



Australian Government  
Australian Radiation Protection  
and Nuclear Safety Agency



# RADIATION PROTECTION COMPUTER CODE ANALYSIS AND MAINTENANCE PROGRAM

## 2022 APRIL USERS VIRTUAL MEETING

CO-HOSTED BY AUSTRALIA

UNITED STATES NUCLEAR REGULATORY COMMISSION

(USA) APRIL 4-7, 2022

(AUSTRALIA) APRIL 5-8, 2022



# WELCOME!

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## Audio

All participants will be muted.

## Video

All participants video will be disabled.

Meeting Recording - This meeting (aside from selected small sessions) will be recorded and may be posted on NRC's website or used internally. If you do not wish to have your voice recorded, please do not speak during the meeting. If you do not wish you have your image recorded, please turn off your camera or participate only by phone. If you speak or use a video connection, you are presumed to consent to recording and to the use of your voice or image.

## Questions

- Questions will be addressed at the end of the presentations.
- Please use Chat to submit any questions.
- Please type your name, country, the question, and the person the question is directed to in the chat.
- If you have questions after the meeting, please email the questions to [RAMP.ADMIN@pnnl.gov](mailto:RAMP.ADMIN@pnnl.gov).

## Electronic Certificates

- Available per request only. Please email [RAMP.ADMIN@pnnl.gov](mailto:RAMP.ADMIN@pnnl.gov).

## Technical Issues

- Please email [RAMP@nrc.gov](mailto:RAMP@nrc.gov).

# WELCOME TO THE 2022 APRIL RAMP USERS' MEETING

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

Welcome to the Radiation Protection Computer Code Analysis and Maintenance Program (RAMP) Users' Meeting. We are pleased that you are joining us for this meeting and for collaboration to enhance nuclear and radiation safety. 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.

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, Federal 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).

The NRC is pleased to co-host this RAMP Users' Meeting with the Australian Radiation Protection and Nuclear Safety Agency. Engaging with our RAMP colleagues is just one of the many ways the NRC works 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. We look forward to your active participation.

**Raymond Furstenau**

**Director of Nuclear Regulatory Research  
U. S. Nuclear Regulatory Commission**

# WELCOME TO THE 2022 APRIL RAMP USERS' MEETING

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## ARPANSA Chief Executive Officer



Dear RAMP participants,

I am honoured to welcome you on behalf the Australian Radiation Protection and Nuclear Safety Agency (ARPANSA) to the Spring 2022 RAMP Users Meeting. We are proud to be co-hosting this event with the United States Nuclear Regulatory Commission (US NRC). Like many events over the past 2 years, this meeting will be hosted virtually, with sessions held 4-7 April (PM) in the US and 5-8 April (AM) in Australia.

ARPANSA was established in 1999 and is the Australian Government's primary authority on radiation protection and nuclear safety. ARPANSA regulates Commonwealth entities that use or produce radiation, undertakes research, provides services, and promotes national uniformity and international best practice across all jurisdictions. Our objective is to protect people and the environment from the harmful effects of radiation.

ARPANSA is made up of approximately 140 staff and works closely with radiation regulators in each State and Territory to promote radiation protection. Priority areas for ARPANSA over the coming years include regulatory oversight of the Australian Government's National Radioactive Waste Management Facility, establishing regulatory frameworks for nuclear powered submarines announced under the trilateral AUKUS alliance and continued research under Australia's enhanced Electromagnetic Energy Program. These initiatives are in addition to our ongoing work with the Comprehensive Test Ban Treaty; maintaining Codes, Standards and regulatory guidance; radiation monitoring; and medical radiation audit and calibration services.

ARPANSA's first use of a RAMP code was in 2017 when using VARSKIN to undertake a skin dose assessment, and this led to officially joining RAMP in 2019. Since that time ARPANSA's use of the RAMP codes has increased, we see great value in the program, not just in the access to computer codes but in the interactions through meetings such as this one. We look forward to sharing insights with all RAMP 2022 participants and joining in conversations about how codes can benefit radiological assessments, environmental evaluations and dose reconstructions. With the Australian morning time zone and the opportunity for online engagement, we also hope to see more participants from the Asia-Pacific region this year.

Thank you to the US NRC for the opportunity to co-host this important event. We hope you get a lot out of the program and look forward to engaging with you to share knowledge and ideas, and to progress international best practice in radiation protection.

**Enjoy the meeting!**

**Dr Gillian Hirth**  
Chief Executive Officer  
ARPANSA

# MEET THE NRC RAMP TEAM

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## ARPANSA CO-HOST & NRC RAMP TEAM



**Blake Orr**  
Senior Scientist,  
Radiation Health  
Services, ARPANSA



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



**Vered Shaffer, Ph.D.**  
RAMP Program  
Manager



**Edward Harvey**  
RAMP Program Team

## PACIFIC NORTHWEST NATIONAL LABORATORY (PNNL) RAMP TEAM



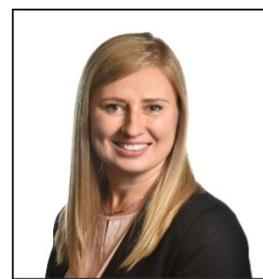
**Bruce McDowell**  
PNNL RAMP Program  
Manager



**Caitlin Condon**  
PNNL Health  
Physicist



**Luba Hamilton**  
PNNL RAMP Program  
Coordinator



**Tanya Korotkov**  
PNNL RAMP Program  
Coordinator

## LEIDOS RAMP TEAM



**Daniel Pomykala**  
Leidos RAMP Program  
Manager

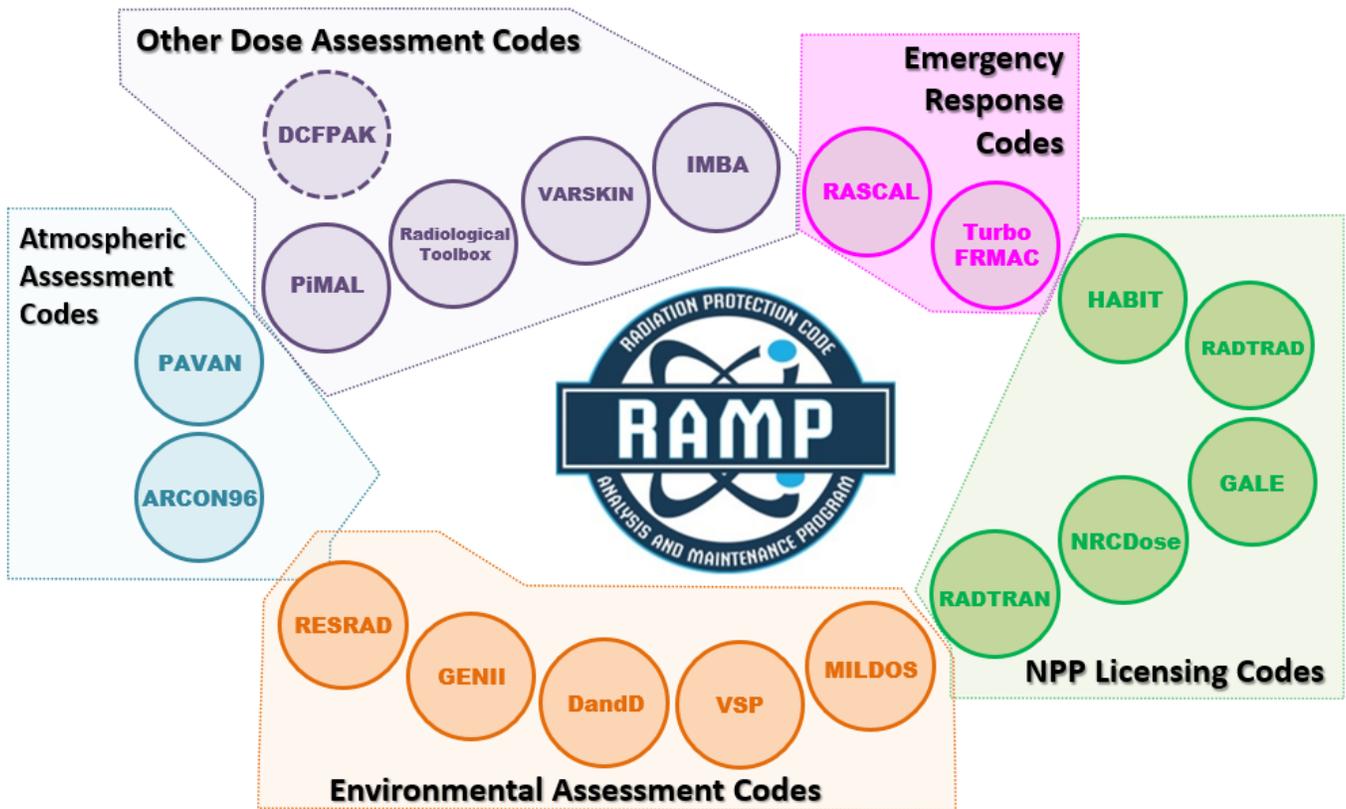


**Wendy Chinchilla**  
Leidos RAMP Website  
Technical Lead



**Frederic Gooding**  
Leidos RAMP Operations  
Support

# RADIATION PROTECTION COMPUTER CODE ANALYSIS AND MAINTENANCE PROGRAM (RAMP) CODES



Information and descriptions of codes: <https://ramp.nrc-gateway.gov/>



**USERS' MEETING**  April 4-7, 2022 (United States P.M.)  
 April 5-8, 2022 (Australia A.M.)



EDT



AEST

Monday, April 4, 2022	Tuesday, April 5, 2022	Day 1
6:00 PM–6:15 PM	8:00 AM–8:15 AM	Opening Remarks Welcome from U.S. NRC   Welcome from ARPANSA
6:15 PM–7:00 PM	8:15 AM–9:00 AM	RAMP Partners Panel <b>Moderator: Stephanie Bush-Goddard</b>
7:00 PM–7:15 PM	9:00 AM–9:15 AM	BREAK
7:15 PM–9:15 PM	9:15 AM–11:15 AM	Handling Legacy Sites Symposium <b>Moderator: Blake Orr</b>
9:15 PM–9:30 PM	11:15 AM–11:30 AM	BREAK
9:30 PM–10:30 PM	11:30 AM–12:30 PM	Dosimetry Analysis in an Industrial Setting <b>Moderator: Vered Shaffer</b>
Tuesday, April 5, 2022	Wednesday, April 6, 2022	Day 2
6:00 PM–6:50 PM	8:00 AM–8:50 AM	NRC RADTRAN
6:50 PM–7:05 PM	8:50 AM–9:05 AM	Break for Session Transition
7:05 PM–10:30 PM	9:05 AM–12:30 PM	VARSKIN
Wednesday, April 6, 2022	Thursday, April 7, 2022	Day 3
6:00 PM–6:50 PM	8:00 AM–8:50 AM	MILDOS
6:50 PM–7:05 PM	8:50 AM–9:05 AM	Break for Session Transition
7:05 PM–10:30 PM	9:05 AM–12:30 PM	RESRAD
Thursday, April 7, 2022	Friday, April 8, 2022	Day 4
6:00 PM–7:50 PM	8:00 AM–9:50 AM	GENII Case Study
7:50 PM–8:05 PM	9:50 AM–10:05 AM	Break for Session Transition
8:05 PM–10:30 PM	10:05 AM–12:30 PM	VSP Case Study



**EDT**



**AEST**

## Monday, April 4, 2022 EDT | Tuesday, April 5, 2022 AEST

### 6:00–6:15 PM (EDT) | 8:00–8:15 AM (AEST)

- Opening Remarks..... Stephanie Goddard-Bush, PhD. (NRC)
- Welcome from U.S. NRC..... Ray Furstenau, Office Director (NRC)
- Welcome from ARPANSA .....Dr. Gillian Hirth, CEO (ARPANSA)

### 6:15–7:00 PM (EDT) | 8:15–9:00 AM (AEST)

#### **RAMP Partners Panel .....Stephanie Goddard-Bush, Moderator (NRC)**

- 1. Australian Radiation Protection and Nuclear Safety Agency (ARPANSA)
- 2. South Africa National Nuclear Regulator (NNR)
- 3. Canadian Nuclear Safety Commission (CNSC)
- 4. Korea Institute of Nuclear Safety (KINS)
- 5. Soreq Nuclear Research Center, Israel (NRC Int'l Assignee)

### 7:00–7:15 PM (EDT) | 9:00–9:15 AM (AEST)

**BREAK**

### 7:15–9:15 PM (EDT) | 9:15–11:15 AM (AEST)

#### **Handling Legacy Sites Symposium .....Blake Orr, Moderator (ARPANSA)**

- The US. Nuclear Legacy in the Marshall Islands ..... Terry Hamilton (LLNL)
- ARPANSA's Marshall Islands Fish Monitoring Program ..... Marcus Grzechnik (ARPANSA)
- Legacy Radionuclides from Nuclear Testing at Montebello, Australia ..... Mat Johansen (ANSTO)
- Distribution of Anthropogenic Radionuclides 137Cs and 241Am in Marine Sediments due to 1950's Nuclear Weapons Testing at the Montebello Islands, Western Australia ..... Madison Hoffman (Edith Cowan University)
- U.S. Los Alamos Nuclear Weapons Testing Site ..... Drew Kornreich (LANL)
- Navajo Nation: Addressing Uranium Contaminated Structures ..... Vivien Craig (Navajo Nation)

### 9:15–9:30 PM (EDT) | 11:15–11:30 AM (AEST)

**BREAK**

### 9:30–10:30 PM (EDT) | 11:30 AM–12:30 PM (AEST)

#### **Dosimetry Analysis in an Industrial Setting ..... Vered Shaffer, PhD., Moderator (NRC)**

- ANSTO: VARSKIN Regulatory Case ..... Jordan Saratsopoulos (ANSTO)
- Dose Assessment of an Iridium-192 Contamination Event ..... David Hamby (RCD)
- Dosimetry in the U.S. Million Person Study ..... Michael Bellamy, (MSKCC)

# NRC RADTRAN – DAY 2

## INSTRUCTORS:



**Caitlin Condon**

Pacific Northwest National  
Laboratory



**Harish Gadey**

Pacific Northwest National  
Laboratory



**Jonathan Napier**

Pacific Northwest National  
Laboratory



The NRC Radioactive Material Transport (NRC-RADTRAN) computer code is used for risk and consequence analysis of radioactive material (RAM) transportation. A variety of RAM is transported annually within this country and internationally. The shipments are carried out by overland modes (mainly truck and rail), marine vessels, and aircraft. Transportation workers and persons residing near or sharing transportation links with these shipments may be exposed to radiation from RAM packages during

routine transport operations; exposures may also occur as a result of accidents. Risks and consequences associated with such exposures are the focus of the NRC-RADTRAN code.

The NRC developed a new graphical user interface (GUI) to support the ease of use for input development and executing RADTRAN 6.02.1. This combined GUI and executable version is titled NRC-RADTRAN v1.0 and is now available for download.

## NRC RADTRAN

### EDT

### PRESENTATION TOPIC

6:00–6:50 PM

NRC RADTRAN

6:50–7:05 PM

Break

# VARSKIN – DAY 2

## INSTRUCTORS:



**David Hamby, Ph.D.**

Renaissance Code Development, LLC (RCD)



**Colby Mangini, Ph.D.**

Renaissance Code Development, LLC (RCD)



VARSKIN+ is used to calculate occupational dose to the skin resulting from exposure to radiation emitted from hot particles or other contamination on or near the skin. These assessments are required by Title 10 of the Code of Federal Regulations (10 CFR) 20.1201©, which states that the assigned shallow dose equivalent is to the part of the body receiving the highest exposure over a contiguous 10 cm<sup>2</sup> of skin at a tissue depth of 0.007 centimeters (7 mg/cm<sup>2</sup>).

With the release of VARSKIN+ three new physics modules are introduced: (1) wound dosimetry; (2) neutron dosimetry; and (3) eye dosimetry. Skin and wound dosimetry implement a new alpha dosimetry model for shallow skin assessments. VARSKIN+ can be used to perform wound dose assessments if the metabolic modeling and dosimetry methods are consistent with NRC regulations (e.g., use of 10 cm<sup>2</sup> averaging area for skin dose assessments and tissue or organ weighting factors as defined in 10 CFR 20.1003).

VARSKIN	
EDT	PRESENTATION TOPIC
7:05–7:50 PM	Introduction SkinDose
7:50–8:00 PM	Break
8:00–8:45 PM	NeutronDose
8:45–8:55 PM	Break
8:55–9:40 PM	WoundDose
9:40–9:50 PM	Break
9:50–10:30 PM	EyeDose Q & A; Wrap-up

# MILDOS – DAY 3

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## INSTRUCTOR:



**David LePoire**

Argonne National Laboratory

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.

MILDOS	
EDT	PRESENTATION TOPIC
6:00–6:50 PM	MILDOS
6:50–7:05 PM	Break

# RESRAD – DAY 3

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## INSTRUCTOR:



**Charley Yu**

Argonne National Laboratory

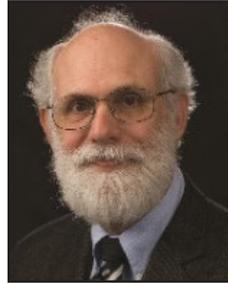
The RESidual RADioactive (RESRAD) family of codes are used to analyze potential human and biota radiation exposures from the environmental contamination of residual radioactive materials. The codes use pathway analysis to evaluate radiation exposure and associated risks, and to derive cleanup criteria 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.

RESRAD	
EDT	PRESENTATION TOPIC
7:05–7:25 PM	Overview of RESRAD-ONSITE
7:25–7:40 PM	Demo of RESRAD-ONSITE
7:40–7:50 PM	Break
7:50–8:15 PM	Overview of RESRAD-OFFSITE
8:15–8:40 PM	Demo of RESRAD-OFFSITE
8:40–8:50 PM	Break
8:50–9:10 PM	Overview of RESRAD-RDD
9:10–9:30 PM	Demo of RESRAD-RDD
9:30–9:40 PM	Break
9:40–10:05 PM	Overview of RESRAD-BIOTA
10:05–10:30 PM	Demo of RESRAD-BIOTA
10:30 PM PM	Adjourn

# GENII – DAY 4

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## INSTRUCTOR:



**Bruce Napier**

Pacific Northwest National Laboratory

GENII Version 2.10 is now part of the Radiation Protection Computer Code Analysis and Maintenance Program (RAMP) at the U.S. Nuclear Regulatory Commission. It is a documented set of programs for calculating radiation dose and risk from radionuclides released to the environment. Although the code was initially developed for the U.S. Environmental Protection Agency (EPA), regulators and decision makers in other federal agencies, including several outside the U.S., employ this state-of-the-art, technically peer reviewed system to analyze hazards and design controls to prevent or mitigate potential accidents. The GENII code is developed by Pacific Northwest National Laboratory for the Department of Energy.

GENII is a set of programs for estimating radionuclide concentrations in the environment and dose to humans from acute or chronic exposures from radiological releases to the environment or initial contamination conditions. It is part of a set of quality-assured and configuration-controlled safety analysis codes managed and maintained for the Department of Energy's Safety Software Central Registry and the United States Nuclear Regulatory Commission.

GENII	
EDT	PRESENTATION TOPIC
6:00–6:10 PM	Introduction
6:10–6:35 PM	GENII Background
6:35–6:45 PM	Case Study Scenario
6:45–6:55 PM	Break
6:55–7:20 PM	Example 1: Heavy Equipment Operator
7:20–7:45 PM	Example 2: Agricultural Resident
7:45–8:00 PM	Questions; break for session transition

# VSP – DAY 4

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## INSTRUCTORS:



**Lisa Newburn**

Pacific Northwest National Laboratory



**Deb Fagan**

Pacific Northwest National Laboratory

Visual Sample Plan (VSP) is a tool that helps ensure the right type, quality, and quantity of data are gathered to support confident decisions and provides statistical evaluations of the data with decision recommendations. Developed with support from the U.S. Department of Energy, U.S. Environmental Protection Agency, Department of Defense, Department of Homeland Security, the Centers for Disease Control, and the United Kingdom.

The underlying methodology employs statistically defensible approaches and has strong Data Quality Objective (DQO) process underpinnings. The objective is to ensure that the right type, quality, and quantity of data are gathered to support confident decisions.

It allows real-time evaluation of the tradeoffs between increased confidence in decisions and costs, or number of samples required. VSP answers the questions of how many samples are required and where samples should be obtained. Designed for the non-statistician, VSP is organized around possible data uses.

VSP CASE STUDY	
EDT	PRESENTATION TOPIC
8:05–8:10 PM	Introduction
8:10–8:25 PM	Visual Sample Plan Overview
8:25–8:45 PM	Systematic Planning Basics
8:45–8:55 PM	Case Study Scenario
8:55–9:20 PM	Example 1: Unity Rule
9:20–9:25 PM	Break
9:25–9:50 PM	Example 2: Estimate a Stratified Mean
9:50–10:15 PM	Example 3: Spatial Analysis
10:15–10:25 PM	VSP Coming Developments
10:25–10:30 PM	Questions and Adjourn

**SPECIAL APPRECIATION  
AND THANK YOU TO  
DR. VERED SHAFFER!**



# THANK YOU FOR ATTENDING

## STAY TUNED

### 2022 Fall Users Group Meeting



**For additional information:**

Email:

[RAMP@nrc.gov](mailto:RAMP@nrc.gov)

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

RAMP Website:

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