



## RADIATION PROTECTION COMPUTER CODE ANALYSIS AND MAINTENANCE PROGRAM

# 2018 FALL USERS MEETING

CANADIAN NUCLEAR SAFETY COMMISSION (CNSC)  
THE ALBERT AT BAY SUITE HOTEL, OTTAWA, ON, CANADA  
OCTOBER 29 – NOVEMBER 2, 2018





# Welcome to the 2018 Fall International RAMP Users Meeting

CNSC, Vice President, Technical Support Branch and Chief Science Officer



Dear RAMP Participants,

On behalf of the Canadian Nuclear Safety Commission (CNSC), I am pleased to welcome you to the 2018 Fall International Radiation Protection Computer Code Analysis and Maintenance Program (RAMP) Users' Group Meeting which will take place in Ottawa, Ontario, from October 29 to November 2, 2018. This meeting is hosted in collaboration with the United States Nuclear Regulatory Commission (US NRC).

The CNSC was created in 2000 to replace the former Atomic Energy Control Board established in 1946. The mandate of the CNSC is to regulate the use of nuclear energy and materials in Canada to protect the health, safety and security of Canadians and the environment; implement Canada's international commitments on the peaceful use of nuclear energy; and disseminate objective scientific, technical and regulatory information to the public.

The CNSC is made up of an independent Commission which is supported by over 800 employees. Employees review applications according to regulatory requirements, make recommendations to the Commission and enforce compliance. The Commission is an independent administrative tribunal that operates at arm's length from the Government of Canada. It makes licensing and regulatory decisions based on recommendations from CNSC staff and input from members of the public, Indigenous peoples and other federal and provincial government departments and agencies.

Science and evidence-based information is the foundation of regulatory decision-making at the CNSC. Science is used as an invaluable source for developing regulatory documents, conducting environmental and radiological assessments, and monitoring and carrying out reviews of licensing submissions. The CNSC staff is made up of scientific, technical and professional staff, many of whom are experts in their respective fields. In my role as Chief Science Officer, I ensure that the appropriate scientific advice informs the CNSC's regulatory decision making and that the best scientific expertise is available.

CNSC's participation in the 2018 Fall International RAMP Meeting will provide training to CNSC staff in the areas of risk assessment, radiation protection, dosimetry and emergency management. The outcomes of the meeting will allow staff to strengthen the tools used in implementing the CNSC's regulatory framework in protecting people and the environment.

On behalf of the CNSC, I would like to thank the US NRC for providing our organization with the opportunity to host the 2018 Fall International RAMP Meeting. I believe it will result in valuable training opportunities for code users and a platform for discussions between user members from around the world. CNSC staff will ensure that RAMP participants benefit from the meeting and their time in Ottawa.

I wish you all a successful and productive meeting.

Peter Elder  
Vice President, Technical Support Branch and Chief Science Officer  
Canadian Nuclear Safety Commission (CNSC)  
Ottawa, Ontario

## CNSC, Environmental Risk Assessment Specialist & RAMP Program Liaison



RAMP meeting participants,

On behalf of the Canadian Nuclear Safety Commission (CNSC), welcome to the Radiation Protection Computer Code Analysis and Maintenance Program (RAMP) Fall 2018 Users Group Meeting in Ottawa, Ontario. I am an Environmental Risk Assessment Specialist in the Environmental Risk Assessment Division at the CNSC and the RAMP Program Liaison for the CNSC.

The CNSC has been a member of RAMP since 2015. CNSC's participation in RAMP has provided staff with access to and training on various codes under RAMP including the Radiological Assessment System for Consequence Analysis (RASCAL) computer code for emergency management and VARSKIN for radiation protection. In addition, a number of CNSC staff have participated in past RAMP meetings and benefited from the opportunity to meet with fellow users and the code developers.

The RAMP community forums and users group meetings allow participants to exchange information and experiences in the areas of radiation protection and emergency management. These meetings provide a unique opportunity to interact with fellow users to discuss lessons learned and other practices used internationally. During the session breaks, I encourage you to meet other users and enhance your network for further collaboration.

Beyond the RAMP meeting, take the time to explore Ottawa, Canada's capital city. The city has lots to offer at this time of year from the Parliament Buildings, the changing fall colors, the museums and galleries as well as other tourist attractions such as the ByWard Market.

I wish you all a very successful and productive RAMP users meeting! I look forward to meeting you throughout the week.

Nana-Owusua (Nana) Kwamena, PhD  
Environmental Risk Assessment Specialist  
Environmental Risk Assessment Division  
Canadian Nuclear Safety Commission (CNSC)  
Ottawa, Ontario

## NRC, Director of Nuclear Regulatory Research (RES)



Welcome to the third international Radiation Protection Computer Code Analysis and Maintenance Program (RAMP) Users' Meeting, sponsored by the U.S. Nuclear Regulatory Commission (NRC) in conjunction with our colleagues in the Canadian Nuclear Safety Commission (CNSC). NRC's Office of Nuclear Regulatory Research (RES) leads RAMP and is co-hosting this meeting. We are pleased that you are joining us for this important meeting and for collaborating to enhance nuclear and radiation safety.

In addition to RAMP, RES plans, recommends, manages, and implements applied research, confirmatory analyses, standards development, and resolution of generic safety issues for nuclear power plants and other facilities regulated by the NRC. RES partners with other NRC offices, US agencies, industry research organizations, international organizations, and universities to achieve our mission. We employ a wide variety of talented and diverse experts in engineering and scientific disciplines, including radiation protection, thermal-hydraulics, severe accident progression, nuclear materials, human factors and human reliability, fire protection, seismology, environmental transport, and probabilistic risk assessment. Our experts provide the technical support, analytical tools, and information necessary to accomplish NRC's nuclear safety and security mission.

Besides RAMP, RES also coordinates domestic and international cooperative nuclear safety research activities, including cooperative code-sharing programs for the following areas:

- thermal hydraulics, called the Code Applications and Maintenance Program (CAMP),
- severe accidents, called the Cooperative Severe Accident Research Program (CSARP).

I hope all participants in this meeting will contribute to and benefit from the collaborative exchange of information and ideas on radiation protection codes. We look forward to your active participation.

Raymond Furstenau  
Director of Nuclear Regulatory Research  
U. S. Nuclear Regulatory Commission

## NRC, Director of the Office of International Programs (OIP)

Supported by the Office of International Programs

RAMP meeting participants,



I would like to add my welcome to the RAMP Users' Meeting on behalf of the NRC's Office of International Programs. Engaging with our RAMP colleagues on radiation protection, dose assessment, and emergency response analysis is just one of the many ways the NRC works, along with its international counterparts, to ensure the safety and security of nuclear materials around the globe. These efforts are critically important as the world becomes more interconnected and interest grows in the use of nuclear technologies.

The NRC's international activities support the agency's domestic mission, as well as broader U.S. domestic and international interests. Our international work includes implementation of treaties and conventions, nuclear nonproliferation, and export-import licensing for nuclear materials and equipment. We also provide support and assistance for safeguards, safety cooperation and assistance, exchange of regulatory and safety information, and cooperative safety research. These activities provide the NRC the opportunity to share as well as learn best practices for regulatory safety and security.

RAMP is one of the important initiatives through which we engage with domestic and international colleagues. The success of our regulatory program is bolstered by strong partnerships such as the RAMP users' group. Our Commission's International Policy Statement recognizes the importance of such partnerships and the benefits they bring to the regulatory programs of the both NRC and our international counterparts.

Thank you for coming and contributing your expertise to our partnership. We look forward to working with you over the course of this week.

Nader Mamish  
Director, Office of International Programs  
U.S. Nuclear Regulatory Commission

## NRC, Radiation Protection Branch Chief



RAMP meeting participants,

I am pleased to welcome you to the Radiation Protection Computer Code Analysis and Maintenance Program (RAMP) Spring 2018 Users Group Meeting at the Canadian Nuclear Safety Commission (CNSC) in Ottawa, Ontario. I am the Chief of the Radiation Protection Branch, and my team of dedicated staff leads this effort at the NRC. We have worked very hard to bring you a thought-provoking and informative RAMP meeting.

As you know, RAMP is a computer code management program that supports development and maintenance of radiation and dose assessment codes. Our goals are to do the following:

- streamline updates
- incorporate the latest accepted state-of-the-art models
- prioritize technical updates
- achieve consistency in documentation
- implement a consistent software quality assurance program
- leverage fiscal resources
- implement centralized and consistent management and control structure
- respond to RAMP user needs
- leverage technical expertise

In addition to the RAMP program, my branch is responsible for a number of regulatory activities. We develop, perform, and manage research programs supporting risk-informed regulatory decision-making in radiation protection at nuclear power plants, materials facilities and users, and fuel cycle facilities. We serve as an agency-wide resource by providing technical support in all aspects of radiation protection to program offices, as well as to the NRC's domestic and international regulatory and scientific counterparts. We develop and maintain computer codes for assessment of radiation doses to workers and members of the public, analyze and report worker exposure to Congress and other stakeholders, and execute research in radiation dosimetry and health studies. We also promote and participate in knowledge management activities within the agency in radiation protection.

We are glad you are here, and we continue to encourage other organizations to join. It is our belief that through RAMP forums and user meetings, participants can make connections and exchange information on radiation protection issues. During the session breaks, take the time to get to know us and create those network connections to further the collaborative exchange of information. We want to hear from you so that we can make RAMP the best program possible.

Rebecca Tadesse  
Chief, Radiation Protection Branch  
U. S. Nuclear Regulatory Commission



## Meet the RAMP Team

### NRC RAMP Team



Stephanie Bush-Goddard, Ph.D.  
RAMP Program  
Manager



John Tomon,  
CHP  
RAMP Program  
Manager



Vered Shaffer,  
Ph.D.  
RAMP Program  
Manager



Minh-Thuy Nguyen  
  
RAMP Program  
Team



Jeff Kowalczyk,  
CHP  
RAMP Program  
Team



Kerstun Norman  
  
RAMP Program  
Team



Gita Samaddar  
  
RAMP Program  
Team

### Pacific Northwest National Laboratory (PNNL) RAMP Team



Michael Smith,  
CHP  
PNNL RAMP  
Program Manager



Tonya Keller  
  
PNNL RAMP  
Project Coordinator



Lubov Lavrentiev  
  
PNNL RAMP  
Project Coordinator



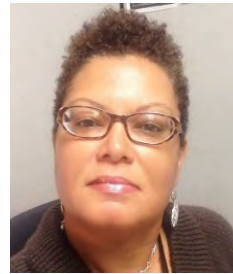
## Leidos RAMP Team



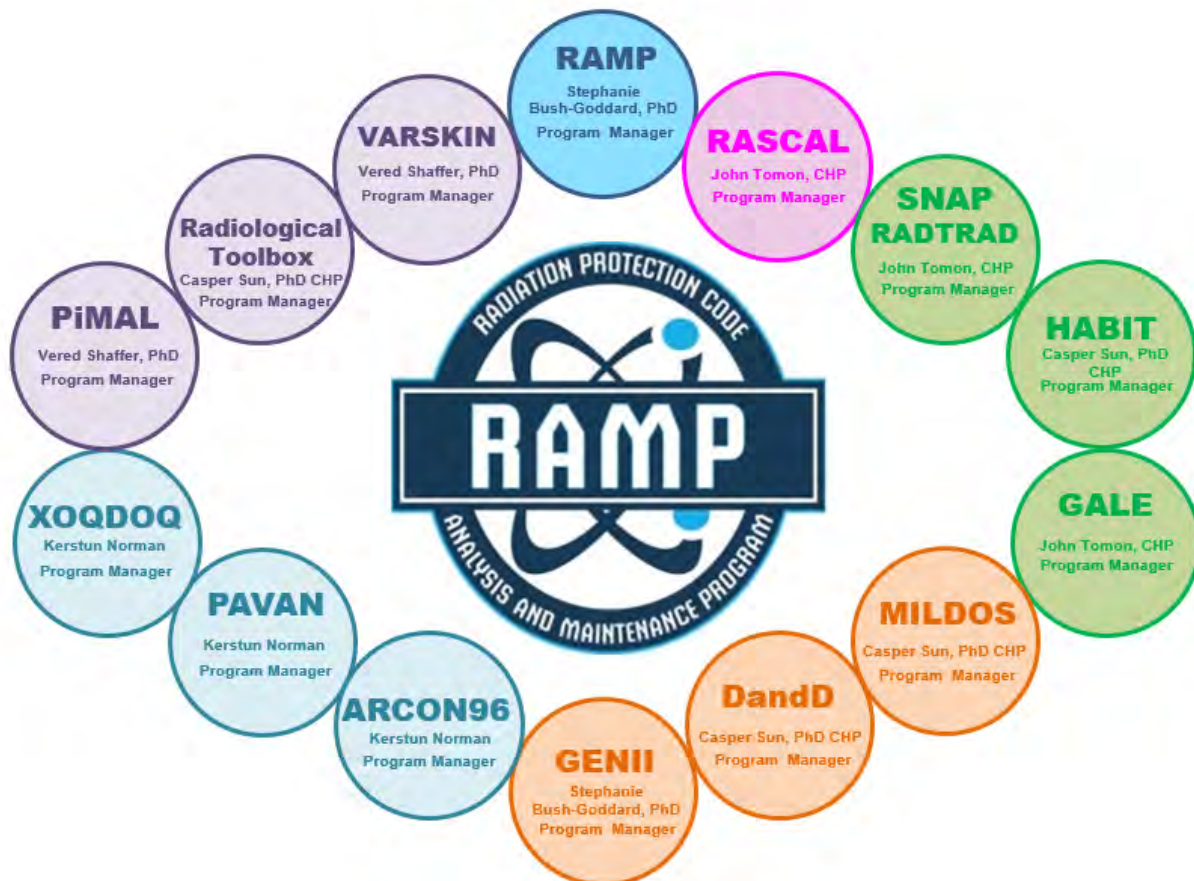
Daniel Pomykala  
RAMP Program  
Manager



Wendy Chinchilla  
RAMP Website  
Technical Lead



Sabrina Rivers-Carigo  
Website Team  
Coordinator



## RAMP Meeting Schedule

		Radiation Protection Computer Code Analysis and Maintenance Program (RAMP)	
		2018 Fall Users Group Meeting, October 29 – November 2, 2018	
		Hosted by: Canadian Nuclear Safety Commission (CNSC)	
		Meeting Venue: The Albert at Bay Suite Hotel 435 Albert Street, Ottawa, Ontario K1R 7X4, Canada	
		RAMP Website: <a href="https://ramp.nrc-gateway.gov">https://ramp.nrc-gateway.gov</a>	
Monday, October 29, 2018	8:30 AM – 9:30 AM	Registration and Check-In	
	9:30 AM – 11:30 PM	Opening Session and Networking Break	
	11:30 AM – 12:30 PM	Lunch	
	12:30 PM – 4:00 PM	RASCAL	VARSKIN Technical Meeting
	4:00 PM – 5:00 PM	CNSC Emergency Operations Center Tour	
	5:30 PM – 7:00 PM	RAMP Social Hour Gibson’s on Queen (Optional)	
Tuesday, October 30, 2018	8:30 AM – 9:00 AM	Morning Primer: RadToolbox	
	9:00 AM – 12:00 PM	RASCAL	VARSKIN Technical Meeting
	12:00 PM – 1:00PM	Lunch	
	1:00 PM – 3:30PM	RASCAL	VARSKIN Technical Meeting
	4:00 PM – 5:00 PM	Turbo FRMAC Overview	
Wednesday, October 31, 2018	8:30 AM – 9:00 AM	Morning Primer: Atmospheric Codes	
	9:00 AM – 12:00 PM	RESRAD	Symposium Dose to the Lens of the Eye
	12:00 PM – 1:00PM	Lunch	
	1:00 PM – 4:30 PM	RESRAD	Symposium Dose to the Lens of the Eye
	5:30 PM	Baton Rouge Ottawa Steakhouse and Bar (Optional Dinner Outing)	
Thursday, November 01, 2018	8:30 AM – 9:00 AM	Morning Primer: MILDOS	
	9:00 AM – 12:00 PM	RESRAD	RAMP Discussions
	12:00 PM – 1:00PM	Lunch	
	1:00 PM – 4:00 PM	Regulatory use of RESRAD	RAMP Discussions
Friday, November 02, 2018	8:30 AM – 11:00 AM	RESRAD Discussions	RAMP Discussions
	11:30 AM – 12:00 PM	RAMP Closing Remarks and Ceremony	

## Opening Agenda

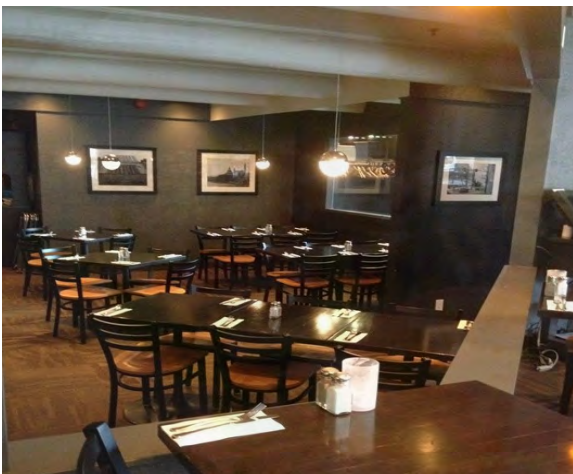
### 2018 Fall RAMP Users Meeting — Opening Session

8:30 – 9:30 AM	Registration and Check-In	
9:30 – 9:40 AM	Welcome & Introduction	Peter Elder , Vice President Technical Support Branch and Chief Science Officer Canadian Nuclear Safety Commission
9:40 – 10:00 AM	NRCs Cooperative Research Program and the RAMP Program	Stephanie Bush-Goddard, Ph.D. U.S. NRC RAMP Program Manager
10:00 – 10:20 AM	Overview of the RAMP Codes & What's New?	Jeff Kowalczyk, CHP U.S. NRC RAMP Program Team
10:20 – 10:40 AM	RAMP User Meeting Information	Vered Shaffer, Ph. D. U.S. NRC RAMP Program Manager
10:40 – 11:30 PM	Networking Break	All

## RAMP Social Hour (Optional)

### Gibson's on Queen

**Location:** 404 Queen Street, Ottawa ON—(613) 230-0400—(5:30 to 7:00 PM)



# VARSKIN Technical Session Agenda

(Part of the 2018 Fall RAMP Users Meeting)

Monday, October 29, 2018

8:00 – 12:00 PM	RAMP Opening Session	
12:00 – 1:00 PM	Lunch	
1:00 – 1:15 PM	Introductions	Stephanie Bush-Goddard, Ph.D. U.S. NRC RAMP Program Manager  David Hamby, Ph.D. Renaissance Code Development, Managing Partner
1:15 – 1:45 PM	The CNSC's Experience in Evaluating Skin Dose Estimates from Direct Contamination	Adelene Gaw Canadian Nuclear Safety Commission (CNSC)
1:45 – 2:15 PM	Shallow Dose Estimates Using EGS and MCNP	Colby Mangini, Ph.D. Paragon Scientific, LLC.
2:15 – 2:45 PM	Break	
2:45 – 3:15 PM	VARSKIN Limitations	David Hamby, Ph.D. Renaissance Code Development, Managing Partner
3:15 – 3:45 PM	Exposure Incident in Australia	Blake Orr Australian Radiation Protection (ARPANSA)
3:45 – 4:15 PM	Assessment of Skin Dose from Contamination at OPG - Past, Present, and Future	John Chase Ontario Power Generation, Whitby

Tuesday, October 30, 2018

8:00 – 8:45 AM	RAMP Morning Primer – RadToolbox	
9:00 – 9:30 AM	Uncertainty/Sensitivity of the Electron and Photon Dosimetry Models	Logan Anspach Oregon State University (OSU)
9:30 – 10:00 AM	Software-Based and Measurement Methods Developed and Used by COG Members for the Determination of Skin Dose	Jacques DuBeau Detec, Gatineau
10:00 – 10:30 AM	Break	
10:30 – 11:00 AM	When and How to Use VARSKIN; Why Not to (Always) Trust It	John Chase Ontario Power Generation, Whitby
11:00 – 11:30 AM	Scoping Study for a VARSKIN Neutron Skin Dosimetry Model	David Hamby, Ph.D. Renaissance Code Development, Managing Partner
11:30 – 12:00 PM	Radiobiological & Clinical Deterministic Effects of Ionizing Radiation Dose to Skin	Chris Nagle Wilderness Medicine, LLC.
12:00 – 1:00 PM	Lunch	
1:00 – 1:30 PM	U.S. NRC and State of Illinois Response to Scalar Pendants	TBD
1:30 – 2:00 PM	Damaged Gauge Incident	Vered Shaffer, Ph. D. U.S. NRC, Office of Nuclear Regulatory Research & RAMP Program Manager
2:00 – 4:00 PM	VARSKIN Examples, Training Modules, Dosimetry Theory <b>(Break Included)</b>	Colby Mangini, Ph.D. Paragon Scientific, LLC.

# Symposium — Dose to the Lens of the Eye Agenda

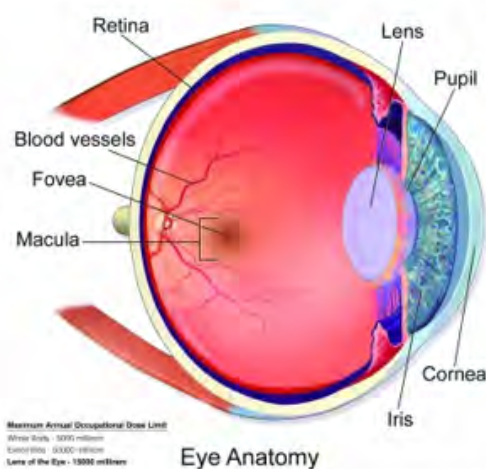
(Albert at Bay Suite Hotel, Ottawa, Ontario, Canada)

Wednesday, October 31, 2018

9:00 – 9:30 AM	Presentation—“What is RAMP?”	Vered Shaffer, Ph. D. U.S. NRC, Office of Nuclear Regulatory Research & RAMP Program Manager
9:00 – 9:40 AM	Introduction	Caroline Purvis Director, Radiation Protection Division, Canadian Nuclear Safety Commission (CNSC)
9:40 – 10:05 AM	Dose to the Lens of the Eye – ICRP’s Latest Recommendations	Christopher Clement, CHP ICRP Scientific Secretary
10:05 – 10:30 AM	The Canadian Nuclear Safety Commission's (CNSC) Dose Limits for Lens to the Eye	Adelene Gaw Canadian Nuclear Safety Commission (CNSC)
10:30 – 10:45 AM	Break	
10:45 – 11:10 AM	U.S. NRC’s Perspective on the Recommendation to Reduce the Regulatory Limit of the Dose to the Lens of the Eye	Stephanie Bush-Goddard, Ph.D. U.S. NRC, Office of Nuclear Regulatory Research & RAMP Program Manage
11:10 – 11:35 AM	Operational Considerations for Dosimetry Service Providers and Dose Registries	Keith Henderson & Philippe Prince Health Canada
11:35 – 12:00 PM	Benchmarking Dose Modeling for Eye Cataracts	Vinita Chauhan Health Canada
12:00 – 1:15 PM	Lunch	
1:15 – 1:40 PM	Australian Radiation Protection and Nuclear Safety Agency’s (ARPANSA) Response to the ICRP’s Dose to the Eye Recommendation	Blake Orr Australian Radiation Protection (ARPANSA)



		Logan Anspach & Nicholas McDaniel Oregon State University (OSU)
1:40 – 2:05 PM	Eye Dosimetry Using VARSKIN	David Hamby, Ph.D. Renaissance Code Development, Managing Partner
2:05 – 2:30 PM	Epidemiology and Mechanistic Effects of Radiation on the Lens of the Eye: Review and Scientific Appraisal of the Literature	Phung Kim Tran Electric Power Research Institute (EPRI)
2:30 – 2:55 PM	Hp(3) Comes into Focus: Views from a Health Physicist	Christopher N. Passmore, CHP Vice President – Dosimetry Services Landauer, Inc.
2:55 – 3:15 PM	Break	
3:15 – 3:35 PM	Development of a Deterministic Eye Dosimetry Model	David Booser Oregon State University (OSU)  David Hamby, Ph.D. Renaissance Code Development, Managing Partner
3:35 – 4:00 PM	Open Discussion	All



(Image Source: <https://blog.universalmedicalinc.com/how-do-lead-glasses-protect-your-eyes>)

# Presentation Descriptions

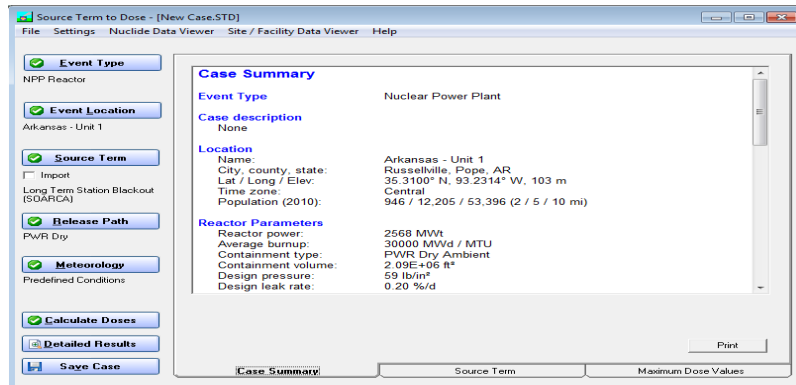
## RASCAL Training

### Instructor:



Jeff Kowalczyk, CHP

U.S. NRC



The Radiological Assessment System for Consequence AnaLysis (RASCAL) computer code is an emergency response software used to assess off-site consequences from a radiological release incident at a nuclear power plant or materials facility. This training course is a hands-on computer class for new and experienced RASCAL users using the current version of the code (RASCAL v4.3.3). It guides users through simulated release scenarios to develop an understanding of the RASCAL models, inputting data, and interpreting results.

### Course Requirements:

- Attendees must provide their own laptop computer with RASCAL 4.3.3 installed prior to the start of the meeting.
- Before taking the course, all attendees should complete the online courses “Introduction to RASCAL” and “RASCAL Fundamentals” available on the RASCAL Training & Presentation page of the RAMP website.



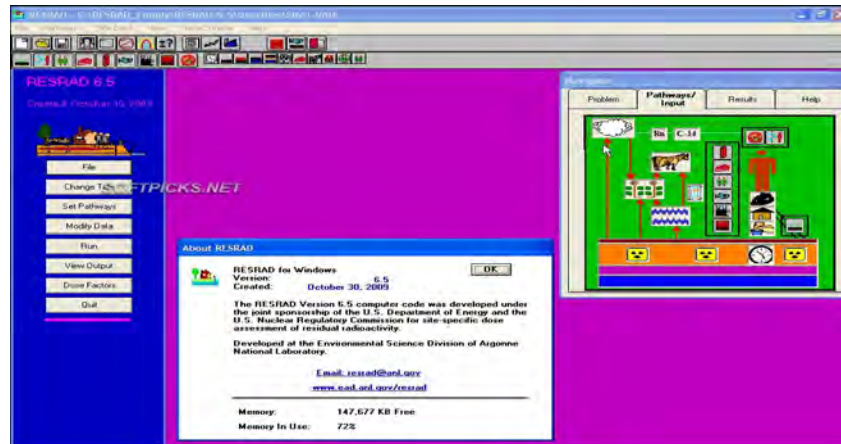
## RESRAD Training

### Instructor:



Charley Yu, Ph.D.

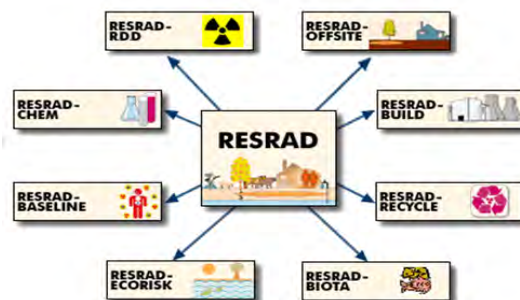
Argonne National  
Laboratory  
(ANL)



The **RES**idual **RAD**ioactive (RESRAD) family of codes are used to analyze potential human and biota radiation exposures from the environmental contamination of residual radioactive materials. The codes use pathway analysis to evaluate radiation exposure and associated risks, and to derive cleanup criteria or authorized limits for radionuclide concentrations in the contaminated source medium. The RESRAD-BIOTA computer code evaluates radiation exposures of nonhuman biota in a terrestrial or aquatic ecosystem. Radiation exposures to biota in a terrestrial or aquatic ecosystem are considered to result from contaminated soil, water, and sediment, which subsequently result in contamination in air and in different food sources. A graded approach that consists of three tiers of analysis is implemented in the RESRAD-BIOTA code. The workshop will focus on demonstrations of the new advanced applications and realistic decontamination and decommissioning scenarios for a variety of facility types and sites, including actual decontamination and decommissioning experiences for NRC licensed facilities.

### Course Requirements:

- Attendees must provide their own laptop computer with the RESRAD family of codes installed prior to the start of the meeting.



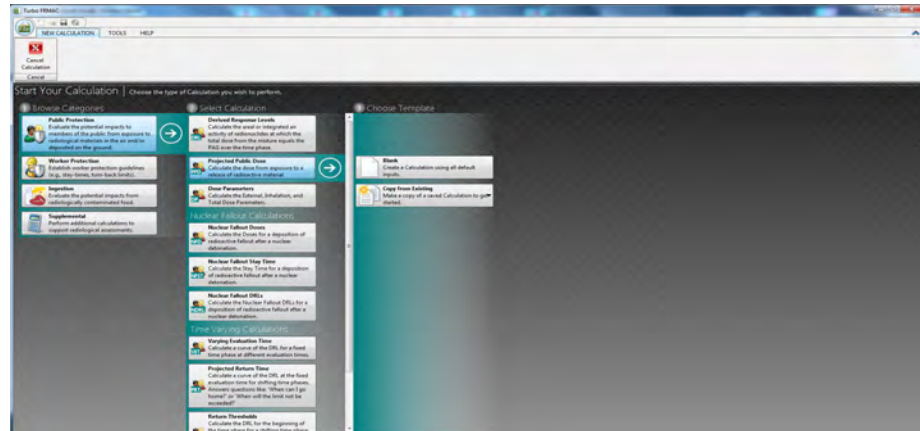
## Turbo FRMAC Overview

**Presenter:**



Jeff Kowalczyk, CHP

U.S. NRC



The **Turbo FRMAC** (TF) software automates the calculations described in Volume 1 of "The Federal Manual for Assessing Environmental Data During a Radiological Emergency", with the 2018 version of the TF software specifically implementing the November 2017 version of the manual. Using values generated by field samples, instrument readings, or computer dispersion models, TF assesses the generated results into values that are meaningful and actionable for a decision maker at a radiological emergency. TF provides calculated results to answer questions such as:

- Do radiation values exceed city, state, or federal limits?
- Should crops be destroyed or can they be utilized?
- Do residents need to be evacuated, sheltered in place, or should another action be taken?
- How long can emergency workers work in a given area?



## Morning Primers

### Radiological Toolbox

#### Description

The Radiological Toolbox provides ready access to data of interest in radiation safety and protection of workers and members of the public. The data include dose coefficients for intakes of radionuclides, external exposure to radionuclides distributed in environments, and for exposures to photon and neutron radiation fields. Other supportive data include interaction constants and coefficients for alpha, beta (i.e., electron), gamma (i.e., photon or x-ray) and neutron radiations, nuclear transformation data, biological, radiological and physiological data, and supplemental information on various related topics.

### Atmospheric Codes

#### Description

The U.S. NRC uses several atmospheric transport and diffusion codes to model radiological dispersion in its licensing of existing and new reactors. These codes include XOQDOQ, PAVAN and ARCON96.

- The **XOQDOQ** code is an atmospheric dispersion code used for routine operational releases.
- The **PAVAN** code is an atmospheric dispersion code used in design basis accident releases to the exclusion area boundary and outer boundary of the low population zone.
- The **ARCON96** code is an atmospheric dispersion code used for design basis accident releases to the control room and technical support center.

The discussion will center on how the U.S. NRC uses these codes and future plans for the codes.

### MILDOS

#### Description

The MILDOS computer code is used to estimate the radiological impacts of airborne emissions from uranium mining and milling facilities. The code allows users to consider both conventional uranium ore operations and operations associated with in situ recovery facilities. The code is used by license applicants and U.S. NRC staff to perform routine radiological impact evaluations for various uranium recovery operations. Version 4 of the code also provides: (a) support for ores containing thorium-232 (Th-232) and its daughter radionuclides in addition to the currently supported uranium-238 (U-238) and its daughter radionuclides, (b) a revised area source model, (c) the capability to perform sensitivity analysis on specific input parameters, (d) the capability to use current meteorological data provided by the National Climatic Data Center, and (e) an interactive results module.

## RAMP Tour

### CNSC Emergency Operations Centre (EOC)

**Location:** 280 Slater Street, Ottawa, Ontario K1P 5S9, Canada

The CNSC's Emergency Operations Centre (EOC) is the master coordination point of the CNSC's nuclear emergency management program. It is the place where, during a nuclear emergency, the CNSC's emergency response priorities are set, information is collected, analyzed and stored, emergency response decisions are made and coordinated, and support for other CNSC operating locations is organized.



## RAMP Dinner (Optional)

### Bâton Rouge Ottawa—Steakhouse and Bar

**Location:** 360, Albert Street (Unit 110) Ottawa, ON—(613) 216-1110—(5:30 to 7:00 PM)





## Other Places of Interest

### Parliament Hill

**Location:** 111 Wellington Street Ottawa, ON K1A 0A6, Canada

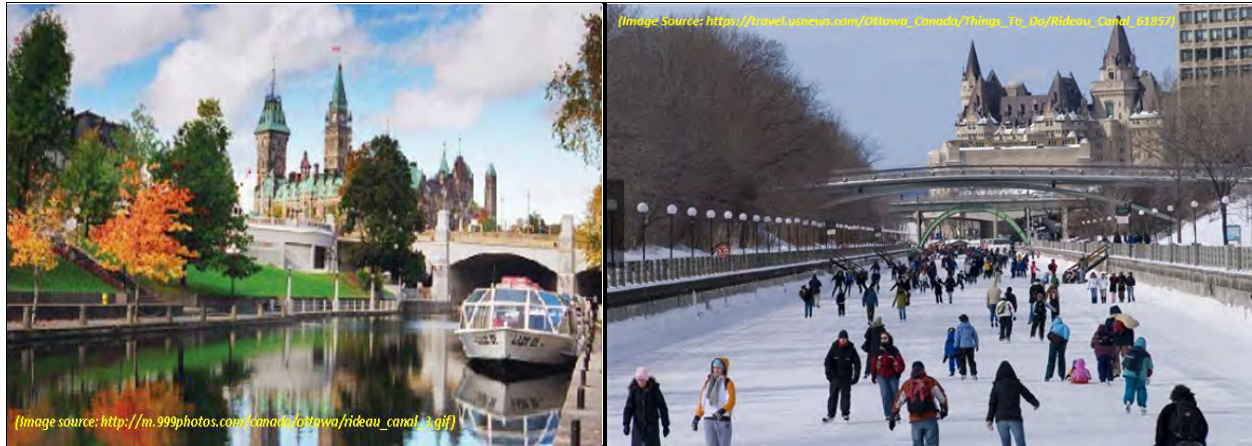
Acting as the anchor of downtown Ottawa, these three neo-Gothic structures are hard to miss. Like its mother country – England – Canada is governed by a parliamentary democracy, and it is here on the Hill that decisions are made on how to run the country. But just like the city itself, the Parliament buildings put tourists on a pedestal, catering to their whims with free guided tours, concerts, cultural exhibitions and even a seasonal after-hours sound and light show. Recent travelers said visiting Parliament Hill is an experience you can't miss, with many saying that walking around the palatial buildings felt like taking a step back in time. The knowledgeable guides were another point of praise for reviewers.



## Rideau Canal

**Location:** Rideau Canal Ottawa, ON 1KM, Canada

Snaking its way through the center of Ottawa, the Rideau Canal is one of the city's most historic attractions. In the summer, this 125-mile waterway, is filled with boats and the paved pathways surrounding it crowded with walkers, runners and bicyclists. As the temperatures begin to drop, the canal transforms into the world's largest skating rink, spanning 4.8 miles.



## ByWard Market

**Location:** 298 Dalhousie Street Ottawa, ON K1N 1B4, Canada

Sitting in the heart of downtown Ottawa, the beloved ByWard Market is one of the country's oldest and largest public markets. Throughout the year, you'll find local vendors selling everything from souvenir trinkets to maple sugar candy to handmade cold-weather necessities like hats and mittens.







THANK YOU FOR ATTENDING  
THE 2018 FALL RAMP USERS MEETING  
Monday, October 29 – Friday, November 02, 2018



SAVE THE DATE FOR THE  
2019 SPRING RAMP USERS MEETING  
WASHINGTON D.C.  
April 8 – 12, 2019



Email:  
[RAMP@nrc.gov](mailto:RAMP@nrc.gov)  
[RAMP.Admin@pnnl.gov](mailto:RAMP.Admin@pnnl.gov)

RAMP Website:  
<https://ramp.nrc-gateway.gov>