Modelling the short range scenario with Hotspot 2.07.1

IAEA EMRAS II, 3rd Technical Meeting

Urban Working Group 5th meeting

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Version: 1

Work program

Calibration against Test 2

Blind runs Test 3 and Test 4

Hotspot 2.07.1

- Hotspot Ver 2.07.1 (National Atmospheric Release Advisory Center NARAC, Lawrence Livermore National Laboratory US) https://narac.llnl.gov/HotSpot/HotSpot.html
- Only considering deposition on the plume centre line
- Allows consideration of two particle sizes: respirable and non-respirable fractions

Calibration against Test 2 Inputs

Varied inputs by trial and error starting with default values:

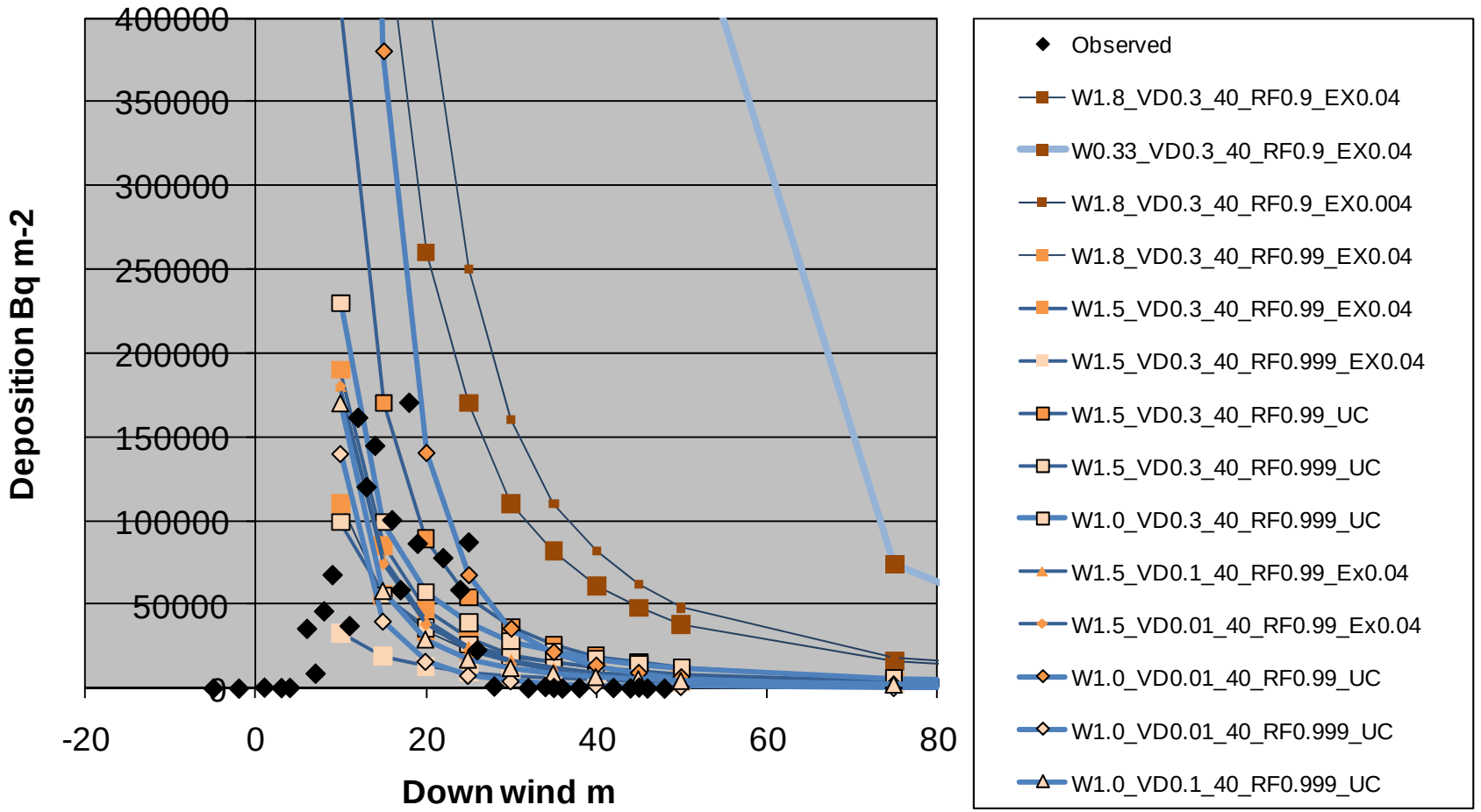
Varied:

- wind speed: 0.33 to 1.8 m s^{-1}
- respirable fraction: 90% to 999%
- respirable deposition velocities 0.3 to 0.01 cm s^{-1}
- explosive 0.04 lb TNT equivalent, or constrained height

Fixed

- stability class: B
- non-respirable deposition velocity: 40 cm s^{-1}

Calibration against Test 2
Preliminary results



Calibration against Test 2

Two distinct zones for radiation protection

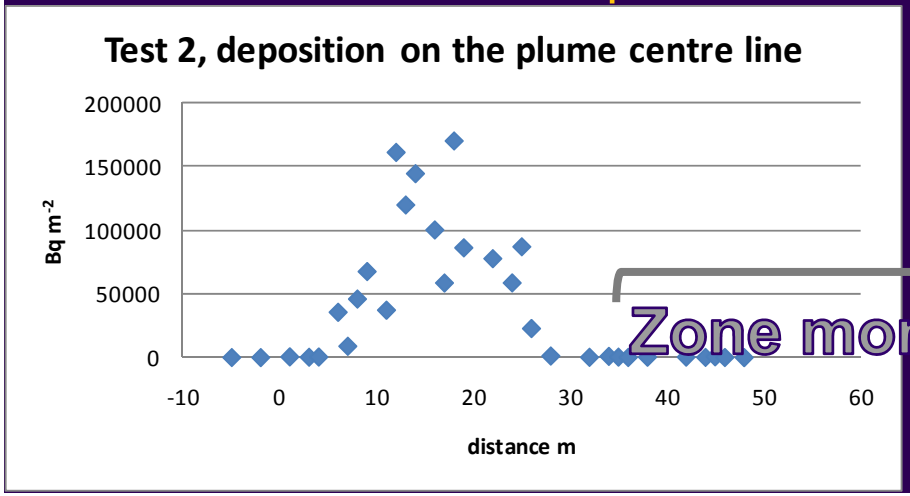
Close in:

direct shine from the plume and inhalation of plume, gives large individual doses delivered immediately – little opportunity for protection.

long term exposure to deposited material: restricted access and clean-up of a small area. – relatively easily protected.

Further out

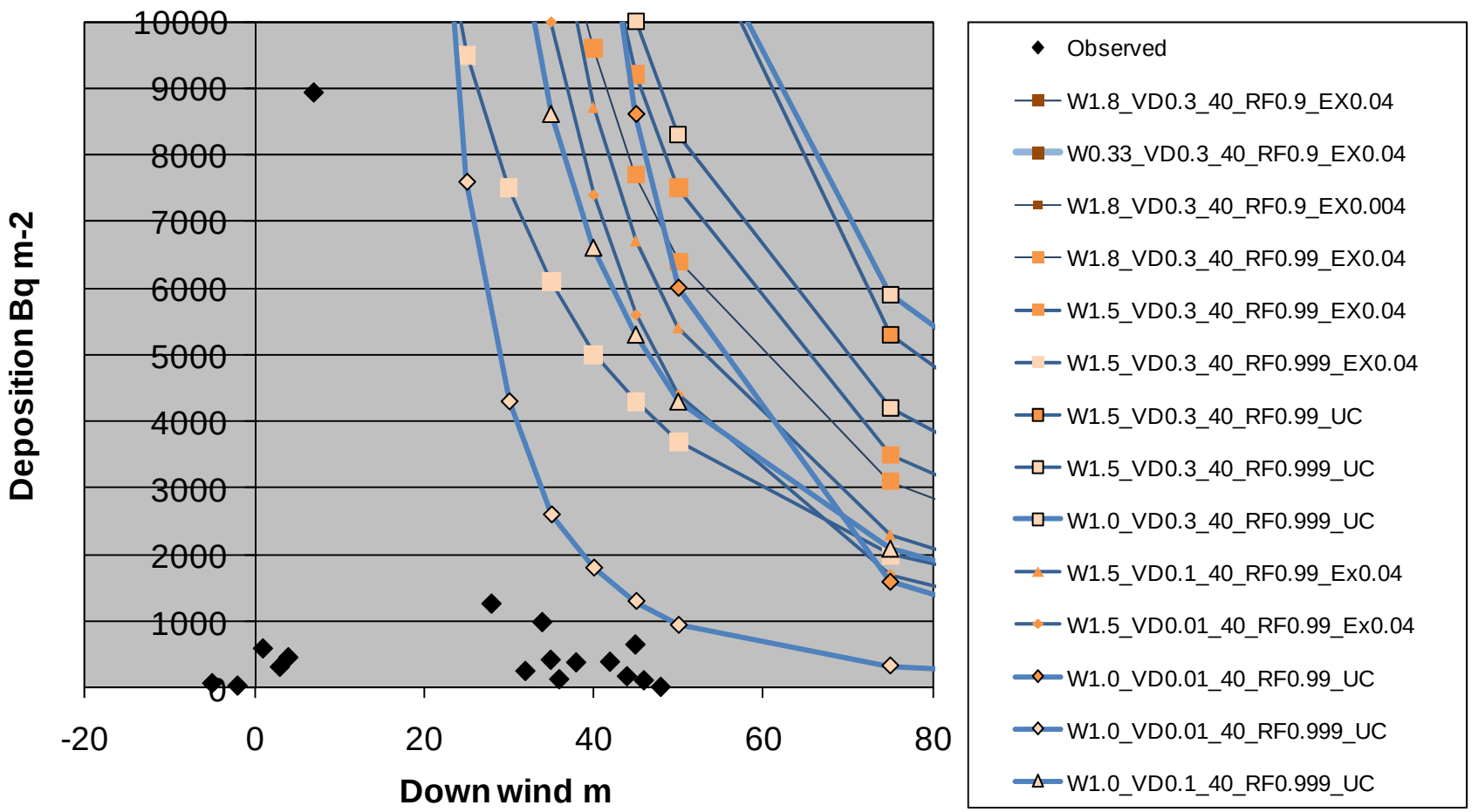
larger collective doses, much larger less well defined area; monitoring, advice and clean-up more difficult.



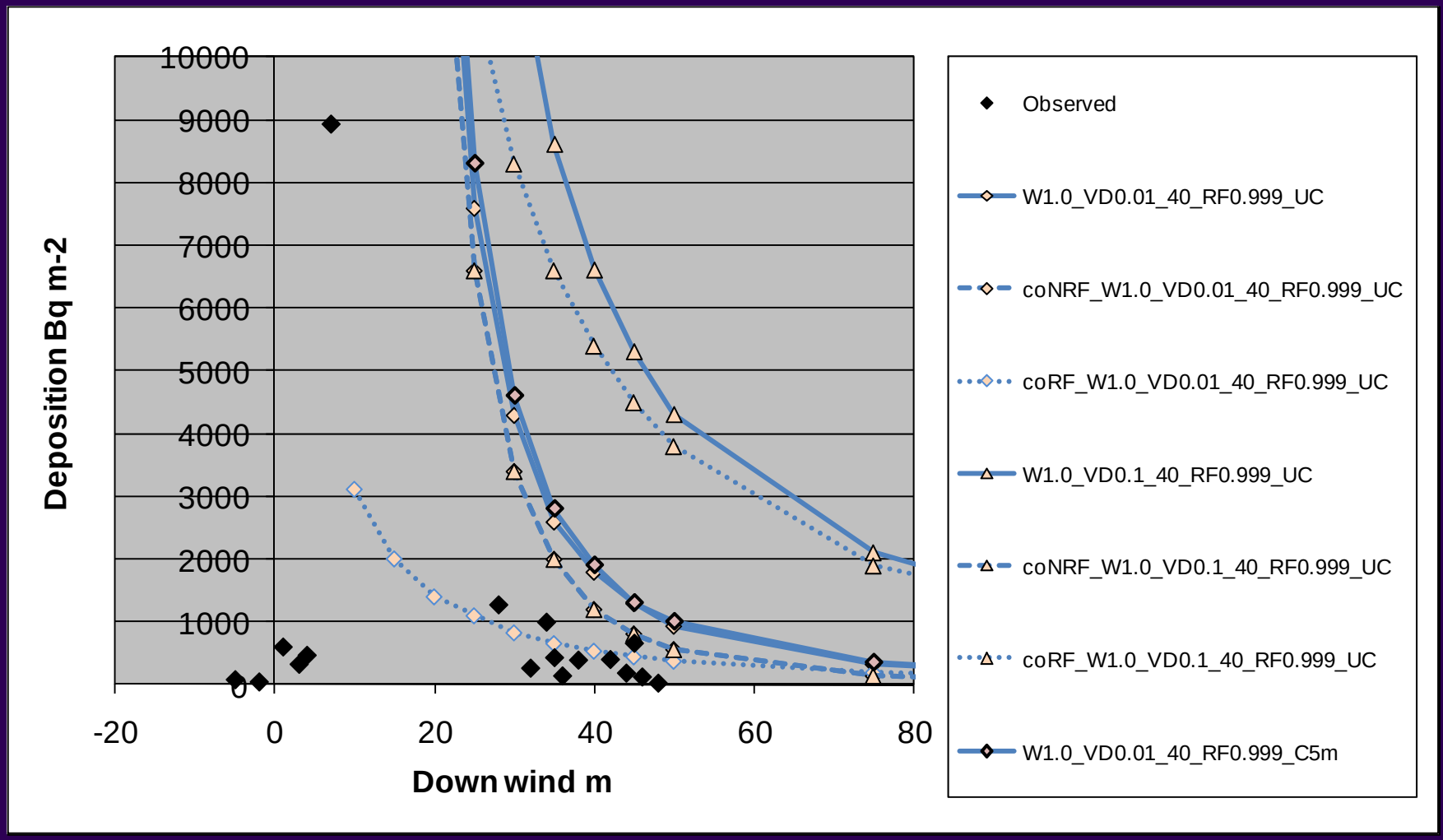
Zone more challenging to provide advice

Calibration against Test 2

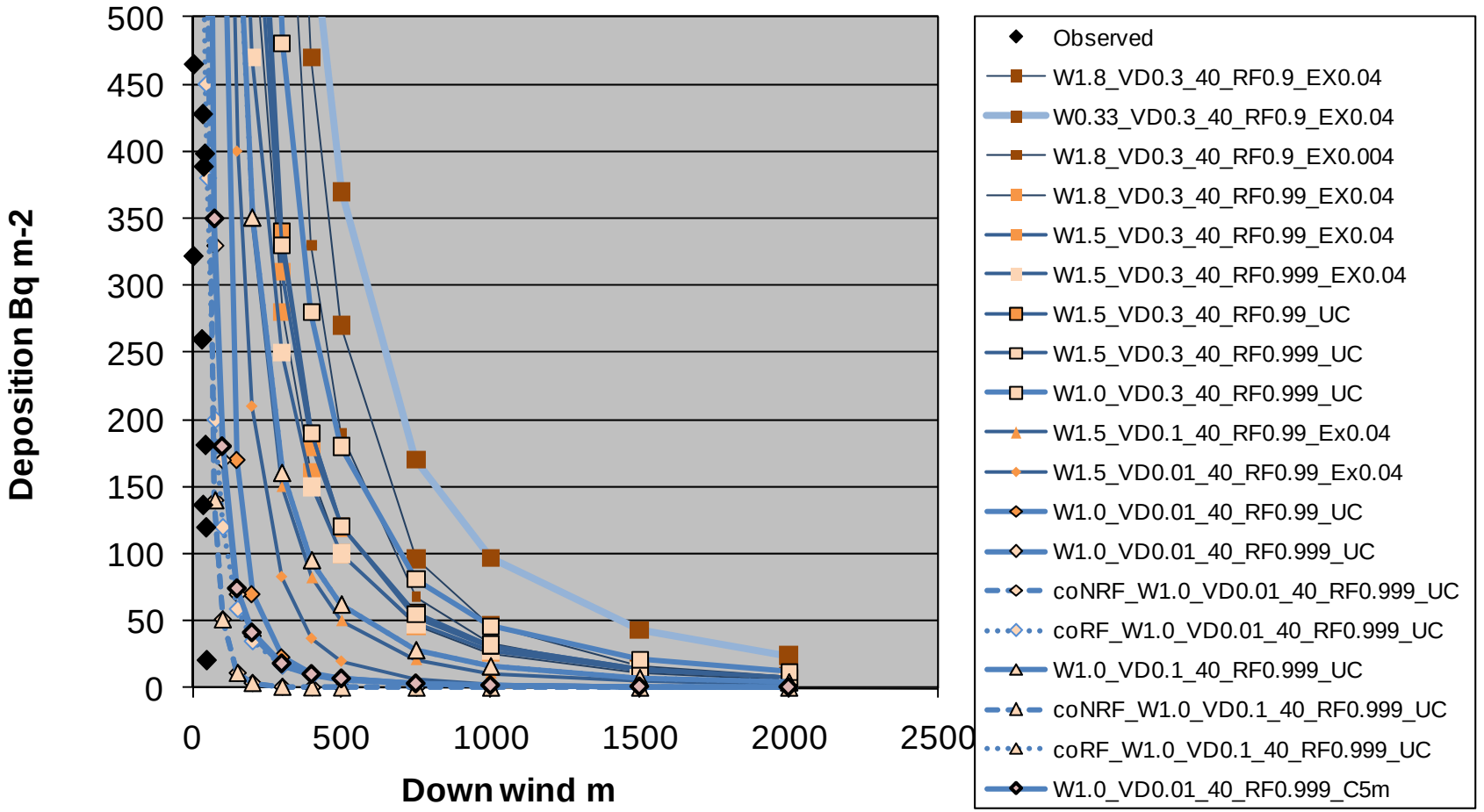
Only a few points to calibrate against:



Calibration against Test 2



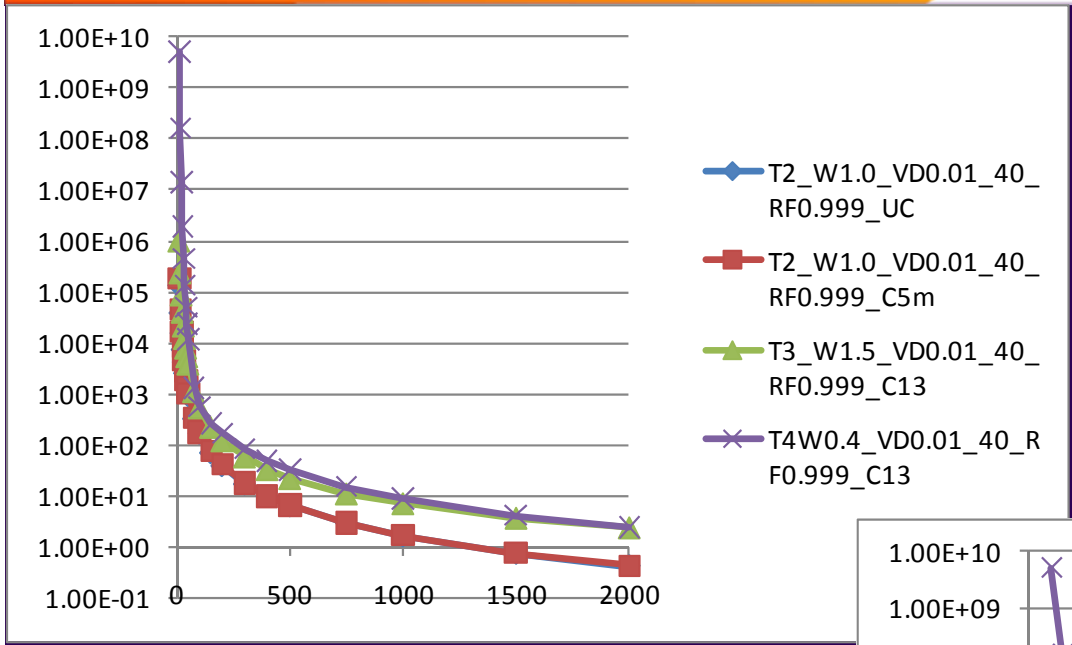
Calibration against Test 2

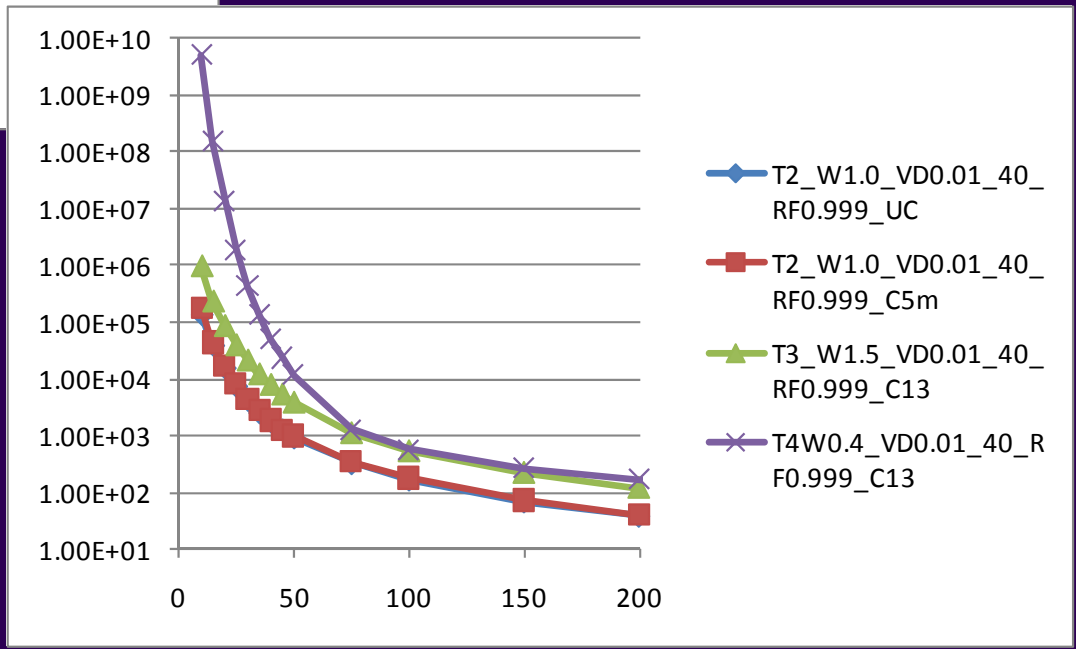


Test 3 and 4, blind runs

	Test 3	Test 4
Wind speed m s^{-1}	1.5	0.4
Stability class	D	C
Respirable fraction	0.999	0.999
Respirable deposition velocity cm s^{-1}	0.01	0.01
Non-respirable deposition velocity cm s^{-1}	40	40
Column height	Constrained to 13m	Constrained to 13m

Results


1.00E+10
1.00E+09
1.00E+08
1.00E+07
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
1.00E+00
1.00E-01
0
500
1000
1500
2000
T2_W1.0_VD0.01_40_RF0.999_UC
T2_W1.0_VD0.01_40_RF0.999_C5m
T3_W1.5_VD0.01_40_RF0.999_C13
T4W0.4_VD0.01_40_RF0.999_C13


1.00E+10
1.00E+09
1.00E+08
1.00E+07
1.00E+06
1.00E+05
1.00E+04
1.00E+03
1.00E+02
1.00E+01
0
50
100
150
200
T2_W1.0_VD0.01_40_RF0.999_UC
T2_W1.0_VD0.01_40_RF0.999_C5m
T3_W1.5_VD0.01_40_RF0.999_C13
T4W0.4_VD0.01_40_RF0.999_C13

Conclusions - Hotspot

- Hotspot does not calculate deposition off axis or distances less than 10m downwind but it can plot contours (but mapping facility has bugs).
- Hotspot estimated a greater plume height (30-40m for test 2 higher for tests 3 and 4) than the agreed defaults (5m for test 2), no direct control of plume volume possible
- Does not model obstacles
- Dry deposition only, no gravitational settlement
- Two particle sizes only (in a single run)

- Simple to use and quick to run