be H row number/N row number (H287/N287).
- 8.3.12 Verify that the summation formulas for the yellow summation rows, Total Activity for each Building/Area are correct. Look at Columns K and L. Column K should have the summation formula corresponding to each turquoise summation row from Column I. Column L should have the summation formula corresponding to each turquoise summation row from Column J. For example, a formula for Column K may look like this: =SUM(I15,I113). RPCF TOTAL COLUMN K EXAMPLE: =SUM(I119,I121,I124,I148,I152,I154). For Column L, the formula may look like this: =SUM(J15,J113). RPCF TOTAL COLUMN L EXAMPLE: =SUM(J119,J121,J124,J148,J152,J154).
- 8.3.13 Verify “YES” and “NO” answers in Column O.
- 8.3.14 Title the spreadsheet “Fermilab Activity Summation of Radioactive Sources and Nuclear Materials – DOE STD 1027-92 as of &[Date].
- 8.3.15 Page set up for landscape legal size.
- 8.3.16 The row 1 Header for this spreadsheet should have the following information:

Facility Location	Isotope	Source ID	Receipt Date	Manufacturer	Configuration/Capsule Model Number	Decayed Activity as of date (Curies)	Sum of Activity by Isotope by Facility (Curies)	Ratio of Cat 2	Ratio of Cat 3	Sum of Threshold Ratios Cat 2 by Location	Sum of Threshold Ratios Cat 3 by Location	DOE STD 1027 Cat 2 Threshold Values (Curies)	DOE STD 1027 Cat 3 Threshold Values (Curies)	Are Facility Threshold Values for Ratio of Cat 2 & Cat 3 Isotopes Less than 1?	Potential for Criticality Threshold Quantity for U-233 (500 gms or 0.00151 Ci)	Potential for Criticality Threshold Quantity for U-235 (700 gms or 0.00151 Ci)	Potential for Criticality Threshold Quantity for Pu-239 (450 gms or 27.923 Ci)
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9.0 Data and Records Management

ESH-RPO-SOURCE-04, DOE STD 1027-92 Summation of Accountable Radioactive Source & Nuclear Material Activity Totals By Facility Spreadsheet Instructions, <https://esh-docdb.fnal.gov/cgi-bin/sso/ShowDocument?docid=151>

10.0 Quality Assurance/Quality Control

This procedure is subject to a review/update frequency requirement of five years and is due 2/2026.

11.0 References

DOE-STD-1027-2018, Hazard Categorization of DOE Nuclear Facilities, <https://www.standards.doe.gov/standards-documents/1000/1027-astd-2018>

12.0 SOP Signature Sheet

N/A

13.0 Procedure Specific Training Checklist

N/A

14.0 Attachments

N/A