# RAMP Code Overview

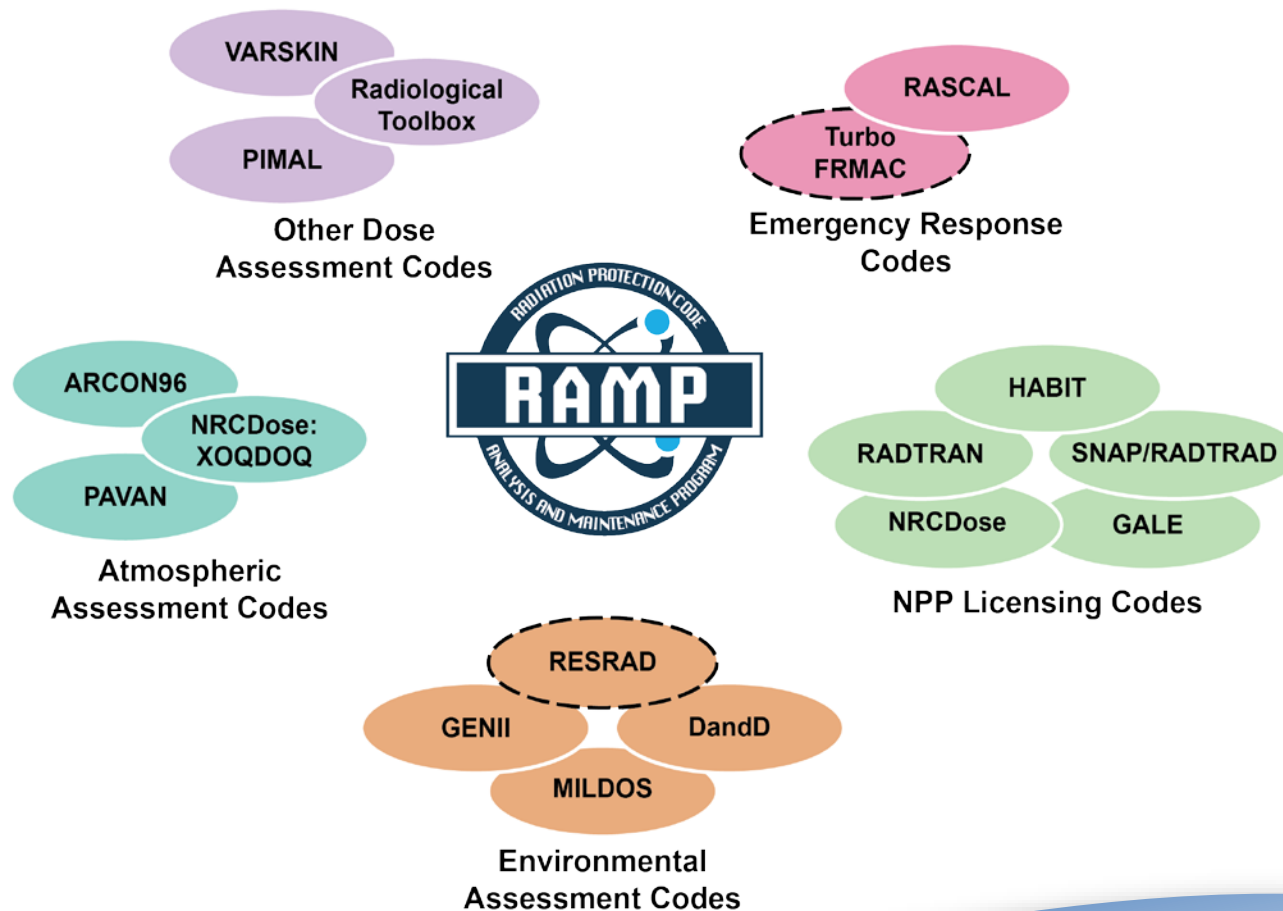## Caitlin Condon

Pacific Northwest National Laboratory

# What codes are in RAMP?

# Radiological Assessment System for Consequence Analysis (RASCAL)

- Fast running software used in radiological incidents to assess off-site dose consequences

- Evaluates atmospheric releases from nuclear power plants, spent fuel storage pools and casks, fuel cycle facilities, and material handling facilities

- Estimates projected radiation doses from a plume to people downwind
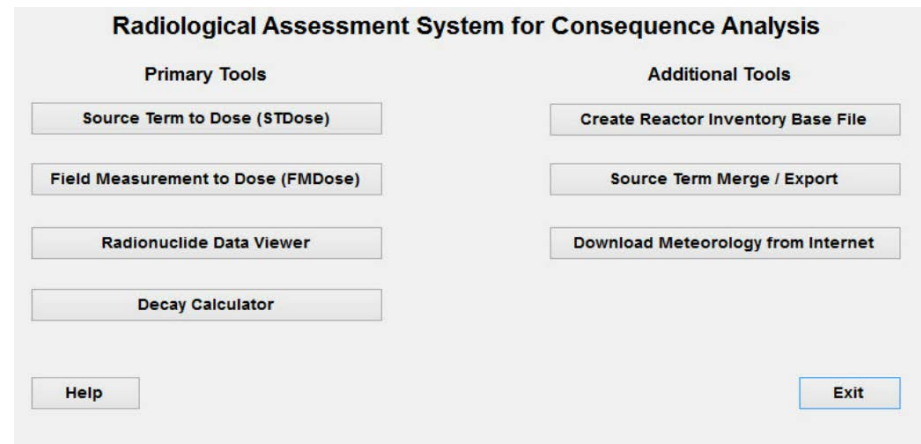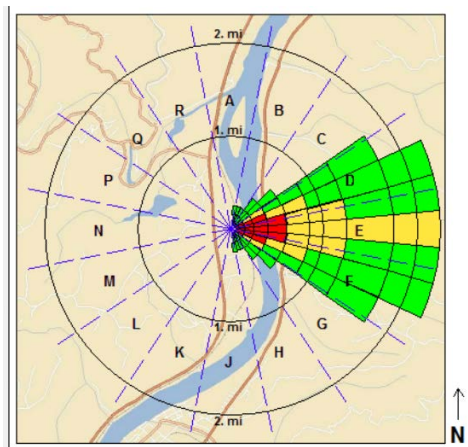
# Turbo FRMAC

- Turbo FRMAC performs complex calculations to quickly evaluate radiological hazards during an emergency response by assessing impacts to the public, workers, and the food supply.

- Developed and maintained by Sandia National Laboratories

- Wide variety of radiological incidents, such as:
    - Radiological Dispersal Devices (RDDs)
    - Nuclear Power Plant Emergencies
    - Fuel Handling Accidents
    - Transportation Accidents

https://ramp.nrc-gateway.gov/content/turbo-frmac

# GENII

- Environmental Assessment Code for estimating radionuclide concentrations in the environment and dose to humans and biota from acute and chronic radiological releases

- Atmospheric and surface water transport models, or options for user input of measured contamination levels

- Part of DOE Safety Software Central Registry

# MILDOS

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Proudly Operated by Battelle Since 1965
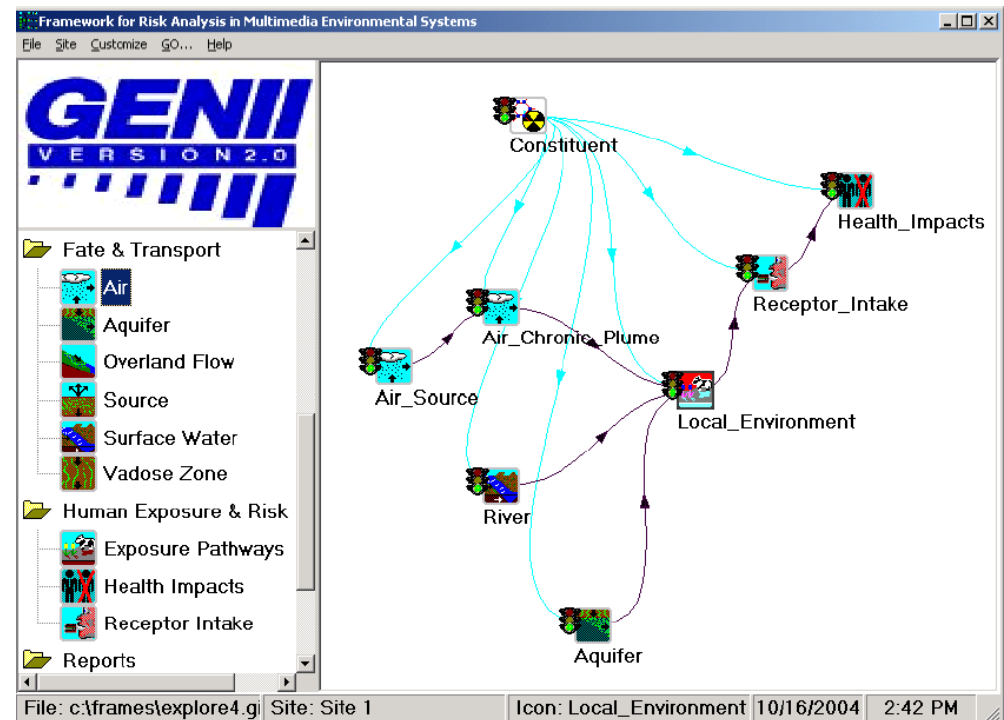
- Estimates the radiological impacts from airborne emissions from uranium recovery facilities

- Calculates the radiological dose received by general population within an 80-km radius of an operating facility

- Calculates air and ground concentrations of radionuclides
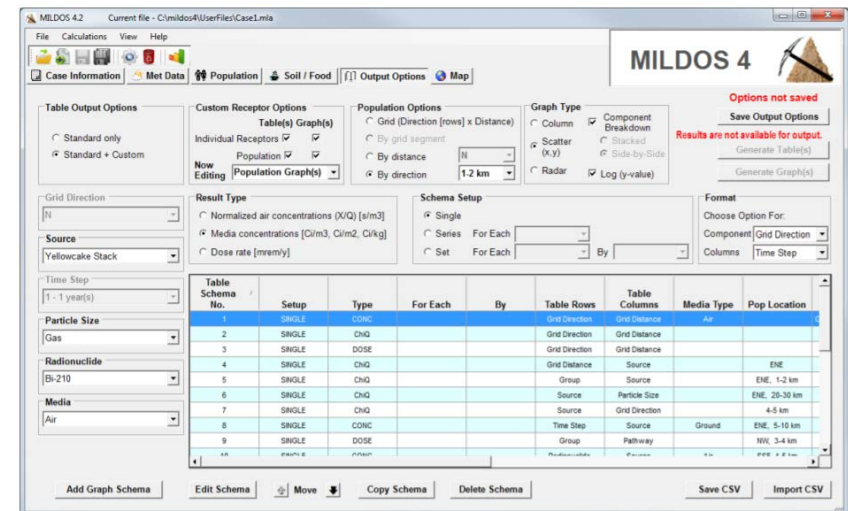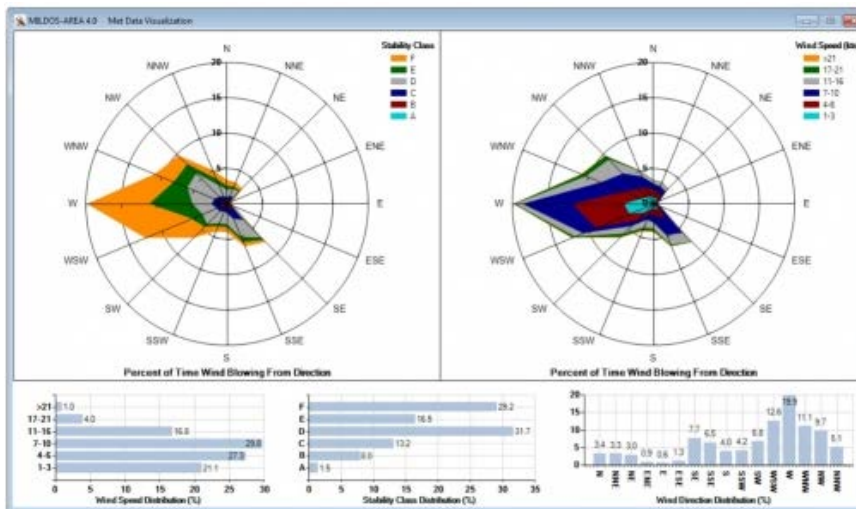
# Decontamination and Decommissioning (DandD)



- DandD estimates annual dose from residual radioactivity in soils and on building surfaces after decommissioning

- Assesses compliance with the dose criteria of 10 CFR Part 20, Subpart E

- NRC has predefined conceptual models for the scenarios along with default parameter distributions (based on NUREG/CR–5512, Volumes 1 and 3)
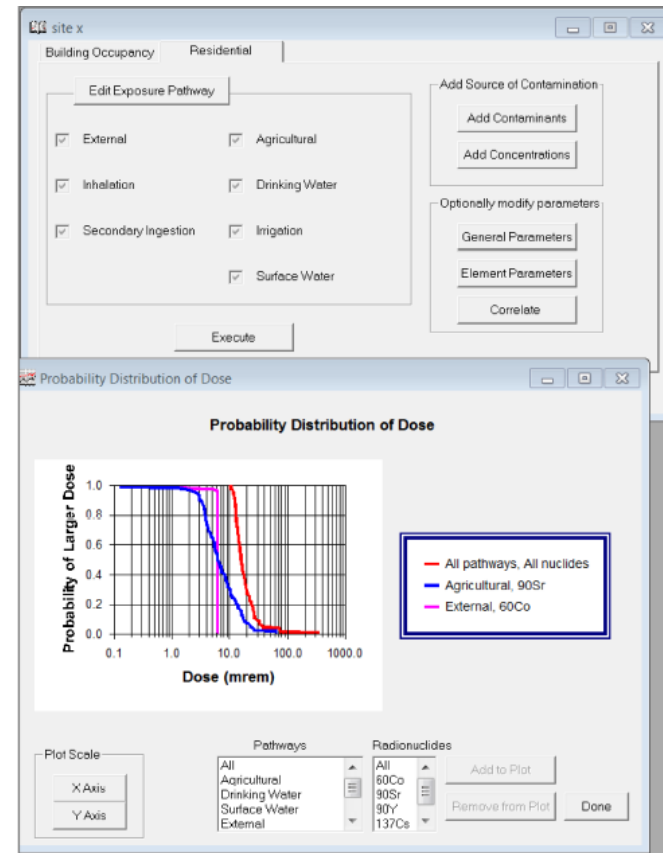
# RADionuclide, Transport, Removal, and Dose Estimation (RADTRAD)

- Performs dose calculations for design-basis accidents at the exclusion area boundary (EAB), low population zone (LPZ), and control room (CR)
- To show compliance with nuclear plant siting criteria
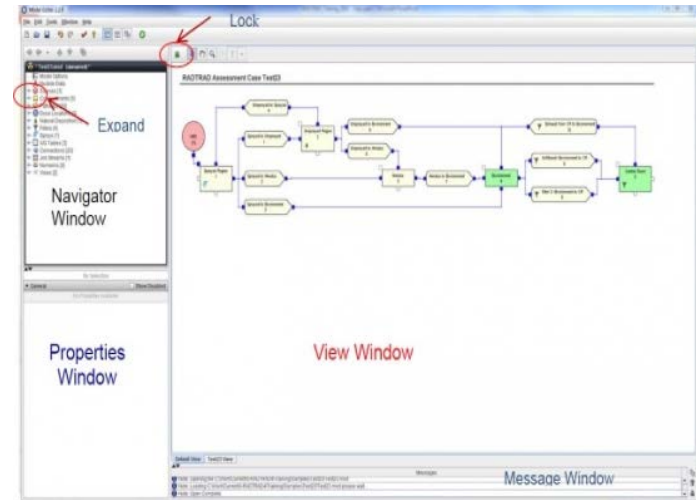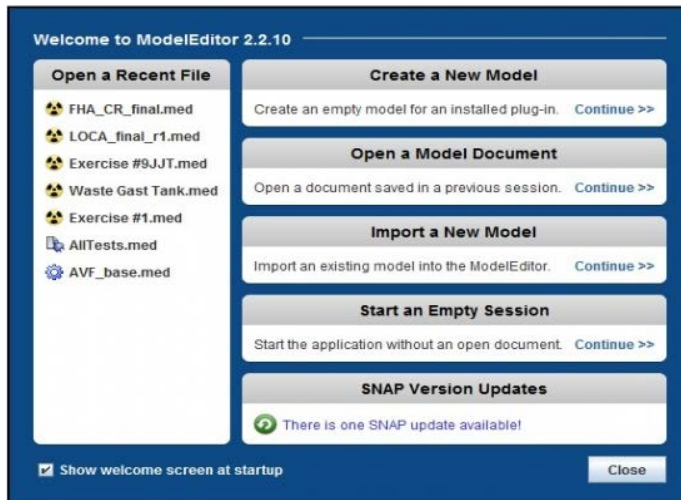
# HABIT

- Evaluation of control room habitability in the event of accidental spills of toxic chemicals or radionuclides

- EXTRAN determines the release rate due to leaks or ruptures of liquid or gas tanks

- CHEM models the chemical dilution by flows in the control room and determines the chemical exposure to control room personnel.

# GASEOUS AND LIQUID EFFLUENTS (GALE)

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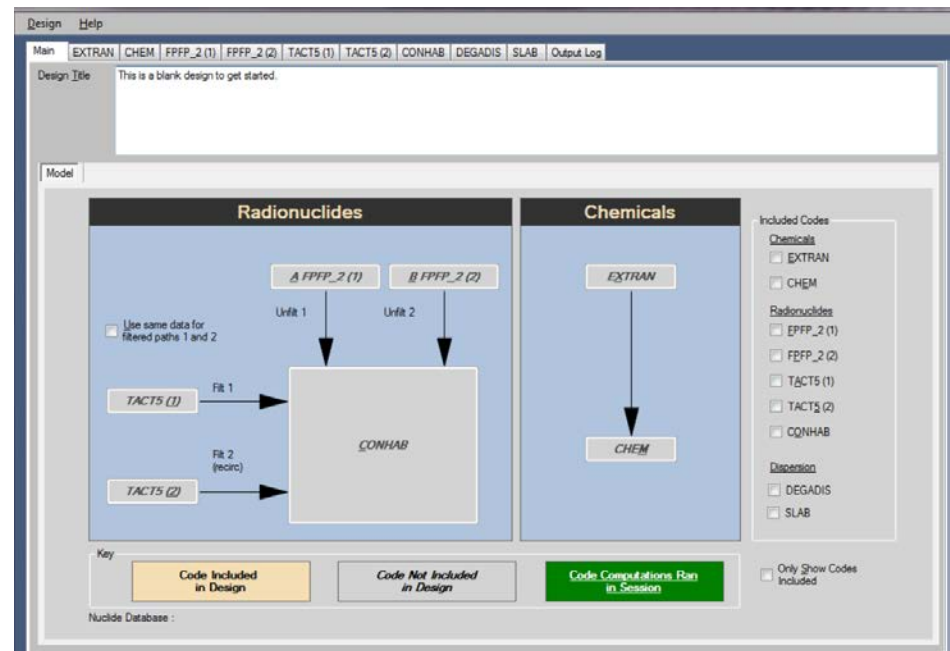
- Four codes that calculate the gaseous and liquid effluent releases from pressurized-water reactors (PWRs) and boiling-water reactors (BWRs).

- Calculate the source term of radionuclides generated by a NPP during routine operation using fixed ANSI/ANS parameters

- Updated recently to GALE 3.2
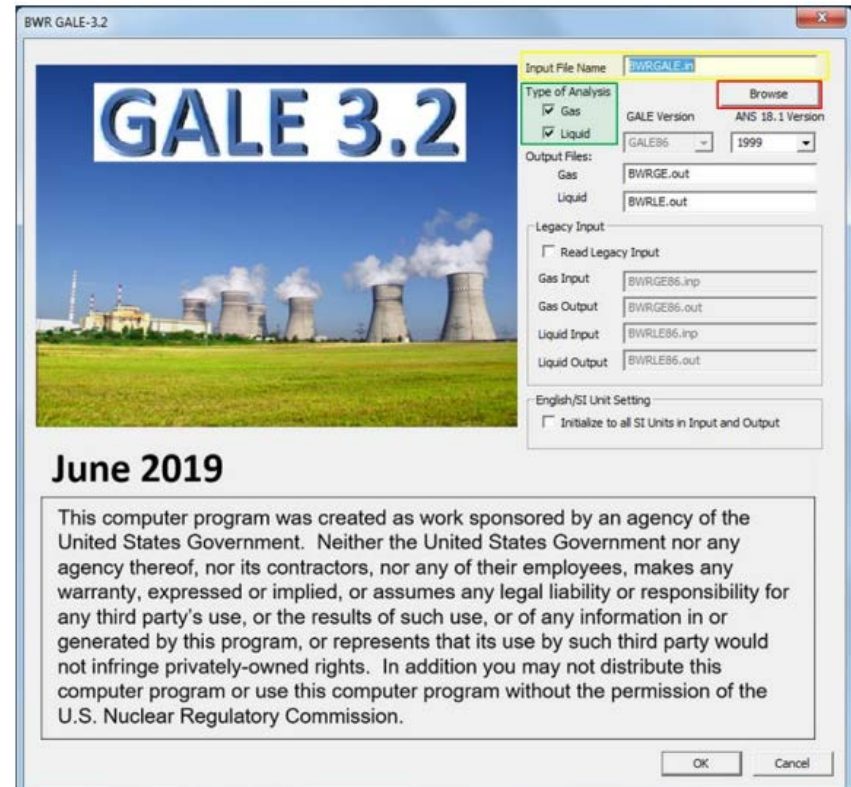
# RADTRAN

- Risk and consequence analysis of radioactive material transport

- Generally used for train or truck transportation routes

- Incident free and accident modelling



Legend
V - Traffic velocity
d - Distance from RAM vehicle to traffic in opposite direction
x - Distance from RAM vehicle to passing vehicle
MIN - Minimum following distance
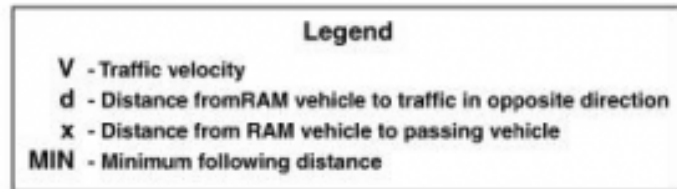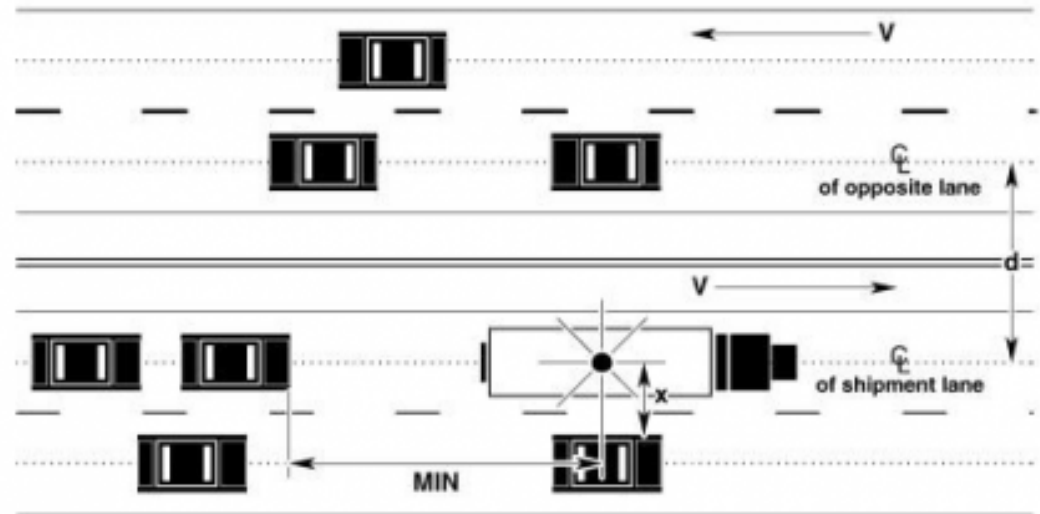
# NRCDose

- User-friendly graphical user interface (GUI) for the LADTAP II, GASPAR II, and XOQDOQ programs

- LADTAP II is the liquid pathway modeling during routine operation.

- GASPAR II is the gaseous effluent pathway modeling during routine operation.

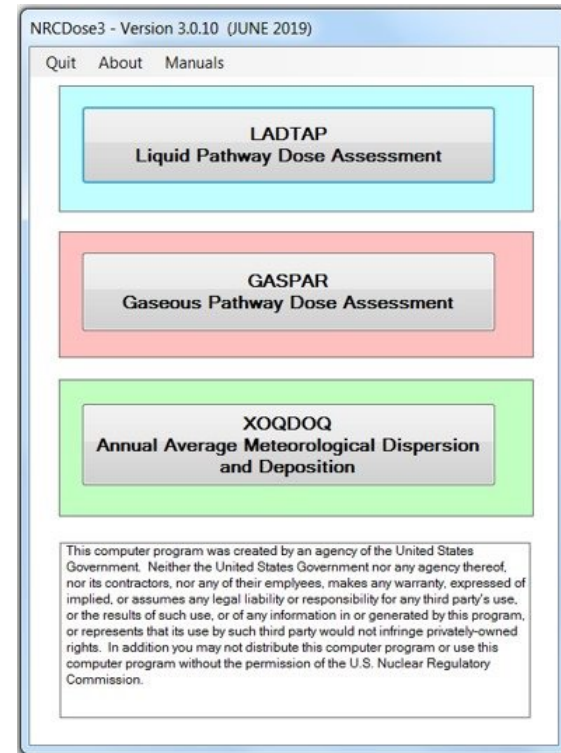- XOQDOQ is the atmospheric dispersion model for evaluating routine releases from nuclear power plants. Calculates annual relative effluent concentrations and annual average relative deposition, at locations specified by the user

NRCDose3 - Version 3.0.10  (JUNE 2019)

Quit    About    Manuals

**LADTAP**
**Liquid Pathway Dose Assessment**

**GASPAR**
**Gaseous Pathway Dose Assessment**

**XOQDOQ**
**Annual Average Meteorological Dispersion and Deposition**

This computer program was created by an agency of the United States Government. Neither the United States Government nor any agency thereof, nor its contractors, nor any of their employees, makes any warranty, expressed of implied, or assumes any legal liability or responsibility for any third party's use, or the results of such use, or of any information in or generated by this program, or represents that its use by such third party would not infringe privately-owned rights.  In addition you may not distribute this computer program or use this computer program without the permission of the U.S. Nuclear Regulatory Commission.

# VARSKIN

- A Computer Code for Skin Contamination Dosimetry

- Calculate occupational dose to the skin resulting from exposure to radiation

- Highest exposure over a contiguous 10 cm$^2$ of skin at a tissue depth of 0.007centimeters (7 mg/cm$^2$)

- Five different source configuration simulations of point, disk, cylinder, sphere, and slab sources
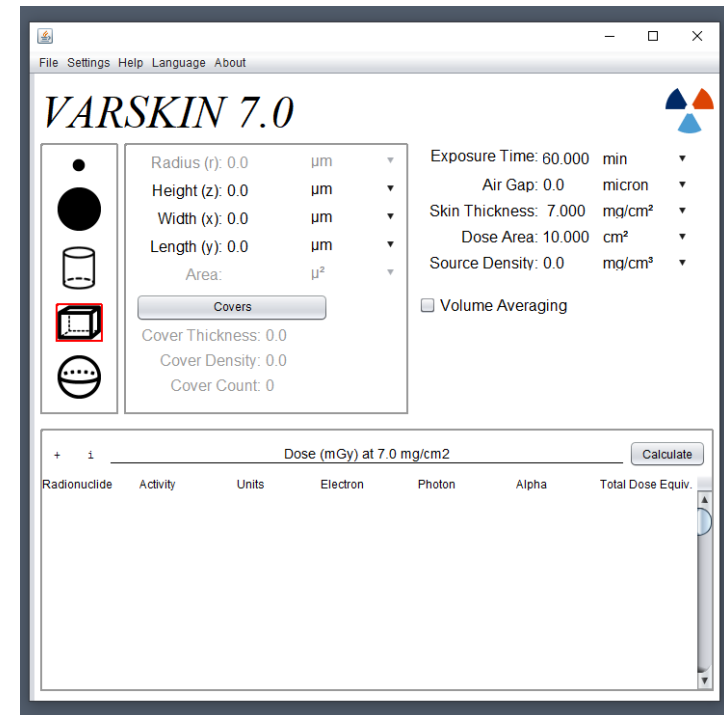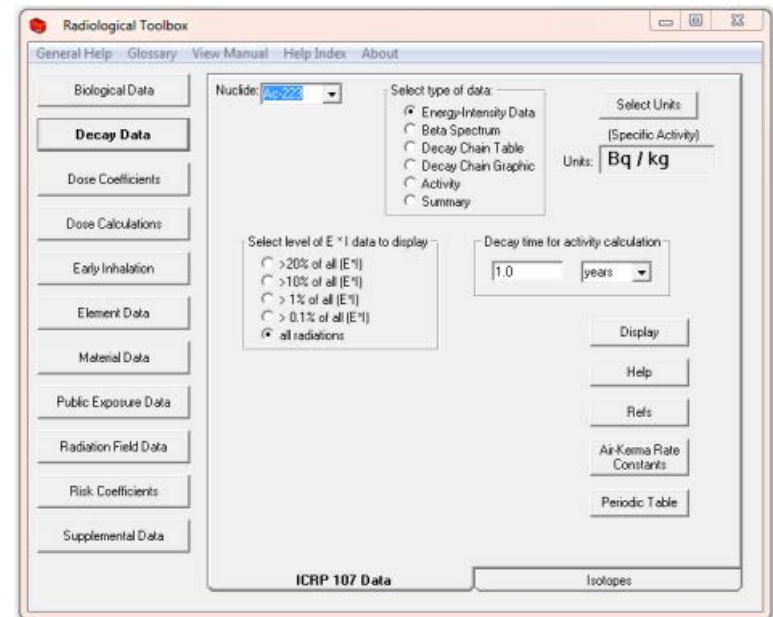
# RADIOLOGICAL TOOLBOX

Electronic access to data that underlies the field of radiation protection

**Table 1.1. General Description of the Radiological Toolbox Data Elements**

| Data Collections | Description of Data Collection |
|---|---|
| Biological Data | Biokinetic models, reference anatomical data, bioassay data, and summary information on radiation health effects |
| Decay Data | Detailed information on the radiations emitted by radionuclides and members of serial decay chains |
| Dose Coefficients | Internal dose coefficients for intakes of radionuclides by workers and members of the public and external dose coefficients for members of the public exposed to radionuclides external to the body |
| Dose Calculation | Calculation of dose for worker or member of the public exposed to a radionuclide mixture |
| Early Inhalation | Absorbed dose coefficient integrated over a user-specific time period following an inhalation intake |
| Element Data | Radiation interaction coefficients with elements for alpha, electron, photon, and neutron radiations |
| Material Data | Radiation interaction coefficients with materials for alpha, electron, photon, and neutron radiations |
| Public Exposure Data | Summary information on radiation exposures to natural background radiation and from medical exposure |
| Radiation Field Data | Organ doses for workers resulting from idealized photon and neutron radiation fields |
| Risk Coefficients | Nuclide-specific risk coefficients for public exposure |
| Supplemental Data | Collection of reference information ranging from SI units to numerical limits on the activity content of radionuclides in transport |

U.S. NRC NUREG/CR-7166 https://ramp.nrc-gateway.gov/system/files/b0a46c847db8f5f5e40fe236731b9fe6/Radiological-Toolbox-Users-Guide.pdf

# PHANTOM WITH MOVING ARMS AND LEGS (PIMAL)

- Generate quantitative figures of merit regarding positioning arms and legs in different geometries

- To assist users for performing dosimetry calculations for exposed individuals

- Create input file for the Monte Carlo N-Particle radiation transport code
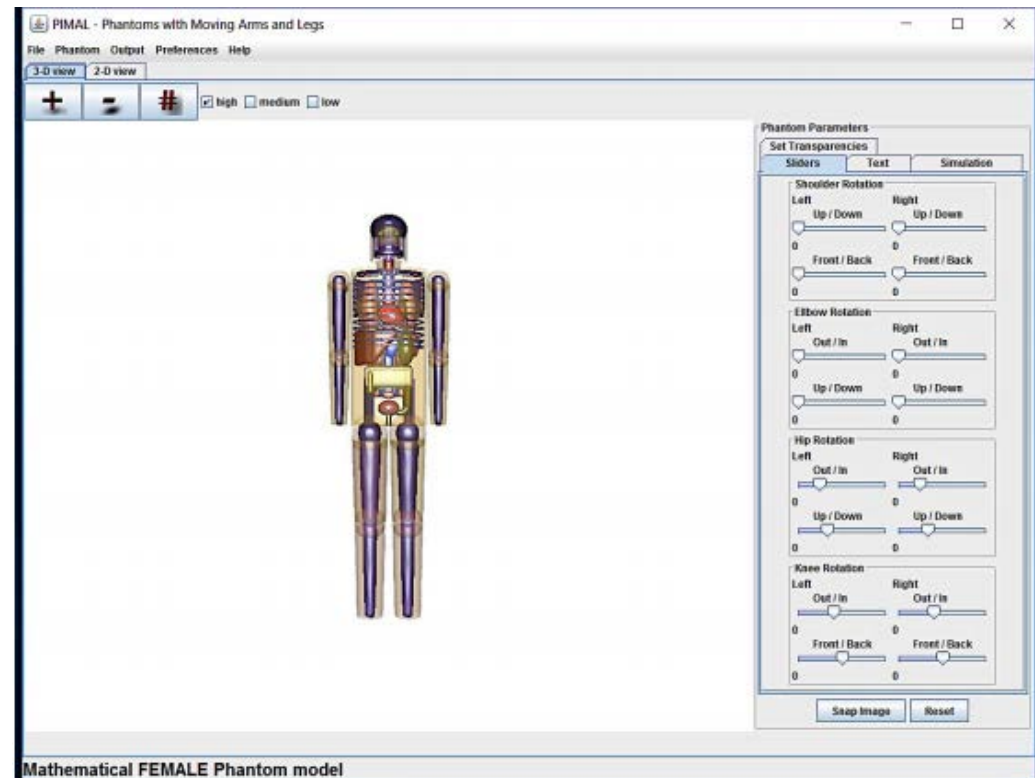
# ATMOSPHERIC ASSESSMENT CODES

Three atmospheric codes calculate  X/Q values using the Gaussian plume model

ARCON calculates X/Q values in the control room from accidental release

PAVAN calculates X/Q values at two offsite locations from accidental release

> Exclusion Area Boundary (EAB)

> Low Population Zone (LPZ)

XOQDOQ (within NRCDose) computes the annual X/Q values from routine emissions at receptor locations beyond the licensee's property boundary

# Code Functions and Data Flow



**Source Term**

What radionuclides are available for potential release to the environment?

Source Term Data

**Release Conditions**

How they are released, e.g., chemistry, particle size, buoyancy, building size, stack height?

Releases

Input to RAMP Codes

RAMP Codes

**Environmental Dispersion**

Where does it go…how much, how far, how fast?

Environmental Fate

Met Data

**Environmental Consequences**

What is the dose?

Report Out

# Overlapping Capabilities

# Questions?

# Thank You!