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"Urban Areas"

Simulation of Kamenna RDD field tests with the RDD_MCC computer code

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CONTENTS

1. INTRODUCTION

- Simulations for Test1 and Test2
- Calculations were carry out with RDD_MMC computer code (Method Monte Carlo)
- Main task for present time – to find an appropriate model for volume source term and distribution of particles
- Assumptions – model and its validation will be completed to end of June

2. MATHEMATICAL MODEL

Model approach

- Lagrangian particle model
- Simulation of fluctuation by the Monte Carlo method
- Fortran 77 code

Meteorological wind field (time independent)

- homogenous wind field
- computer code CALMET
- computer code MATHEW

2. MATHEMATICAL MODEL

Source term

- Initial volume of source term can be composed from up to 8 independent volumes
- Up to 8 diameter of particles (aerosols)
- Each diameter of particle have own density
- Initial distribution of particles in sources (random, hat, gaussian)

Removal processes

- Gravitational settlement, Dry and wet deposition, Radioactive decay

2. MATHEMATICAL MODEL

Dose rate

- Calculation for 1 mono-energetic photon emission
- Dose rate [Gy/h] in air from ground exposure
- Numerical integration of contribution from all area (step 1 x 1 m)
- Berger form of a build-up factor
- Energy of gamma rays, E = 0.140510 MeV

3. UNCERTAINTIES

- Meteorological uncertainties – wind speed, wind direction, category of stability
- Geometric shape and dimension of initial clouds
- Distribution of volume activity in initial clouds
- Distribution of the activity as function of the aerosol (particle) diameters
- Distribution of particles with different diameter as function of the height
- Density for each diameter of aerosols (particles)

4. INPUT DATA

We suppose that geometrical shape of initial source term is composed from 2 independent volumes

Table: Simulation of source term volumes for Test2

No.	Center of volume X,Y,Z [m]	Length, Wide, Thickness [m]	Fraction of emission [-]
1	0.0, 0.0, 1.0	13.0, 6.0, 2.0	0.20
2	0.0, 0.0, 3.5	4.0, 2.0, 3.0	0.80


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Measured and used meteorological input data

Date	Explosion time	Wind speed	Wind direction *	Stability category
06-12-2007	12:45 pm	4.00 m/s	SW	C (ETE)
15-05-2008	11:30 am	0.59 m/s	S	A (ETE)
05-05-2009	12:22 pm	1.30 m/s	WNW	B (ETE)
14-07-2010	12:42 pm	0.20 m/s	S	A (estimate)

05-05-2009 – data from 1st meteorological station,

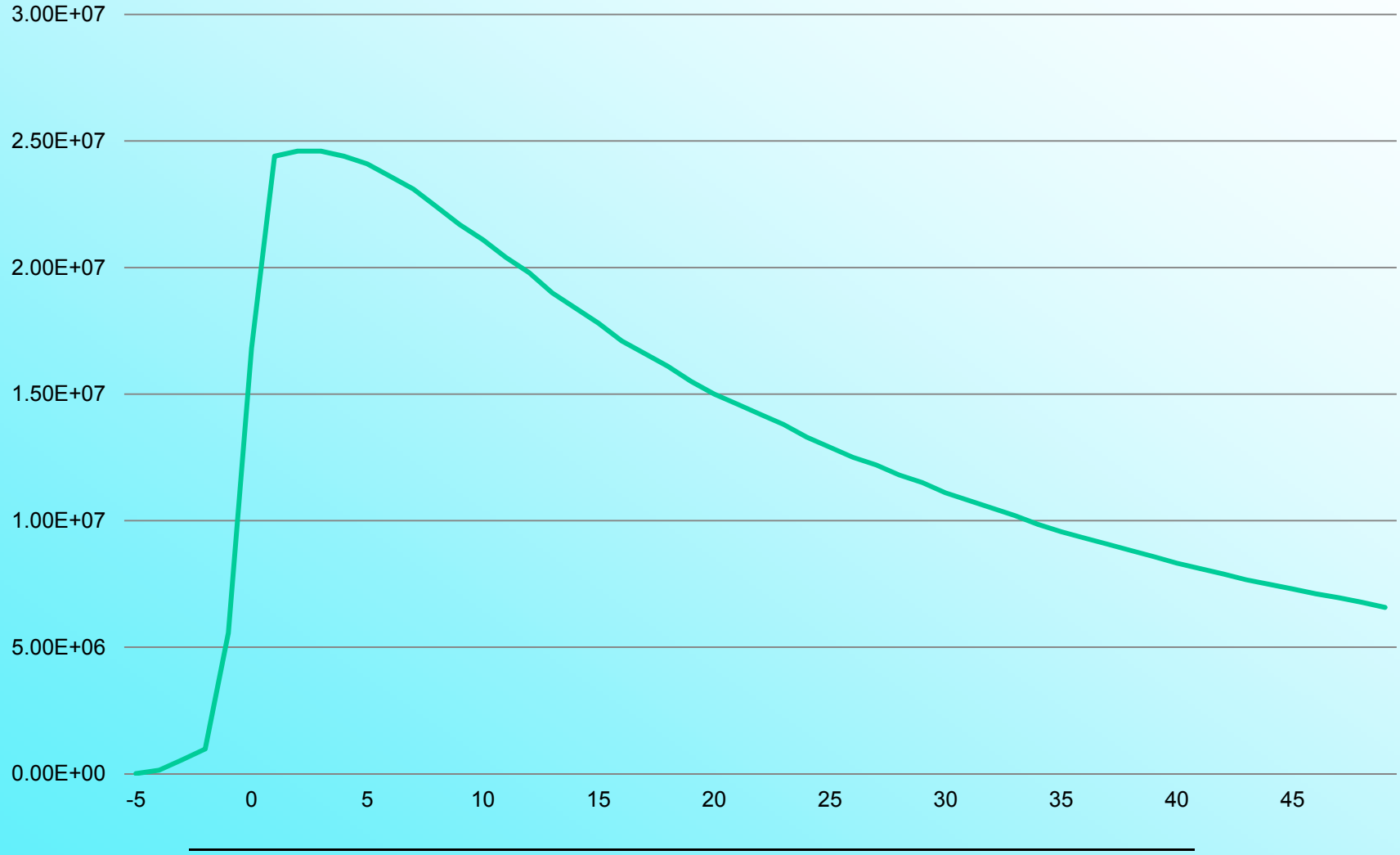
* measured value, for calculation was used the direction South + 10 degrees

ETE – meteorological station near to NPP Temelin

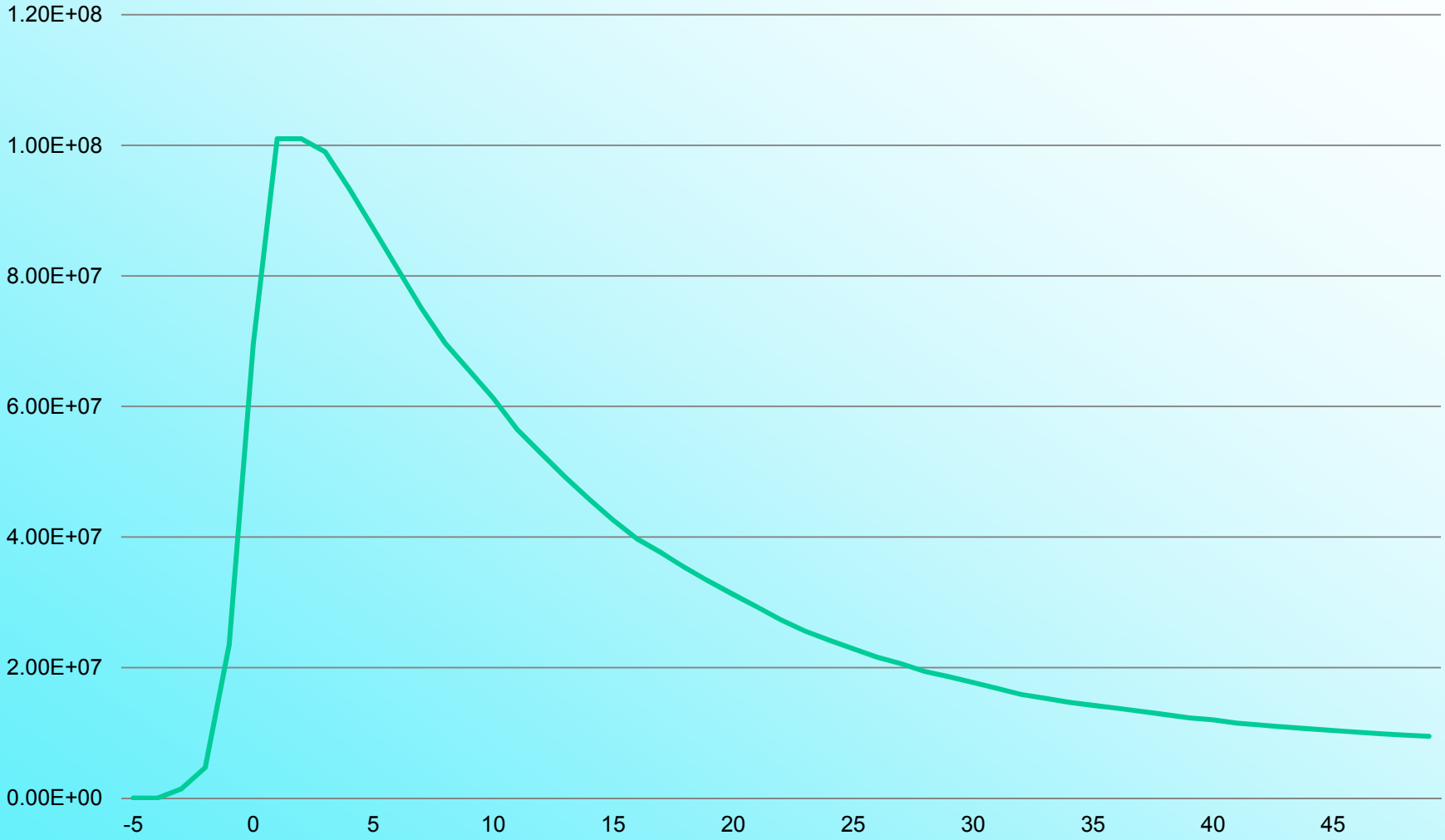
List of simulated particles parameters

No.	Diameter [μm]	Density [g/cm^3]	Dry deposition velocity [m/s]	Fraction of emission [-]
1	0.2	1.0	5.0E-03	0.20
2	1.0	1.0	1.5E-04	0.15
3	8.0	1.5	1.0E-03	0.50
4	20.0	2.0	8.0E-03	0.15

Calculated deposition for TEST 1



Calculated deposition for TEST 2



5. PRELIMINARY RESULTS OF COMPARISON

- Test 1 – result for deposition are in approximately agreement with measurements (max. value ≈ 10^7 Bq/m^2)
- Test 2 – result for deposition are not in agreement with measurements (max. value ≈ 10^5 Bq/m^2)
- Main task for present time – to find an appropriate model for volume source term and distribution of particles
- Assumptions – model and its validation will be completed to end of June

Thank you for your attention