

# Health Physics Journal

## OAK RIDGE RESERVATION ENVIRONMENTAL PROTECTION RAD NESHAPS RADIONUCLIDE INVENTORY WEB DATABASE AND RAD NESHAPS SOURCE AND DOSE DATABASE

--Manuscript Draft--

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| <b>Abstract:</b>                                     | <p>The US Environmental Protection Agency promulgated national emission standards for emissions of radionuclides other than radon from US Department of Energy facilities in Chapter 40 of the Code of Federal Regulations (CFR) 61, Subpart H. This regulatory standard limits the annual effective dose that any member of the public can receive from Department of Energy facilities to 0.1 mSv. As defined in the preamble of the final rule, all of the facilities on the Oak Ridge Reservation, i.e., the Y-12 National Security Complex, Oak Ridge National Laboratory, East Tennessee Technology Park, and any other Department of Energy operations on Oak Ridge Reservation, must meet the annual dose limit of 0.1 mSv. At Oak Ridge National Laboratory, there are monitored sources and numerous unmonitored sources. To maintain radiological source and inventory information for these unmonitored sources, e.g., laboratory hoods, equipment exhausts, and room exhausts not currently venting to monitored stacks on the Oak Ridge National Laboratory campus, the Environmental Protection Rad NESHAPs Inventory Web Database was developed. This database is updated annually and is used to compile emissions data for the annual Radionuclide National Emission Standards for Hazardous Air Pollutants (Rad NESHAPs) report required by 40 CFR 61.94. It also provides supporting documentation for facility compliance audits. In addition, a Rad NESHAPs source and dose database was developed to import the source and dose summary data from Clean Air Act Assessment Package-1988 computer model files. This database provides Oak Ridge Reservation and facility-specific source inventories, as well as, doses associated with each source, facility, and for the Oak Ridge Reservation.</p> |

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Manuscript title: Oak Ridge Reservation Environmental Protection Rad Neshaps Radionuclide Inventory Web Database AND Rad Neshaps Source and Dose Database

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## Reviewer Comments HPJ-D-16-00199

Note to Reviewer: Thank you for your review and comments – we tried to address all of your comments.

## General/global comments:

1. Population dose is now referred to as Collective Dose (e.g. 10 CFR 20.1003). Change all instances of Pop. dose and Population dose. – text and table1&2 [revised]
2. Provide a brief explicit statement somewhere of why the system is not used for major sources would be informative. [revised to include statement]
3. Not sure how to best address (and not sure if it's just "my read") but on P5, line 14 "...expected to be..." struck me as odd. My impression in the reading the earlier text was that the data were being used after the fact to estimate the doses from actual final emission estimates, but at this sentence the data are being used prospectively for planning purposes. Maybe make a statement (if true!) in the Introduction that (something like) ...data is entered for planning purposes... then verified at the end of the year when compliance calculations are finalized. [revised reflect concern]
4. For Figures that only show a portion of the full form (e.g. Fig 3) change caption to "Sample...". Also review text callouts to see if text needs to be updated.[revised]
5. When CAP88 files are referred to, e.g. .DAT, make file extensions uniformly all caps.[revised]

## Materials&amp;Methods –

6. Pg3, line54. ..."inaccurate at best." A footnote here providing an example of "inaccuracy" would be informative. [revised]
7. Pg3, line 58. Change "...and also to verify.." to "as an acceptable method of verifying.." because it doesn't make intuitive sense that a mathematical calculation of a release would verify that a greater release didn't occur. [revised]
8. P4, line 20. Typo - Lower case I on "inventories." [revised]
9. P4, line 22. Suggest changing "must be" to "are" [revised]
10. P4, line 50. Suggest changing "established" to "posted" to be more consistent with prior text and not introduce any additional confusion by the change in terminology. [revised]
11. P4, line 58. Delete "List of" to make more consistent with the format of the other bullets. Also change "for" to "during" [revised]
12. P5, lines 8-10. Suggest combining bullets "Annual amount in curies with documentation..." Also, delete the "(40CFR 61.95)" in the bulleted items; its mentioned in the following paragraph and I think it is best called out in the paragraph. Related topic(in Fig 5), there's a dropdown box for entry of activity units. If you can enter the activity in units other than Ci, that would be good to mention here page5. People like to have flexibility in the units they report. [revised text]
13. P5, line22. Typo – change "...sum or radioactive..." to "...sum of radio..." [revised]
14. P6, line8. Change "Excel" to "spreadsheet" [revised]
15. P6, line 12. After "also", suggest inserting "presented the appropriate time to" or something similar, for better subject verb agreement. [revised]
16. P6, line44. Suggest changing "per distance and direction" to "per receptor location" [revised]
17. P7, line12. Typo – change "provide" to "provides" [actually changed reports to report and changed to provides –editor addressed]
18. P7, lines 31-34. This assumption would not be true for short-lived nuclides when the source MEI is a significantly farther distance away. This assumption would be sufficient if the reference dose location and the source MEI distances were similar. A sentence (?or footnote) would be useful here to state this limitation of the % dose distribution. [included text to address limitation]
19. P8, line10. Suggest changing "eliminating data.." to "eliminating additional data handling..."

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- 20. P8, line 14. Delete this last sentence, it duplicates statement made at the end of the previous section. [revised]
- 21. Caption of Fig 9 – Suggest changing to: Manage sources form of RNDS. [revised]
- 22. Table 1. Fourth line of table. Capitalize “max” [revised]
- 23. Table 2. The “progeny” line in this example is curious. An explanation, as a table footnote or in the paper’s text would be informative. [Included text in paper]
- 24. When reviewing Fig 3 – Interested to know if it tracks the name of the person entering data. And if it tracks-for-review when sources are deleted. May or may not choose to include this information in the paper’s text. [No it does not – only selected people have access to updating inventory information]

SOFTWARE NOTE (outside the scope of paper review) -- In RNDS (figure 9 and 10), the units should be displayed for numerical information. I think the units are not variable in each field in RNDS, so adding the units after the header should work (?). [You are right units are not variable – will revise RNDS to include units –thanks.]

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**Editorial Office Comments:**

Response to Comments: Thank you for your comments – gave our editors your Table style and they revised the tables. We checked our Tables regarding the E-notation. However were unable to change the E-notation in the screenshots (see emails 2/16 and 2/20).

\*\*Your tables are not in HPJ/ORS style. Please see the attached file for example table style. To view this attached file, please click "view attachments" from the edit manuscript menu.

Also, it seems as though some of your figures use E-notation. Powers of 10 should be used--not E-notation.

**Note**

**OAK RIDGE RESERVATION ENVIRONMENTAL PROTECTION  
RAD NESHAPS RADIONUCLIDE INVENTORY WEB DATABASE  
AND RAD NESHAPS SOURCE AND DOSE DATABASE**

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The authors declare no conflicts of interest.

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**Abstract**—The US Environmental Protection Agency promulgated national emission standards for emissions of radionuclides other than radon from US Department of Energy facilities in Chapter 40 of the Code of Federal Regulations (CFR) 61, Subpart H. This regulatory standard limits the annual effective dose that any member of the public can receive from Department of Energy facilities to 0.1 mSv. As defined in the preamble of the final rule, all of the facilities on the Oak Ridge Reservation, i.e., the Y-12 National Security Complex, Oak Ridge National Laboratory, East Tennessee Technology Park, and any other US Department of Energy operations on Oak Ridge Reservation, combined, must meet the annual dose limit of 0.1 mSv. At Oak Ridge National Laboratory, there are monitored sources and numerous unmonitored sources. To maintain radiological source and inventory information for these unmonitored sources, e.g., laboratory hoods, equipment exhausts, and room exhausts not currently venting to

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4 monitored stacks on the Oak Ridge National Laboratory campus, the Environmental Protection Rad  
5 NESHAPs Inventory Web Database was developed. This database is updated annually and is used to  
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7 compile emissions data for the annual Radionuclide National Emission Standards for Hazardous Air  
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9 Pollutants (Rad NESHAPs) report required by 40 CFR 61.94. It also provides supporting documentation  
10  
11 for facility compliance audits. In addition, a Rad NESHAPs source and dose database was developed to  
12  
13 import the source and dose summary data from Clean Air Act Assessment Package–1988 computer  
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15 model files. This database provides Oak Ridge Reservation and facility-specific source inventory; doses  
16  
17 associated with each source and facility; and total doses for the Oak Ridge Reservation dose.  
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19

20  
21 Key words: environmental assessment; emissions, atmospheric; radiation dose; modeling, dose  
22  
23 assessment  
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## 25 26 27 INTRODUCTION 28 29

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31 The US Environmental Protection Agency (EPA) promulgated national emission standards for emissions  
32  
33 of radionuclides other than radon from US Department of Energy (DOE) facilities in Chapter 40 of the  
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35 Code of Federal Regulations (CFR) 61, Subpart H. This regulatory standard limits the annual effective  
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37 dose that any member of the public can receive from DOE facilities to 0.1 mSv (10 mrem).<sup>\*</sup> As defined in  
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39 the preamble of the final rule, the entire DOE facility on the Oak Ridge Reservation (ORR) must meet the  
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41 regulatory standard limit. In other words, the combined effective dose from all radiological air emission  
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43 sources from Y-12 National Security Complex, Oak Ridge National Laboratory (ORNL), East Tennessee  
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45 Technology Park, and any other DOE operations on the reservation must meet the annual dose limit of  
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47 0.1 mSv (10 mrem). There are a number of sources associated with each of these facilities.  
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50 To maintain radiological source and inventory information for unmonitored sources, e.g., laboratory  
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52 hoods, equipment exhausts, and room exhausts not currently venting to monitored stacks on the ORNL  
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54 campus, the ORNL Environmental Protection Services Division Rad NESHAPs Inventory Web Database  
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56 (EPRNIW) was developed and is updated annually. It is used to compile emissions data for unmonitored  
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58 minor sources for the annual Radionuclide National Emission Standards for Hazardous Air Pollutants  
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60 (Rad NESHAPs) report required by 40 CFR 61.94 and provides supporting documentation for facility  
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4 compliance audits. In addition, a Rad NESHAPs source and dose database (RNDS) was developed to  
5  
6 import the source and dose summary data from the Clean Air Act Assessment Package–1988 (CAP-88)  
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8 computer model PC version (CAP-88 PC<sup>†</sup>) files. The Rad NESHAPs source and dose database provides  
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10 Oak Ridge Reservation (ORR) and facility-specific source inventories as well as doses associated with  
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12 each source and facility, and source and facility-specific dose contributions for ORR. The elements  
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14 associated with development and uses of these databases are described further below.  
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## 19 **MATERIALS AND METHODS**

### 20 **Environmental Protection Rad NESHAPs Inventory Web Database**

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24 Title 40 CFR 61.93 requires that all emission points with potential annual doses greater than or  
25  
26 equal to 0.001 mSv (0.1 mrem) be sampled or directly monitored continuously. These sources are  
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28 categorized or designated as major sources. All release points that have a potential to release  
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30 radionuclides into the air with potential annual doses less than 0.001 mSv (0.1 mrem) are designated as  
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32 minor sources, for which, in accordance with, 40 CFR 61.93 (b)(4)(i), “periodic confirmatory  
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34 measurements shall be made to verify low emissions.” In evaluating potential radionuclide emissions,  
35  
36 40 CFR 61.93 (f) requires that “estimated radionuclide release rates . . . be based on the discharge of the  
37  
38 effluent stream that would result if all pollution control equipment did not exist, but the facilities operations  
39  
40 were otherwise normal.”  
41

42  
43 ORR has an EPA-approved compliance plan<sup>‡</sup> that outlines agreements made between DOE and  
44  
45 EPA Region 4 concerning implementation of the Rad NESHAPs requirements of 40 CFR 61, Subpart H,  
46  
47 on ORR and serves as an ongoing guidance document. Within this compliance plan are approved  
48  
49 methods to estimate potential radionuclide emissions from minor sources, which include periodic grab  
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51 sampling, radiological control data, engineering estimates, or using 40 CFR 61 Appendix D calculations.  
52  
53 For the many laboratory hoods, equipment exhausts, general building ventilation systems, and other  
54  
55 miscellaneous minor release points across the ORNL campus, emission rates are extremely low and  
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57 stack sampling would be impractical at worst and inaccurate at best. For example, extremely low  
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59 emission rates may not afford enough loading of radioactive material on the sample media to meet  
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4 minimum analytical detection limits. Therefore, 40 CFR 61 Appendix D calculations have been approved  
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6 in the ORR compliance plan for use in estimating emissions for annual reporting and use in verifying low  
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8 emissions for these sources. The ORR compliance plan also allows limitation of evaluation of potential  
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10 radionuclide emission sources to those sources located in posted radiological areas as determined under  
11  
12 facility radiological worker protection programs. Any potential emission source not located in a posted  
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14 radiological area does not have to be evaluated. Finally, due to the large number of these sources on the  
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16 ORNL campus and ORR, the ORR compliance plan allows minor sources to be grouped and evaluated  
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18 as a group for compliance purposes to reduce the administrative burden of estimating releases  
19  
20 individually.  
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23         EPRNIW was developed to compile and maintain radiological source and inventory information for  
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25 laboratory hoods, equipment exhausts, and room exhausts not currently venting to monitored stacks on  
26  
27 the ORNL campus. Rad NESHAPs inventories for all laboratory hood, equipment, and room exhaust  
28  
29 systems registered in EPRNIW are completed by January 31 of each year for previous calendar year  
30  
31 emissions reporting. These data are used to calculate emission rates used for determining the off-site  
32  
33 dose to members of the public for annual Rad NESHAPs reporting required by 40 CFR 61.94. These data  
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35 also provide supporting documentation for facility compliance audits for these sources. The EPRNIW  
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37 database replaced paper data entry forms, and data are automatically entered into the database online,  
38  
39 eliminating one level of data entry. In calendar year 2015, 73 radionuclide emission sources were  
40  
41 released from 36 exhaust locations (some hoods exhaust into a plenum before exhausting through a roof  
42  
43 vent), which resulted in 1,641 radioisotope emission records. The EPRNIW database helps to streamline  
44  
45 the data entry, emission calculation, and reporting process for these minor sources.  
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47         Three criteria are used to determine whether a particular radiological laboratory hood is a Rad  
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49 NESHAPs minor source:  
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- Are there potential airborne radiological emissions?
  - Are the emissions exhausted by forced air ventilation?
  - Do emissions occur in a posted radiological area?

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4 If the answer to all three questions is yes, then the laboratory hood, equipment exhaust, or room  
5 exhaust and associated radionuclide inventory must be entered into the EPRNIW database. If the  
6 radionuclide requirements apply, the following information needs to be completed.  
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- 10 • Isotopes that were used or handled during the calendar year
- 11 • Physical state of the material (gas/liquid/particulate)
- 12 • Whether the material was heated above 100°C
- 13 • Annual amount in curies<sup>s</sup> and documentation of how the curie amounts were determined
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20 The annual amount of curies entered into the database should be the total amount of radioactive  
21 material handled for the calendar year. EPA-allowed emission factors are added by the ORNL  
22 Environmental Protection Services Division to calculate annual emissions. Inventory documentation  
23 should be of sufficient quality to allow an independent auditor to verify the accuracy of the calculations or  
24 values reported (per 40 CFR 61.95). Historical methods for determining radionuclide inventories include  
25 analysis; annual sum of radioactive material handled for a year, e.g., logbook; specific activity  
26 calculations; waste profile data; radiation protection low volume air sampling data; radioactive decay  
27 calculations; building radionuclide material inventory data; reactor data; and isotope purchasing records.  
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37 The EPRNIW database uses ColdFusion version 11\*\*, which creates a data entry interface for users,  
38 and Microsoft SQL Server Enterprise<sup>††</sup> to store the data. The ColdFusion version 11 server and Microsoft  
39 SQL server are managed by the ORNL Information Technology Services Division (ITSD). Figs. 1 through  
40 6 are screen shots of the EPRNIW user interface elements of the database. Figs. 1 and 2 are samples of  
41 the database search capability for identifying specific source location and source information. Figs. 3  
42 through 6 are samples of the steps through the EPRNIW menus used for updating source location data  
43 and radiological data, uploading calculation method documentation, and updating the Rad NESHAPS  
44 inventory data. Fig. 7 shows a sample spreadsheet that uses the Rad NESHAPS inventory data to  
45 develop the source term for dose calculations. It should be noted that user authentication is in place for  
46 update and uploading functions.  
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## Rad NESHAPs Source and Dose Database

The source term data provided by EPRNIW are among the many source terms used for CAP-88 modeling for ORNL radionuclide air emissions. Originally CAP-88 mainframe modeling results were manually entered into interconnected Excel spreadsheets and later, using a macro program, imported to a series of interconnected Excel spreadsheets. This approach was cumbersome to maintain and update. With the use of CAP-88 PC version 3, the system was updated to a Microsoft Access database and Visual Basic program that imported source and dose information from CAP-88 PC version 3 input and output files. This Access database simplified data entry and automatically produced spreadsheet summary reports. The use of CAP-88 PC version 4 required that the database be updated to account for formatting changes and also presented the opportunity to create a web-based application that would be maintained by ITSD. This database, called Rad NESHAPS Database and Software (RNDS), is a web application that uses a Microsoft model-view-controller framework and Microsoft SQL Server<sup>††</sup> database. RNDS is designed to use files from CAP-88 PC version 4 and produces summary reports that can be imported to Excel spreadsheets. In addition, RNDS is subject to the ORNL software quality assurance (SQA) requirements, and an SQA plan was developed and is maintained by ITSD and can be accessed in ORNL's SharePoint Portal.

RNDS is used to import data from three CAP-88 PC version 4 files: the input file (.DAT), the synopsis file (.SYN), and the summary file (.SUM). Fig. 8 shows a sample of the menu for uploading CAP-88 PC version 4 files into RNDS. Multiple sets of files can be imported from each source. At ORNL, particularly for laboratory hood sources, a large number of radionuclides may be associated with a given source location. The Managing Sources tab, a sample shown in Figure 9, allows review and edit of source, receptor, and facility information. Fig. 10 shows a sample of source-specific data, which are entered into each source record. Fig. 11 is a sample of a Managing Receptor tab, which shows receptor-specific records, e.g., estimated doses per source and facility at the given receptor location.

The information from these files is used to populate a number of summary reports. RNDS retrieves source physical parameter data, nuclide-specific emission and dose data, and dose matrix data (doses per receptor location) from the CAP-88 PC version 4 files. Using logarithmic interpolation, RNDS also

calculates doses at receptor locations that do not directly correspond to the locations provided by CAP-88 PC version 4 output files. The summary reports created by RNDS include the following.

- Release Report—displays radionuclide-specific emission data for each source and facility and for ORR.
- Air Summary Report—summarizes radionuclide-specific emission data and doses per radionuclide and nuclide percent contribution to each facility maximum exposed individual (MEI) dose and ORR MEI dose.
- Reservation Summary Report—provides a matrix of receptor doses per source, facility, and ORR. This summary report also provides the collective doses per source, facility, and ORR.
- Major/Minor Report—summarizes emission data for each major source at ORNL and provides the total ORNL minor source inventory.
- Single Source Summary Report—provides detailed information regarding individual sources, i.e., physical parameters; actual and potential emissions; and doses per radionuclide at source MEI location, facility MEI location, and ORR MEI location.
- Source Distance and Direction Reports—list the distance and direction from the selected source to each receptor location in the report set. This information is used to select input distances for CAP-88 PC v4. Universal Transverse Mercator coordinates are used to calculate distance and direction between sources and receptors.

Tables 1 and 2 are examples of an Air Summary Report and Single Source Summary Report, respectively. The reference doses in Table 2 are the CAP-88 PC version 4 calculated MEI doses per radionuclide at the maximum dose location determined within the dose matrix (.SUM file). This location may not necessarily coincide with an actual receptor location; however, the percent dose distribution at this location is used to determine dose contribution per radionuclide at the actual source MEI location. This approach is considered to be conservative for most radionuclides (possible exception short-lived radionuclides) since the reference dose location may often be at a receptor distance closest to the source. CAP88PC v4 estimates doses, at the reference location, for source term radionuclides and their progeny. The doses associated with progeny are added and included, as shown in Table 3. Based on ORR meteorology, source, and facility activities, the MEI for sources, facilities, and ORR may vary

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4 annually, and thus MEI locations cannot be consistently predicted. As a result, this method has been  
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6 used to estimate doses for ORR sources and facilities.  
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8 One of the primary benefits of RNDS is minimization of the number of times the CAP-88 PC version  
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10 4 output data are manipulated. RNDS also has the capacity to include a large number of sources and  
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12 radionuclides and the capability to be used for multiple sites, not just ORR. ORNL ISTD maintains RNDS  
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14 and the associated SQA documentation.  
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## 18 **CONCLUSIONS**

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22 The original purpose of the EPRNIW database was to facilitate the collection of radionuclide  
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24 emission data for minor source laboratory hoods, equipment, and room exhausts and to replace paper  
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26 data entry forms. It allows online data entry, and because the data are automatically entered into a  
27  
28 database, one data entry step has been eliminated. The source terms derived from the EPRNIW  
29  
30 database are among the many source terms used in CAP-88 PC version 4 modeling for ORNL  
31  
32 radionuclide air emissions. CAP-88 PC version 4 files are imported directly to RNDS, eliminating  
33  
34 additional data handling.  
35  
36

### 37 **ACKNOWLEDGMENT OF FUNDING (OFFICE OF SCIENCE)**

38  
39 This material is based upon work supported by the US Department of Energy, Office of Science, Office of  
40  
41 [insert the sponsoring SC Program Office, e.g., Basic Energy Sciences], [Add any additional  
42  
43 acknowledgments or information requested by the sponsoring SC Program Office] under contract number  
44  
45 DE-AC05-00OR22725.  
46

### 47 **FOOTNOTES**

48  
49 \*Non-SI units are provided because the regulatory basis and software use are in non-SI units.  
50

51  
52 †CAP-88 PC is the PC version of CAP-88 (Clean Air Act Assessment Package–1988), a set of computer  
53  
54 programs, databases, and associated utility programs for estimating dose and risk from radionuclide  
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56 emissions to air. EPA uses it as a regulatory compliance tool under NESHAPs.  
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4 ‡US Department of Energy, Oak Ridge Office, *Compliance Plan: National Emission Standards for*  
5  
6 *Hazardous Air Pollutants for Airborne Radionuclides on the Oak Ridge Reservation, Oak Ridge,*  
7  
8 *Tennessee, DOE/ORO/2196, Rev. 1, April 4, 2013.*  
9

10  
11 §Units entered can also be millicuries ( $10^{-3}$  Ci), microcuries ( $10^{-6}$  Ci) and picocuries ( $10^{-12}$  Ci).  
12  
13

14 \*\*ColdFusion version 11 is an Adobe application which provides a single platform to rapidly build and  
15  
16 deploy web and mobile applications.  
17  
18

19 ††Microsoft SQL Server Enterprise is a relational database management system developed by Microsoft.  
20  
21 As a database server, it is a software product with the primary function of storing and retrieving data as  
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23 requested by other software applications.  
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**Figure Captions**

**Fig. 1.** Sample search form to identify building and source location for data input.

**Fig. 2.** Sample search results by division.

**Fig. 3.** Sample source data verification and update menu.

**Fig. 4.** Sample calculation method documentation upload form.

**Fig. 5.** Sample Rad NESHAPs inventory data entry form.

**Fig. 6.** Sample updated Rad NESHAPs inventory in database.

**Fig. 7.** Sample Rad NESHAPS inventory used for source term development.

**Fig. 8.** Sample CAP-88 PC version 4 import.

**Fig. 9.** Sample managing sources form of RNDS.

**Fig. 10.** Sample source-specific data imported to RNDS.

**Fig. 11.** Sample individual receptor record.

**Table Titles**

**Table 1.** Air Summary Report example—Radionuclide-specific dose contribution at ORNL and ORR MEI location.

**Table 2.** Single-source summary example.

**Table 1.** Air Summary Report example—Radionuclide-specific dose contribution at ORNL and ORR MEI location.<sup>a</sup>

|  |                   |                   |             | ORNL <sup>b</sup>      |                        |                       |                        |  | ORR Total <sup>b,c</sup> |                        |                       |     |
|--|-------------------|-------------------|-------------|------------------------|------------------------|-----------------------|------------------------|--|--------------------------|------------------------|-----------------------|-----|
| Location                                 |                   |                   |             | ORNL                   |                        | ORR                   |                        | Maximum individual E (mrem) <sup>d</sup> |                          | 4.01×10 <sup>-1</sup>  |                       |     |
| Maximum individual E (mrem) <sup>d</sup> |                   |                   |             | 3.9×10 <sup>-1</sup>   |                        | 3.9×10 <sup>-1</sup>  |                        | Maximum individual E (mrem) <sup>d</sup> |                          | 4.01×10 <sup>-1</sup>  |                       |     |
| % of ORR max individual E                |                   |                   |             |                        |                        | 9.84×10 <sup>1</sup>  |                        |  |                          |                        |                       |     |
| Collective E (person-rem) <sup>d</sup>   |                   |                   |             | 9.41                   |                        |                       |                        | Collective E (person-rem) <sup>d</sup>   |                          | 1.08×10 <sup>1</sup>   |                       |     |
| % of ORR collective E                    |                   |                   |             | 8.7×10 <sup>1</sup>    |                        |                       |                        |  |                          |                        |                       |     |
|  |                   |                   |             | ORNL Totals            |                        |                       |                        |  | ORR Totals               |                        |                       |     |
| Nuclide                                  | Type <sup>e</sup> | AMAD <sup>f</sup> | Form        | ORNL maximum           |                        | ORR maximum           |                        | ORR maximum                              |                          | Actual Emission (Ci)   | E (mrem)              | % E |
|  |                   |                   |             | E (mrem)               | % E                    | E (mrem)              | % E                    | E (mrem)                                 | % E                      |                        |                       |     |
| Ac-225                                   | M                 | 1                 | particulate | 1.35×10 <sup>-4</sup>  | 3.96×10 <sup>-4</sup>  | 1.00×10 <sup>-1</sup> | 3.96×10 <sup>-4</sup>  | 1.00×10 <sup>-1</sup>                    | 1.35×10 <sup>-4</sup>    | 3.96×10 <sup>-4</sup>  | 9.87×10 <sup>-2</sup> |     |
| Ac-226                                   | M                 | 1                 | particulate | 8.50×10 <sup>-6</sup>  | 3.79×10 <sup>-6</sup>  | 9.61×10 <sup>-4</sup> | 3.79×10 <sup>-6</sup>  | 9.61×10 <sup>-4</sup>                    | 8.50×10 <sup>-6</sup>    | 3.79×10 <sup>-6</sup>  | 9.45×10 <sup>-4</sup> |     |
| Ac-227                                   | M                 | 1                 | particulate | 2.89×10 <sup>-7</sup>  | 1.11×10 <sup>-5</sup>  | 2.82×10 <sup>-3</sup> | 1.11×10 <sup>-5</sup>  | 2.82×10 <sup>-3</sup>                    | 2.89×10 <sup>-7</sup>    | 1.11×10 <sup>-5</sup>  | 2.78×10 <sup>-3</sup> |     |
| Ac-228                                   | M                 | 1                 | particulate | 2.34×10 <sup>-5</sup>  | 7.05×10 <sup>-5</sup>  | 1.79×10 <sup>-2</sup> | 7.05×10 <sup>-5</sup>  | 1.79×10 <sup>-2</sup>                    | 2.34×10 <sup>-5</sup>    | 7.05×10 <sup>-5</sup>  | 1.76×10 <sup>-2</sup> |     |
| Ag-110m                                  | M                 | 1                 | particulate | 5.68×10 <sup>-5</sup>  | 1.86×10 <sup>-5</sup>  | 4.71×10 <sup>-3</sup> | 1.86×10 <sup>-5</sup>  | 4.71×10 <sup>-3</sup>                    | 5.68×10 <sup>-5</sup>    | 1.86×10 <sup>-5</sup>  | 4.63×10 <sup>-3</sup> |     |
| Ag-110m                                  | S                 | 1                 | particulate | 2.09×10 <sup>-6</sup>  | 7.83×10 <sup>-7</sup>  | 1.98×10 <sup>-4</sup> | 7.83×10 <sup>-7</sup>  | 1.98×10 <sup>-4</sup>                    | 2.09×10 <sup>-6</sup>    | 7.83×10 <sup>-7</sup>  | 1.95×10 <sup>-4</sup> |     |
| Ag-111                                   | M                 | 1                 | particulate | 1.05×10 <sup>-3</sup>  | 1.45×10 <sup>-6</sup>  | 3.68×10 <sup>-4</sup> | 1.45×10 <sup>-6</sup>  | 3.68×10 <sup>-4</sup>                    | 1.05×10 <sup>-3</sup>    | 1.45×10 <sup>-6</sup>  | 3.62×10 <sup>-4</sup> |     |
| Am-241                                   | F                 | 1                 | particulate | 1.79×10 <sup>-6</sup>  | 4.35×10 <sup>-5</sup>  | 1.10×10 <sup>-2</sup> | 4.35×10 <sup>-5</sup>  | 1.10×10 <sup>-2</sup>                    | 1.79×10 <sup>-6</sup>    | 4.35×10 <sup>-5</sup>  | 1.09×10 <sup>-2</sup> |     |
| Am-241                                   | M                 | 1                 | particulate | 9.98×10 <sup>-6</sup>  | 3.42×10 <sup>-4</sup>  | 8.67×10 <sup>-2</sup> | 3.42×10 <sup>-4</sup>  | 8.67×10 <sup>-2</sup>                    | 9.99×10 <sup>-6</sup>    | 3.42×10 <sup>-4</sup>  | 8.53×10 <sup>-2</sup> |     |
| Am-243                                   | M                 | 1                 | particulate | 6.92×10 <sup>-9</sup>  | 1.60×10 <sup>-7</sup>  | 4.06×10 <sup>-5</sup> | 1.60×10 <sup>-7</sup>  | 4.06×10 <sup>-5</sup>                    | 1.04×10 <sup>-8</sup>    | 1.60×10 <sup>-7</sup>  | 4.23×10 <sup>-5</sup> |     |
| Ar-41                                    | B                 | 0                 | unspecified | 3.17×10 <sup>2</sup>   | 5.48×10 <sup>-3</sup>  | 1.39×10 <sup>0</sup>  | 5.48×10 <sup>-3</sup>  | 1.39×10 <sup>0</sup>                     | 3.17×10 <sup>2</sup>     | 5.48×10 <sup>-3</sup>  | 1.37×10 <sup>0</sup>  |     |
| Ba-131                                   | M                 | 1                 | particulate | 1.23×10 <sup>-4</sup>  | 3.91×10 <sup>-7</sup>  | 9.91×10 <sup>-5</sup> | 3.91×10 <sup>-7</sup>  | 9.91×10 <sup>-5</sup>                    | 1.23×10 <sup>-4</sup>    | 3.91×10 <sup>-7</sup>  | 9.75×10 <sup>-5</sup> |     |
| Ba-137m                                  | B                 | 0                 | unspecified | 1.16×10 <sup>-12</sup> | 2.38×10 <sup>-11</sup> | 6.03×10 <sup>-9</sup> | 2.38×10 <sup>-11</sup> | 6.03×10 <sup>-9</sup>                    | 1.16×10 <sup>-12</sup>   | 2.38×10 <sup>-11</sup> | 5.93×10 <sup>-9</sup> |     |
| Ba-139                                   | M                 | 1                 | particulate | 3.20×10 <sup>-1</sup>  | 1.83×10 <sup>-6</sup>  | 4.63×10 <sup>-4</sup> | 1.83×10 <sup>-6</sup>  | 4.63×10 <sup>-4</sup>                    | 3.20×10 <sup>-1</sup>    | 1.83×10 <sup>-6</sup>  | 4.56×10 <sup>-4</sup> |     |
| Ba-140                                   | M                 | 1                 | particulate | 7.14×10 <sup>-4</sup>  | 2.81×10 <sup>-6</sup>  | 7.13×10 <sup>-4</sup> | 2.81×10 <sup>-6</sup>  | 7.13×10 <sup>-4</sup>                    | 7.14×10 <sup>-4</sup>    | 2.81×10 <sup>-6</sup>  | 7.02×10 <sup>-4</sup> |     |
| Ba-140                                   | S                 | 1                 | particulate | 2.82×10 <sup>-5</sup>  | 1.32×10 <sup>-7</sup>  | 3.35×10 <sup>-5</sup> | 1.32×10 <sup>-7</sup>  | 3.35×10 <sup>-5</sup>                    | 2.82×10 <sup>-5</sup>    | 1.32×10 <sup>-7</sup>  | 3.29×10 <sup>-5</sup> |     |

<sup>a</sup>This table has been truncated; there are many more radionuclides in the full Air Summary Report.

<sup>b</sup>ORNL MEI location was the same as the ORR MEI location.

<sup>c</sup>Omitted columns for East Tennessee Technology Park and Y-12 National Security Complex for example; however, contributions from these facilities may impact emissions and doses in ORR totals.

<sup>d</sup>Dose units are mrem and person-rem since CAP88PC version 4 individual dose units are mrem and collective doses are person-rem.

<sup>e</sup>Type: M = moderate, S = slow, F = fast, and B = blank, i.e., no value given.

<sup>f</sup>AMAD = activity median aerodynamic diameter.

**Table 2.** Single-source summary example.

|                               |                   |                   |             |                             |                        |                       |                        |                       |                        |                       |                       |                        |                       |                       |
|-------------------------------|-------------------|-------------------|-------------|-----------------------------|------------------------|-----------------------|------------------------|-----------------------|------------------------|-----------------------|-----------------------|------------------------|-----------------------|-----------------------|
| Source                        | X-3018            |                   |             | Facility                    | Source                 | ORNL                  | ORR                    |                       |                        |                       |                       |                        |                       |                       |
| File                          | X05               |                   |             | Maximum individual E (mrem) | 5.37×10 <sup>-8</sup>  | 2.90×10 <sup>-8</sup> | 2.90×10 <sup>-8</sup>  |                       |                        |                       |                       |                        |                       |                       |
| Type                          | Point             |                   |             | Distance (m)                | 5030                   | 5115                  | 5115                   |                       |                        |                       |                       |                        |                       |                       |
| Release height (m)            | 61                |                   |             | Direction                   | SW                     | E                     | E                      |                       |                        |                       |                       |                        |                       |                       |
| Diameter (m)                  | 4.11              |                   |             | % of maximum E              |                        | 7.35×10 <sup>-6</sup> | 7.23×10 <sup>-6</sup>  |                       |                        |                       |                       |                        |                       |                       |
| Exit gas velocity (m/s)       | 0.17              |                   |             | Collective E (person-rem)   |                        |                       |                        |                       |                        |                       |                       |                        |                       |                       |
| Exit gas temperature (deg. C) | Ambient           |                   |             | % of Collective E           |                        | 0.00                  | 0.00                   |                       |                        |                       |                       |                        |                       |                       |
|                               |                   |                   |             | <u>Reference</u>            | <u>Source</u>          | <u>ORNL</u>           | <u>ORR</u>             |                       |                        |                       |                       |                        |                       |                       |
| Nuclide                       | Type <sup>a</sup> | AMAD <sup>b</sup> | Form        | Actual emission (Ci)        | E (mrem)               | % E                   | E (mrem)               | E/Ci                  | E (mrem)               | % E                   | E/Ci                  | E (mrem)               | % E                   | E/Ci                  |
| Am-241                        | F                 | 1                 | particulate | 2.80×10 <sup>-9</sup>       | 1.13×10 <sup>-7</sup>  | 5.41×10 <sup>1</sup>  | 2.90×10 <sup>-8</sup>  | 1.04×10 <sup>1</sup>  | 1.57×10 <sup>-8</sup>  | 3.97×10 <sup>-6</sup> | 5.60×10 <sup>0</sup>  | 1.57×10 <sup>-8</sup>  | 3.91×10 <sup>-6</sup> | 5.60×10 <sup>0</sup>  |
| Pu-239                        | F                 | 1                 | particulate | 1.30×10 <sup>-10</sup>      | 6.41×10 <sup>-9</sup>  | 3.07×10 <sup>0</sup>  | 1.65×10 <sup>-9</sup>  | 1.27×10 <sup>1</sup>  | 8.90×10 <sup>-10</sup> | 2.25×10 <sup>-7</sup> | 6.84×10 <sup>0</sup>  | 8.90×10 <sup>-10</sup> | 2.22×10 <sup>-7</sup> | 6.84×10 <sup>0</sup>  |
| Pu-240                        | F                 | 1                 | particulate | 1.30×10 <sup>-10</sup>      | 6.42×10 <sup>-9</sup>  | 3.07×10 <sup>0</sup>  | 1.65×10 <sup>-9</sup>  | 1.27×10 <sup>1</sup>  | 8.91×10 <sup>-10</sup> | 2.26×10 <sup>-7</sup> | 6.85×10 <sup>0</sup>  | 8.91×10 <sup>-10</sup> | 2.22×10 <sup>-7</sup> | 6.85×10 <sup>0</sup>  |
| Sr-89                         | S                 | 1                 | particulate | 1.60×10 <sup>-8</sup>       | 5.08×10 <sup>-10</sup> | 2.43×10 <sup>-1</sup> | 1.30×10 <sup>-10</sup> | 8.15×10 <sup>-3</sup> | 7.05×10 <sup>-11</sup> | 1.79×10 <sup>-8</sup> | 4.41×10 <sup>-3</sup> | 7.05×10 <sup>-11</sup> | 1.76×10 <sup>-8</sup> | 4.41×10 <sup>-3</sup> |
| Sr-90                         | S                 | 1                 | particulate | 1.60×10 <sup>-8</sup>       | 5.99×10 <sup>-8</sup>  | 2.87×10 <sup>1</sup>  | 1.54×10 <sup>-8</sup>  | 9.61×10 <sup>-1</sup> | 8.31×10 <sup>-9</sup>  | 2.11×10 <sup>-6</sup> | 5.20×10 <sup>-1</sup> | 8.31×10 <sup>-9</sup>  | 2.07×10 <sup>-6</sup> | 5.20×10 <sup>-1</sup> |
| U-233                         | S                 | 1                 | particulate | 5.50×10 <sup>-10</sup>      | 2.42×10 <sup>-9</sup>  | 1.16×10 <sup>0</sup>  | 6.21×10 <sup>-10</sup> | 1.13×10 <sup>0</sup>  | 3.36×10 <sup>-10</sup> | 8.51×10 <sup>-8</sup> | 6.11×10 <sup>-1</sup> | 3.36×10 <sup>-10</sup> | 8.37×10 <sup>-8</sup> | 6.11×10 <sup>-1</sup> |
| U-234                         | S                 | 1                 | particulate | 5.50×10 <sup>-10</sup>      | 2.37×10 <sup>-9</sup>  | 1.13×10 <sup>0</sup>  | 6.09×10 <sup>-10</sup> | 1.11×10 <sup>0</sup>  | 3.29×10 <sup>-10</sup> | 8.33×10 <sup>-8</sup> | 5.98×10 <sup>-1</sup> | 3.29×10 <sup>-10</sup> | 8.20×10 <sup>-8</sup> | 5.98×10 <sup>-1</sup> |
| U-235                         | S                 | 1                 | particulate | 1.82×10 <sup>-10</sup>      | 1.14×10 <sup>-9</sup>  | 5.45×10 <sup>-1</sup> | 2.93×10 <sup>-10</sup> | 1.61×10 <sup>0</sup>  | 1.58×10 <sup>-10</sup> | 4.01×10 <sup>-8</sup> | 8.69×10 <sup>-1</sup> | 1.58×10 <sup>-10</sup> | 3.94×10 <sup>-8</sup> | 8.69×10 <sup>-1</sup> |
| U-238                         | S                 | 1                 | particulate | 4.40×10 <sup>-10</sup>      | 1.64×10 <sup>-9</sup>  | 7.85×10 <sup>-1</sup> | 4.21×10 <sup>-10</sup> | 9.57×10 <sup>-1</sup> | 2.28×10 <sup>-10</sup> | 5.77×10 <sup>-8</sup> | 5.17×10 <sup>-1</sup> | 2.28×10 <sup>-10</sup> | 5.67×10 <sup>-8</sup> | 5.17×10 <sup>-1</sup> |
| Progeny                       | *                 | 0                 | unspecified | 0.00×10 <sup>0</sup>        | 1.52×10 <sup>-8</sup>  | 7.27×10 <sup>0</sup>  | 3.90×10 <sup>-9</sup>  |                       | 2.11×10 <sup>-9</sup>  | 5.34×10 <sup>-7</sup> |                       | 2.11×10 <sup>-9</sup>  | 5.25×10 <sup>-7</sup> |                       |
| Totals                        |                   |                   |             | 3.68×10 <sup>-8</sup>       | 2.09×10 <sup>-7</sup>  | 1.00×10 <sup>2</sup>  | 5.37×10 <sup>-8</sup>  |                       | 2.90×10 <sup>-8</sup>  | 7.35×10 <sup>-6</sup> |                       | 2.90×10 <sup>-8</sup>  | 7.23×10 <sup>-6</sup> |                       |

<sup>a</sup>Type—F = fast, S = slow, and \* indicates a combination of types.

<sup>b</sup>AMAD = activity median aerodynamic diameter.

portal06.ornl.gov/sites/epws/epw/air/neshaps/radinventory/Pages/inventorydata.aspx

**Rad NESHAPs Inventory** · Rad NESHAPs Inventory Database

Environmental Protection Services Division and Transportation and Waste Management Division | [EPS](#) | [LWS](#) | [Div. Support](#) | [Analytical Services Program](#)

**ENVIRONMENTAL PROTECTION SERVICES**  
**OAK RIDGE NATIONAL LABORATORY** **RAD NESHAPS HOOD INVENTORY DATABASE**

[SEARCH](#)   [VALID USERS](#)   [HELP](#)

**SEARCH FORM**  
SEARCH CRITERIA: SELECT BUILDING OR DIVISION OR BUILDING AND DIVISION OR BUILDING AND ENTER ROOM.

**BUILDING:**

**DIVISION:**

**ROOM:**

**SELECT SOURCE TYPE**

- All Rad Sources
- Only sources that require an inventory
- Rad Sources that have been archived

Rad NESHAPs Inventory - Rad NESHAPs Inventory Database

Environmental Protection System Status and Environmental and Waste Management Status

SEARCH ADD SOURCE PRINT OPTIONS VALID USERS HELP

### SEARCH RESULTS (FOR CY 2016)

Rad Sources For Division = CSD (Chemical Sciences Division)  
33 Records Found Matching the Search Criteria

PLEASE NOTE: Rad sources with a gold blinking arrow pointing to the Source ID No. hyperlink require a rad inventory  
(Use the horizontal and vertical scroll bars to see all of your data.)

| Update Multiple Records | Last Certified | Certified By | Division | Building (Shop Program) | Corridor | Room | Vent ID (Diagram) | Source ID No. (Rad Source Inventory) | Source ID No. Type | Source Type | Source Status | Source Use | Rad Area Type            | Rad Material Type    | Emissions Monitored? | Stack ID | Control Device | Permit No. | Comments   |
|-------------------------|----------------|--------------|----------|-------------------------|----------|------|-------------------|--------------------------------------|--------------------|-------------|---------------|------------|--------------------------|----------------------|----------------------|----------|----------------|------------|--|
|                         | 02/02/2016     | NS           | CSD      | 4000                    | 2        | C263 | 000               | 7                                    | R                  | HOOD        | ON            | RESEARCH   | Contamination Area       | Sealed, But Operable | NO                   | NA       | HEPA           |            | RCRA SITE 30 Data Only   |
|                         | 02/02/2016     | NS           | CSD      | 4000                    | 2        | 0258 | 028               | 7                                    | NA                 | GLOVESBOX   | ON            | RESEARCH   | Radiological Area        | Sealed, But Operable | NO                   | NA       | HEPA           |            |  |
|                         | 02/02/2016     | NS           | CSD      | 4000                    | 2        | 0258 | 04C               | 7                                    | R                  | HOOD        | ON            | OTHER      | Contamination Area       | Sealed, But Operable | NO                   | NA       | HEPA           |            | MELALAB HOOD, EP 7. Part of C 2009 GLOVE BOX UNBROKE THIS YEAR   |
|                         | 02/02/2016     | NS           | CSD      | 4000                    | 2        | 0258 | 04B               | 7                                    | AP                 | GLOVESBOX   | OFF           | RESEARCH   | Contamination Area       | Sealed, Not Used     | NO                   | NA       | HEPA           |            | Alpha Gamma only   |
|                         | 02/02/2016     | NS           | CSD      | 4000                    | 2        | 0274 | 001               | 7                                    | R                  | HOOD        | ON            | RESEARCH   | Contamination Area       | Sealed, But Operable | NO                   | NA       | HEPA           |            | Alpha Gamma only   |
|                         | 02/02/2016     | NS           | CSD      | 4000                    | 2        | 0263 | 004               | 7                                    | R                  | HOOD        | ON            | OTHER      | Contamination Area       | Sealed, But Operable | NO                   | NA       | HEPA           |            | MELALAB HOOD, EP 5 NORTHWEST   |
|                         | 02/02/2016     | NS           | CSD      | 4000                    | 2        | 0263 | 00C               | 7                                    | R                  | HOOD        | ON            | OTHER      | Contamination Area       | Sealed, But Operable | NO                   | NA       | HEPA           |            | Gamma only USED FOR STORAGE  |
|                         | 02/02/2016     | NS           | CSD      | 4000                    | 3        | 0138 | 008               | 0030                                 | R                  | HOOD        | ON            | RESEARCH   | Fuel, Contamination Area | Fuel                 | NA                   | NA       | HEPA           |            | MELALAB HOOD, EP 200 WEST  |
|                         | 02/02/2016     | NS           | CSD      | 4001                    | 2        | 031  | 007               | 7                                    | R                  | HOOD        | ON            | RESEARCH   | Contamination Area       | Sealed, But Operable | NO                   | NA       | HEPA           |            |  |
|                         | 02/02/2016     | NS           | CSD      | 4001                    | 2        | 031  | 007               | 7                                    | R                  | HOOD        | ON            | RESEARCH   | Contamination Area       | Sealed, But Operable | NO                   | NA       | HEPA           |            |  |
|                         | 02/02/2016     | NS           | CSD      | 4001                    | 2        | 031  | 007               | 0030                                 | R                  | HOOD        | ON            | RESEARCH   | Contamination Area       | Decommissioned       | YES                  | 0030     | HEPA           | X-3039     | Emissions are captured in Rad 0039 Record attached. Extracts to 3039 stack. Formerly extracted to 3038 stack. Now extracts to local stack. |

# EDIT/DELETE RAD NESHAP SOURCE DATA ENTRY FORM

MODIFY THIS RECORD BY EDITING THE APPROPRIATE FIELDS AND CLICKING  
ON THE "SUBMIT" BUTTON BELOW.

CANCEL

Required fields are **bold rust**.

**DIVISION:**

CSD

**BUILDING:**

4500S

**LOCATION/ROOM:**

100 CHARACTERS ALLOWED

C263

**CORRIDOR:**

ONLY APPLIES TO 4500N&S

2

**VENT ID:**

ENTER 3 DIGITS: 001,010,179

059

[Click Here For Vent ID Help](#)

**TYPE OF SOURCE:**

HOOD

**SOURCE ID NO.:**

8499

**SOURCE ID TYPE:**

IE

If Source ID Type=NA, then Source ID No. must be NA.

**SOURCE STATUS:**

ON

**SOURCE USE:**

RESEARCH

**CONTROL DEVICE:**

HEPA

**RAD AREA TYPE:**

Contamination\_Area

**RAD MATERIAL TYPE:**

Sealed\_But\_Opened

**HOW ARE EMISSIONS  
DETERMINED?**

INVENTORY

**DISCHARGE TO PERMITTED  
STACK? IF NOT, NA.**

NA

**AIR PERMIT NO.:**

**DESCRIPTION/COMMENTS:**

RCRA SITE 32.  
Beta only.

RESET

SUBMIT

← → <https://portal06.ornl.gov/sites/epws/ep/air/neshaps/radinventory/Pages/inventorydata.aspx>

× Google Search Share More

Suggested Sites

One Action

**Rad NESHAPs Inventory** • Rad NESHAPs Inventory Database

Environmental Protection Services Division and Transportation and Waste Management Division EPS LWS Div. Support

Air Quality Compliance  
Dose Assessments  
Rad NESHAPs Compliance  
Rad NESHAPs Inventory  
EPS TestBox

NEPA Compliance  
Solid and Hazardous Waste Compliance  
Water Quality Protection

## RAD NESHAP INVENTORY DATA ENTRY FORM

FOR CY 2016

RETURN PRINT

**A Rad NESHAPs Inventory is required for this source.**

### SOURCE DATA

Division: Chemical Sciences Division (CSD) Building: 45005 Room: C263  
Corridor: 2 Vent ID No.: 059 Source ID No.: 8499 Type of Source: HOOD  
Source Status: ON Source Use: RESEARCH

Radikological Data **Calculation Method Documentation** Rad NESHAPs Inventory Data

### CALCULATION METHOD DOCUMENTATION

Upload Rad Inventory Calculation Methods Documentation Here: You can only upload one file as documentation. PDF file formats are preferred, however, Excel and Word file formats will also be accepted. If you have backup documentation in different file formats, combine as one PDF file and then upload here. Your document file name will be changed to: [Source Record No]CalcDoc\_[Reporting Year].[Your file extension]

**Calculation Method:** Annual Sum (e.g., logbook) ✓

**Description:**

**Documentation:** SRC1348CalcDoc\_2015.pdf

**Upload New File:** Browse...

UPLOAD/SAVE (Button Help)

RESET UPLOAD/SAVE

Browser address bar: <https://portal06.ornl.gov/sites/epws/ep/air/neshaps/radinventory/Pages/inventorydata.aspx>

Page Title: Rad NESHAPs Inventory - Rad NESHAPs Inventory Database

Navigation: Environmental Protection Services Division and Transportation and Waste Management Division | EPS | LWS | OHS Support

Left Sidebar: Air Quality Compliance, Dose Assessments, Rad NESHAPs Compliance, Rad NESHAPs Inventory, EPS ToolBox, NEPA Compliance, Solid and Hazardous Waste Compliance, Water Quality Protection

Buttons: RETURN, PRINT

Message: A Rad NESHAPs Inventory is required for this source.

Section: SOURCE DATA

Source Information: Division: Chemical Sciences Division (CSD) Building: 4501 Room: 218 Corridor: 0 Vent ID No.: 008 Source ID No.: 9117 Type of Source: HOOD Source Status: ON Source Use: RESEARCH

Navigation: Radiological Data | Calculation Method Documentation | Rad NESHAPs Inventory Data

Section: RAD NESHAPs INVENTORY DATA

SELECT YEAR: [Dropdown menu]

Button: VIEW INVENTORY DATA FROM A PREVIOUS YEAR

Information: EPA Exception for Heating Uranium & Tungsten

Text: All other isotopes that are heated above 100 °C that are NOT Uranium or Tungsten must be indicated as HEATED in the database.

Text: To Delete a record, click on the Delete button next to the record you want to delete. To Edit a record, change the data in the record to the desired values and click on the Save button. To Add a record, use the "Add An Isotope" form below. When you are complete with your Rad Inventory for the calendar year, click on the "Rad Inventory Complete" button below the table, and your entries will be locked in the database. Please note that you will not be able to add, edit or delete entries once you click that your Rad Inventory is Complete.

Text: If your source previously required a rad inventory but there was no activity this calendar year, either zero out the values for the isotopes listed previously or delete the isotope records by clicking on the "DELETE" button.

| Isotope                          | Heated                      | Physical Form                   | Amount Used | Units | Time Period | Comments |
|----------------------------------|-----------------------------|---------------------------------|-------------|-------|-------------|----------|
| <input type="checkbox"/> Ag-110m | <input type="checkbox"/> NO | <input type="checkbox"/> Liquid | 1.59E-005   | Ci    | Year        | N/A      |
| <input type="checkbox"/> Am-241  | <input type="checkbox"/> NO | <input type="checkbox"/> Liquid | 0.00015     | Ci    | Year        | N/A      |
| <input type="checkbox"/> Am-243  | <input type="checkbox"/> NO | <input type="checkbox"/> Liquid | 9.55E-005   | Ci    | Year        | N/A      |
| <input type="checkbox"/> Bk-211  | <input type="checkbox"/> NO | <input type="checkbox"/> Liquid | 8.31E-007   | Ci    | Year        | N/A      |
| <input type="checkbox"/> Cm-240  | <input type="checkbox"/> NO | <input type="checkbox"/> Liquid | 1E-006      | Ci    | Year        | N/A      |



**Minor Source Inventory Lab Hoods 2015**

This data was calculated using the queryRadGroupSourcesImport\_ORNLbyBLOG query from the RadInventoryData.mdb data base located at \\EPWData\$\\Air\ on the EPWSD server.

Table D  
Paragraph 2-b Paragraph 2-c

| BLOG | ROOM  | ID   | DIVISION | ISOTOPE | CONTROL | HEATED | FORM  | USEAMT | USEAMTUNIT | USETIMEUNIT | Conversion<br>mCi/uCi/pCi to Ci | Solb<br>Factor | Liquid<br>Factor | Powder<br>Factor | HEAT<br>Factor | Form<br>Factor<br>Selected | HEPA<br>Factor | BLDG | ISOTOPE | Table D<br>Emissions<br>Ci/Year |          |
|------|-------|------|----------|---------|---------|--------|-------|--------|------------|-------------|---------------------------------|----------------|------------------|------------------|----------------|----------------------------|----------------|------|---------|---------------------------------|----------|
| 1    | 2007  | 102  | 1162     | NRPD/O3 | H-3     | OTHER  | FALSE | Sas    | 1.9        | uCi         | Year                            | 0.000001       | 1                | 1                | 0              | 1                          | 0.000001       | 0.01 | 2007    | H-3                             | 1.90E-08 |
| 2    | 2649  | BAR  | 1        | UCOR    | Am-241  | HEPA   | FALSE | Solid  | 63.3       | uCi         | Year                            | 0.000001       | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 2649    | Am-241                          | 6.33E-13 |
| 3    | 2649  | BAR  | 1        | UCOR    | C-14    | HEPA   | FALSE | Solid  | 2.75       | uCi         | Year                            | 0.000001       | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 2649    | C-14                            | 2.75E-14 |
| 4    | 2649  | BAR  | 1        | UCOR    | Cm-244  | HEPA   | FALSE | Solid  | 150.23     | uCi         | Year                            | 0.000001       | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 2649    | Cm-244                          | 1.50E-12 |
| 5    | 2649  | BAR  | 1        | UCOR    | Co-60   | HEPA   | FALSE | Solid  | 116.22     | uCi         | Year                            | 0.000001       | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 2649    | Co-60                           | 1.16E-12 |
| 6    | 2649  | BAR  | 1        | UCOR    | Cs-134  | HEPA   | FALSE | Solid  | 225.75     | uCi         | Year                            | 0.000001       | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 2649    | Cs-134                          | 2.26E-12 |
| 7    | 2649  | BAR  | 1        | UCOR    | Cs-137  | HEPA   | FALSE | Solid  | 2220       | uCi         | Year                            | 0.000001       | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 2649    | Cs-137                          | 2.22E-11 |
| 8    | 2649  | BAR  | 1        | UCOR    | Eu-152  | HEPA   | FALSE | Solid  | 437.5      | uCi         | Year                            | 0.000001       | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 2649    | Eu-152                          | 4.38E-12 |
| 9    | 2649  | BAR  | 1        | UCOR    | Eu-154  | HEPA   | FALSE | Solid  | 302.5      | uCi         | Year                            | 0.000001       | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 2649    | Eu-154                          | 3.03E-12 |
| 10   | 2649  | BAR  | 1        | UCOR    | Eu-155  | HEPA   | FALSE | Solid  | 83.25      | uCi         | Year                            | 0.000001       | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 2649    | Eu-155                          | 8.33E-13 |
| 11   | 2649  | BAR  | 1        | UCOR    | H-3     | HEPA   | FALSE | Solid  | 52         | uCi         | Year                            | 0.000001       | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 2649    | H-3                             | 5.20E-11 |
| 12   | 2649  | BAR  | 1        | UCOR    | Pu-238  | HEPA   | FALSE | Solid  | 2.623      | uCi         | Year                            | 0.000001       | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 2649    | Pu-238                          | 2.62E-14 |
| 13   | 2649  | BAR  | 1        | UCOR    | Pu-239  | HEPA   | FALSE | Solid  | 2.873      | uCi         | Year                            | 0.000001       | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 2649    | Pu-239                          | 2.88E-14 |
| 14   | 2649  | BAR  | 1        | UCOR    | Pu-241  | HEPA   | FALSE | Solid  | 26.75      | uCi         | Year                            | 0.000001       | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 2649    | Pu-241                          | 2.68E-13 |
| 15   | 2649  | BAR  | 1        | UCOR    | Ru-106  | HEPA   | FALSE | Solid  | 1240       | uCi         | Year                            | 0.000001       | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 2649    | Ru-106                          | 1.24E-11 |
| 16   | 2649  | BAR  | 1        | UCOR    | Sr-90   | HEPA   | FALSE | Solid  | 1813       | uCi         | Year                            | 0.000001       | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 2649    | Sr-90                           | 1.81E-11 |
| 17   | 2649  | BAR  | 1        | UCOR    | U-232   | HEPA   | FALSE | Solid  | 4.473      | uCi         | Year                            | 0.000001       | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 2649    | U-232                           | 4.48E-14 |
| 18   | 2649  | BAR  | 1        | UCOR    | U-233   | HEPA   | FALSE | Solid  | 63.23      | uCi         | Year                            | 0.000001       | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 2649    | U-233                           | 6.33E-13 |
| 19   | 2649  | BAR  | 1        | UCOR    | U-235   | HEPA   | FALSE | Solid  | 3.77       | uCi         | Year                            | 0.000001       | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 2649    | U-235                           | 3.77E-14 |
| 20   | 3025E | Cell | CellAcc  | NRPD    | Am-241  | HEPA   | FALSE | Solid  | 1.1558E-05 | Ci          | Year                            | 1              | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 3025E   | Am-241                          | 1.16E-13 |
| 21   | 3025E | Cell | CellAcc  | NRPD    | Be-7    | HEPA   | FALSE | Solid  | 0.010056   | Ci          | Year                            | 1              | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 3025E   | Be-7                            | 1.01E-10 |
| 22   | 3025E | Cell | CellAcc  | NRPD    | Cm-242  | HEPA   | FALSE | Solid  | 4.1713E-06 | Ci          | Year                            | 1              | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 3025E   | Cm-242                          | 4.17E-14 |
| 23   | 3025E | Cell | CellAcc  | NRPD    | Cm-243  | HEPA   | FALSE | Solid  | 0.00013581 | Ci          | Year                            | 1              | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 3025E   | Cm-243                          | 2.36E-12 |
| 24   | 3025E | Cell | CellAcc  | NRPD    | Cm-244  | HEPA   | FALSE | Solid  | 0.00013581 | Ci          | Year                            | 1              | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 3025E   | Cm-244                          | 2.36E-12 |
| 25   | 3025E | Cell | CellAcc  | NRPD    | Cm-245  | HEPA   | FALSE | Solid  | 5.9477E-07 | Ci          | Year                            | 1              | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 3025E   | Cm-245                          | 5.95E-15 |
| 26   | 3025E | Cell | CellAcc  | NRPD    | Cm-246  | HEPA   | FALSE | Solid  | 5.9477E-07 | Ci          | Year                            | 1              | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 3025E   | Cm-246                          | 5.95E-15 |
| 27   | 3025E | Cell | CellAcc  | NRPD    | Co-60   | HEPA   | FALSE | Solid  | 0.17842    | Ci          | Year                            | 1              | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 3025E   | Co-60                           | 1.78E-09 |
| 28   | 3025E | Cell | CellAcc  | NRPD    | Cr-51   | HEPA   | FALSE | Solid  | 0.04132    | Ci          | Year                            | 1              | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 3025E   | Cr-51                           | 4.13E-10 |
| 29   | 3025E | Cell | CellAcc  | NRPD    | Cs-134  | HEPA   | FALSE | Solid  | 0.00543029 | Ci          | Year                            | 1              | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 3025E   | Cs-134                          | 4.30E-12 |
| 30   | 3025E | Cell | CellAcc  | NRPD    | Cs-137  | HEPA   | FALSE | Solid  | 0.001419   | Ci          | Year                            | 1              | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 3025E   | Cs-137                          | 1.42E-11 |
| 31   | 3025E | Cell | CellAcc  | NRPD    | Fe-59   | HEPA   | FALSE | Solid  | 0.022871   | Ci          | Year                            | 1              | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 3025E   | Fe-59                           | 2.29E-10 |
| 32   | 3025E | Cell | CellAcc  | NRPD    | Gd-153  | HEPA   | FALSE | Solid  | 0.0080478  | Ci          | Year                            | 1              | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 3025E   | Gd-153                          | 8.05E-11 |
| 33   | 3025E | Cell | CellAcc  | NRPD    | Ir-192  | HEPA   | FALSE | Solid  | 0.0012744  | Ci          | Year                            | 1              | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 3025E   | Ir-192                          | 1.27E-11 |
| 34   | 3025E | Cell | CellAcc  | NRPD    | Mn-54   | HEPA   | FALSE | Solid  | 0.10624    | Ci          | Year                            | 1              | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 3025E   | Mn-54                           | 1.06E-09 |
| 35   | 3025E | Cell | CellAcc  | NRPD    | Nb-95   | HEPA   | FALSE | Solid  | 0.003601   | Ci          | Year                            | 1              | 0.000001         | 1                | 1              | 0                          | 0.000001       | 0.01 | 3025E   | Nb-95                           | 3.60E-11 |

Inventory Source: Total Emissions: 1000's 2000's 3000's 4000's 5000's 6000's 7000's

### Upload CAP88 Results

Source  
K16 (K-2500-H-D)

Files  
No files selected.

Active Report Set:  
**2015 RadNeshaps**  
Last Recalculation: Jun 01, 2016 12:34 PM  
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**Source List**

[Create New](#) [Show Inactive](#)

| Source Name      | File | Plant | Active | UTM                         | Nuclides | CAP88 Doses | Estimated Doses |  |
|------------------|------|-------|--------|-----------------------------|----------|-------------|-----------------|--|
| K-1200 South Bay | K21  | K25   | Y      | X:735754.00<br>Y:3979424.00 | 24       | 320         | 111             | <a href="#">Details</a>   <a href="#">Recalculate</a>   <a href="#">Edit</a> |
| K-1407-AL CWTS   | K20  | K25   | Y      | X:735713.23<br>Y:3980196.40 | 8        | 320         | 111             | <a href="#">Details</a>   <a href="#">Recalculate</a>   <a href="#">Edit</a> |
| K-2500-H Stack B | K22  | K25   | Y      | X:734874.15<br>Y:3980381.20 | 6        | 320         | 111             | <a href="#">Details</a>   <a href="#">Recalculate</a>   <a href="#">Edit</a> |
| K-2500-H Stack C | K18  | K25   | Y      | X:734883.89<br>Y:3980381.76 | 6        | 320         | 111             | <a href="#">Details</a>   <a href="#">Recalculate</a>   <a href="#">Edit</a> |
| K-2500-H-D       | K16  | K25   | Y      | X:734905.94<br>Y:3980373.20 | 6        | 320         | 111             | <a href="#">Details</a>   <a href="#">Recalculate</a>   <a href="#">Edit</a> |
| X-1000 LabHoods  | X32  | X10   | Y      | X:741625.47<br>Y:3978748.11 |          |             | 111             | <a href="#">Details</a>   <a href="#">Recalculate</a>   <a href="#">Edit</a> |
| X-2000 Lab Hoods | X31  | X10   | Y      | X:741625.47<br>Y:3979279.34 | 19       | 320         | 111             | <a href="#">Details</a>   <a href="#">Recalculate</a>   <a href="#">Edit</a> |
| X-2028           | X02  | X10   | Y      | X:741828.05<br>Y:3979192.31 | 21       | 320         | 111             | <a href="#">Details</a>   <a href="#">Recalculate</a>   <a href="#">Edit</a> |
| X-2099           | X03  | X10   | Y      | X:741844.92<br>Y:3979166.41 | 13       | 320         | 111             | <a href="#">Details</a>   <a href="#">Recalculate</a>   <a href="#">Edit</a> |
| X-3000 LabHoods  | X33  | X10   | Y      | X:742164.31<br>Y:3979279.34 | 60       | 320         | 111             | <a href="#">Details</a>   <a href="#">Recalculate</a>   <a href="#">Edit</a> |
| X-3018           | X05  | X10   | Y      | X:741988.00<br>Y:3979336.00 | 10       | 320         | 111             | <a href="#">Details</a>   <a href="#">Recalculate</a>   <a href="#">Edit</a> |
| X-3020           | X06  | X10   | Y      | X:741955.00<br>Y:3979288.00 | 15       | 320         | 111             | <a href="#">Details</a>   <a href="#">Recalculate</a>   <a href="#">Edit</a> |
| X-3039           | X07  | X10   | Y      | X:742113.56<br>Y:3979265.41 | 20       | 320         | 111             | <a href="#">Details</a>   <a href="#">Recalculate</a>   <a href="#">Edit</a> |
| X-3544           | X10  | X10   | Y      | X:742140.36<br>Y:3978915.48 | 15       | 320         | 111             | <a href="#">Details</a>   <a href="#">Recalculate</a>   <a href="#">Edit</a> |
| X-3608-A5        | X11a | X10   | Y      | X:742303.19<br>Y:3978922.07 | 17       | 320         | 111             | <a href="#">Details</a>   <a href="#">Recalculate</a>   <a href="#">Edit</a> |
| X-3608-7P        | X11b | X10   | Y      | X:742303.16<br>Y:3978923.07 | 14       | 320         | 111             | <a href="#">Details</a>   <a href="#">Recalculate</a>   <a href="#">Edit</a> |
| X-4000 Lab Hoods | X34  | X10   | Y      | X:742381.78<br>Y:3979314.29 | 165      | 320         | 111             | <a href="#">Details</a>   <a href="#">Recalculate</a>   <a href="#">Edit</a> |
| X-5505M          | X12b | X10   | Y      | X:742743.42<br>Y:3979333.04 | 16       | 320         | 111             | <a href="#">Details</a>   <a href="#">Recalculate</a>   <a href="#">Edit</a> |
| X-5505NS         | X12a | X10   | Y      | X:742771.04<br>Y:3979333.00 | 16       | 320         | 111             | <a href="#">Details</a>   <a href="#">Recalculate</a>   <a href="#">Edit</a> |

Active Report Set:

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# OAK RIDGE

National Laboratory

RNDS 1.0

Current User: ORNL/g448

Home Process Manage Reports Admin

Sources Receptors Plants Report Set

## X-6000 Lab Hoods

Source Name: ORNL  
 Short Name: X-6000 Lab Hoods  
 Source Code (File): X35  
 Source Type: P  
 Stack Height: 15  
 Stack Diameter: 0.5  
 Exit Velocity (m/s): 0  
 Exit Temperature (degrees Celsius): Ambient  
 Exit Direction: V  
 Heat Release Rate calories/second:  
 Plant: X10

**Highest CAPES Dose**  
 Amount: 6.3E-08  
 Direction: WSW  
 Distance: 681  
 Potential Dose: 0E+00

**Highest Active Receptor Estimated Dose**  
 Receptor: 22  
 Amount: 6.7E-09  
 Direction: SW  
 Distance: 5849

**Population Dose**  
 Enter

**Nuclides** [Edit](#) [Clear](#)

| Nuclide Name | Solubility | AMAD | Form        | Emission | Reference Ind. Dose | %ED      | Source ED | Potential Emission | Potential Dose |
|--------------|------------|------|-------------|----------|---------------------|----------|-----------|--------------------|----------------|
| I-124        | V          | 0    | vapor       | 3.59E-18 | 4.1E-17             | 6.47E-08 | 4.33E-18  |                    |                |
| I-125        | V          | 0    | vapor       | 5.62E-10 | 7.4E-11             | 1.17E-01 | 7.82E-12  |                    |                |
| I-126        | V          | 0    | vapor       | 4.11E-10 | 1.03E-10            | 1.62E-01 | 1.09E-11  |                    |                |
| I-129        | V          | 0    | vapor       | 8.94E-13 | 8.09E-13            | 1.28E-03 | 8.55E-14  |                    |                |
| I-130        | V          | 0    | vapor       | 2.28E-32 | 5.23E-27            | 8.25E-18 | 5.53E-28  |                    |                |
| I-131        | V          | 0    | vapor       | 3.16E-07 | 5.93E-08            | 9.35E+01 | 6.27E-09  |                    |                |
| I-133        | V          | 0    | vapor       | 1.73E-35 | 6.74E-27            | 1.06E-17 | 7.12E-28  |                    |                |
| Kr-79        | B          | 0    | unspecified | 1.6E-29  | 9.99E-29            | 1.58E-19 | 1.06E-29  |                    |                |
| Kr-81        | B          | 0    | unspecified | 3.49E-15 | 7.52E-21            | 1.19E-11 | 7.95E-22  |                    |                |
| Kr-85        | B          | 0    | unspecified | 3.52E-07 | 4.79E-12            | 7.56E-03 | 5.06E-13  |                    |                |
| Th-232       | S          | 1    | particulate | 1.28E-11 | 3.03E-09            | 4.78E+00 | 3.2E-10   |                    |                |
| U-234        | M          | 1    | particulate | 6.63E-16 | 1.84E-14            | 2.9E-05  | 1.94E-15  |                    |                |

Active Report Set

## 2015 RadNeshaps

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**Source Options**  
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### Receptor Details

**Name**  
12A  
**Active**  
Y  
**Use For Max**  
Y  
**Type**  
H  
**UTM X**  
747051.84  
**UTM Y**  
3980062.74  
**Elevation**  
0

Active Report Set:  
**2015 RadNeshaps**  
Last Recalculation: Jun 24, 2016 11:01 AM  
[Details](#) | [Change](#)

**Options**  
[Edit](#)  
[Recalculate](#)

### Plant Totals

| Plant      | mrem     |
|------------|----------|
| K25        | 1.2E-05  |
| X10        | 5.9E-01  |
| Y12        | 6.3E-03  |
| Report Set | 4.01E-01 |

### Estimated Doses by Source [Show Inactive](#)

| Source                 | Plant | Direction (From Source) | Distance (m) | Estimated Dose (mrem) |
|------------------------|-------|-------------------------|--------------|-----------------------|
| K16 (K-2500-H-D)       | K25   | E                       | 12149        | 1E-06                 |
| K18 (K-2500-H-Stack-C) | K25   | E                       | 12173        | 6.6E-07               |
| K20 (K-1407-A4-CWTS)   | K25   | E                       | 11339        | 5.6E-06               |
| K21 (K-1200-South Bay) | K25   | E                       | 11315        | 9.3E-10               |
| K22 (K-2500-H-Stack-B) | K25   | E                       | 12181        | 4.8E-06               |
| X01 (X-8915-SNS-Stack) | X10   | ESE                     | 4242         | 1.1E-01               |
| X02 (X-2026)           | X10   | E                       | 5295         | 6.7E-03               |
| X03 (X-2099)           | X10   | E                       | 5283         | 5.2E-07               |
| X05 (X-3018)           | X10   | E                       | 5115         | 2.9E-08               |
| X06 (X-3020)           | X10   | E                       | 5155         | 2.6E-03               |
| X07 (X-3039)           | X10   | E                       | 5002         | 5.4E-03               |
| X10 (X-3544)           | X10   | ENE                     | 5043         | 2.4E-06               |
| X11a (X-3608-AS)       | X10   | ENE                     | 4883         | 2.8E-03               |
| X11b (X-3608-EP)       | X10   | ENE                     | 4883         | 1.6E-09               |

Introductory Sentence:

This note describes two databases developed to compile radiological emissions data for unmonitored sources, source inventory, and dose information for the Oak Ridge Reservation annual Radionuclide National Emission Standards for Hazardous Air Pollutants (Rad NESHAPs) report.

Pat Scofield is a Dose Assessment Specialist in the Environmental Protection and Waste Services Division at Oak Ridge National Laboratory. Her primary responsibilities involve conducting dose assessments associated with Oak Ridge Reservation activities. Pat holds masters degrees from the University of Michigan in Environmental Health (Radiological Health) and Industrial Health Sciences. Her email is [scofieldpa@ornl.gov](mailto:scofieldpa@ornl.gov).



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