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NESHAP Dose-Release Factor Isopleths for Five Source-to-Receptor Distances from the Center of Site and H-Area for all Compass Sectors at SRS using CAP88-PC Version 4.0

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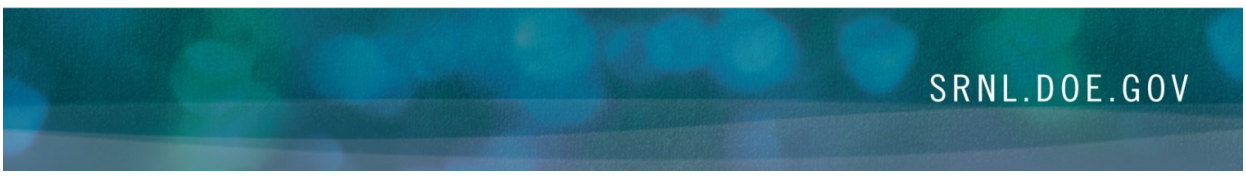
SRNL-STI-2017-00473

Revision 0 – August 2017



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EXECUTIVE SUMMARY

The Environmental Protection Agency (EPA) requires the use of the computer model CAP88-PC to estimate the total effective doses (TED) for demonstrating compliance with 40 CFR 61, Subpart H (EPA 2006), the National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations. As such, CAP88 Version 4.0 was used to calculate the receptor dose due to routine atmospheric releases at the Savannah River Site (SRS). For estimation, NESHAP dose-release factors (DRFs) have been supplied to Environmental Compliance and Area Closure Projects (EC&ACP) for many years. DRFs represent the dose to a maximum receptor exposed to 1 Ci of a specified radionuclide being released into the atmosphere. They are periodically updated to include changes in the CAP88 version, input parameter values, site meteorology, and location of the maximally exposed individual (MEI). This report presents the DRFs of tritium oxide released at two onsite locations, center-of-site (COS) and H-Area, at 0 ft. elevation to maximally exposed individuals (MEIs) located 1000, 3000, 6000, 9000, and 12000 meters from the release areas for 16 compass sectors. The analysis makes use of area-specific meteorological data (Viner 2014).

TABLE OF CONTENTS

LIST OF TABLES

LIST OF FIGURES

LIST OF ABBREVIATIONS

CAP88	Clean Air Assessment Package-1988
COS	Center of site
DOE	U. S. Department of Energy
EPA	U. S. Environmental Protection Agency
MEI	Maximally Exposed Individual
NESHAP	National Emission Standards for Hazardous Air Pollutants
SRS	Savannah River Site
TED	Total effective dose
DRF	Dose-Release Factor
EC & ACP	Environmental Compliance and Area Closure Projects

1.0 Introduction

Operations at the Savannah River Site (SRS) results in releases of small amounts of radioactive materials to the atmosphere. For regulatory compliance purposes, potential offsite radiological doses are estimated annually using computer models that follow U.S Nuclear Regulatory Commission (NRC) regulatory guides (NRC1977a and 1977b). The Environmental Protection Agency (EPA) requires the use of the computer model CAP88-PC V4 to estimate the total effective dose (TED) for demonstrating compliance with 40 CFR 61, Subpart H (EPA 2006), the National Emission Standards for Hazardous Air Pollutants (NESHAP) regulations. The most recent version, CAP88-PC Version 4.0 was used for the calculations found in this report and is referred to hereafter as CAP88.

NESHAP dose-release factors (DRFs) have been supplied to Environmental Compliance and Area Closure Projects (EC&ACP) for many years. DRFs represent the dose to a maximally exposed individual (MEI) member-of-the-public from a unit release (1 Ci) of a specified radionuclide being released SRS operating areas into the atmosphere. The DRFs are simply a ratio of the TED to the release rate and, therefore, are directly scalable. The DRF values listed in Table 2.1 can be applied to expected release values from each area to estimate the potential dose to an individual adult at that location. They are periodically updated to include changes in the CAP88 version, input parameter values, site meteorology, and location of the MEI.

This report presents the DRFs of tritium oxide released at the center-of-site (COS) at 0 ft. elevation to maximally exposed individual (MEI) located 1000, 3000, 6000, 9000, and 12000 meters for the 16 compass sectors. The analysis makes use of area-specific meteorological data (Viner 2014).

2.0 Methods

For determining the DRFs for an adult individual, CAP88 was executed for the ground-level releases of 1 Ci of tritium oxide, from two release locations, COS and H-Area, for various MEI distances. All TED calculations were made to reference the MEI locations at source-to-receptor distances of 1000, 3000, 6000, 9000, and 12000 meters from the release locations for 16 compass directions. Meteorological data (Viner 2014), located in file CAP88 M88H0711, was used in CAP88 to complete the dose assessment for both release areas. DRF values calculated by CAP88 are drawn into an isopleth seen on Figure 3.1, 3.2, and 3.3 that illustrates the dose estimate at SRS.

Table 2.1. Input Parameter Values for MEI locations

Release Point:	COS & H-Area							
Direction:	N	NNE	NE	ENE	E	ESE	SE	SSE
Distances (m):	1000, 3000, 6000, 9000, 12000							
Met File:	CAP88 M88H7011							
Source:	1							
Height (m):	0							

Release Point:	COS & H-Area							
Direction:	S	SSW	SW	WSW	W	WNW	NW	NNW
Distances (m):	1000, 3000, 6000, 9000, 12000							
Met File:	CAP88 M88H7011							
Source:	1							
Height (m):	0							

3.0 Results and Conclusion

Since tritium oxide releases account for a large percent, nearly 90% of the annual dose at SRS, the emission of tritium oxide is used to compare the dose-release factors from COS and H-Area to onsite MEI locations for ground-level releases. The DRFs for the onsite MEI locations were calculated for source-to-receptor distances of 1000, 3000, 6000, 9000, and 12000 meters from the COS and H-Area for all compass sectors. The DRFs listed in Table 3.1 were plotted into an isopleth for an estimate of the dose concentrations at SRS.

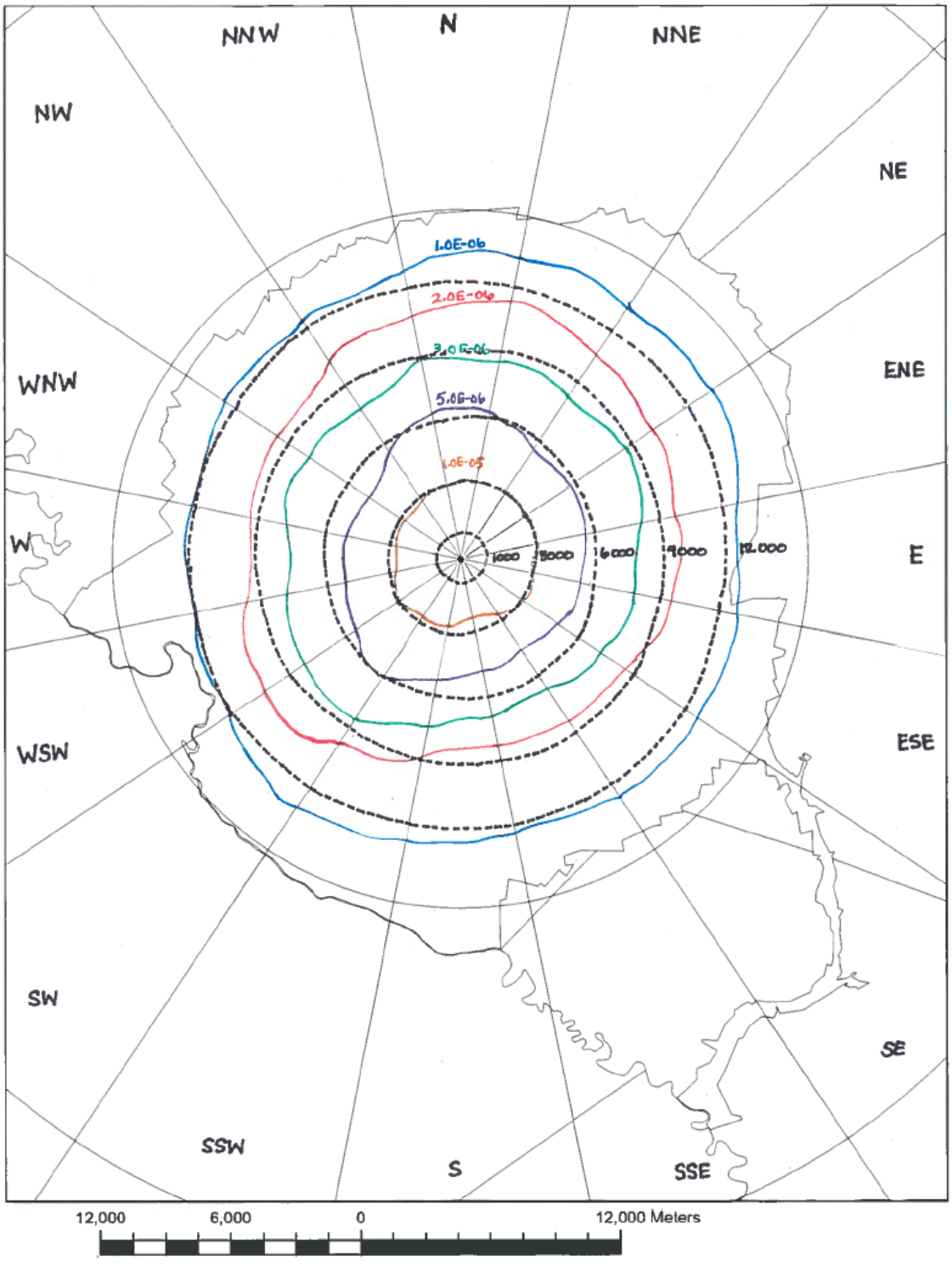
Differences in the DRFs at the MEI locations are due to source-to-receptor distances and the meteorological data. COS and H-Area used the same meteorological data file for CAP88 and is located in file CAP88 M88H7011. The DRF values are expected to remain the same at all MEI locations for all compass sectors and thus, results in an identical but shifted isopleth for H-Area compared to the Cos isopleth.

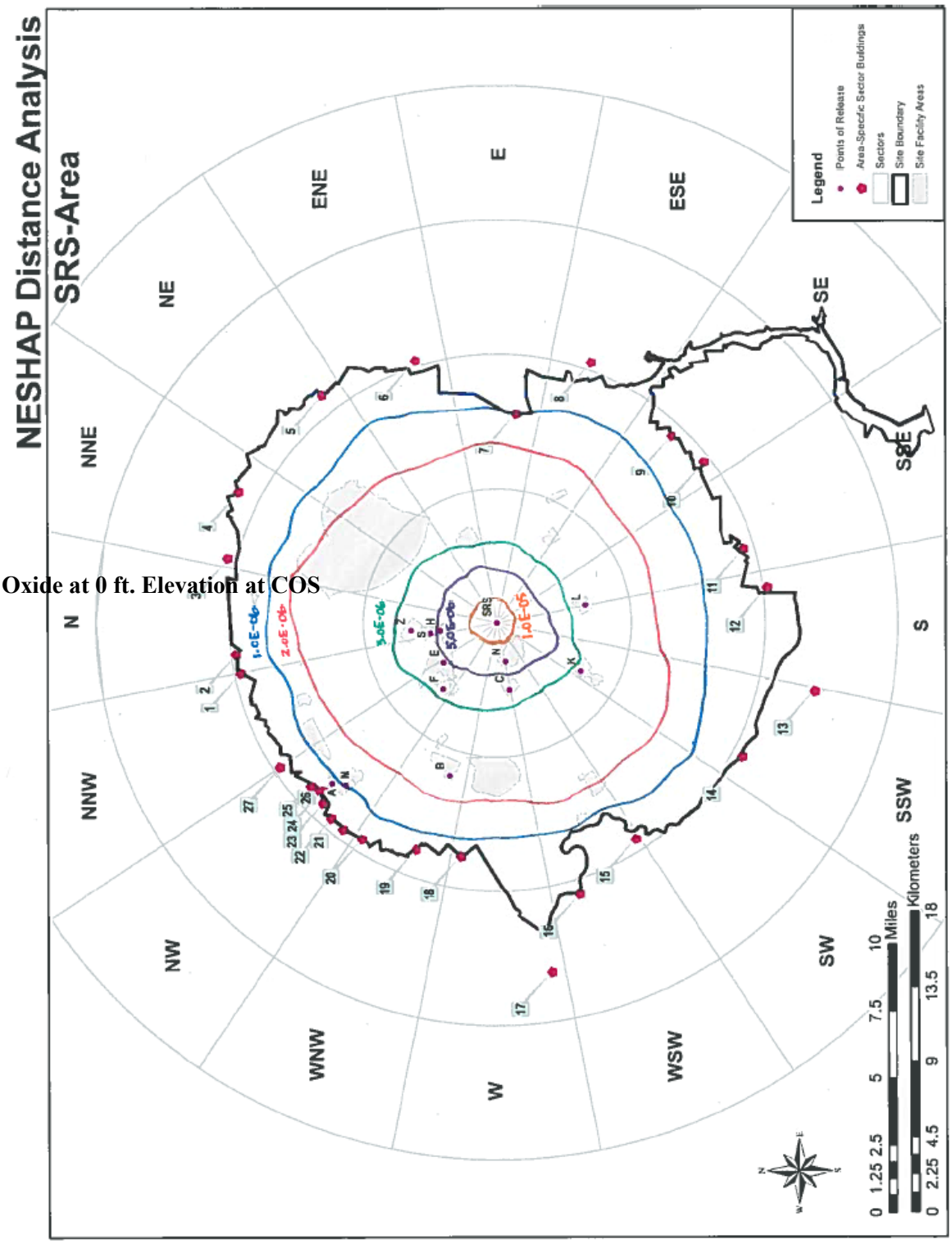
The DRFs are inversely proportional to the stack height and source-to-receptor distance and are also affected by the specified meteorological data at the specified location. According to the 2007-2011 wind rose seen on Figure 3.2, the wind blows north northeast with the calmer winds in the west. Winds are more turbulent moving east resulting in a dispersion of the radionuclides and explains the decrease in dose towards that direction. Aside from the source-to-receptor distance and stack heights, SRS also attributes the dose differences to the meteorological data.

Table 3.1. NESHAP Dose-Release Factors mrem/Ci

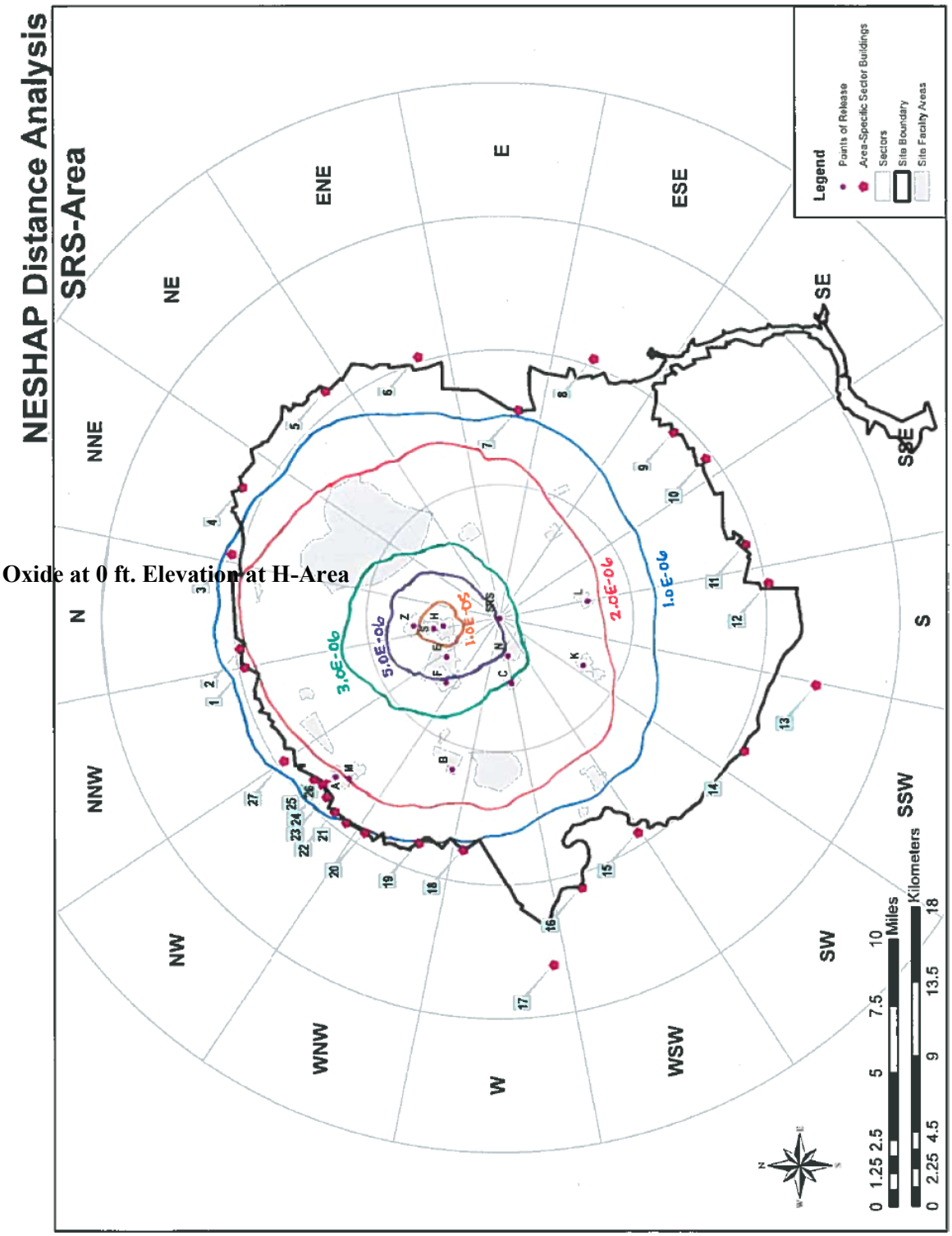
Release Point:	**COS & H-Area**				
Radionuclide:	**Tritium Oxide (H-3)**				
Height (m):	**0**				
	Source-to-Receptor distances (m)				
Compass Sector	**1000**	**3000**	**6000**	**9000**	**12000**
N	9.36E-05	1.51E-05	5.50E-06	3.07E-06	2.11E-06
NNE	9.07E-05	1.46E-05	5.34E-06	2.99E-06	2.05E-06
NE	8.64E-05	1.38E-05	5.00E-06	2.79E-06	1.91E-06
ENE	8.71E-05	1.38E-05	4.94E-06	2.74E-06	1.87E-06
E	7.97E-05	1.26E-05	4.51E-06	2.51E-06	1.71E-06
ESE	7.38E-05	1.17E-05	4.20E-06	2.33E-06	1.59E-06
SE	6.00E-05	9.58E-06	3.48E-06	1.94E-06	1.33E-06
SSE	5.61E-05	8.97E-06	3.27E-06	1.83E-06	1.26E-06
S	5.75E-05	9.17E-06	3.34E-06	1.86E-06	1.28E-06
SSW	6.68E-05	1.07E-05	3.87E-06	2.16E-06	1.48E-06
SW	8.85E-05	1.41E-05	5.07E-06	2.81E-06	1.91E-06
WSW	7.72E-05	1.22E-05	4.36E-06	2.41E-06	1.64E-06
W	6.88E-05	1.09E-05	3.91E-06	2.17E-06	1.48E-06
WNW	6.61E-05	1.05E-05	3.81E-06	2.12E-06	1.45E-06
NW	6.79E-05	1.09E-05	3.95E-06	2.21E-06	1.51E-06
NNW	7.79E-05	1.25E-05	4.59E-06	2.57E-06	1.76E-06

Figure 3.1. Isopleth for NESHAP Dose-Release Factors in mrem/Ci (Release Rate Ci/yr)



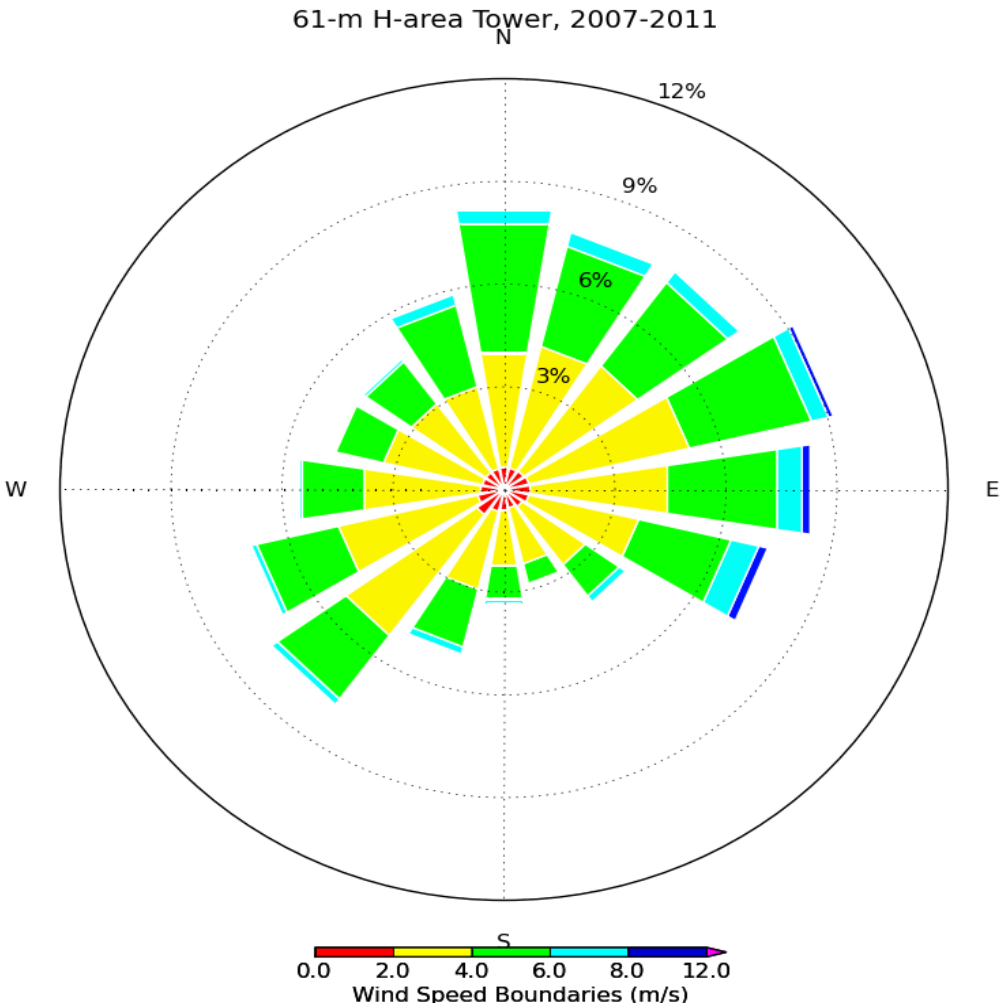


RS DRFs for Tritium Oxide at 0 ft. Elevation at COS



RFs for Tritium Oxide at 0 ft. Elevation at H-Area

Figure 3.4. Savannah River Site Wind Rose



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NESHAP Dose-Release Factors for Onsite Locations for Five Source-to-Receptor Distances from the Center of Site at SRS using CAP88-PC Version 4.0

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