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# 2012 Canadian RDD Field Trials: Quick Summary for DOE Modelers

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2012 Canadian RDD Field Trials: Summary for DOE Modelers

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A series of three explosive RDD experiments was conducted in 2012 by Defense Research and Development Canada (DRDC) and collaborating organizations from Canada, the US and the UK. Trial details and measurement data were provided by Lorne Erhardt of DRDC. In order to characterize the dispersion and deposition of radioactive material from an RDD, a source of La-140 (which has a half-life of 1.6781 days) was dispersed by detonation of 0.2 kg of high explosive in each of the three tests. Measurements of the subsequent dispersion and deposition were made using multiple experimental techniques.

The focus of the initial model comparison effort conducted by the National Atmospheric Release Advisory Center (NARAC) was focused on comparison of modeled results to Canadian deposition data, including checking for consistency with the Green Field and Roller Coaster data sets. Witness plates allowed for localized beta measurements using AB100 beta detectors at 350 locations. The beta measurements of deposition on the witness plate array represent well characterized data with the best spatial resolution of the data collected.

See also:

Green AR, Erhardt L, Lebel L, Duke MJM, Jones T, White D, Quayle D. Overview of the full-scale radiological dispersal device field trials. Health Phys 110(5):403–417; 2016.

Neuscamman SJ, Yu K. National Atmospheric Release Advisory Center Dispersion Modeling of the Full-Scale Radiological Dispersal Devices (FSRDD) Field Trials. Health Phys 110(5): 491-498; 2016.

Database

The trial database is contained in an Excel Spreadsheet, sent to Heather Pennington and Craig Tenney at Sandia National Lab on January 25, 2018 with filename

RDD\_Database\_Text\_20130503\_NoRS250.xlsx

The file contains the following information for the FSRDD campaign, where each numbered entry on the following list represents a new tab in the spreadsheet. Blue tab names indicate meteorological data. Bolded tabs were particularly used for the initial NARAC comparison study.

- 1) Shot\_Text: Shot information (date, initial activity, detonation location, comments)
- 2) Unit\_of\_Measurement\_Text: Definition of units used for measurements

- 3) **Organization\_Text**: Description of data included in spreadsheet
- 4) **Location\_Text**: Identification of measurement positions (including lat/long, distance from detonation location, and angle (0°-120° from North))
- 5) **RSL\_InSitu\_HPGe\_Text**: RSL in situ gamma measurements (HPGe; decay corrected deposition concentration in Bq/cm<sup>2</sup> and uCi/m<sup>2</sup>)
- 6) **RSL\_Plume\_Air\_Filter\_Text**: RSL high volume integrated air samples during plume passage (decay corrected plume concentration in uCi/m<sup>3</sup>)
- 7) **RSL\_Resuspension\_Air\_Filter\_Text**: RSL high volume integrated air samples after plume passage (during field deployment) – these data may give a look at resuspension, but were not investigated by NARAC
- 8) **Beta\_Data\_Meter\_Text**: Serial numbers of the beta probes used (AB-100s)
- 9) **Beta\_Data\_Operator\_Text**: Names of beta probe operator team members
- 10) **Beta\_Data\_MeterOperator\_Text**: Beta operator team/probe use records
- 11) **Beta\_Data\_All\_Text**: Deposition data from AB-100 beta probes measuring on witness plates; decay corrected background subtracted deposition concentration – this is the primary data that NARAC compared model output to
- 12) **MATS\_Survey\_Text**: Mobile microspec data from system mounted on unmanned ground vehicle; 1 second output (uSv/h), also includes met data (for the measurement time/location, not detonation values)
- 13) **DND\_Met\_Data\_Radiosonde\_Text**: Radiosonde data from balloon launched by Canada Department of National Defense before and after each shot.
- 14) **CMC\_Forecasts\_Issued\_Date\_Text**: Canadian Meteorological Center forecast dates and discussion
- 15) **CMC\_Forecasts\_Text**: Canadian Meteorological Center forecast data
- 16) **SNL\_Resp\_Mass\_Fraction\_Text**: Sandia indoor air sampling data for respirable fraction
- 17) **SNL\_PSD\_Cascade\_Text**: Sandia indoor air sampling data for particle size distribution
- 18) **DND\_CJIRU\_Met\_Text**: Met data from fixed met station near base camp
- 19) **DRDC\_Ottawa\_Met\_Text**: Met data from fixed met station near decon line
- 20) **DRDC\_Ottawa\_SVG2\_Text**: Beta measurements near ground zero and along the plume length using SVG-2 detectors (only used for Shot 3); decay corrected deposition in Bq/m<sup>2</sup>
- 21) **DRDC\_Ottawa\_3D\_Wind\_Text**: 1 second Met data from 3D sonic anemometers 20m upwind of GZ at three different heights (2m, 4.5m, 12m)
- 22) **RS250\_Filter\_Data\_Text**: Deposition on filter paper measurements.  
See Figures 4&5 in Erhard L, Lebel L, Korpach E, Berg R, Inrig E, Watson I, Liu C, Gilhuly C, Quayle, D. Deposition Measurements From the Full-Scale Radiological Dispersal Device Field Trials. Health Phys 110(5): 442-457; 2016.
- 23) **RS250\_Met\_Text**: Met data from fixed met stations near the RS-250 detectors
- 24) **ISR\_Location\_Names\_Text**: Record of location names for consistency (database prioritizes labels in tab four “Location\_Text”)

### RadEye Data

Raw data is available for the RadEye detectors for each of the three shots as well as background surveys. However, the more useful record of the output is included in Dr. Lorne Erhardt’s

presentation “Thermo RadEye PRD Network for the FSRDD Field Trials – Plume Passage Results” and has been sent with the following file name:

#### 4.3 RadEye PRD Network - Plume Passage – (Erhardt).ppt

##### Meteorological Data

Additional met data was provided by RSL for Shots 1&2 in the following files:

windmaster shot wind 6-6-12a.xls  
windmaster shot wind 6-12-12a.xls

As evidenced by the list of material in the Database (above), several different sources of meteorological data are available to modelers. The following tables offer a quick comparison of the data for each shot, with height in m, speed in m/s, Temp in C and pressure in mb. Lorne’s summary refers to the values included in the published literature. “Radiosonde 1st before” refers to the first level recorded by the radiosonde which was released before the shot; similarly, “Radiosonde 2<sup>nd</sup> before” is the second recorded level and “...after” entries are for the radiosonde released after the shot. Time averages used to calculate the table entries from the raw data may not be consistent between data points in the tables. The tables are intended to give a general idea of the variability between the conditions recorded by various methods during the experiment. Modelers should refer to provided data files when creating met input for simulations.

Meteorological Data Shot 1

	TIME	HEIGHT	SPEED	DIR	TEMP	RH	PRESSURE
Lorne's Summary	9:28	4.5	6.9	218	13.4		
Radiosonde 1st before	7:13	3.5	5.5	223	13.6	0.78	919.4
Radiosonde 2nd before	7:13	121.5	6.8	226	12.7	0.87	906.6
Radiosonde 1st after	10:20	1.5	5.8	202	15	0.56	921.5
Radiosonde 2nd after	10:20	2.5	5.2	207	14.9	0.56	921.3
Ottawa (5min av)	9:28	3	5.6	171	13.4	0.69	
3D anemometer 1	9:28	2	6.8	208			
RSL 1st level	9:28	2	5.71	209	13.65		921.5
3D anemometer 2	9:28	4.5	7.7	218			
RSL 2nd level	9:28	4.5	6.48	218	13.5		
3D anemometer 3	9:28	12	9.2	212			
RSL 3rd level	9:28	12	7.85	212	14.25		

Meteorological Data Shot 2

	TIME	HEIGHT	SPEED	DIR	TEMP	RH	PRESSURE
Lorne's Summary	9:38	4.5	4.3	260	18.4		
Radiosonde 1st before	6:43	3.5	1.6	240	9.7	0.82	930.5

Radiosonde 2nd before	6:43	146.5	7	247	12.1	0.73	914.7
Radiosonde 1st after	10:11	3.5	3.7	226	19.7	0.51	929.4
Radiosonde 2nd after	10:11	52.5	4.4	252	18.5	0.55	924.1
Ottawa (5min av)	9:38	3	4	242	17.4	0.56	
3D anemometer 1	9:38	2	3.8	247			
RSL 1st level	9:38	2	3.71	274	18.7		1013
3D anemometer 2	9:38	4.5	4.4	261			
RSL 2nd level	9:38	4.5	4.24	253	19		
3D anemometer 3	9:38	12	4.8	248			
RSL 3rd level	9:38	12	4.69	248	18.3		

### Meteorological Data Shot 3

	TIME	HEIGHT	SPEED	DIR	TEMP	RH	PRESSURE
Lorne's Summary	11:28	4.5	2.9	282	10.5		
Radiosonde 1st before	11:00	3.5	3	267	10.5	0.84	934
Radiosonde 2nd before	11:00	10.5	3.6	267	10.8	0.87	933.2
Radiosonde 1st after	12:05	3.5	2.6	300	14.4	0.7	936.4
Radiosonde 2nd after	12:05	21.5	1.9	302	15	0.69	934.4
Ottawa (5min av)	11:28	3	3.5	306	12.8	0.79	
3D anemometer 1	11:28	2	2.9	304			
3D anemometer 2	11:28	4.5	3.3	295			
3D anemometer 3	11:28	10	3.6	292			