EMRAS – Environmental Modelling for Radiation Safety
Theme 2 – Remediation of sites with radioactive residues

Working Group 1- NORM Issues:_Scenario Development

Hypothetical point source scenario: Version 1.2

Introduction

The purpose of a hypothetical scenario is to provide a means for comparing the predictions of different models against each other. This particular scenario is for a stack source, using the information supplied in the Figures and Tables below.

Site Description

The site is a mineral smelting plant with a single stack with an effective height of 100 m.

The plan of the site is shown in Figure 1. This figure also shows the reference direction for the wind rose, the direction of groundwater flow, and the locations of two houses, at distances of 300 m and 1000 m from the edge of the waste pit.

The annual wind rose data and atmospheric stability data are shown in Tables 1 and 2 respectively.

The dietary data are shown in Table 3.

In Table 4, assume that the time spent outdoors is spent in the field surrounding the house occupied by the person whose annual dose is to be estimated.

The stack discharge data are shown in Table 5.

The aim is to estimate the annual doses to residents of the two houses shown in Figure 2, assuming that each person spends 16 hours indoors and 8 hours outdoors (see Table 4).. Assume that a resident of House #1 works only in Field #1 and that a resident of House #2 works only in Field #2.

At each house, drinking water is supplied from a well situated at the location of the house. Irrigation water is drawn from an uncontaminated source.

Requests to Modellers

1. It would be appreciated if the model calculations could be done four times, using the wind rose in Table 1 and then repeating the calculation with the wind rose rotated 90, 180 and 270 degrees.
2. Please use the data specified in the tables, as this will enable the model outputs to be directly compared with each other.
3. If local data are available, please repeat the calculations using those data and send in the results, as this will provide a measure of the sensitivity of the model being used to changes in input data.

Data Tables and Figures

Table 1: Annual wind rose data

Sector	Wind Direction	Frequency
		(%)
1	345° - < 15°	4.6
2	15° - < 45°	5.4
3	45° - < 75°	7.6
4	75° - < 105°	5.4
5	105° - < 135°	3.8
6	135° - < 165°	7.4
7	165° - < 195°	14.1
8	195° - < 225°	20.3
9	225° - < 255°	13.3
10	255° - < 285°	7.5
11	285° - < 315°	6
12	315° - < 345°	4.1

Table 2: Annual atmospheric stability and wind speed data

Pasquill stability category	Frequency	Mean Wind Speed
	(%)	($m\ s^{-1}$)
A	0.5	1
B	0.5	1.5
C	4	2.5
D	28	5
E	38	8
F	27	6
G	2	4

Table 3: Dietary data

drinking water	well		400	$L\ y^{-1}$
irrigation	river		1	$L\ m^{-2}\ d^{-1}$ for 100 days
cattle	river		60	$L\ d^{-1}$
sheep	river		6	$L\ d^{-1}$
diet	fish		5	$kg\ y^{-1}$
	grains	+ grain products	80	$kg\ y^{-1}$
	fruits	+ juices	80	$kg\ y^{-1}$
	vegetables		70	$kg\ y^{-1}$
	meat	+ sausages	40	$kg\ y^{-1}$
	milk	+ milk products	90	$kg\ y^{-1}$
	root crops	without tubers	70	$kg\ y^{-1}$
	tubers		90	$kg\ y^{-1}$

Table 4: Occupancy data

indoors - sleeping	8	h
indoors - light exercise	8	h
outdoors - light exercise	4	h
outdoors - heavy exercise	4	h

Table 5: Discharge data

effective stack height	100	m
air discharge rate	100	$m^3 s^{-1}$
Rn-222 discharge rate	100	Bq s^{-1}
Po-210 discharge rate	100	Bq s^{-1}

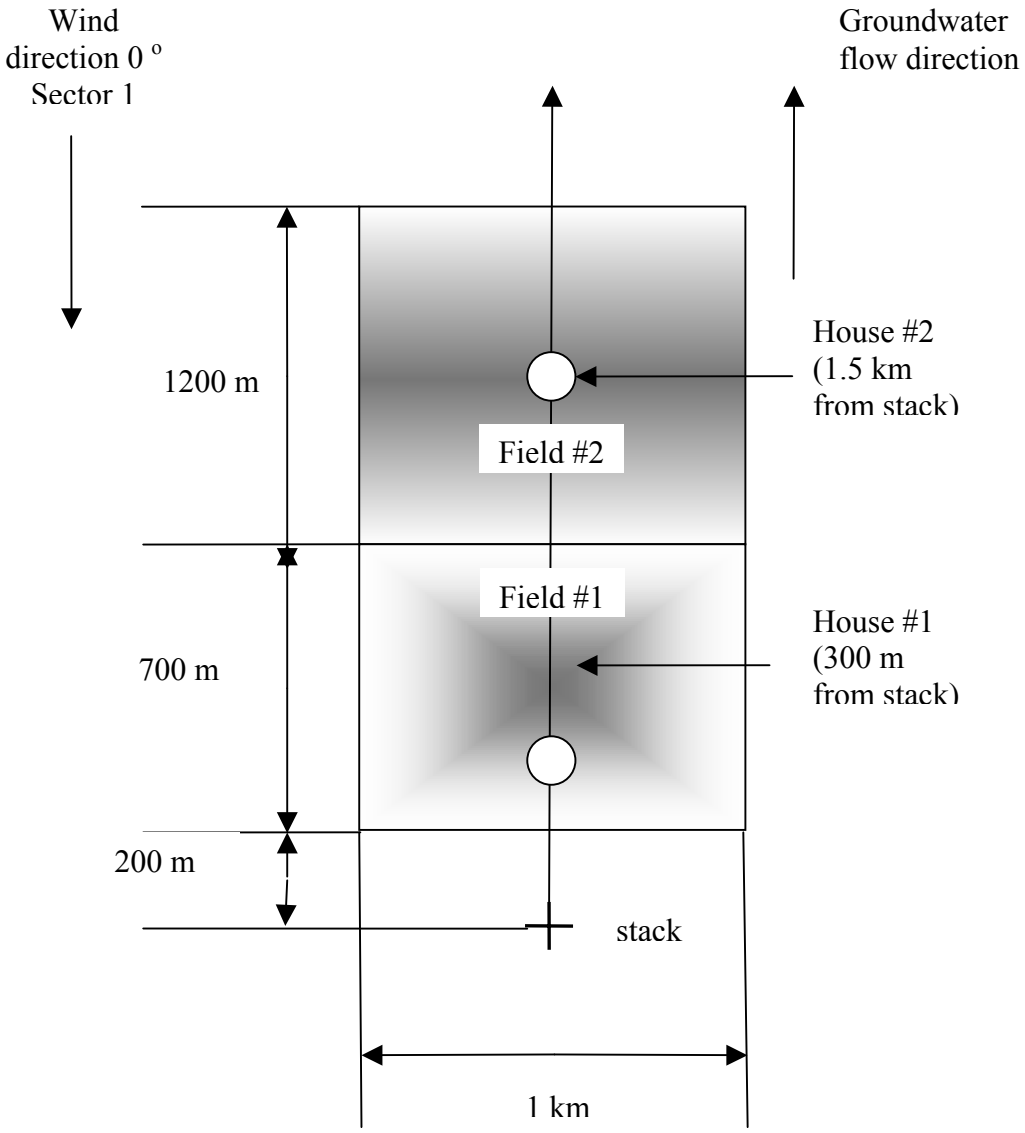

Fig. 1: Plan of the site