THE RASCAL ACRONYM STANDS FOR RADIOLOGICAL ASSESSMENT SYSTEM FOR CONSEQUENCE ANALYSIS

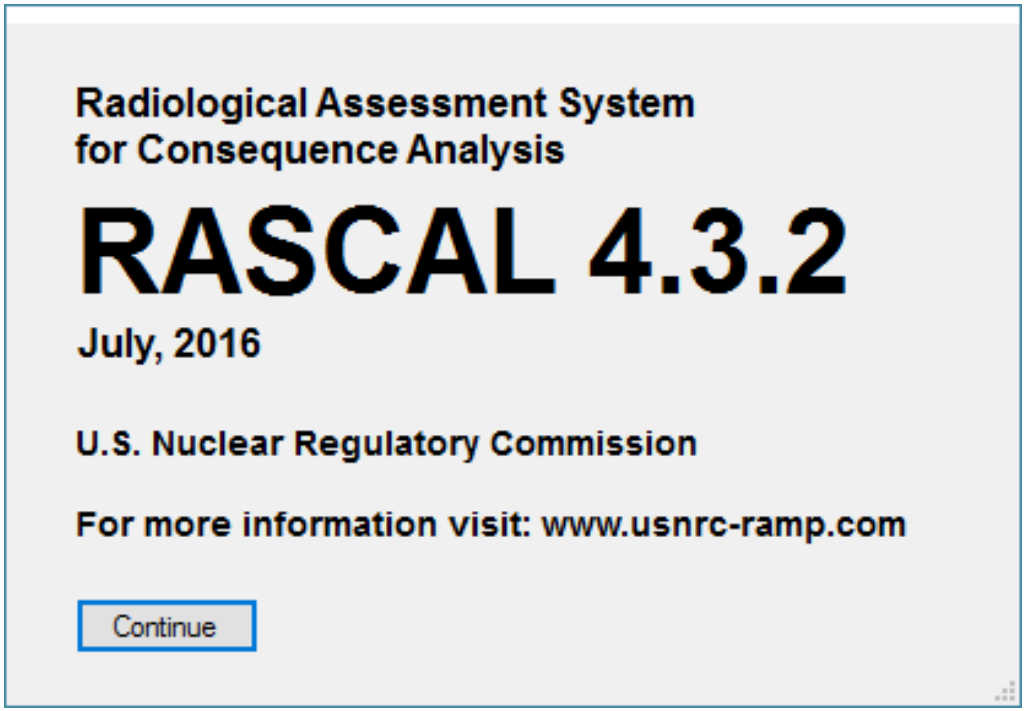
RASCAL began with work in the mid-1990s to computerize the hand calculations and paper methods of the NRC's Response Technical Manual (RTM) and the source term document NUREG-1228.

RASCAL 4.3.2 is the current version, incorporating lessons learned from Fukushima and other exercises.

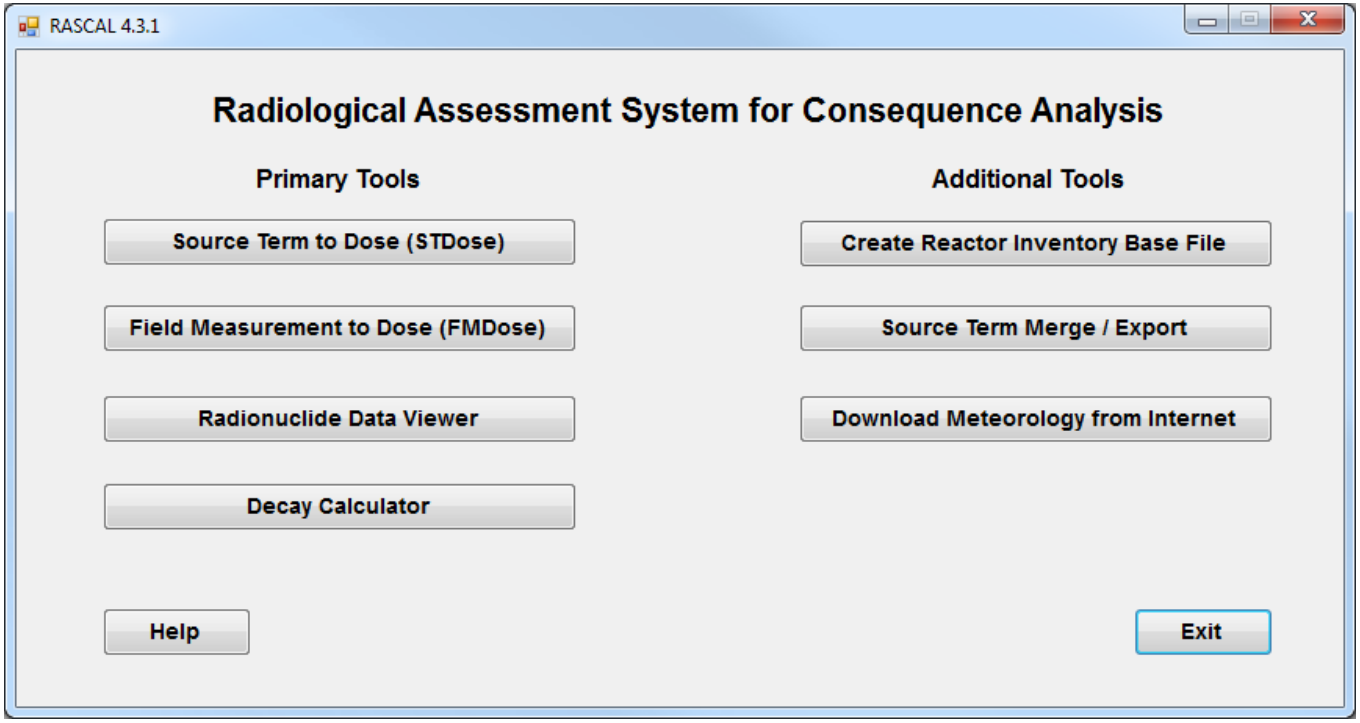
ALL SUPPORT FOR RASCAL LOCATED AT WWW.USNRC-RAMP.COM

- Code Distribution
  - All users should obtain their own copy (free for Fed/State/Local gov)
- Technical Support
  - Technical documentation
  - Training
  - FAQs, Forums, Email

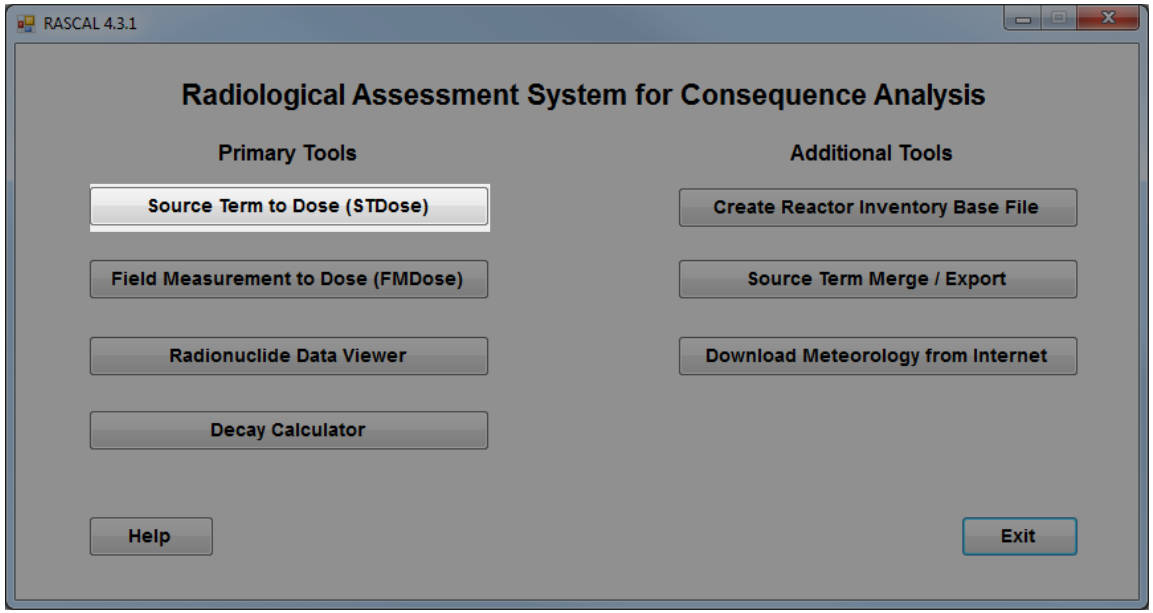
OPENING RASCAL IN WINDOWS



There are 4 primary tools and 3 additional tools on the RASCAL Home Page.

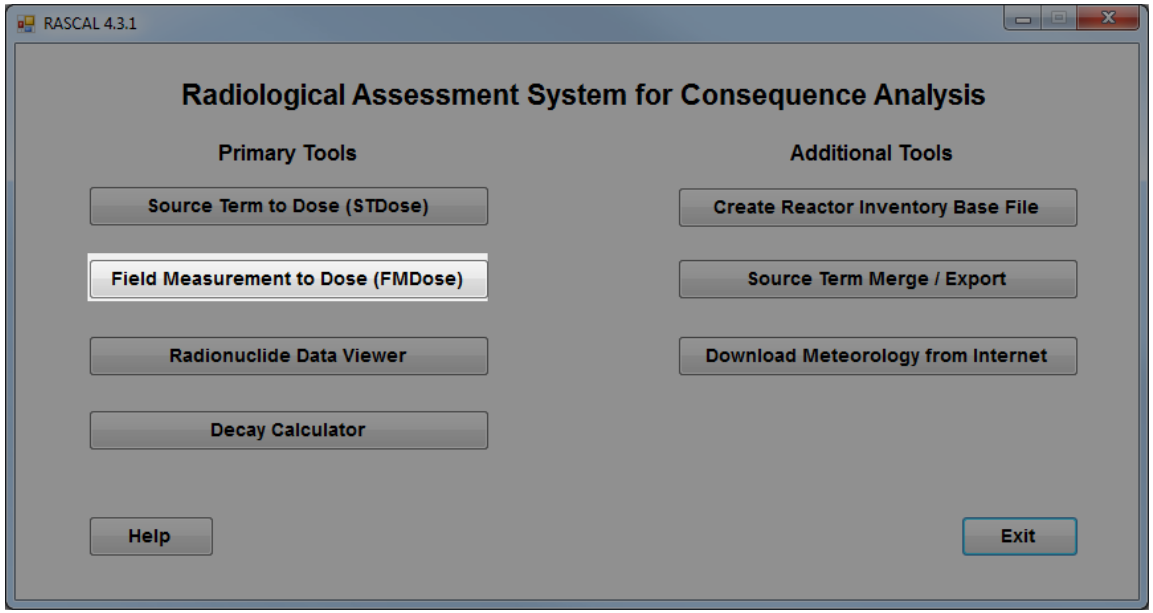


SOURCE TERM TO DOSE (STDOSE)



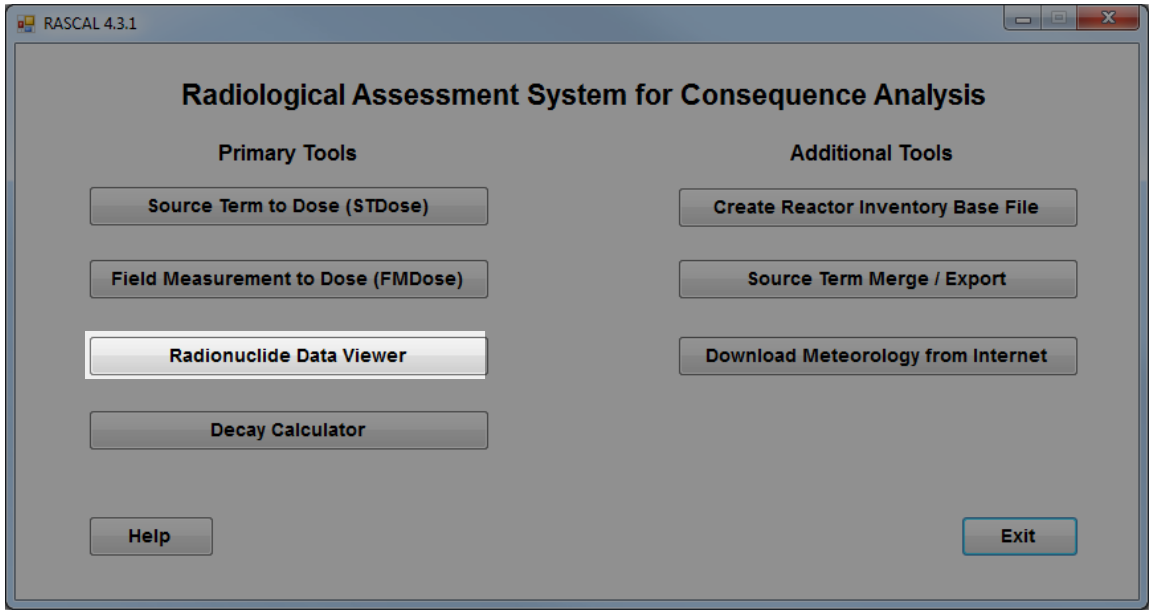
Processes scenario information to determine a radioactive source term, models the transportation of the material downwind, and calculates dose or concentration of material at given distances.

Field Measurement to Dose (FMDose)



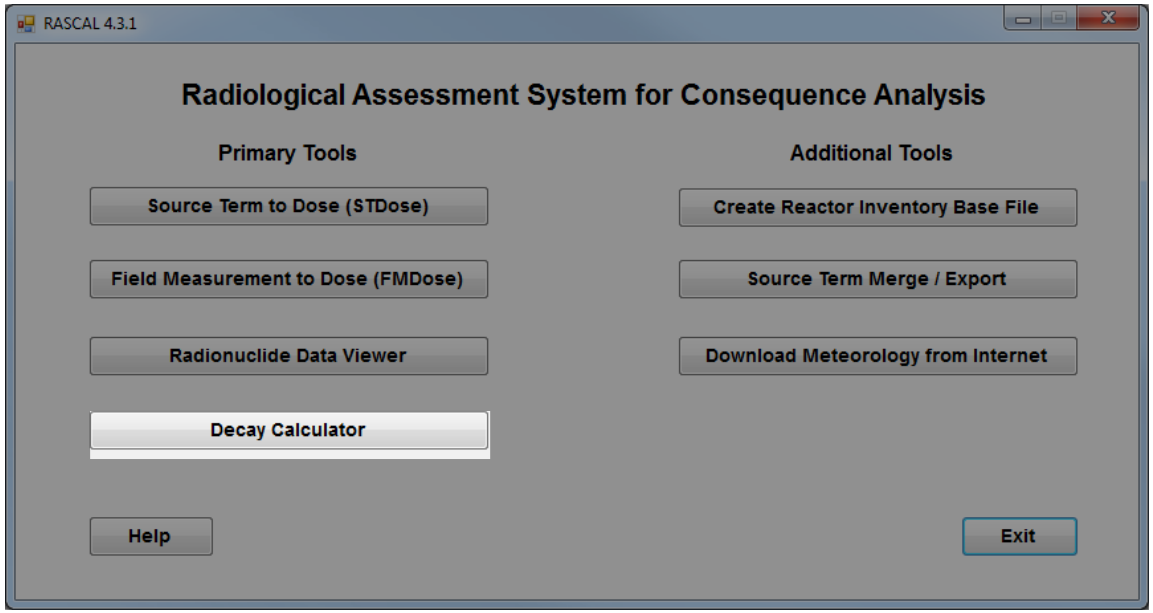
From an input concentration (field team measurement), calculates an estimated intermediate or long-term source term and dose at that given location

Radionuclide Data Viewer



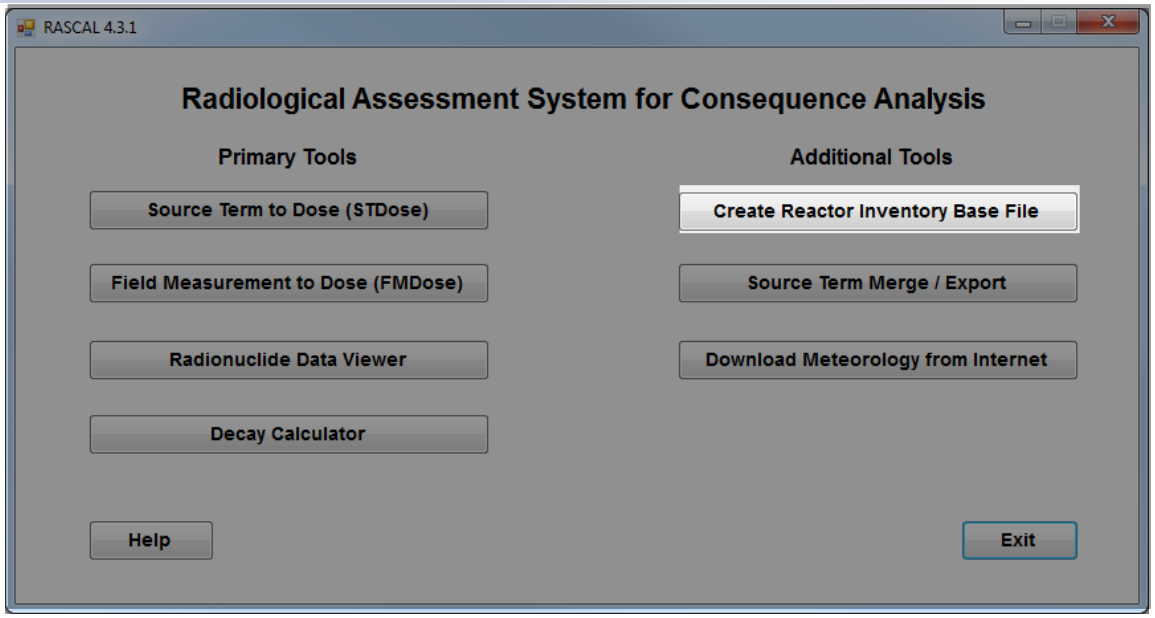
Contains all the dose and decay coefficients used by RASCAL's various models, which may support hand calculations or understanding potential differences between models.

Decay Calculator



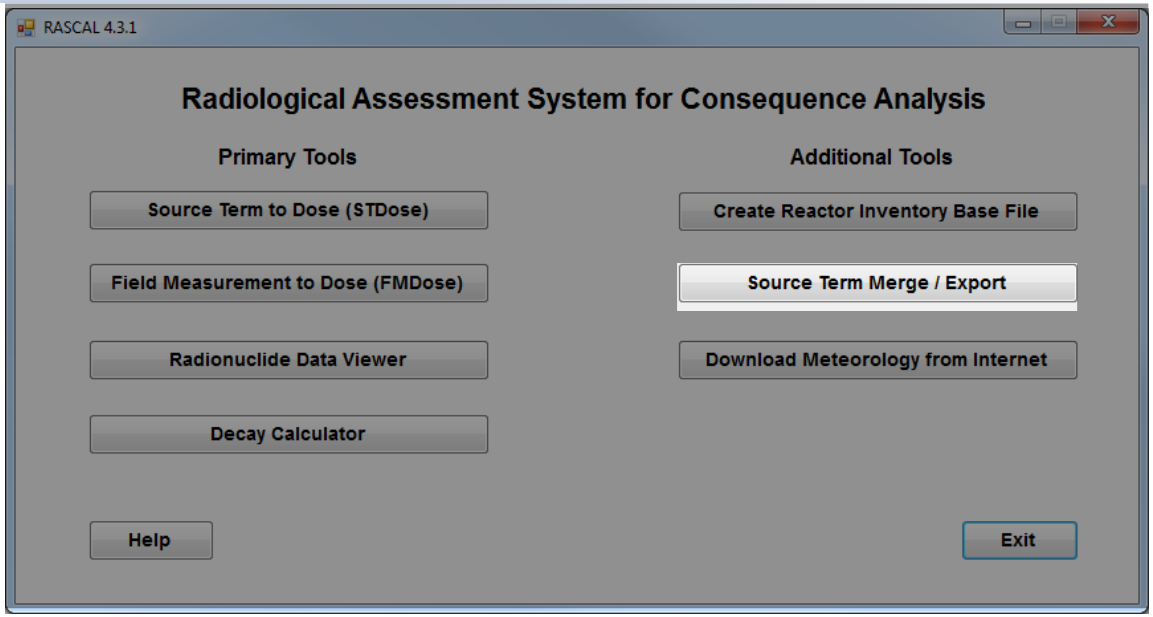
Simple tool (legacy) that takes an existing activity of one or more nuclides, and calculates remaining activity after a given time. It is still operational, but since decay calculators are common online, certain decay chains have not been fully updated.

Create Reactor Inventory Base File



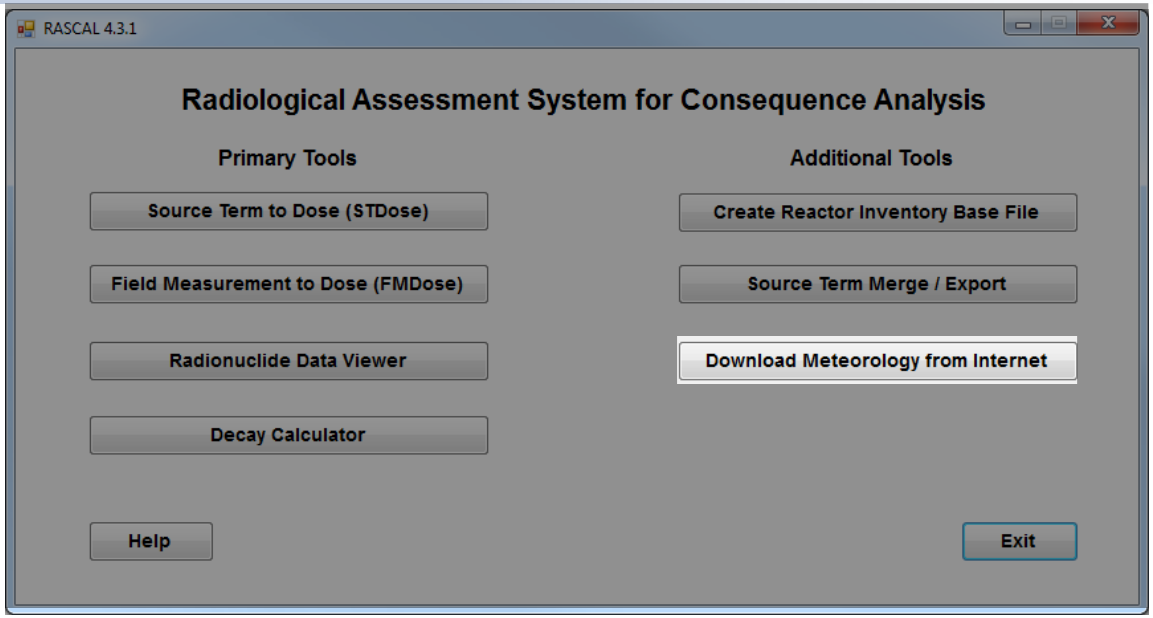
For refining an inventory for specific units based on their fuel management history. This tool can update fuel, coolant, and spent fuel radionuclide inventories if you have time and want a bit more precision in your data.

SOURCE TERM MERGE / EXPORT



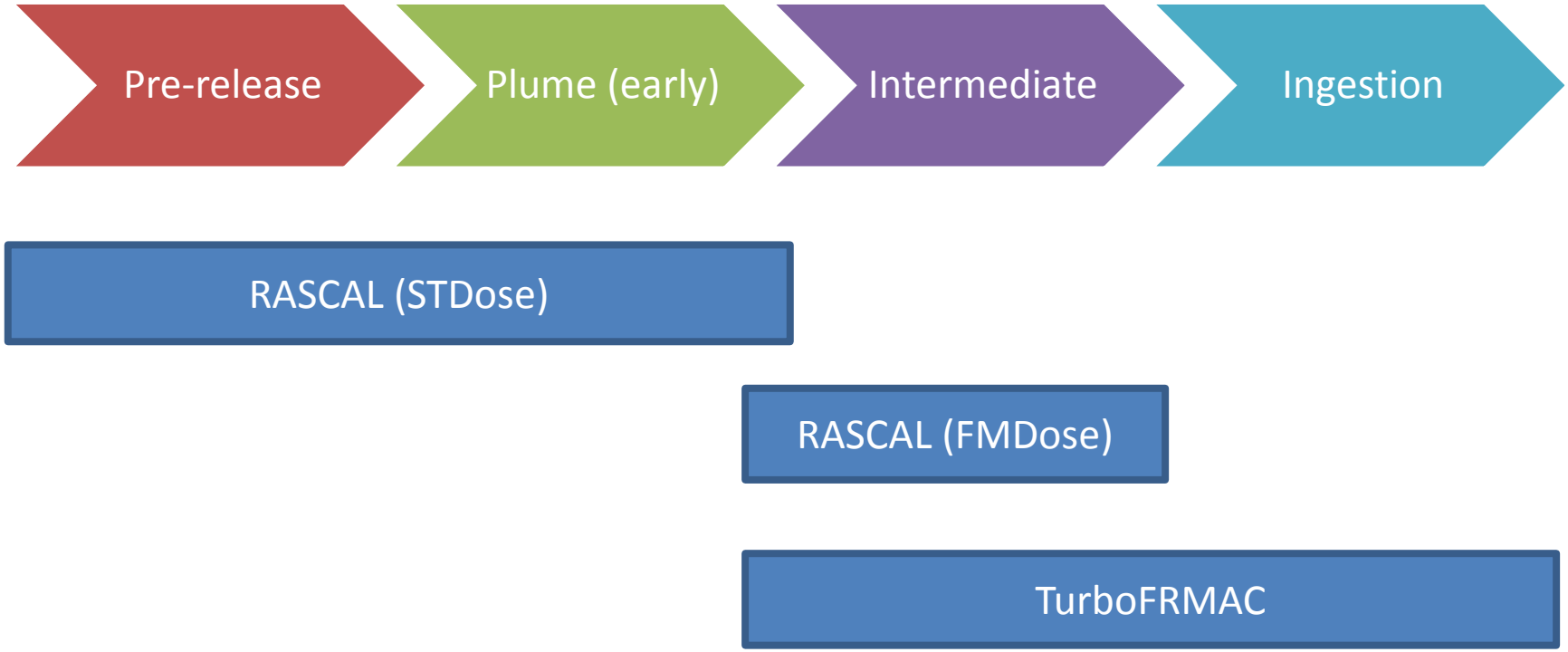
Combines STDose source terms and releases from a single height and geographic location to support multi-unit releases.

Download Meteorology from Internet



Obtains available weather forecast and observation data from the National Weather Service, making input of actual weather data more automated.

WHERE DOES RASCAL FIT IN THE PHASES OF A RADIOLOGICAL EMERGENCY?

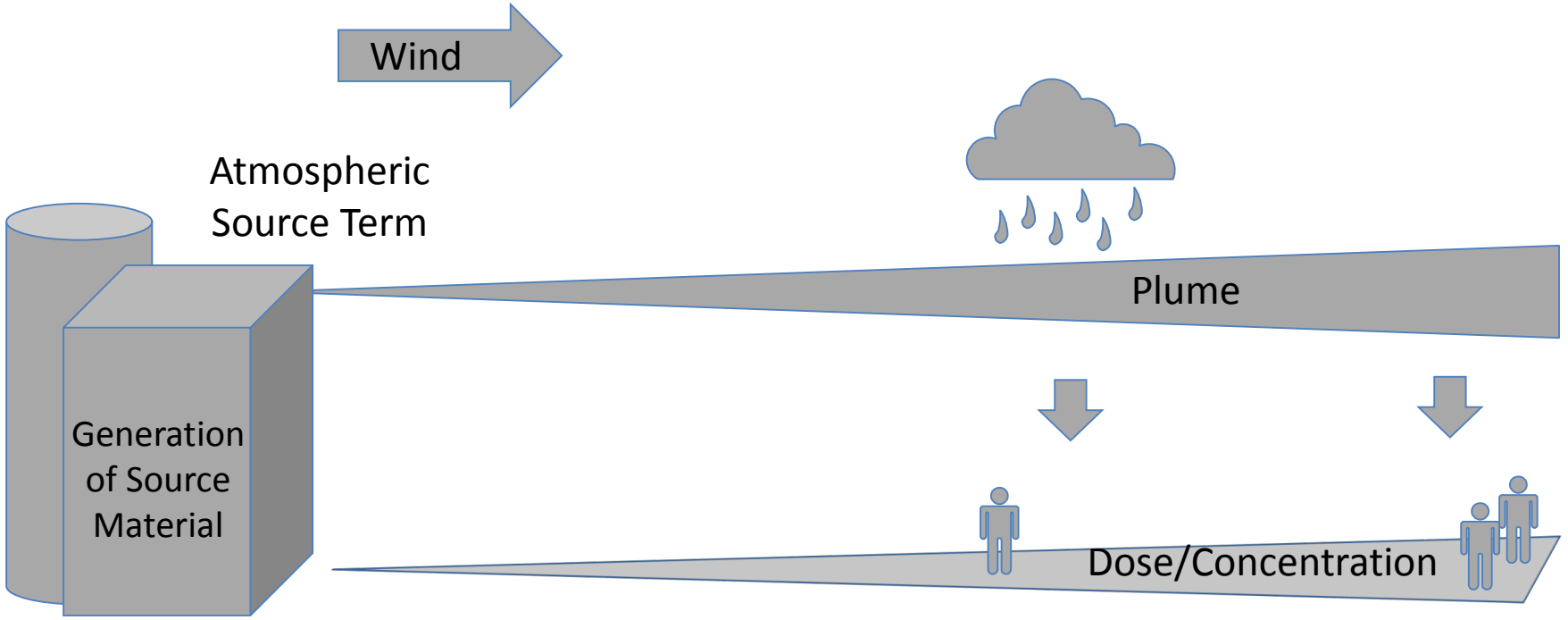


WHY ARE YOU USING RASCAL?

- Estimate doses
- Help generate Protective Action Recommendations / Protective Action Decisions
- Plan for “just-in-case” / Evaluate “what if”
- Compare against results from other tools

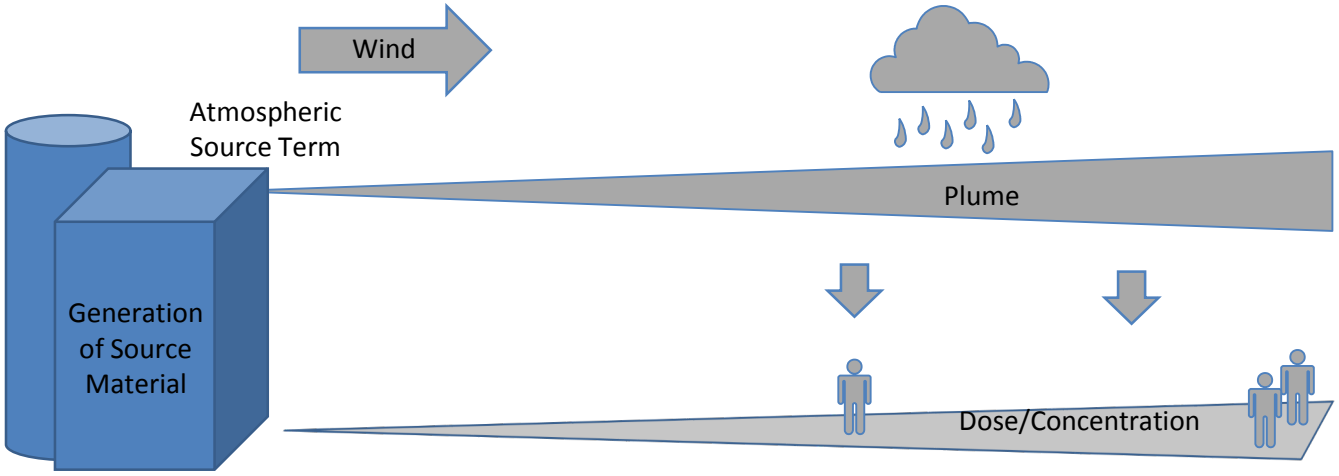
This Training Will Focus on STDose

- **Source Term to Dose Module Creates Source Term, Processes Met Conditions, & Calculates Doses**



RASCAL Defines Atmospheric Source Term

- Determines radionuclides available for release
  - May be single nuclide or complex core damage
  - Time-dependent isotopes and activity
- Source material may be filtered, reduced, or decayed

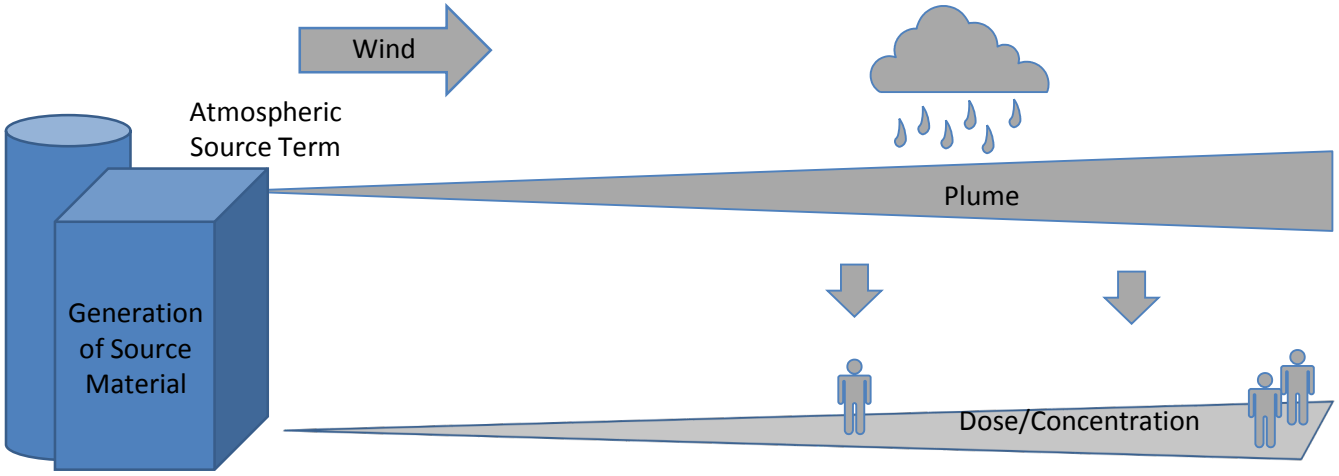


Result is Radionuclides Released to Environment Over Time (Atmospheric Source Term)

- **Isotopic activity over time (15 min)**

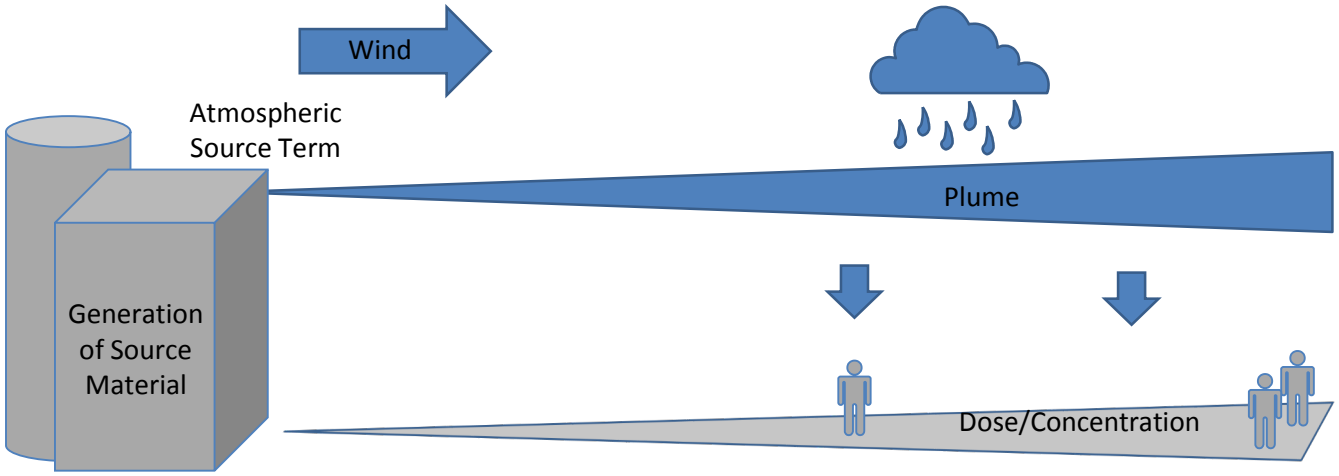
(Ci) released to atmosphere (by nuclide and time step)

Interval	2016/02/02	2016/02/02	2016/02/02	2016/02/02	2016/02/02	2016/02/02	2016/02/02	20
Start	00:00	00:15	00:30	00:45	01:00	01:15	01:30	01:
Am-241	0.00E+00	0.00E+00	4.62E-10	1.46E-09	2.75E-09	4.17E-09	5.63E-09	
Ba-139	0.00E+00	0.00E+00	5.62E+00	8.62E+00	9.99E+00	1.04E+01	1.02E+01	1
Ba-140	0.00E+00	0.00E+00	7.25E+00	1.26E+01	1.66E+01	1.95E+01	2.17E+01	3
Ce-141	0.00E+00	0.00E+00	1.67E-01	2.92E-01	3.83E-01	4.51E-01	5.01E-01	1
Ce-143	0.00E+00	0.00E+00	1.51E-01	2.61E-01	3.42E-01	4.01E-01	4.43E-01	1
Ce-144*	0.00E+00	0.00E+00	1.35E-01	2.35E-01	3.09E-01	3.64E-01	4.04E-01	1
Cm-242	0.00E+00	0.00E+00	1.71E-03	2.97E-03	3.91E-03	4.60E-03	5.11E-03	
Cs-134	3.62E+00	6.30E+00	1.16E+01	1.56E+01	1.85E+01	2.07E+01	2.23E+01	2
Cs-136	1.48E+00	2.57E+00	4.73E+00	6.35E+00	7.53E+00	8.41E+00	9.09E+00	9
Cs-137*	2.50E+00	4.36E+00	8.05E+00	1.08E+01	1.28E+01	1.43E+01	1.54E+01	1
Cs-138	0.00E+00	1.73E+01	3.76E+01	5.65E+01	6.04E+01	5.41E+01	4.37E+01	3
I-131	2.65E+01	4.60E+01	1.05E+02	1.49E+02	1.81E+02	2.05E+02	2.23E+02	2
I-132	3.84E+01	6.49E+01	1.49E+02	2.07E+02	2.49E+02	2.81E+02	3.05E+02	2
I-133	5.37E+01	9.27E+01	2.11E+02	2.95E+02	3.57E+02	4.01E+02	4.32E+02	4
I-134	5.92E+01	8.46E+01	1.58E+02	1.85E+02	1.85E+02	1.72E+02	1.53E+02	1
I-135	5.13E+01	8.70E+01	1.94E+02	2.67E+02	3.18E+02	3.50E+02	3.71E+02	3
Kr-83m	4.08E+00	7.43E+00	3.14E+01	5.10E+01	6.69E+01	7.94E+01	8.91E+01	8
Kr-85	2.89E-01	5.78E-01	2.69E+00	4.81E+00	6.91E+00	9.00E+00	1.12E+01	
5m	8.25E+00	1.58E+01	7.11E+01	1.22E+02	1.69E+02	2.12E+02	2.52E+	



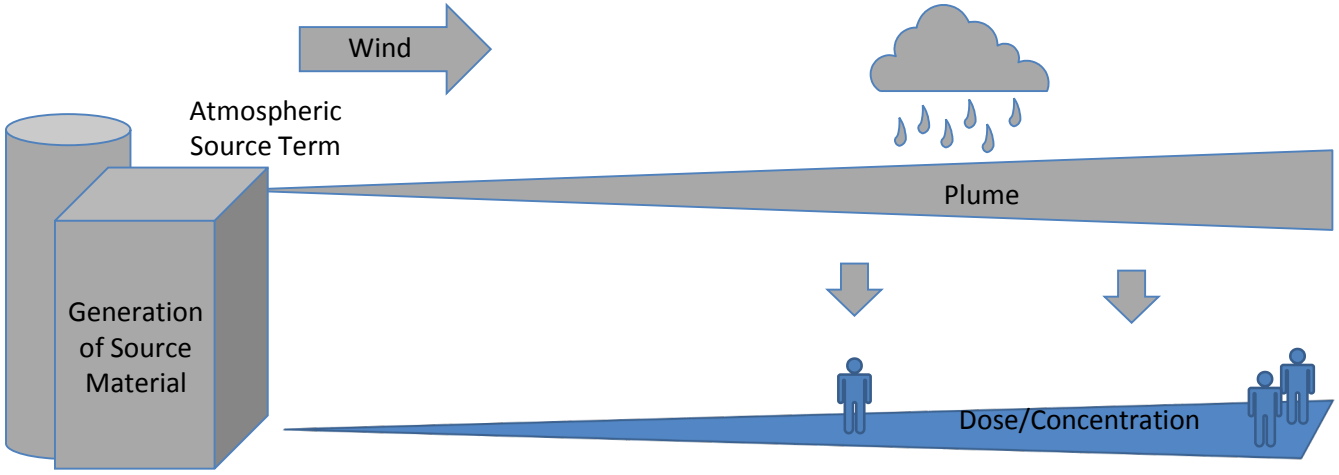
Atmospheric Source Term is Moved using ATD Models

- **Atmospheric Transport and Dispersion Models**
  - **Transport material based on weather conditions**
  - **Track material to where it falls/washes on ground**
  - **Accounts for dry/wet processes and particle size**



Final Calculations Provide Doses and Concentrations over Calculation Area

- Dose calc accounts for multiple pathways
  - External (Groundshine + cloudshine)
  - Internal (Inhalation + ~~ingestion)~~
- Results includes other display/calculation options

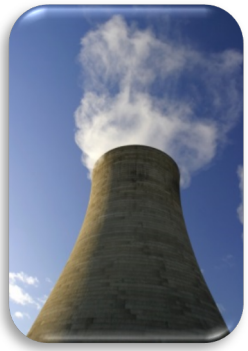


Course Scenario Disclaimer

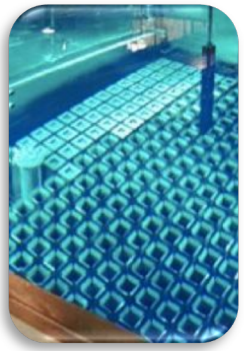
This RASCAL presentation was developed by the U.S. Nuclear Regulatory Commission to support training for its Incident Response Program and the Radiation Protection Computer Code Analysis and Maintenance Program (RAMP). The situations presented may not be realistic or likely and are for training purposes only.

Additionally, the current version of RASCAL contains mostly US plants. These training scenarios will use US plants and English units.

Before We Start, Do We Need to Review Any Basics on technology?



Nuclear Power Plant



Spent Fuel

Fuel Cycle

Other Material