

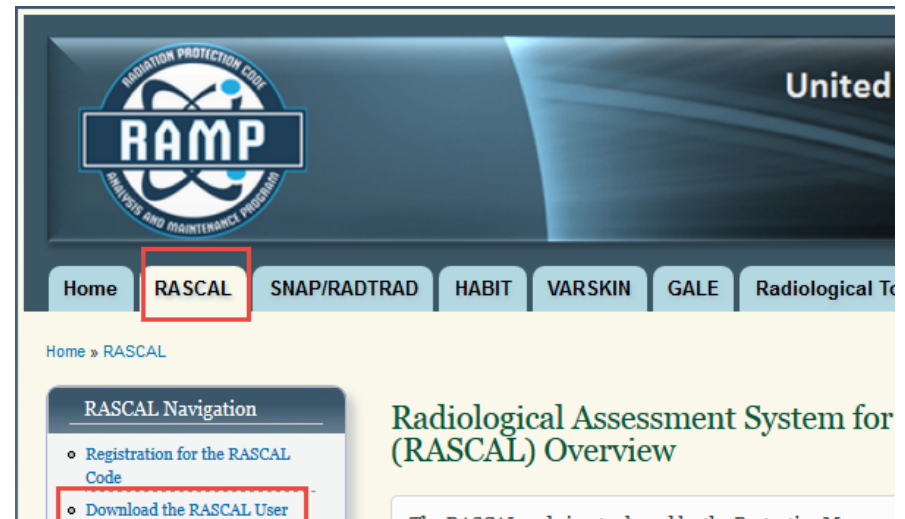
THE RASCAL ACRONYM STANDS FOR RADIOLOGICAL ASS^USSMENT SYSTEM FOR CONSEQUENCE ANALYSIS

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.

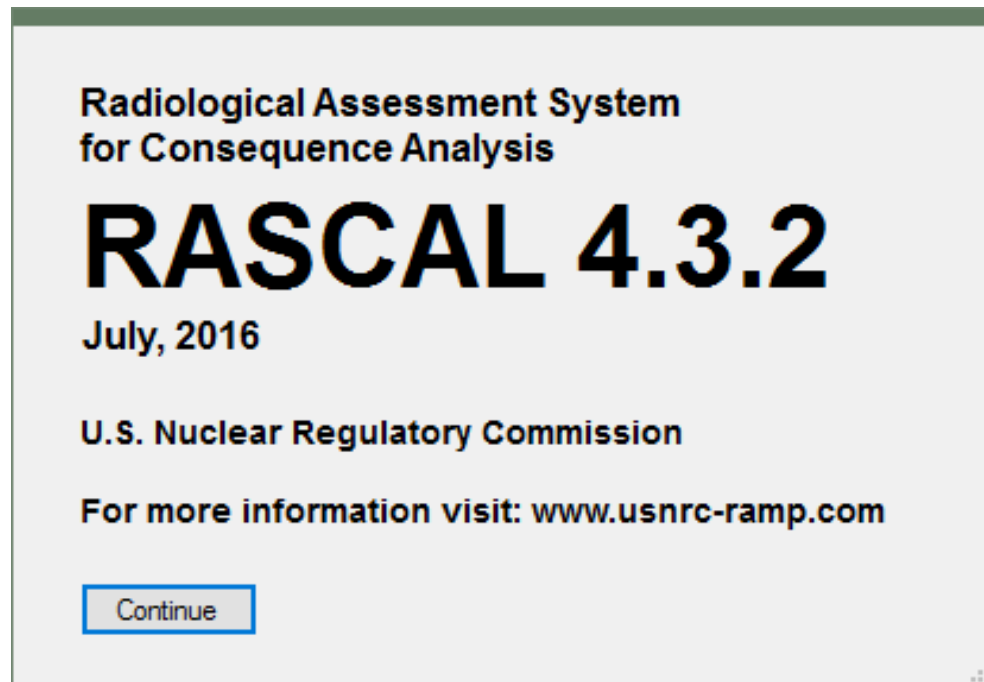
RASCAL 4.3.2 is the current version, incorporating lessons learned from Fukushima and other exercises.

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

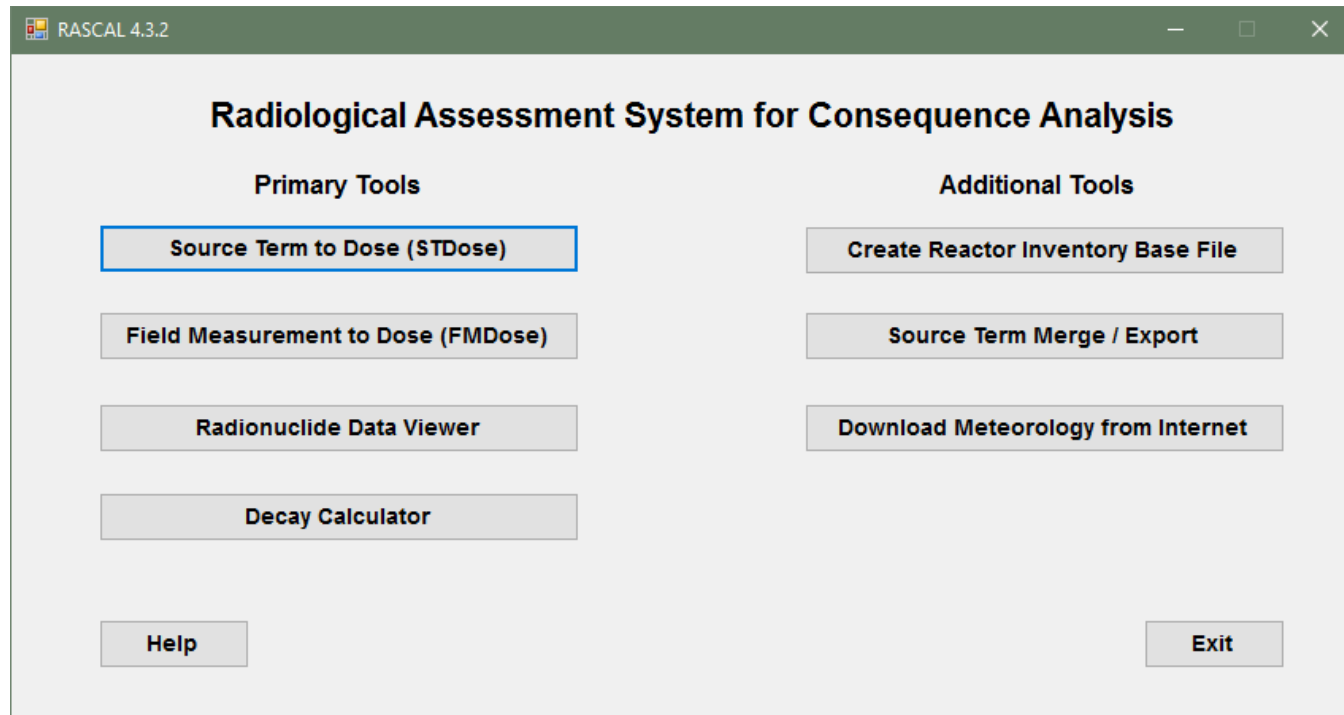
- **Code Distribution**
 - All users should obtain their own copy (free for Fed/State/Local gov)
- **Technical Support**
 - Technical documentation
 - Training
 - FAQs, Forums, Email



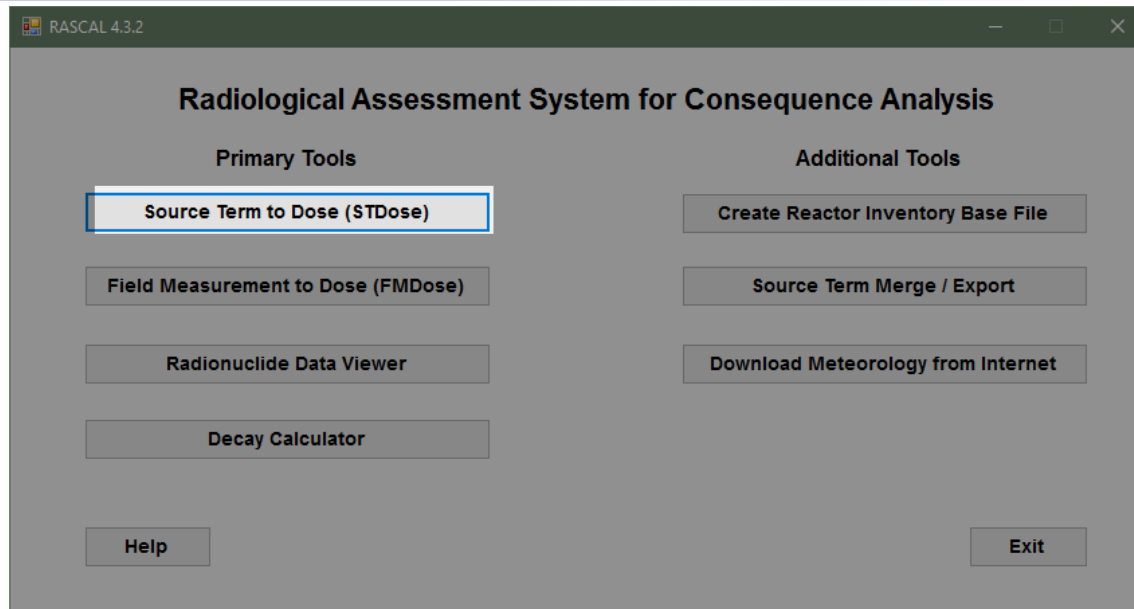
OPENING RASCAL IN WINDOWS



THERE ARE 4 PRIMARY TOOLS AND 3 ADDITIONAL TOOLS ON THE RASCAL HOME PAGE.

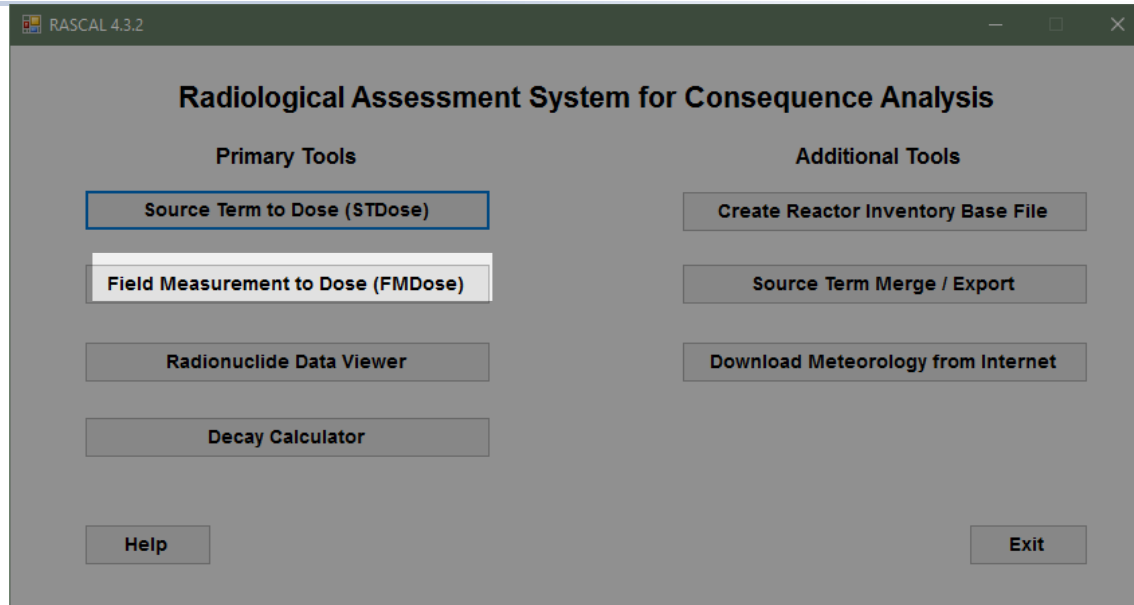


SOURCE TERM TO DOSE (STDose)



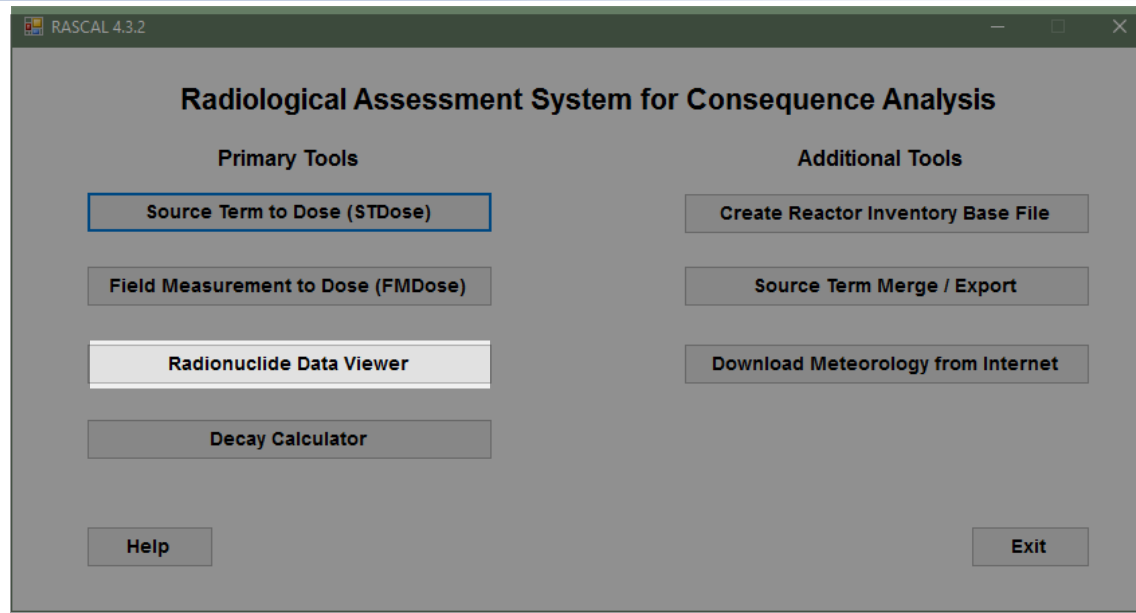
Processes scenario information to determine a radioactive source term, models the transportation of the material downwind, and calculates dose or concentration of material at given distances.

FIELD MEASUREMENT TO DOSE (FMDose)



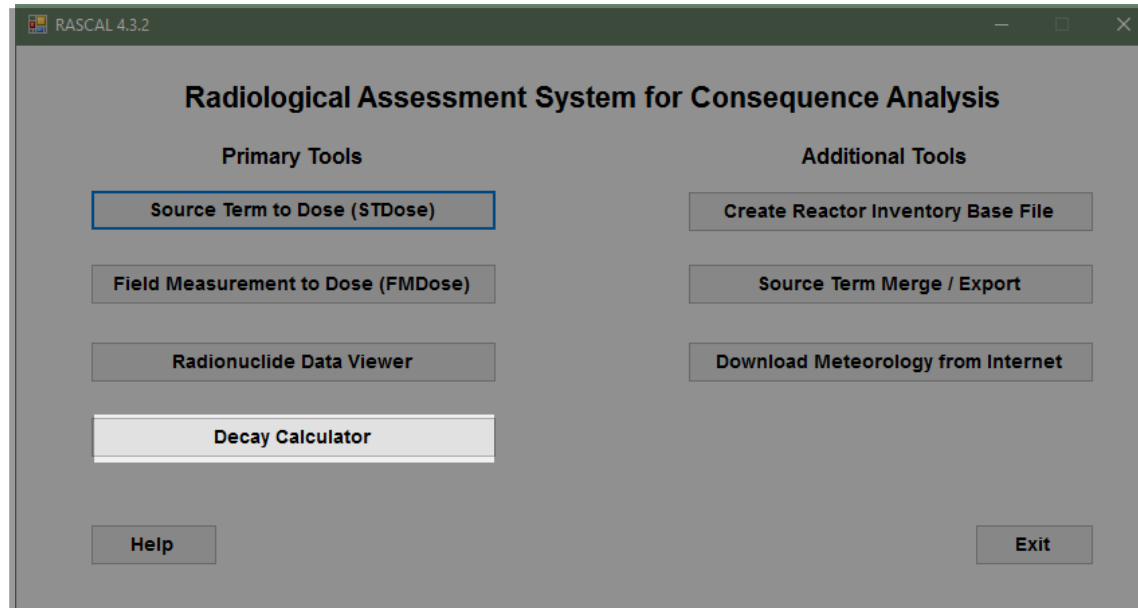
From an input concentration (field team measurement), calculates an estimated intermediate or long-term source term and dose at that given location

RADIONUCLIDE DATA VIEWER



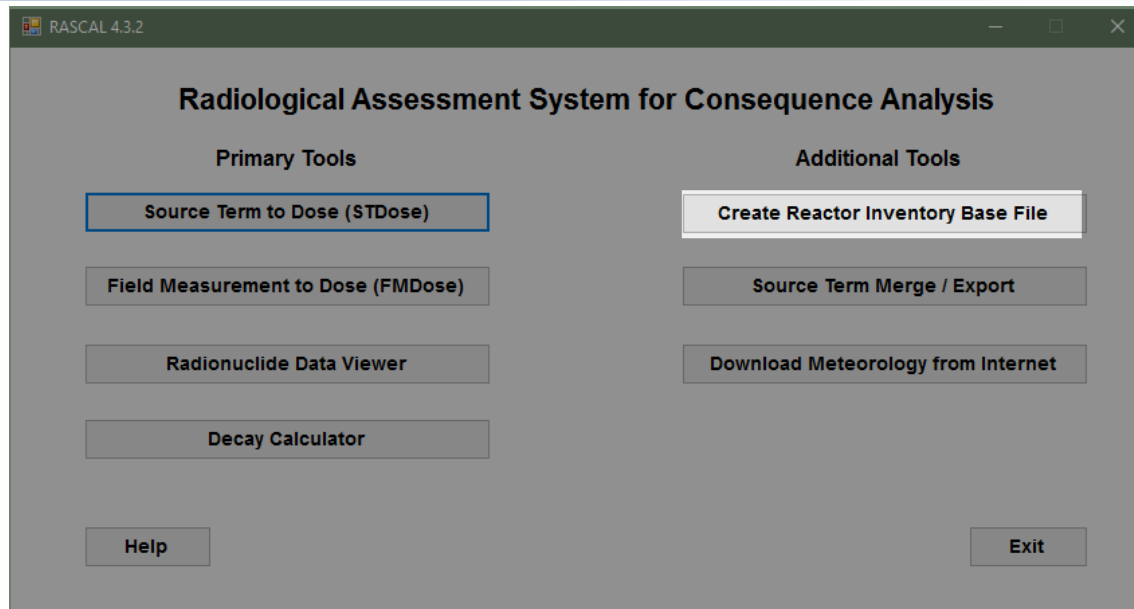
Contains all the dose and decay coefficients used by RASCAL's various models, which may support hand calculations or understanding potential differences between models.

DECAY CALCULATOR



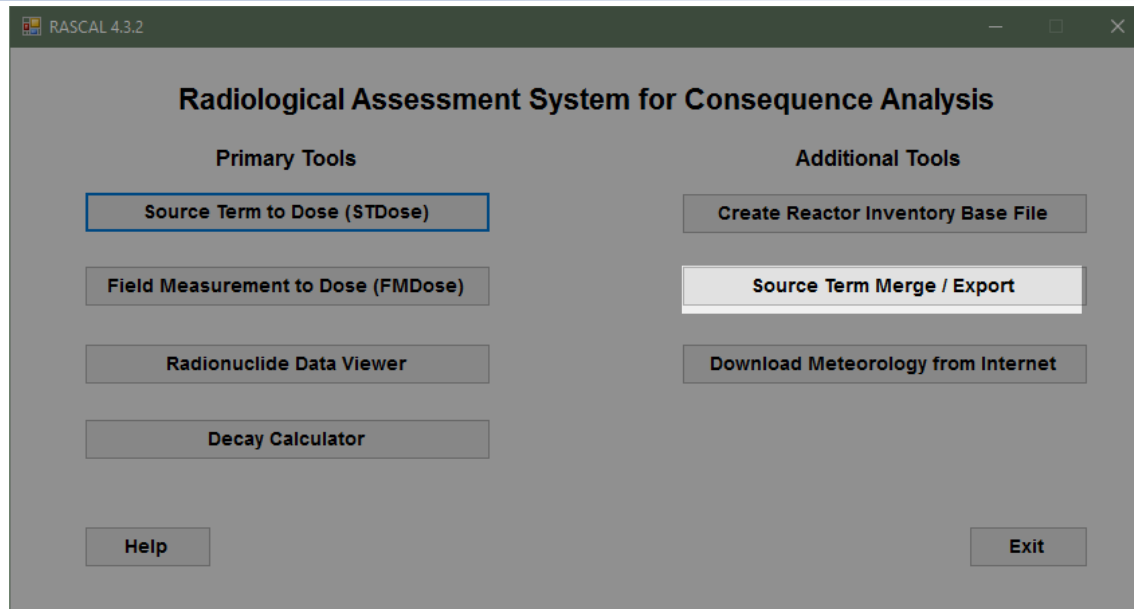
Simple tool (legacy) that takes an existing activity of one or more nuclides, and calculates remaining activity after a given time. It is still operational, but since decay calculators are common online, certain decay chains have not been fully updated.

CREATE REACTOR INVENTORY BASE FILE



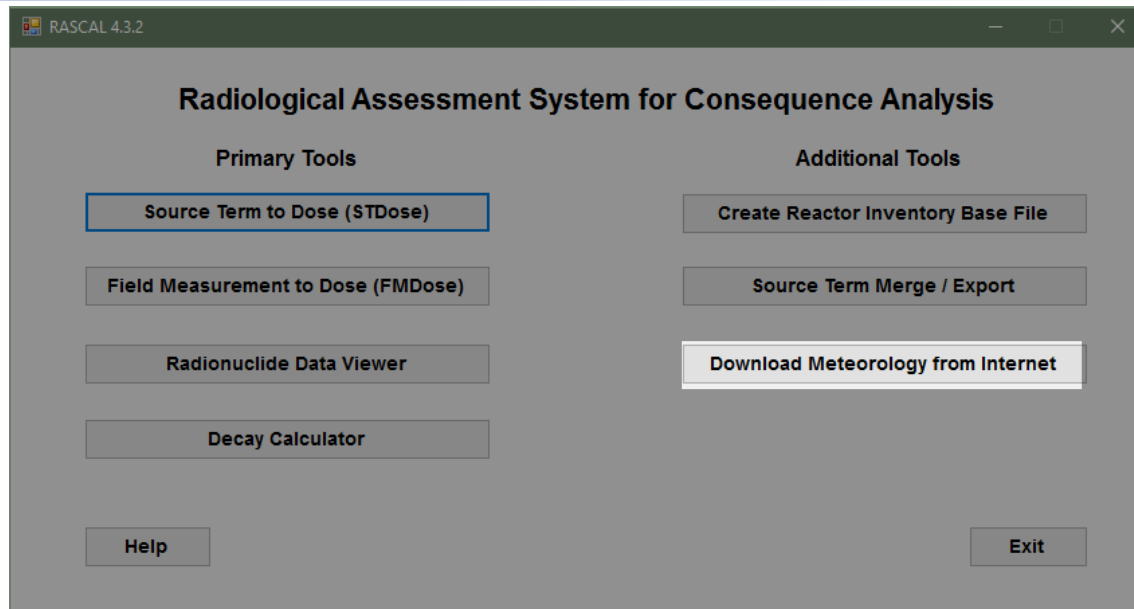
For refining an inventory for specific units based on their fuel management history. This tool can update fuel, coolant, and spent fuel radionuclide inventories if you have time and want a bit more precision in your data.

SOURCE TERM MERGE / EXPORT



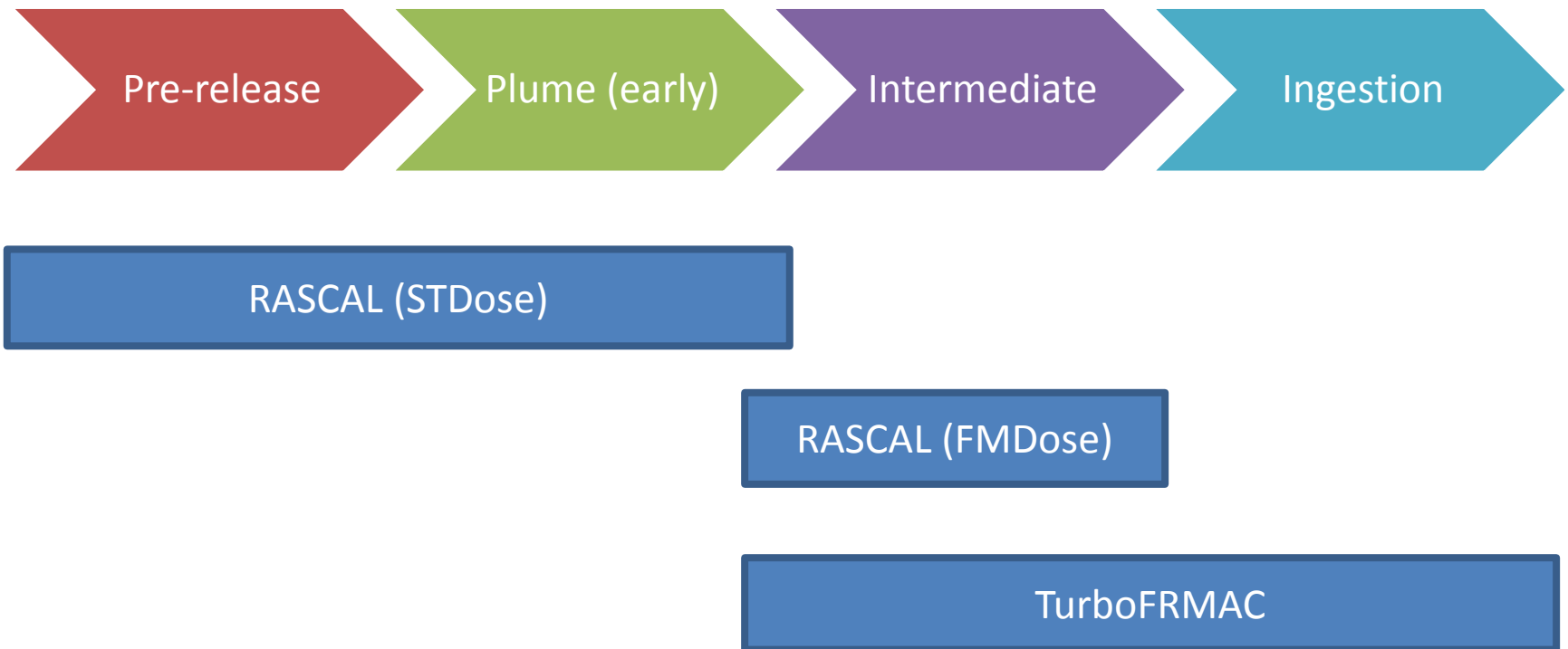
Combines STDose source terms and releases from a single height and geographic location to support multi-unit releases.

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?

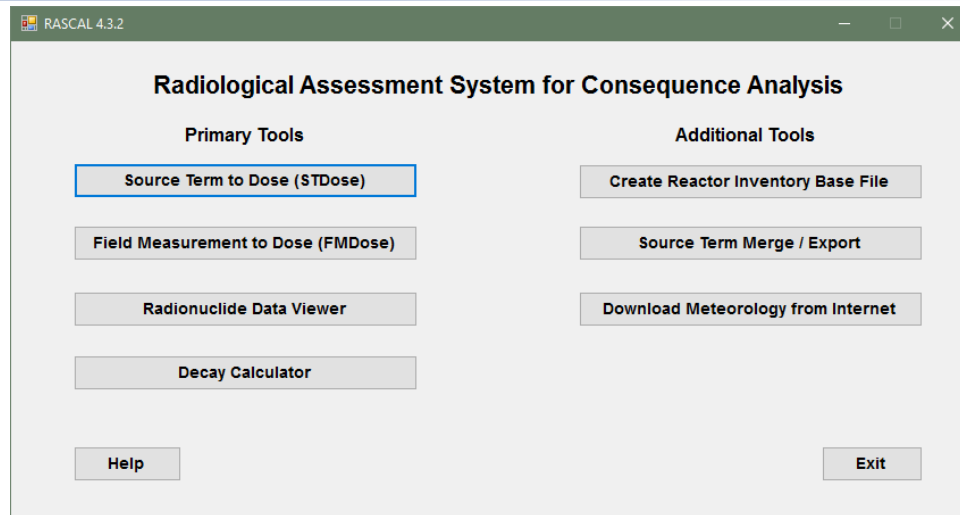


WHY ARE YOU USING RASCAL?

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



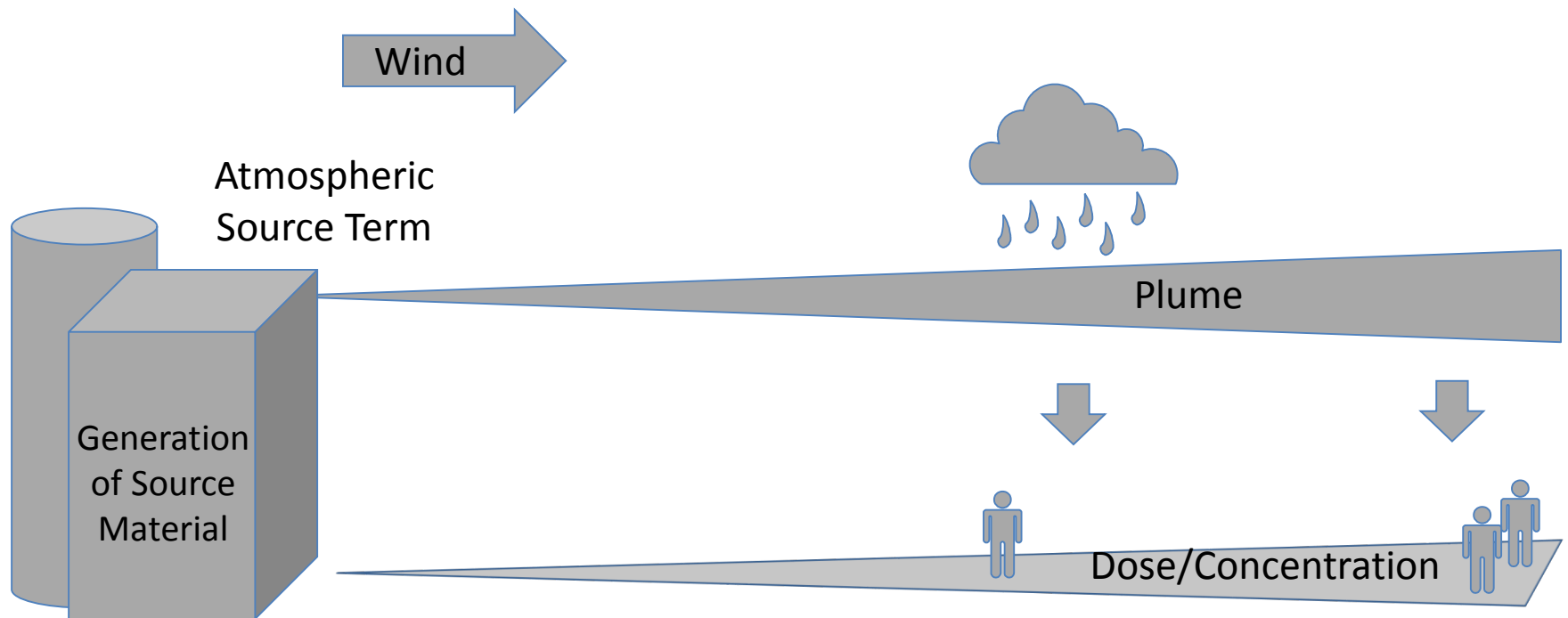
WHICH TOOL SHOULD BE USED TO EVALUATE THE SCENARIO?



- Degrading situation at Nuclear Power Plant; determine if evacuation or sheltering is warranted.
- A materials leak ends up near a residential neighborhood; activity is measured by a field team; determine if residents must relocate.
- A tornado struck a nuclear power facility, affecting both units and a spent fuel pool; determine how field team measurements compare against model.

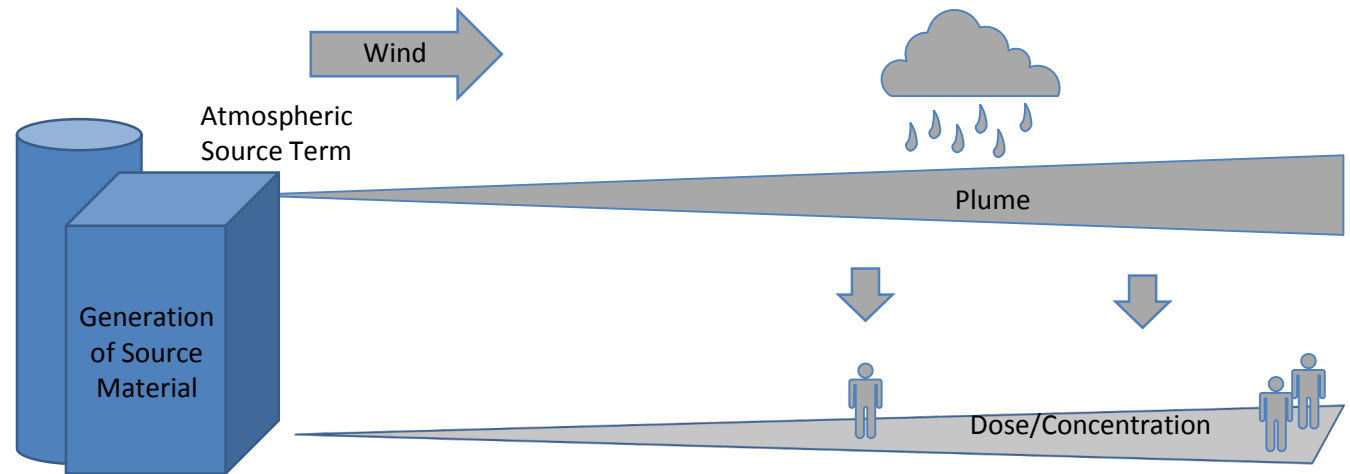
THIS TRAINING WILL FOCUS ON STDose

- **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**

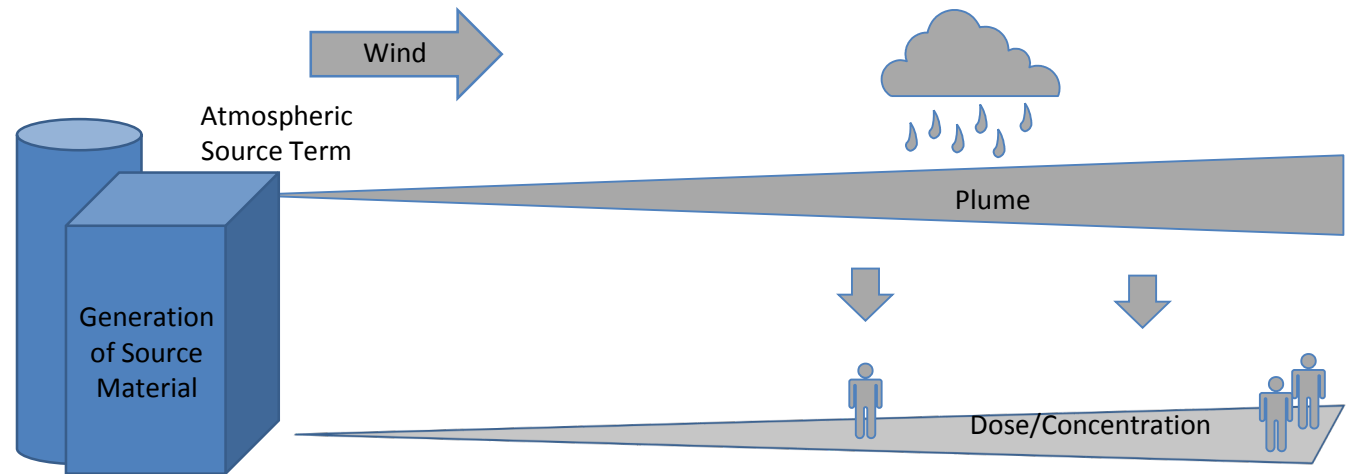


RESULT IS RADIONUCLIDES RELEASED TO ENVIRONMENT OVER TIME (ATMOSPHERIC SOURCE TERM)

- Isotopic activity over time (15 min)

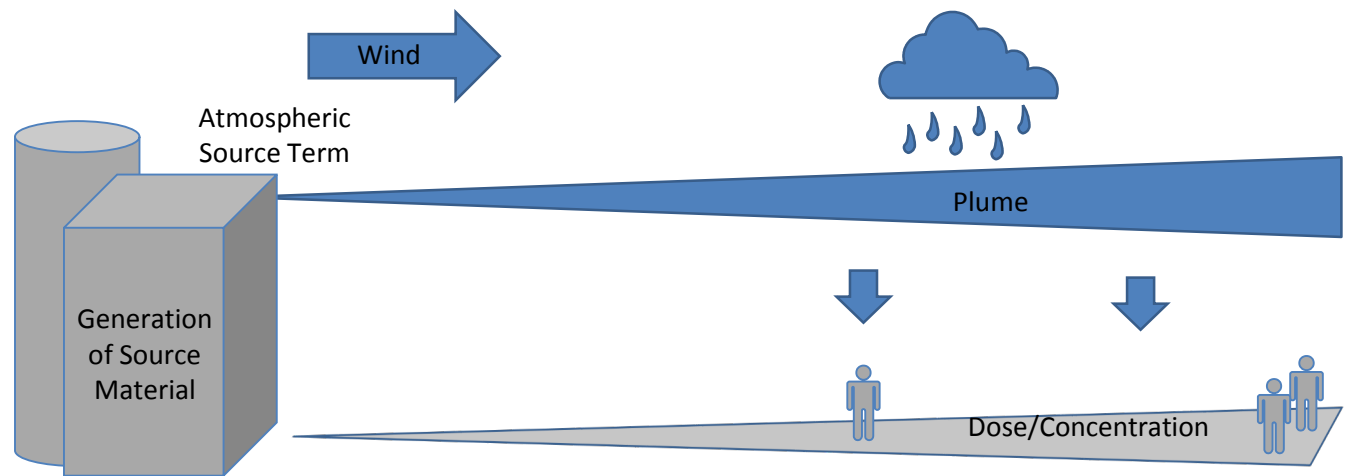
Activity (Ci) released to atmosphere (by nuclide and time step)

Interval	2016/02/02 00:00	2016/02/02 00:15	2016/02/02 00:30	2016/02/02 00:45	2016/02/02 01:00	2016/02/02 01:15	2016/02/02 01:30	2016/02/02 01:45
Am-241	0.00E+00	0.00E+00	4.62E-10	1.46E-09	2.75E-09	4.17E-09	5.63E-09	7.09E-09
Ba-139	0.00E+00	0.00E+00	5.62E+00	8.62E+00	9.99E+00	1.04E+01	1.02E+01	1.00E+01
Ba-140	0.00E+00	0.00E+00	7.25E+00	1.26E+01	1.66E+01	1.95E+01	2.17E+01	2.39E+01
Ce-141	0.00E+00	0.00E+00	1.67E-01	2.92E-01	3.83E-01	4.51E-01	5.01E-01	5.41E-01
Ce-143	0.00E+00	0.00E+00	1.51E-01	2.61E-01	3.42E-01	4.01E-01	4.43E-01	4.79E-01
Ce-144*	0.00E+00	0.00E+00	1.35E-01	2.35E-01	3.09E-01	3.64E-01	4.04E-01	4.39E-01
Cm-242	0.00E+00	0.00E+00	1.71E-03	2.97E-03	3.91E-03	4.60E-03	5.11E-03	5.52E-03
Cs-134	3.62E+00	6.30E+00	1.16E+01	1.56E+01	1.85E+01	2.07E+01	2.23E+01	2.39E+01
Cs-136	1.48E+00	2.57E+00	4.73E+00	6.35E+00	7.53E+00	8.41E+00	9.09E+00	9.67E+00
Cs-137*	2.50E+00	4.36E+00	8.05E+00	1.08E+01	1.28E+01	1.43E+01	1.54E+01	1.64E+01
Cs-138	0.00E+00	1.73E+01	3.76E+01	5.65E+01	6.04E+01	5.41E+01	4.37E+01	3.43E+01
I-131	2.65E+01	4.60E+01	1.05E+02	1.49E+02	1.81E+02	2.05E+02	2.23E+02	2.39E+02
I-132	3.84E+01	6.49E+01	1.49E+02	2.07E+02	2.49E+02	2.81E+02	3.05E+02	3.29E+02
I-133	5.37E+01	9.27E+01	2.11E+02	2.95E+02	3.57E+02	4.01E+02	4.32E+02	4.58E+02
I-134	5.92E+01	8.46E+01	1.58E+02	1.85E+02	1.85E+02	1.72E+02	1.53E+02	1.34E+02
I-135	5.13E+01	8.70E+01	1.94E+02	2.67E+02	3.18E+02	3.50E+02	3.71E+02	3.89E+02
Kr-83m	4.08E+00	7.43E+00	3.14E+01	5.10E+01	6.69E+01	7.94E+01	8.91E+01	9.67E+01
Kr-85	2.89E-01	5.78E-01	2.69E+00	4.81E+00	6.91E+00	9.00E+00	1.12E+01	1.34E+01
Xe-135m	8.25E+00	1.58E+01	7.11E+01	1.22E+02	1.69E+02	2.12E+02	2.52E+02	2.89E+02



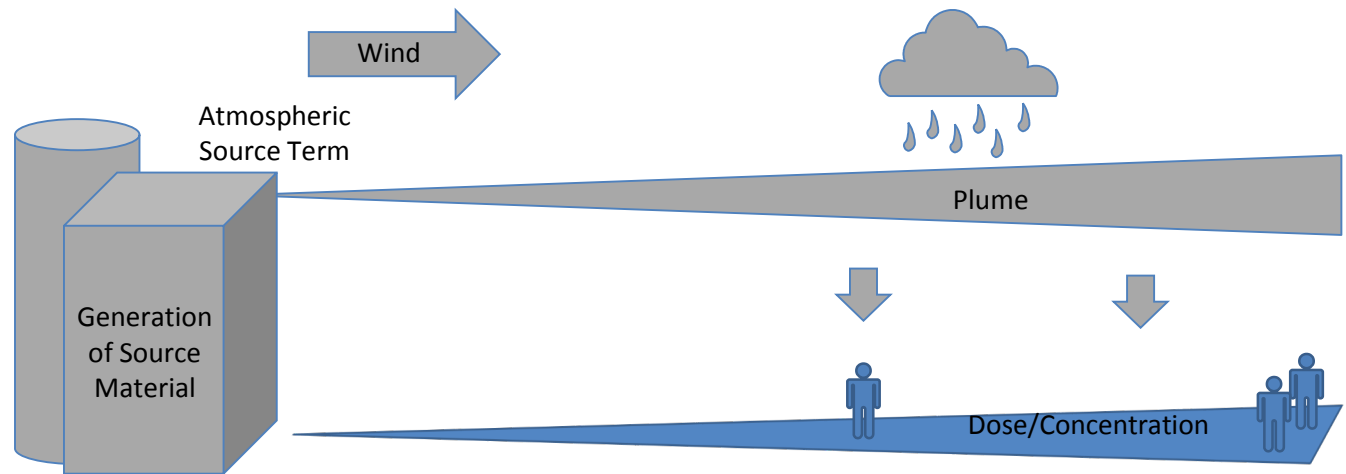
ATMOSPHERIC SOURCE TERM IS MOVED USING ATD MODELS

- **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

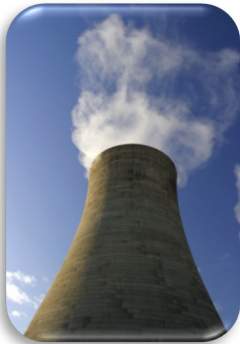
- Dose calc accounts for multiple pathways
 - External (Groundshine + cloudshine)
 - Internal (Inhalation + ~~ingestion~~)
- Results includes other display/calculation options



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.

BEFORE WE START, DO WE NEED TO REVIEW ANY BASICS ON TECHNOLOGY?



**Nuclear Power
Plant**



Spent Fuel



Fuel Cycle



Other Material