 Fermilab		ES&H Section Procedures	
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Fermilab Radioactive Sources Database Entry Procedure, Inventory Lists, and Accountability Report

Approvals

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Revision History

Author	Description of Change	Revision Number	Revision Date
K. Graden	Editorial changes	0	2/25/2016
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Procedure

1.0 Purpose

This procedure describes how to make Radioactive Sources database entries, create radioactive source inventory lists, and complete the Radioactive Source Accountability Report.

2.0 Scope

This procedure is limited to Oracle Application Express (APEX) Radioactive Source database, inventory reports, and accountability report.

3.0 Summary

The Fermilab Radioactive Sources database is contained in an Oracle Application Express (APEX) platform. This procedure describes how to update this database for entry of new sources, source loans, returns, transfers, transfers of sources on instruments, and sources to be disposed. This procedure also provides instructions for downloading various types of source inventory lists and instructions for completion of the radioactive source accountability report.

4.0 Definitions

N/A

5.0 Responsibilities

The Fermilab ES&H Section Radiation Physics Operations (RPO) Department Program Coordinator/Source Physicist is responsible to complete the updates to Oracle APEX database, create and distribute inventory reports, and complete the monthly accountability report.

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
- Radiation Physics forms as referenced in Section 11.0, References

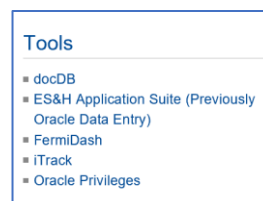
7.2 Training Required

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

8.0 Procedural Steps

8.1 Logon to Oracle APEX Radioactive Sources database

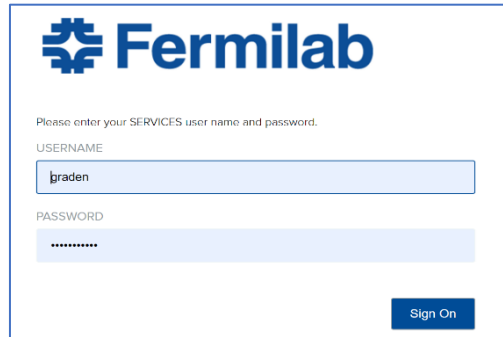
- 8.1.1 Go to ES&H Section webpage, *Tools* section on left side of page. Click *ESH Application Suite*.



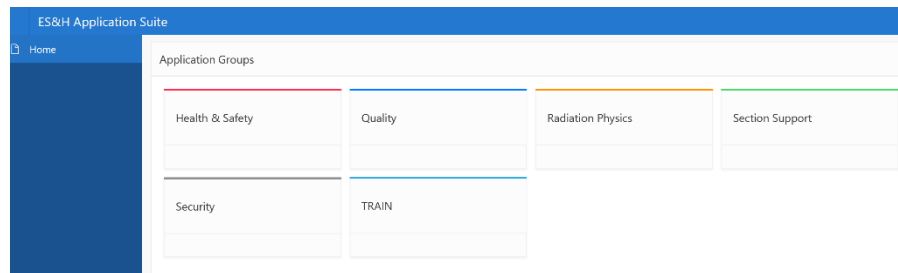
- 8.1.2 Please note that only the Source Physicist and the Source Physicist Backup have access to this database. If you need access, contact Core Computing Division Business Applications Group Leader to request access. Logon in by clicking *Continue* when Fermilab authentication system page appears as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



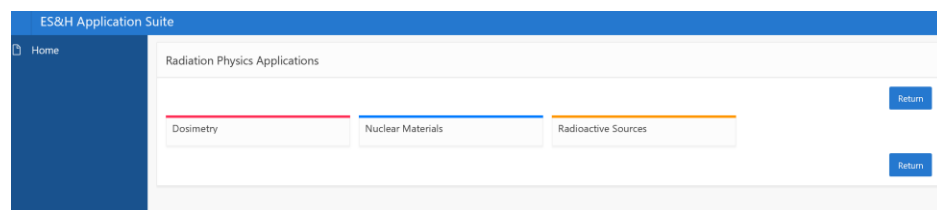
- 8.1.3 Click *Sign On* as shown below:



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



- 8.1.5 Click on *Radioactive Sources*.

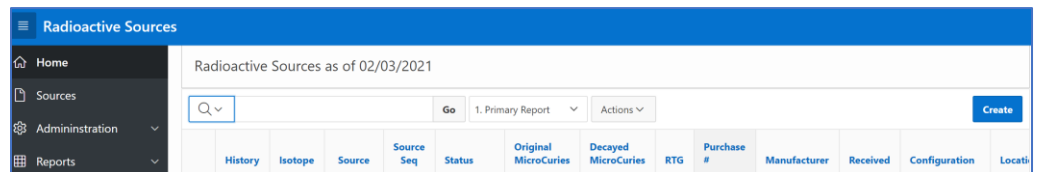


8.1.6 You will see the Oracle APEX radioactive source database appear as shown below:

History	Isotope	Source	Source Seq	Status	Original MicroCuries	Decayed MicroCuries	RTG	Purchase #	Manufacturer	Received	Configuration	Location
	RU-106	106(-1.1)	1	Disposed	.1	0	-	16212	IPL	27-AUG-84	ON SITE 7/16" NI DISK	-
	RU-106	106(-1.1)	2	Disposed	.1	0	No	21749	IPL	20-NOV-84	ON SITE 7/16" NI DISK	RPS SI LARGE
	RU-106	106(-1.1)	3	Disposed	.1	0	-	30891	IPL	19-APR-85	ON SITE 7/16" NI DISK	RPS SI LARGE
	RU-106	106(-1.1)	4	Disposed	.1	0	No	U.OF ROCH.	IPL	09-MAR-88	ON SITE 1 INCH DISK IN DEVICE	-
	RU-106	106(-1.1)	5	New	.055	.05	No	671073	ANALYTICS	18-DEC-20	2 INCH ALUMINUM FLANCHET	RPS R SAMPL CHAN
	RU-106	106(-1.2)	1	Disposed	.2	0	-	635490-00	IPL	12-SEP-90	ON SITE CUSTOM SS DISK/Hartman	RPS SI LARGE
	RU-106	106(-1.3)	1	On Loan	.3	0	No	U.OF ROCH.	IPL	07-MAR-90	SAN/PC BOARD/BLA TEV	DZERC CULTR

8.2 Entering a New Radioactive Source(s) into Oracle APEX Radioactive Sources Database

8.2.1 To enter a new radioactive source into this database, click the *Create* button as shown below:



8.2.2 After the *Create* button is clicked, this screen will appear:

The form contains the following fields:

- Source Code (required)
- Seq
- Purchase Num
- Status (required)
- Isotope (required)
- Received (calendar icon)
- Assigned To (dropdown)
- Location (dropdown)
- Configuration (text area)
- Comments (text area)
- UCI At Cal (required)
- Manufacturer (dropdown)
- Specific Activity
- Leak Date (calendar icon)
- RTG (required)
- Used By (dropdown)
- Interior Location

8.2.3 Refer to *Record of Radioactive Material Receipts and Shipments* form (R.P. Form #20) for entry of information for new radioactive source information. The ES&H Section Hazard Control Technology Team (HCTT) Source Technician will provide this completed form.

- 8.2.4 Click the 'Source Code' field. Enter new source ID into 'Source Code' field by entering the first 2 sets of numbers (including dash) of the source ID into the 'Source Code' field. Include the dash between the 1st and 2nd number and include the dash after the 2nd number. Examples: Source ID 137-0.4-400 must be entered as '137-0.4-' into 'Source Code' field. Source ID 137(-2.2)56, must be entered as '137(-2.2)' with **no dash before or after** the parentheses into 'Source Code' field. Source ID QCD.1-71 must be entered as 'QCD.1-' into 'Source Code' field.
- 8.2.5 Click 'Seq' field and enter the 3rd portion of the Source ID. Examples: Source ID 137-0.4-400 must be entered as '400' into the 'Seq.' field. Source ID 137(-2.2)56, must be entered as '56' into 'Seq.' field. Source ID QCD.1-71 must be entered as '71' into 'Seq.' field.
- 8.2.6 Click 'Purchase Number' field and enter purchase number for the new source(s).
- 8.2.7 Click 'Status' field and use pull down list to select *New*.
- 8.2.8 Click 'Isotope' field and use pull down list to select the isotope of the new source.
- 8.2.9 Click 'Received' field and use calendar to select the date the source was received.
- 8.2.10 If the source has not been loaned, leave 'Assigned To' blank. If the source has been loaned, see Section 8.3 below.
- 8.2.11 Click 'Location' field. Use pull down list to enter the current location of the radioactive source. If the location is not listed, click on *Administration* at the left side of the web page. Click on *Locations*. Click Edit tab. Look down the 'Area' column and locate a location that states 'Blank.' Click the box to the left. A check mark will appear. Locate column named 'Subarea' and click this field to enter the new location. Click the *Save* button. This screen is shown below:

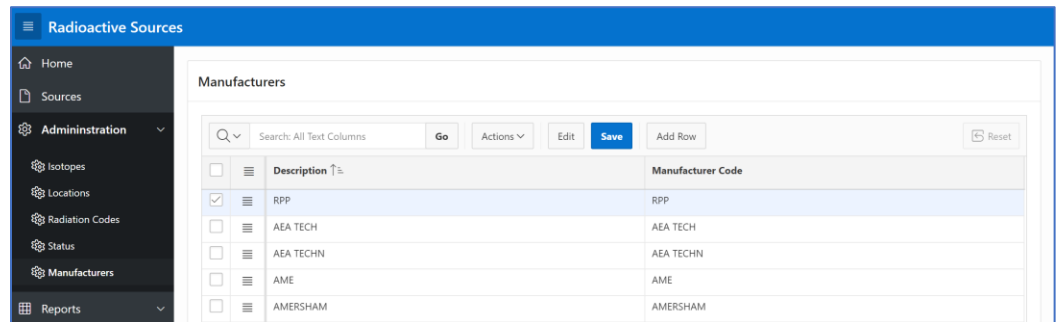
	Area ↑	Location Code	Subarea
<input checked="" type="checkbox"/>	AD	1	BZERO AREA
<input type="checkbox"/>	AD	41	AP 50 BOX 1
<input type="checkbox"/>	AD	310	NUMI ALCOVES
<input type="checkbox"/>	AD	270	MUCOOL TEST AREA BOX 17
<input type="checkbox"/>	AD	123	RCT HOT SHOP
<input type="checkbox"/>	AD	102	APP ROW 12

- 8.2.12 Click the back arrow to return to the *Create* page. Click 'Location' field. Use pull down list to enter the current location of the radioactive source.
- 8.2.13 Click 'Configuration' field. If the source is **accountable** as listed in Attachment 1, *10 CFR Part 835 Appendix E Values for Establishing Sealed Radioactive Source Accountability*, enter "**ACCOUNTABLE**" then continue to enter the source capsule model number or type of configuration such as 2 inch aluminum disk, wand, A2 capsule, 1 inch plastic disk, etc.
- 8.2.14 Skip 'Comments' field unless there is some useful information to add that is not already entered into another field.
- 8.2.15 Click 'UCI At Cal' field. Enter the activity of the new source in units of microCuries.

WARNING: Paper copies of this procedure may be obsolete after it is printed.

The current version of this procedure is found at: ESH DocDB 2139

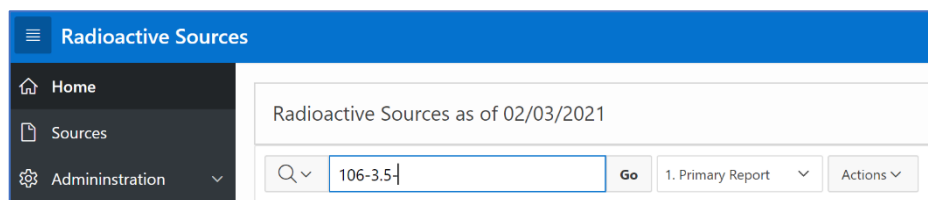
- 8.2.16 Click 'Manufacturer' field. Use pull down list to enter the manufacturer of the radioactive source. If the manufacturer is not listed, click on *Administration* at the left side of the web page. Click on *Manufacturers*. Click *Add Row* button. Enter the new manufacturer. Click the *Save* button. This screen is shown below:



- 8.2.17 Click the back arrow to return to the *Create* page. Click 'Manufacturer' field. Use pull down list to enter the manufacturer of the radioactive source.
- 8.2.18 Skip 'Specific Activity' field.
- 8.2.19 Skip 'Leak Date' field.
- 8.2.20 Click 'RTG' field and use pull down list to select *No*. This field is obsolete and was for irradiators.
- 8.2.21 Skip 'Used By' field.
- 8.2.22 Skip 'Interior Location' field.
- 8.2.23 After all required information has been added, click *Create* button. This will automatically save and enter the new source information in the database.

8.3 Accessing Data for Existing Radioactive Sources in Oracle APEX Radioactive Sources Database

- 8.3.1 To access and then make updates to Oracle APEX sources database, go to the SEARCH magnifying glass as shown below. Enter the first 2 parts of the source ID number including all dashes. Do not enter the last portion of the source ID. If the entire source ID is entered, the search will respond with "No data found." Click the *Go* button. See example for source ID 106-3.5-5 below:



8.3.2 All sources that have matching isotope (first number in source ID) and activity (second number in source ID) will appear as shown in the example below. Click on pencil icon to the left of the Source ID that needs to be updated.

Radioactive Sources as of 02/03/2021

Go 1. Primary Report Actions Create

Row text contains '106-3.5-'

History	Isotope	Source	Source Seq	Status	Original MicroCuries	Decayed MicroCuries	RTG	Purchase #	Manufacturer	Received	Configuration	Location
	RU-106	106-3.5-	1	Disposed	0	0	-	-	-	10-APR-77	-	-
	RU-106	106-3.5-	2	Disposed	0	0	-	-	-	10-APR-77	-	-
	RU-106	106-3.5-	3	On Loan	5000	.054	No	170694	IPL	21-JUN-04	2 INCH DISK	NEUTRINO NM4 BOX 15
	RU-106	106-3.5-	4	On Loan	5000	511.692	No	638189	E & Z IPL	12-OCT-17	ACCOUNTABLE A3203-4 CAP IN STD BETA GUN	NEUTRINO LAB C/D X-CONNECT BOX 5
	RU-106	106-3.5-	5	New	5000	4572.562	No	672568	E & Z IPL	18-DEC-20	ACCOUNTABLE A3203-4 CAPSULE MODEL PHI-106	RPS SITE 40-LARGE SAFE SHELF 2

8.3.3 A screen will appear that looks like the example below. All source ID updates can be made from this screen within the Oracle APEX database.

Sources

Cancel Delete Apply Changes

* Source Code 106-3.5-
Seq 5
Purchase Num 672568
* Status New
* Isotope RU-106
Received 18-DEC-2020
Assigned To
Location RPS SITE 40-LARGE SAFE SHELF 2
Configuration ACCOUNTABLE A3203-4 CAPSULE MODEL PHI-106
41 of 254
Comments

* UCI At Cal 5000
Manufacturer E & Z IPL
Specific Activity
Leak Date 18-DEC-2020
* RTG No
Used By
Interior Location

8.4 Entering

Data for Radioactive Source Loans

8.4.1 Refer to completed and signed *Radioactive Source Loan Form* (R.P. Form #12) for entry of information for radioactive source loans. This blank form is located on DocDB here: <https://esh-docdb.fnal.gov/cgi-bin/sso/ShowDocument?docid=1290>.

8.4.2 Follow instructions described in Section 8.3, *Accessing Data for Existing Radioactive Sources in Oracle APEX Radioactive Sources Database* to access the page that will allow source information to be updated.

8.4.3 Click on 'Status' field and use pull down list to enter 'On Loan.'

- 8.4.4 Click on 'Assigned To' field and use the pull down list or type in the name of the person to whom the source has been issued.
- 8.4.5 Click on 'Location' field and use the pull down list to choose the location where the source will be used and stored as indicated on the source loan form.
- 8.4.6 Click on *Apply Changes* button.

8.5 Entering Data for Radioactive Source Transfers

- 8.5.1 Refer to completed *Radioactive Source Transfer Form* (R.P. Form #45) for entry of information for radioactive source transfers. This blank form is located on DocDB here: <https://esh-docdb.fnal.gov/cgi-bin/sso/ShowDocument?docid=1307>
- 8.5.2 Follow instructions described in Section 8.3, *Accessing Data for Existing Radioactive Sources in Oracle APEX Radioactive Sources Database* to access the page that will allow source information to be updated.
- 8.5.3 Click on 'Status' field and use pull down list to enter 'Transferred.'
- 8.5.4 Click on 'Location' field and use the pull down list to choose the location where the source will be transferred to as indicated on the transfer form.
- 8.5.5 Click on *Apply Changes* button.

8.6 Entering Data for Radioactive Source Transfers (Installation/Removal) on Instruments

- 8.6.1 In almost all cases, one source will be newly installed on an instrument and an old source will be removed from the same instrument. Sources installed on and removed from instruments are considered source instrument transfers.
- 8.6.2 Refer to emails received from ES&H Section Radiation Physics Engineering (RPE) Instrumentation Team members for information regarding instrument transfers.
- 8.6.3 Follow instructions described in Section 8.3, *Accessing Data for Existing Radioactive Sources in Oracle APEX Radioactive Sources Database* to access the page that will allow source information to be updated.
- 8.6.4 Click on 'Status' field and use pull down list to enter 'Transferred.'
- 8.6.5 Click on 'Location' field and use the pull down list to choose the location where the source will be transferred to as indicated on the email from RPE Instrumentation Team member. For example, if the source is installed on a Chipmunk, the location is 'RPI-CHIPMUNKS.'
- 8.6.6 Click on 'Configuration' and change information according to email. For sources being installed on instruments, enter the instrument name and instrument number. For example, if source ID 137-0.4-496 is installed on chipmunk 23, then enter 'CHIPMUNK 23' in configuration field. For sources being removed from an instrument, configuration information needs to state the capsule type. For example, Cs-137 sources are usually '1 INCH DISK' and Sr-90 sources are usually '343 CAPSULE.'
- 8.6.7 Click on *Apply Changes* button.

8.7 Entering Data for Radioactive Source Returns

- 8.7.1 Refer to *Radioactive Source Return Form* (R.P. Form #44) for entry of information for radioactive source returns. This blank form is located here: <https://esh-docdb.fnal.gov/cgi-bin/sso/ShowDocument?docid=1306>.

- 8.7.2 Follow instructions described in Section 8.3, *Accessing Data for Existing Radioactive Sources in Oracle APEX Radioactive Sources Database* to access the page that will allow source information to be updated.
 - 8.7.3 Click on 'Status' field and use pull down list to enter 'Returned.'
 - 8.7.4 Click on 'Assigned To' and remove name of person that source was loaned to.
 - 8.7.5 Click on 'Location' field and use the pull down list to choose the location where the source will be returned to as indicated on the source return form.
 - 8.7.6 Click on *Apply Changes* button.
- 8.8 Entering Data for Radioactive Source To Be Disposed/Removed from Active Inventory
- 8.8.1 Refer to *Sources to be Disposed Log* (R.P. Form #4) OR *Record of Radioactive Material Receipts and Shipments* form (R.P. Form #20) for entry of information for radioactive sources to be disposed or for sources that are permanently shipped off-site. This blank form is located on DocDB here: <https://esh-docdb.fnal.gov/cgi-bin/sso/ShowDocument?docid=2381>.
 - 8.8.2 Follow instructions described in Section 8.3, *Accessing Data for Existing Radioactive Sources in Oracle APEX Radioactive Sources Database* to access the page that will allow source information to be updated.
 - 8.8.3 Click on 'Status' field and use pull down list to enter 'Disposed.'
 - 8.8.4 Click on 'Configuration, enter the word '**ON SITE**' at the beginning of the configuration field description. In addition, if the source is **ACCOUNTABLE** as listed in Attachment 1, *10 CFR Part 835 Appendix E Values for Establishing Sealed Radioactive Source Accountability*, it must be designated as an accountable source. If this is the case, in 'Configuration' field, enter: '**ON SITE ACCOUNTABLE**.' If the source is being shipped off-site permanently, enter the facility name that the source was shipped to.
 - 8.8.5 Click on *Apply Changes* button.
- 8.9 Downloading Oracle APEX Data into an Excel Spreadsheet and Generation of Location, Isotope, and Field Copy Source Inventory Lists
- 8.9.1 Three inventory lists are generated each month. The first list is sorted by **Location** and the second list is sorted by **Isotope**. The third list is the **Field Copy** which comprises only sources that are to be inventoried and wiped each month where source boxes, source check stations located in the field, and RCT sources are located. This list also includes the sealed neutron sources since they are also inventoried and wiped on a monthly basis. Sources installed in detectors such as CDF and DZero and all sources installed on instruments (RPI) are excluded from the **Field Copy** list.
 - 8.9.2 Follow steps in Section 8.1 to login to Oracle APEX radioactive sources database.
 - 8.9.3 Click on *Reports* on the left-hand margin. An example of what the screen looks like is shown below:

	History	Isotope	Source
		RU-106	106(-1.1)
		RU-106	106(-1.1)
		RU-106	106(-1.1)
		RU-106	106(-1.1)
		RU-106	106(-1.1)
		RU-106	106(-1.1)

8.9.4 To generate the *Location* report, click on *Radioactive Sources By Location* 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 Inventory by Location' 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 Inventory by Location as of &[Date]*

8.9.5 To create the Radioactive Source Inventory *FIELD COPY*, go to *Month Year Radioactive Sources by Location* Report that was just generated. Conduct a 'Save As' and rename the report *Month Year Radioactive Source FIELD COPY Inventory*.

- The FIELD COPY inventory is the list the HCTT uses to conduct monthly source inventory and leak testing. The FIELD COPY inventory list must be modified to include ONLY sources located in source boxes, source check stations located in the field, RCT sources, and RPS RPCF Cave 1 Neutron Sources. Delete many locations such as BNB MINOS Muon Alcoves, BZero Area, DZero Hall, DZero Outdoors, RPI, and RPS (except neutron sources).
- An example of some locations to **include** in FIELD COPY is shown below:
AD - RCT OFFICES AREA-RCT RAD MATERIALS CABINET
AD-RCT HOT SHOP
AD-RCT OFFICES AREA
AD-TRANS GALLERY NORTH BOX 14
LIQUID ARGON TEST FACILITY BOX 2

BOOSTER NEUTRINO BEAMLINE-MINOS SERVICE BUILDING BOX 8
 BOOSTER NEUTRINO BEAMLINE SCIBOONE BOX 23
 COMPUTING FCC 3RD FLOOR BOX 4
 MESON-MESON DET WEST BOX 7
 MUON CAMPUS MC1 BOX 9
 NEUTRINO-LAB A MU2E TESTING ROOM
 NEUTRINO-LAB C/D X-CONNECT BOX 5
 NEUTRINO-LAB G BOX 21
 NEUTRINO-NM4 BOX 15
 PROTON-PAB BOX 6
 PROTON PB7 WIDEBAND BOX 18
 RPS RPCF-CAVE 1 NEUTRON STORAGE SAFE
 RPS SITE 40 HIGH BAY
 TECHNICAL-IB1
 VILLAGE-LAB 3 BOX 10
 VILLAGE-LAB 5 BOX 11

- For semi-annual source inventory, the FIELD COPY must also include all 'RPS' areas as these sources will be inventoried as well.

8.9.6 To generate the *Isotope* report, click on *Radioactive Sources By Isotope* 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 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 Inventory by Isotope as of &[Date]*

8.9.7 Email Location, FIELD COPY, and Isotope inventory lists to the HCTT Source Technician and Source Technician backup around the 20th of each month.

8.9.8 Post inventory lists on DocDB here: <https://esh-docdb.fnal.gov/cgi-bin/sso/ShowDocument?docid=154>

8.10 Downloading Oracle APEX Data into Excel Spreadsheet and Generation of Radioactive Sources To Be Disposed On-Site Inventory List

8.10.1 Follow steps in Section 8.1 to login to Oracle APEX radioactive sources database.

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

8.10.3 To generate the *Radioactive Sources To Be Disposed* report, click on *Radioactive Sources To Be Disposed* 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 Sources To Be Disposed' 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 Sources to Be Disposed as of &[Date]*
- Thousands of lines of data will be retrieved, but the only data that should be included in this inventory list are sources that are still located **on-site**. Those sources are designated as 'ON SITE' in the configuration field. Conduct a sort by Configuration. Be sure to check the box that says 'My data has headers'
- Delete all data lines **except** those listed as **ON SITE** in the configuration column. Don't delete the header (line 1)
- Sort Data again by 'Isotope', then click 'Add a Level' and then select 'Source ID'
- Format as needed. Be sure to go to *Page Layout, Sheet*, and Enter *Rows to Repeat at Top* and *Print Area*

8.11 Downloading Oracle APEX Data into Excel Spreadsheet and Generation of Accountable Isotope Inventory List

- 8.11.1 Follow steps in Section 8.1 to login to Oracle APEX radioactive sources database.
- 8.11.2 Click on *Reports* on the left-hand margin.
- 8.11.3 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]*

8.12 Generating Monthly Radioactive Source Accountability Report

- 8.12.1 Follow steps in Section 8.1 to login to Oracle APEX radioactive sources database.
- 8.12.2 Click on *Reports* on the left-hand margin.
- 8.12.3 Click on *Source Inventory Totals* report.
- 8.12.4 Highlight the report, copy, and paste into a Word document. Use this report as the basis for the accountability report.

- 8.12.5 Use Fermilab Source Accountability Report, R.P. Form #30 to complete this report. This blank form is located on DocDB here: <https://esh-docdb.fnal.gov/cgi-bin/sso/ShowDocument?docid=153>.
- 8.12.6 Tally up all sources that were loaned, returned, transferred, instrument transfers, newly added, and deleted/to be disposed sources over the past month. It is important to keep a file of all source changes so that it is easy to tally up all the types of changes each month.
- 8.12.7 Use Source Inventory Totals report to complete the rest of the information on the Source Accountability Report which shows the number of sources at each location.
- 8.12.8 The total number of sources in the inventory must reconcile each month based on newly added sources and sources that have been deleted from the active inventory (to be disposed). Refer to the previous month's Source Accountability Report (R.P. Form #30) to record the total number of sources last month. To this number, add newly added sources to that total and then subtract any sources deleted from the active inventory. This is the total number of sources that must be recorded on the Source Accountability Report (R.P. Form #30). This total number must be identical to the total number shown on Source Inventory Totals report. If the totals do not match, go through the latest set of monthly changes to the database to find the data entry error. It may require going through every data entry for that month to find the error. Correct the error in the database and generate a new Source Inventory Totals report. Verify that this report reconciles with last month's total inventory number.
- 8.12.9 Staple all source changes for the month to the Source Inventory Totals report and file.
- 8.12.10 Post the Radioactive Source Accountability report on DocDB here: <https://esh-docdb.fnal.gov/cgi-bin/sso/ShowDocument?docid=153>.

9.0 Data and Records Management

ESH-RPO-SOURCE-02, Fermilab Radioactive Sources Database Entry Procedure, Inventory Lists, and Accountability Report, <https://esh-docdb.fnal.gov/cgi-bin/sso/ShowDocument?docid=2139>.
Radioactive Source Inventory Lists, <https://esh-docdb.fnal.gov/cgi-bin/sso/ShowDocument?docid=154>.

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

Radiation Physics Form #4, Sources To Be Disposed Log, <https://esh-docdb.fnal.gov/cgi-bin/sso/ShowDocument?docid=2381>

Radiation Physics Form #12, Radioactive Source Loan Form, <https://esh-docdb.fnal.gov/cgi-bin/sso/ShowDocument?docid=1290>

Radiation Physics Form #20, Record of Radioactive Material Receipts and Shipments, <https://esh-docdb.fnal.gov/cgi-bin/sso/ShowDocument?docid=1295>

Radiation Physics Form #30, Radioactive Source Accountability Report, <https://esh-docdb.fnal.gov/cgi-bin/sso/ShowDocument?docid=153>

Radiation Physics Form #44, Radioactive Source Return Form, <https://esh-docdb.fnal.gov/cgi-bin/sso/ShowDocument?docid=1306>

Radiation Physics Form #45, Radioactive Source Transfer Form, <https://esh-docdb.fnal.gov/cgi-bin/sso/ShowDocument?docid=1307>

12.0 SOP Signature Sheet

N/A

13.0 Procedure Specific Training Checklist

N/A

14.0 Attachments

10 CFR Part 835 Appendix E Values for Establishing Sealed Radioactive Source Accountability

Attachment 1

10 CFR Part 835 Appendix E

Values for Establishing Sealed Radioactive Source Accountability

The data presented in appendix E are to be used for identifying accountable sealed radioactive sources and radioactive material areas as those terms are defined at §835.2(a), establishing the need for radioactive material area posting in accordance with §835.603(g), and establishing the need for radioactive material labeling in accordance with §835.605.

Nuclide	Activity (μCi)
H-3	1.5E+08
Be-7	3.1E+03
Be-10	1.4E+05
C-14	4.6E+06
Na-22	1.9E+01
Al-26	1.5E+01
Si-32	4.9E+04
S-35	2.4E+06
Cl-36	5.2E+05
K-40	2.7E+02
Ca-41	9.3E+06
Ca-45	1.1E+06
Sc-46	6.2E+01
Ti-44	1.5E+02
V-49	1.0E+08
Mn-53	7.5E+07

Mn-54	6.5E+01
Fe-55	2.9E+06
Fe-59	1.9E+02
Fe-60	8.1E+03
Co-56	3.9E+01
Co-57	2.3E+02
Co-58	1.3E+02
Co-60	1.7E+01
Ni-59	3.2E+06
Ni-63	1.3E+06
Zn-65	1.1E+02
Ge-68	5.6E+02
As-73	5.3E+02
Se-75	6.3E+01
Se-79	8.7E+05
Rb-83	9.1E+01
Rb-84	2.0E+02
Sr-85	1.2E+02
Sr-89	4.8E+05
Sr-90	3.5E+04
Y-88	3.3E+01
Y-91	5.0E+04

Zr-88	1.1E+02
Zr-93	9.3E+04
Zr-95	1.9E+02
Nb-91	6.9E+01
Nb-91m	3.6E+02
Nb-92	1.8E+01
Nb-93m	4.4E+02
Nb-94	2.3E+01
Nb-95	3.4E+02
Mo-93	7.7E+01
Tc-95m	1.3E+02
Tc-97	8.1E+01
Tc-97m	3.5E+02
Tc-98	2.5E+01
Tc-99	8.4E+05
Ru-103	4.4E+02
Ru-106	2.5E+02
Rh-101	8.7E+05
Rh-102	3.0E+05
Rh-102m	6.4E+05
Pd-107	9.3E+06
Ag-105	3.3E+06

Ag-108m	1.8E+01
Ag-110m	2.2E+01
Cd-109	1.6E+02
Cd-113m	2.0E+04
Cd-115m	1.0E+04
In-114m	7.7E+02
Sn-113	3.1E+02
Sn-119m	3.3E+02
Sn-121m	8.1E+05
Sn-123	1.3E+04
Sn-126	1.8E+02
Sb-124	9.1E+01
Sb-125	6.7E+01
Te-121m	1.8E+02
Te-123m	2.8E+02
Te-125m	4.4E+02
Te-127m	8.0E+02
Te-129m	2.3E+03
I-125	3.5E+02
I-129	1.8E+02
Cs-134	2.6E+01
Cs-135	1.3E+06

Cs-137	6.0E+01
Ba-133	5.1E+01
La-137	2.7E+05
Ce-139	2.4E+02
Ce-141	2.4E+03
Ce-144	1.4E+03
Pm-143	1.3E+02
Pm-144	2.9E+01
Pm-145	2.6E+02
Pm-146	4.4E+01
Pm-147	7.7E+05
Pm-148m	1.0E+02
Sm-145	2.4E+06
Sm-146	4.0E+02
Sm-151	2.5E+05
Eu-148	1.1E+06
Eu-149	1.1E+07
Eu-152	3.1E+01
Eu-154	3.1E+01
Eu-155	3.6E+02
Gd-146	5.1E+05
Gd-148	9.0E+01

Gd-151	2.9E+06
Gd-153	2.1E+02
Tb-157	2.5E+03
Tb-158	9.0E+04
Tb-160	1.2E+02
Dy-159	1.0E+07
Ho-166m	2.1E+01
Tm-170	8.4E+03
Tm-171	2.8E+04
Yb-169	5.5E+02
Lu-173	1.8E+06
Lu-174	9.3E+05
Lu-174m	1.0E+06
Lu-177m	5.8E+01
Hf-172	7.3E+04
Hf-175	3.0E+06
Hf-178m	8.7E+03
Hf-181	3.4E+02
Hf-182	7.5E+03
Ta-179	9.3E+06
Ta-182	7.3E+01
W-181	1.0E+03

W-185	3.9E+06
W-188	6.3E+04
Re-183	5.3E+02
Re-184	2.6E+02
Re-184m	1.5E+02
Re-186m	3.4E+05
Os-185	1.3E+02
Os-194	6.4E+04
Ir-192	1.3E+02
Ir-192m	1.4E+05
Ir-194m	2.7E+01
Pt-193	8.7E+07
Au-195	4.8E+02
Hg-194	5.2E+04
Hg-203	4.9E+02
Tl-204	2.2E+04
Pb-202	1.9E+05
Pb-205	9.0E+01
Pb-210	9.2E+01
Bi-207	1.7E+01
Bi-208	1.5E+01
Bi-210m	1.2E+03

Po-209	6.3E+03
Po-210	1.2E+03
Ra-226	2.2E+02
Ra-228	1.5E+03
Ac-227	4.2E+00
Th-228	8.4E+01
Th-229	3.1E+01
Th-230	5.4E+00
Th-232	9.3E+01
Pa-231	3.0E+01
U-232	1.0E+02
U-233	3.9E+02
U-234	2.9E+02
U-235	6.7E+01
U-236	3.1E+02
U-238	3.5E+02
Np-235	1.1E+02
Np-236	2.1E+01
Np-237	4.9E+01
Pu-236	2.0E+02
Pu-237	3.3E+02
Pu-238	9.0E+01

Pu-239	8.4E+01
Pu-240	8.4E+01
Pu-241	4.6E+03
Pu-242	8.7E+01
Pu-244	9.0E+01
Am-241	7.2E+01
Am-242m	1.1E+02
Am-243	7.3E+01
Cm-241	1.0E+05
Cm-242	6.2E+02
Cm-243	4.8E+01
Cm-244	1.5E+02
Cm-245	5.0E+01
Cm-246	1.0E+02
Cm-247	8.5E+01
Cm-248	2.8E+01
Cm-250	5.4E+00
Bk-247	6.0E+01
Bk-249	2.7E+04
Cf-248	4.4E+02
Cf-249	5.5E+01
Cf-250	1.2E+02

Cf-251	5.3E+01
Cf-252	5.2E+00
Cf-254	1.2E+02
Es-254	6.3E+01
Es-255	8.8E+03
Fm-257	5.1E+02
Md-258	6.1E+02

Any alpha emitting radionuclide not listed in appendix E and mixtures of alpha emitters of unknown composition have a value of 10 μ Ci.

With the exception that any type of STC has a value of 10 Ci, any radionuclide other than alpha emitting radionuclides not listed in appendix E and mixtures of beta emitters of unknown composition have a value of 100 μ Ci.

Note: Where there is involved a mixture of radionuclides in known amounts, derive the value for the mixture as follows: determine, for each radionuclide in the mixture, the ratio between the quantity present in the mixture and the value otherwise established for the specific radionuclide when not in the mixture. If the sum of such ratios for all radionuclides in the mixture exceeds unity (1), then the accountability criterion has been exceeded.