ADDAM in Short-Range Dispersion and Deposition Scenario

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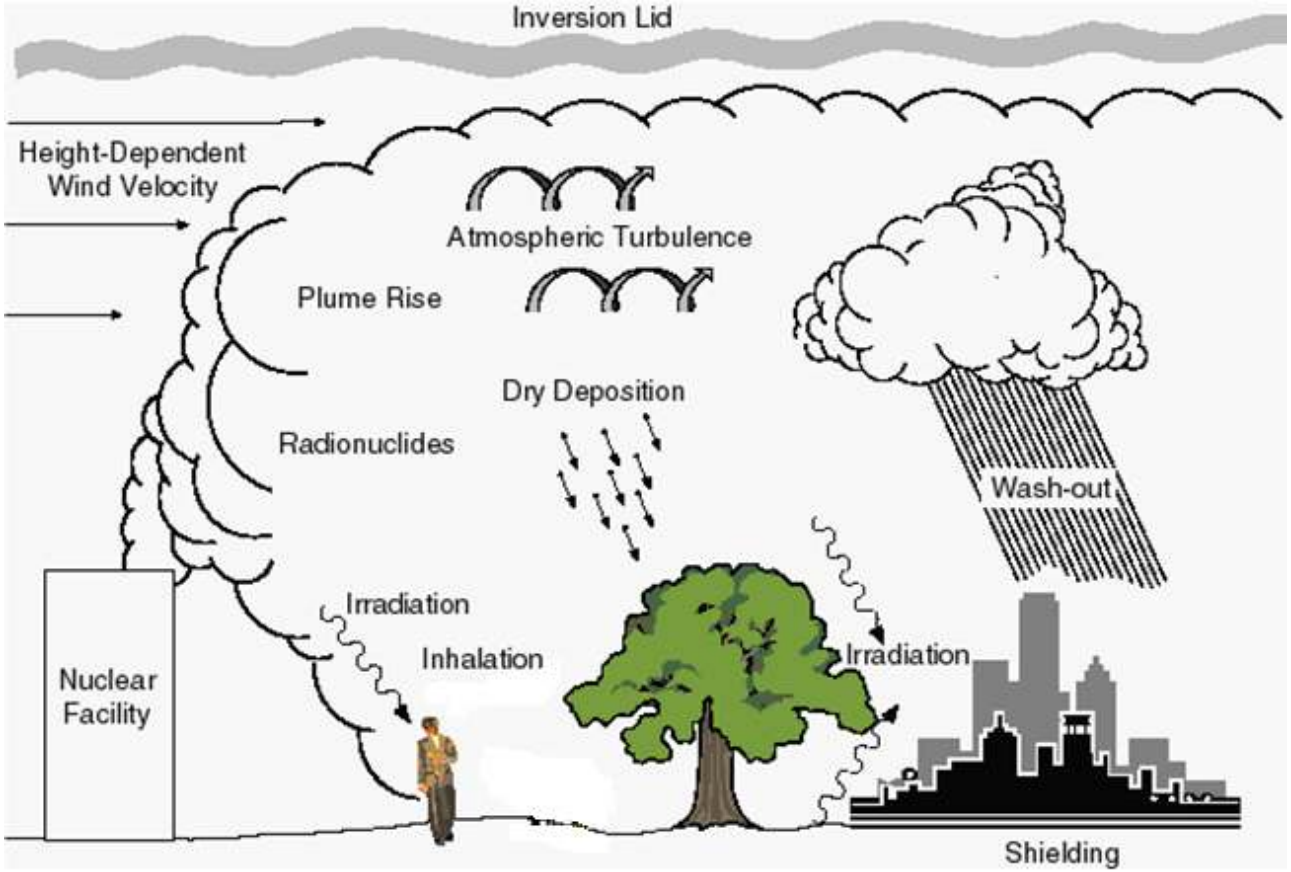
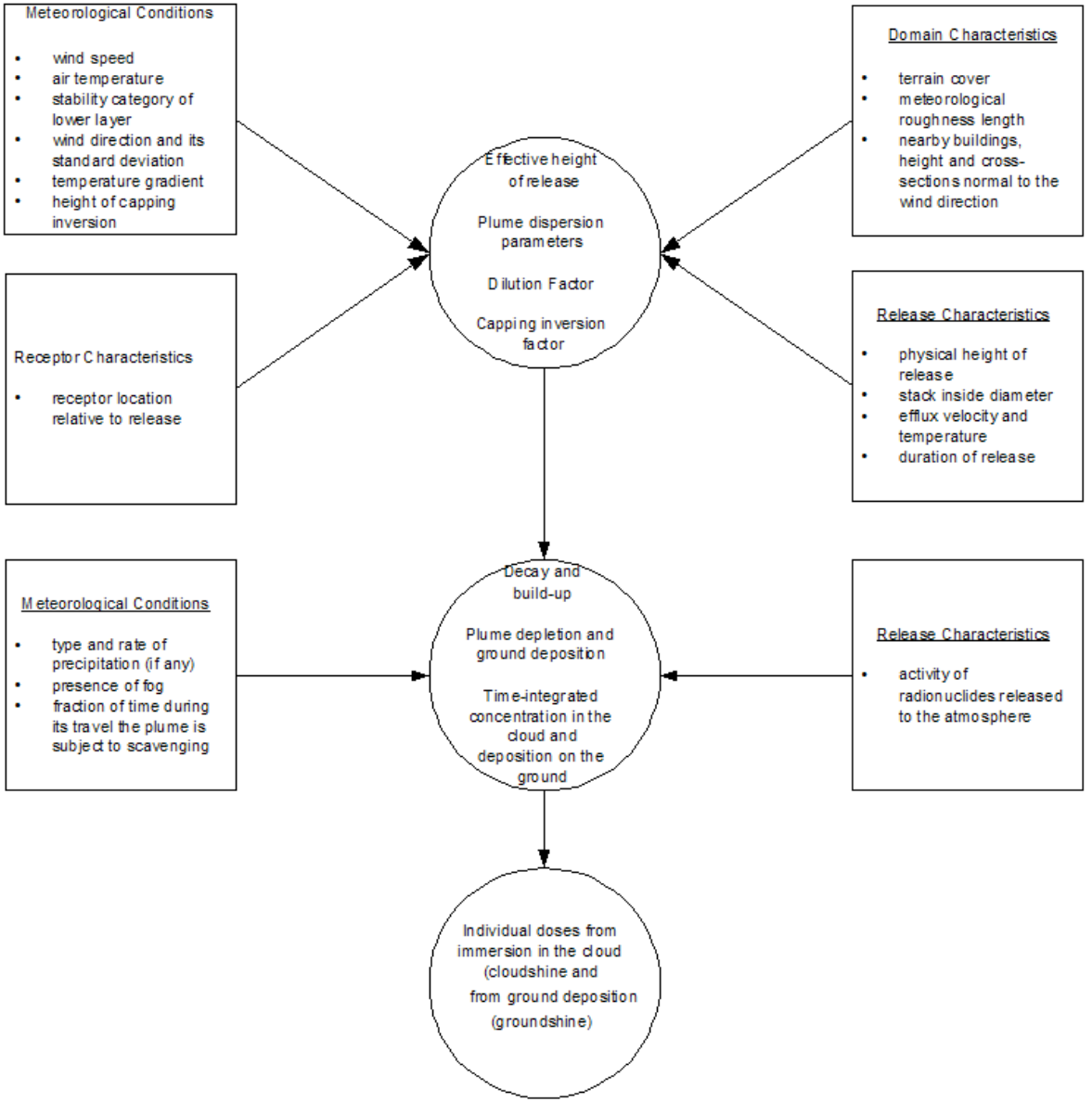
Processes Modelled in ADDAM

ADDAM code was introduced to this working group in January 2010 meeting.

The illustrative picture below is from GENII, 2004.



Data Requirements and Calculations in ADDAM



Application of the model to the short-range scenario

- ADDAM is not designed for modelling very short-term releases of explosive materials
- Its participation in this scenario is simply to learn how it will compare with other kinds of models and with the experimental data
- ADDAM has some options for making either conservative or realistic predictions; only the realistic options were used in these calculations

Adapting the data in the scenario description to the model

- Tc-99m, halflife ~ 6 hours
- Activity released: 1.22e+9 Bq for Test 3
- Activity released: 8.95e+8 Bq for Test 4, after accounting for the 1 hour and 42 minute delay between when the activity was measured and the explosion took place

Assumptions made to match the model to the scenario

- Actual release was an instantaneous explosion, but 10 minutes release duration used in ADDAM
- Explosion time was noon (May 5 and Jul 14), Air temperature: Test3, 10.8 Degree; Test 4, 26.9 degree
- No rain
- Wind speed 2.7 m/s for Test 3 and 0.726 m/s for Test 4

Assumptions made to match the model to the scenario (continued)

- σ_θ 11.65° and vertical stability class D for Test 3
- σ_θ 28.45° and vertical stability class A for Test 4

Specific parameter values used for the scenario

- ADDAM only makes predictions at the plume centerline for each meteorological record and only starting at 100 m downwind distance. CSA-ERM used for making predictions at other grid locations.

- Effective release height 6 m to account for the plume height of 12 m right after the explosion

- Right after the explosion, the plume cloud was 7 m wide and 7 m long. This spread was accounted for to some degree by applying the building wake of 12 m high and 7 m wide to Σ_y and Σ_z

- Building constant C_b = 2 for first 100 m, = 1 at 125 m, and = 0.5 beyond 125 m for Test 3, and C_b = 0.5 at all distances for Test 4

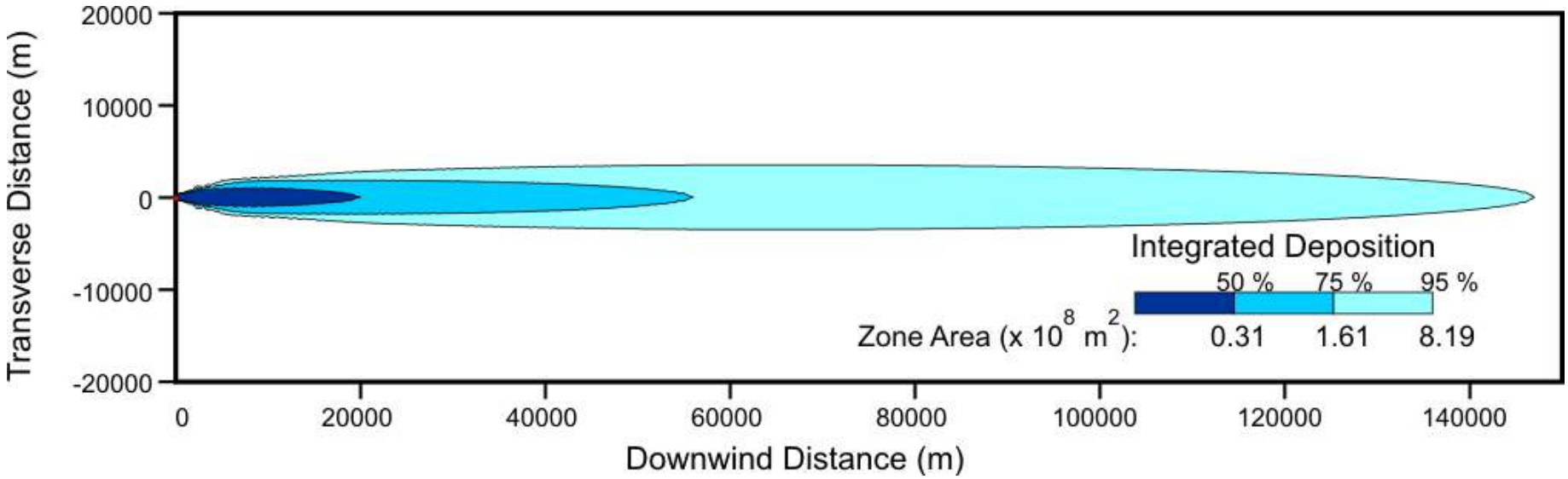
Specific parameter values used for the scenario (continued)

- Inversion layer height 5000 m
- σ_y calculated from σ_θ, and short-term dilution factor model used
- Terrain cover grass, and roughness length 0.4 m.
- Dry deposition 1.0e-2 m/s (average value used)
- Receptor height used 0 m, and dose expected to be same at 1 m height because high energy gamma from Tc-99m.

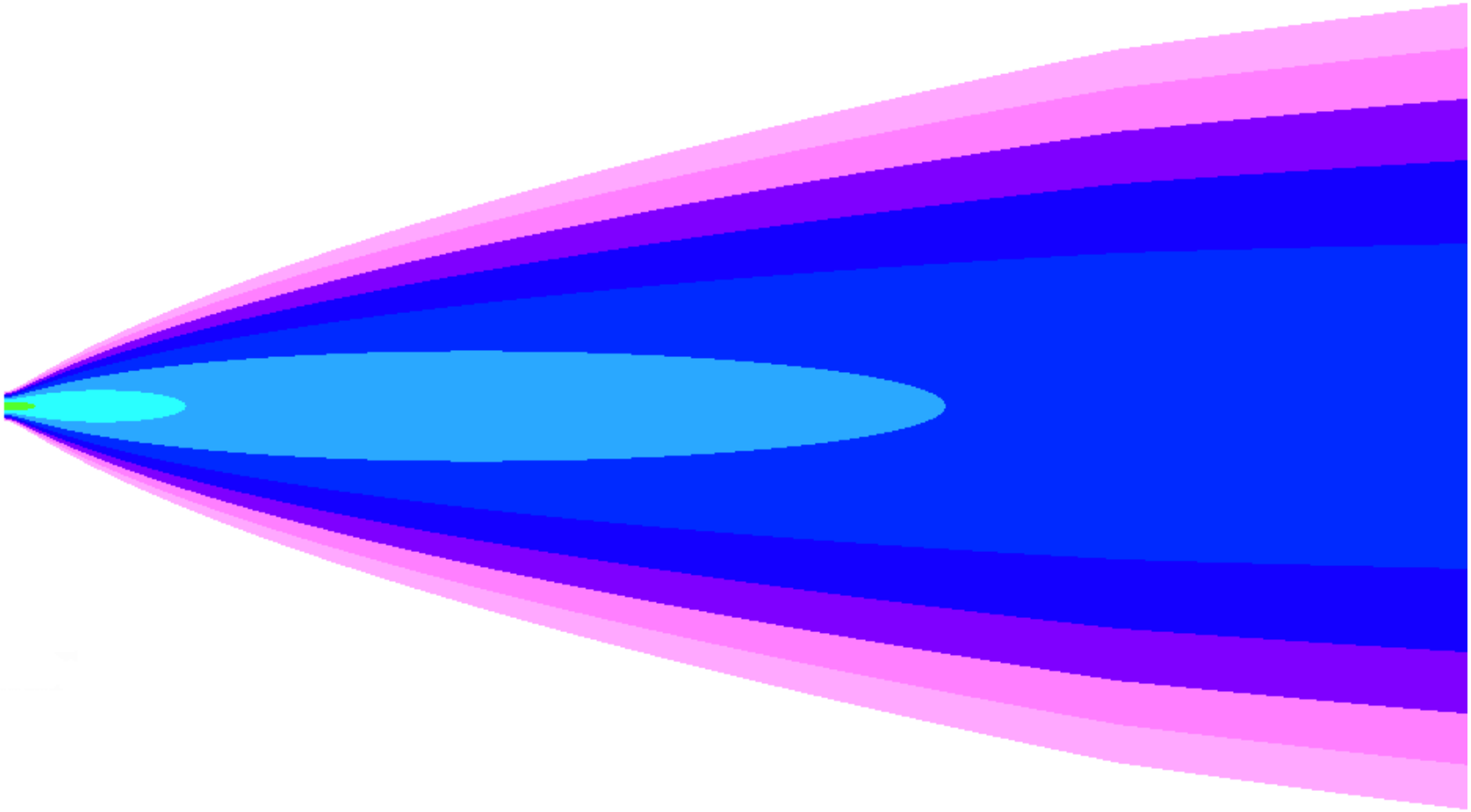
Specific parameter values used for the scenario (continued)

- Finite cloud correction factor not applied
- Immersion effective DCF for adult 5.3e-15 Sv/(Bq.s.m-3), and groundshine effective DCF for adult 1.1e-16 Sv/(Bq.s.m-2)
- Immersion dose calculated for the plume duration added with groudhshine dose for one hour to give the dose rates in Sv/hr.

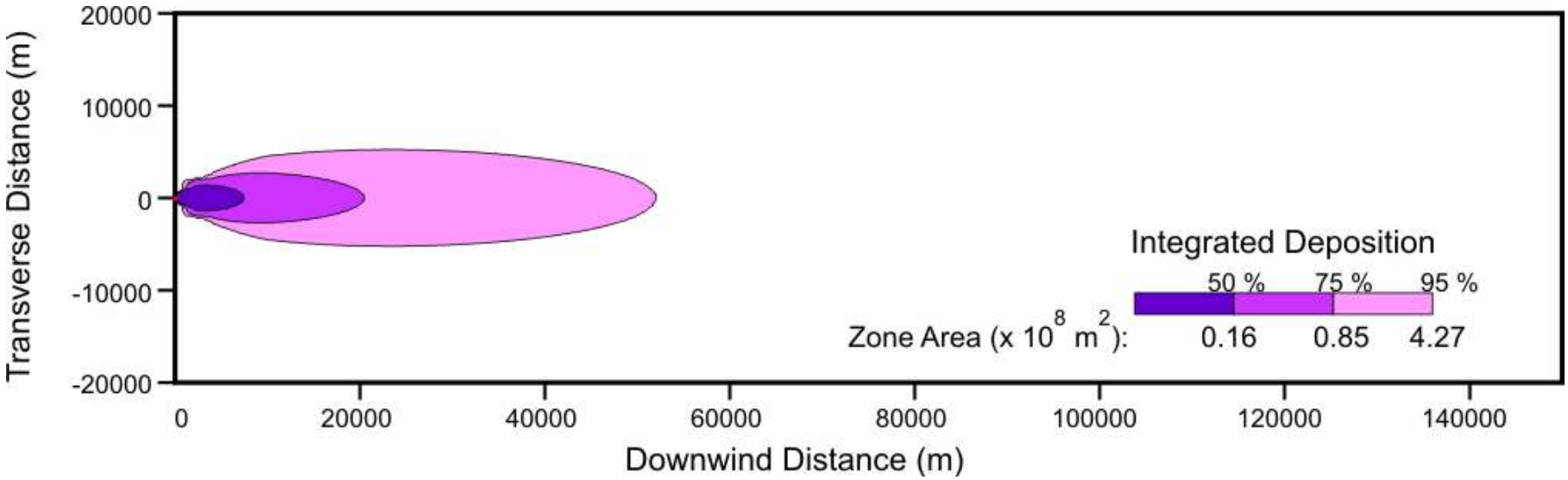
Results: Contamination zones (integrated deposition percentiles of the total activity released) for Test 3



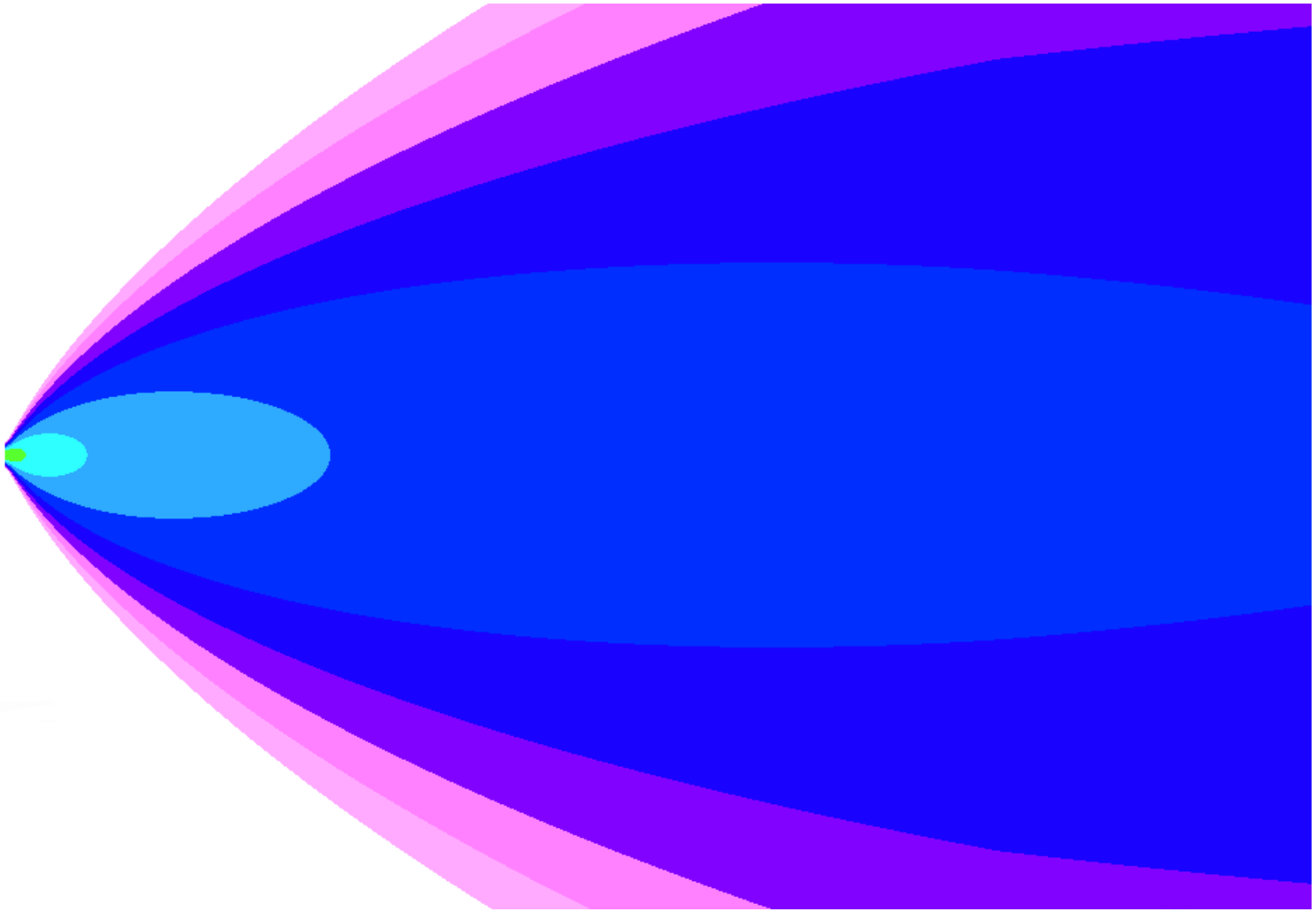
Results (continued): Visual display of the total plume spread for Test 3



Results (continued): Contamination zones (integrated deposition percentiles of the total activity released) for Test 4



Results (continued): Visual display of the total plume spread for Test 4



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Results (continued)

- The ADDAM's predictions of air concentrations at the plume centerline do not change much with the height of the receptor (0 m to 5 m).

- The contamination zones (integrated deposition percentiles of the total activity released: 50%, 75%, and 95%) were estimated by monitoring the cut-off value of multiplication of the depletion factor and the decay factor.

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