



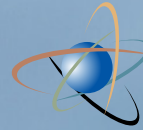
RADIATION PROTECTION COMPUTER CODE  
ANALYSIS AND MAINTENANCE PROGRAM

# 2023 Spring Users' Group Meeting Fiesta Royale Hotel Accra, Ghana, West Africa

April 25–28, 2023



**Nuclear Regulatory Authority**  
*'ensuring the protection of people and the  
environment from radiation hazard'*



**U.S. NRC**  
UNITED STATES NUCLEAR REGULATORY COMMISSION  
*Protecting People and the Environment*



# WELCOME

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## Virtual Meeting

### Audio

All participants will be muted unless directed otherwise by the facilitator.

### Video

All participants should have video turned off.

### Meeting Recording

All virtual sessions will be recorded.

The recordings 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 to 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).
- In-person participants will receive their certificate during the closing session on Friday, April 28, 2023.

### Technical Issues

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

# 2023 SPRING RAMP USERS' MEETING

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## **NRC, Director, Office 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 host this RAMP Users' Meeting and we look forward to collaboration with all attendees. 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*

# 2023 GHANA SPRING RAMP USERS' MEETING

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## **Director-General Nuclear Regulatory Authority, Ghana**

Greetings from the Nuclear Regulatory Authority (NRA), Ghana. I am honoured to welcome all of you to the Radiation Protection Computer Code Analysis and Maintenance Program (RAMP) users' meeting taking place here in Accra, Ghana, from 25-28 April 2023 at Fiesta Royale Hotel. This meeting is being conducted in cooperation with the United States Nuclear Regulatory Commission (USNRC). We are proud to be co-hosting such an important event with the USNRC.

NRA was established in 2016 by the Nuclear Regulatory Authority Act of 2015 (Act 895) and is the independent nuclear regulatory authority for radiation protection and nuclear safety, security, and safeguards. NRA regulates entities in Ghana that use or produce radiation, undertake research, provide radiological services to industries and medical centres, and promotes national uniformity and international best practice across all jurisdictions.

NRA has a staff strength of 97 for both administrative and technical roles. Priority areas for NRA over the past and coming years include regulatory oversight of the Ghana's research reactor and radioactive waste management facility and is working to establish a regulatory framework for the nuclear power programme.

The NRA joined the Radiation Protection Computer Code Analysis and Maintenance Program (RAMP) in 2018 to cooperate with the USNRC on radiation protection research, to benefit from the technical assistance and guidance for applying the codes, as well as exchange views regarding code improvement. An NRA staff member used the RAMP code, RASCAL to undertake his doctoral studies on radiological consequence assessment on hypothetical release for radionuclides. There is also a growing interest of other NRA staff in the use of the RAMP codes. We look forward to sharing insights with all RAMP 2023 participants and joining in discussion about how the codes can benefit radiological assessments, environmental evaluations, and dose reconstructions.

I would like to express my sincere appreciation to the USNRC for collaborating with the NRA to host such an important international meeting. I want also to extend my appreciation to the RAMP team for their ongoing efforts towards improving the codes and assisting RAMP users by offering them the opportunity to exchange their views in a very interactive manner. I am confident that this International RAMP meeting in Accra will provide a platform for an open discussion between code developers and users of the codes around the world.

I wish you a successful meeting and I welcome you. I say Akwaaba!

**Nii Kwashie Allotey, PhD, PE-GhIE**

*Director-General  
Nuclear Regulatory Authority, Ghana*



# MEET THE NRC AND GHANA NRA TEAM

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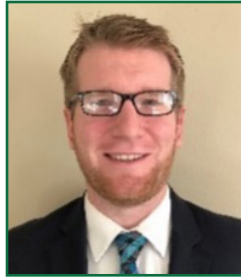
## NRC RAMP TEAM



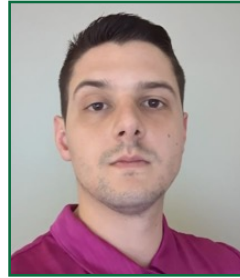
**JOHN  
TOMON**  
*Branch Chief*



**STEPHANIE  
BUSH-GODDARD**  
*Senior RAMP  
Program Manager*



**EDWARD  
HARVEY**  
*RAMP Program  
Manager*



**RIGEL  
FLORA**  
*RAMP Program  
Team*



**DANIEL  
SHAPIRO**  
*RAMP Program  
Analyst*

## NUCLEAR REGULATORY AUTHORITY, GHANA



**EMMANUEL  
AMPOMAH-AMOAKO**



**SYLVESTER  
BIRIKORANG**



**SAMUEL  
WOTORCHI**

# MEET THE PNNL AND LEIDOS RAMP TEAM

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## PACIFIC NORTHWEST NATIONAL LABORATORY (PNNL) RAMP TEAM



**CAITLIN  
CONDON**  
*PNNL RAMP  
Program Manager*



**HARISH  
GADEY**  
*PNNL RAMP Deputy  
Program Manager*

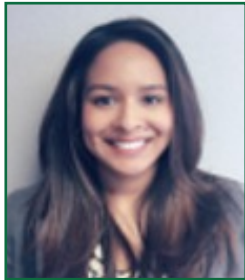


**LUBA  
HAMILTON**  
*PNNL RAMP  
Program Coordinator*



**TANYA  
KOROTKOV**  
*PNNL RAMP  
Program Coordinator*

## LEIDOS RAMP TEAM



**WENDY  
CHINCHILLA**  
*Leidos RAMP Program  
Manager*



**FREDERIC  
GOODING**  
*Leidos RAMP  
Operations Support*



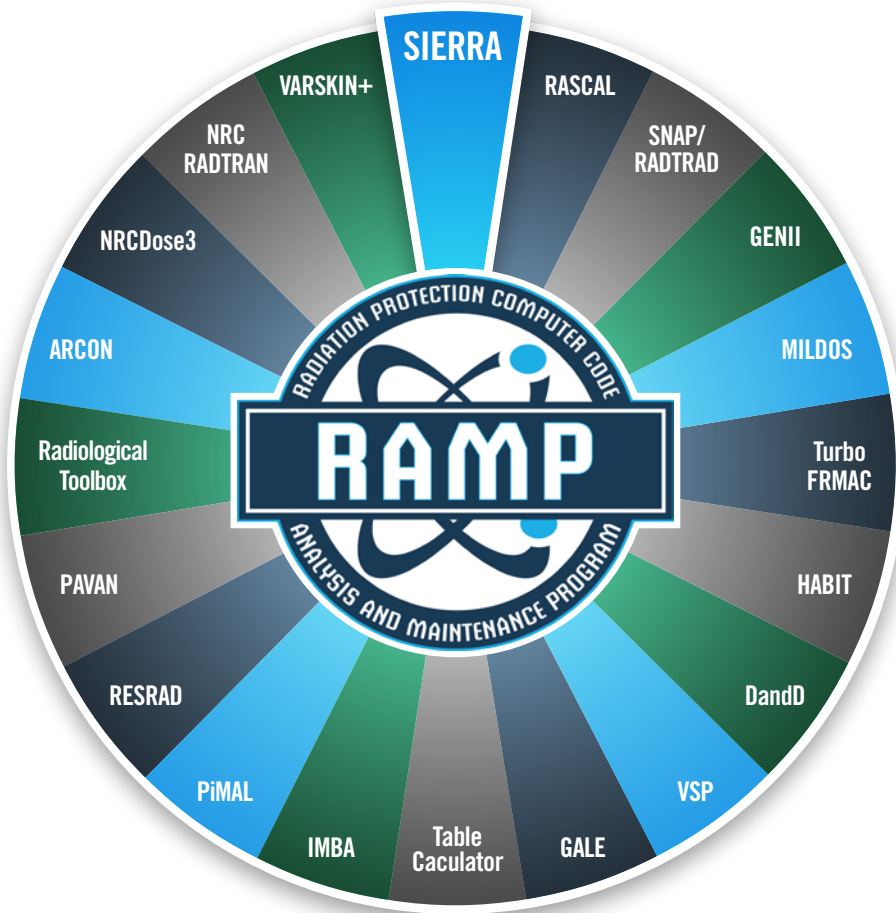
**MICHAEL CAUSEY**  
*Leidos RAMP Content  
Management*



**VENUKUMAR  
DEVLANDLA**  
*Leidos RAMP Drupal  
Developer*

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

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## DOSE ASSESSMENT CODES IN RAMP

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

# SPRING 2023 RAMP USERS' GROUP MEETING



<b>DAY 1</b>		<b>Tuesday, April 25, 2023</b>	
Open Registration and Networking Opportunities	8:00 AM – 9:00 AM	4:00 AM – 5:00 AM	
Opening Session	9:00 AM – 11:30 AM	5:00 AM – 7:30 AM	
Working Lunch – Overview of NRC's Licensees Toolkits			
IMBA (Virtual)	1:00 PM – 4:00 PM	9:00 AM – 12:00 PM	
Social Night Out			
<b>DAY 2</b>		<b>Wednesday, April 26, 2023</b>	
Open Registration and Networking Opportunities	8:00 AM – 9:00 AM	4:00 AM – 5:00 AM	
VARSKIN+	9:00 AM – 12:00 PM	5:00 AM – 8:00 AM	
Working Lunch – Physical Protection of Radioactive Material			
ALARA in Diagnostic Imaging	1:00 PM – 4:00 PM	9:00 AM – 12:00 PM	
RASCAL Beginners (Virtual)	1:00 PM – 4:00 PM	9:00 AM – 12:00 PM	
<b>DAY 3</b>		<b>Thursday, April 27, 2023</b>	
Open Registration and Networking Opportunities	8:00 AM – 9:00 AM	4:00 AM – 5:00 AM	
PiMAL/MCNP	9:00 AM – 12:00 PM	5:00 AM – 8:00 AM	
Working Lunch – NRC Licensee Toolkit			
VARSKIN+ Scenarios	1:00 PM – 4:00 PM	9:00 AM – 12:00 PM	
RASCAL Day 2 (Virtual)	1:00 PM – 4:00 PM	9:00 AM – 12:00 PM	
<b>DAY 4</b>		<b>Friday, April 28, 2023</b>	
Open Registration and Networking Opportunities	8:00 AM – 9:00 AM	4:00 AM – 5:00 AM	
RAMP Code Help and Mentoring Opportunities	9:00 AM – 10:00 AM	5:00 AM – 6:00 AM	
Meeting Closeout	10:00 AM – 10:30 AM	6:00 AM – 6:30 AM	
Country to Country Meeting: Ghana	10:30 AM – 11:30 AM	6:30 AM – 7:30 AM	
Country to Country Meeting: Open	11:30 AM – 12:00 PM	7:30 AM – 8:00 AM	

Full agenda, registration, and additional information will be available on the RAMP website:

[ramp.nrc-gateway.gov](http://ramp.nrc-gateway.gov)



# DAY 1 – RAMP OPENING SESSION



GMT

TOPIC

PRESENTER

RAMP Opening Session		
8:00 AM – 9:00 AM	Registration	All
9:00 AM – 9:05 AM	Opening and Housekeeping	Stephanie Bush-Goddard <i>RAMP Program Manager</i>
9:05 AM – 9:10 AM	Welcome	Nii Kwashie Allotey <i>Director-General Ghana Nuclear Regulatory Authority</i>
9:10 AM – 9:30 AM	The Genesis of Ghana Nuclear Programme and its Current Stage	Samuel Wotochi-Gordon <i>Ghana Nuclear Regulatory Authority</i>
9:30 AM – 10:00 AM	NRC: What It Is and What It Does	Stephanie Bush-Goddard <i>RAMP Program Manager</i>
10:00 AM – 10:15 AM	Break	All
10:15 AM – 10:45 AM	The RAMP Program	Rigel Flora <i>NRC RAMP Program Manager</i>
10:45 AM – 11:00 AM	RAMP User Meeting Information	Charlotte Rose <i>Renaissance Code Development</i>
11:00 AM – 11:30 AM	Survey/Ice Breaker/Introductions	All Participants
11:30 AM – 1:00 PM	Working Lunch Overview of NRC's Licensees Toolkits	Erin Kennedy

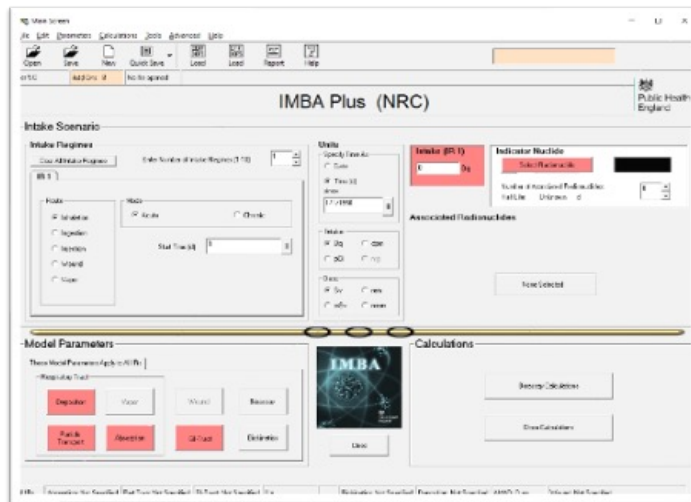
# IMBA – DAY 1

## INSTRUCTOR:



**COLBY  
MANGINI, PH.D.**

*Renaissance Code  
Development  
(RCD), LLC*

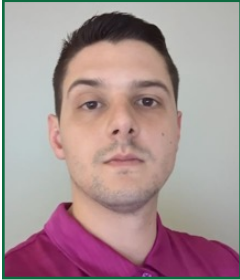


The IMBA code is a suite of software modules for internal dosimetry that implements respiratory tract, GI-tract, tissue dosimetry, biokinetic and bioassay models as recommended by the International Commission on Radiological Protection (ICRP). Originally designed by the UK's Health Security Agency, the IMBA modules can estimate single or multiple intakes of different radionuclides and calculate resulting doses in the body and/or excrement for workers based on ICRP Publication 68 and US 10 CFR 835. IMBA provides a platform for conducting customized dose calculations with different user set parameters. The suite has functionalities to:

- Perform simple and more complex dose calculations
- Vapor inhalation
- Forward bioassay calculations, and
- Intake estimation for multiple regimes.

# VARSKIN+ – DAY 2 AND DAY 3

## INSTRUCTOR:



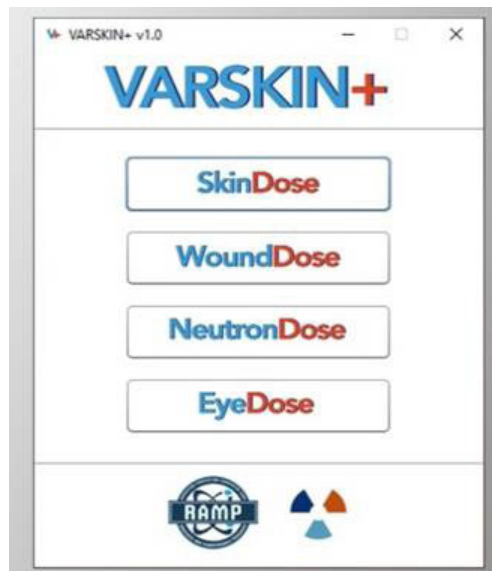
**RIGEL FLORA**  
*U.S. Nuclear  
Regulatory  
Commission*

**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(c), 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).

### *Course Requirements:*

- Attendees must provide their own laptop computer with the current version of VARSKIN+ installed prior to the start of the meeting.
- Before taking the course, all attendees should complete the online course “Introduction to VARSKIN.”



# ALARA – DAY 2

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## INSTRUCTOR:



**CHARLOTTE  
ROSE**

*Renaissance Code  
Development  
(RCD), LLC*

## **ALARA in Diagnostic Imaging**

ALARA in diagnostic imaging shares lessons learned to reduce doses to personnel and the public. The presentation will begin by talking about recent trends in patient shielding based on regulatory guidance regarding shielding during diagnostic exams. Additionally, the focus will be on the importance of radiation protection and how to set up staff and program managers to succeed in this realm. Demonstration of these principles will be done with the help of RAMP modeling software, PIMAL (and MCNP™), that will illustrate the dose consequences in both well shielded and poorly shielded examples. Two case studies will be shown, simulating both a typical X-ray exam and one in a nuclear medicine suite, showing consequences to staff and caregivers in situations both following ALARA and without.

## RASCAL – DAY 2 AND DAY 3

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### INSTRUCTOR:



**JEFF  
KOWALCZYK**

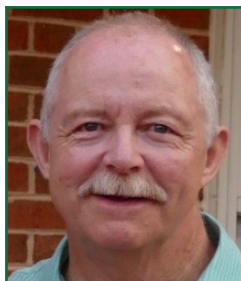
*U.S. Nuclear  
Regulatory  
Commission*

### RASCAL Training for Beginner Users

This RASCAL training course is a hands-on computer class for new RASCAL users. No experience with RASCAL is required, but a general familiarity of radiological assessments will be helpful. Instructors will walk users through a step-by-step example of doing a dose assessment using RASCAL 4.3.4. Discussion topics include:

- RASCAL capabilities & tools
- Site locations
- Source term models
- Atmospheric models
- Reading results

### INSTRUCTOR:



**GEORGE ATHEY**  
*Athey Consulting, Inc.*

Users are required to have RASCAL 4.3.4. installed on their computer prior to attending.

### RASCAL Training for Intermediate Users

This RASCAL training course is a hands-on computer class for intermediate and experienced RASCAL users. Experience with RASCAL is required. Instructors will walk users through a series of dose assessments, focusing on comparing models in a real-world scenario. Discussion topics include:

- Building RASCAL runs for severe accident progressions
- Core damage estimation using containment radiation monitors
- Comparing small and large break coolant accidents

Users are required to have RASCAL 4.3.4. installed on their computer prior to attending.



## PiMAL/MCNP – DAY 3

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### INSTRUCTOR:



**CHARLOTTE  
ROSE**

*Renaissance Code  
Development  
(RCD), LLC*

PiMAL is a collection of computational human phantoms useable with MCNP® for the assessment of radiation dose to various organs in standard and nonstandard positions through the user inputted articulation of arms and legs. A phantom model, included in the GUI, enables visualization of the arms and legs as they are positioned using slider bars. An MCNP® input file is then generated and the radiation transport simulations using MCNP® are performed through the GUI. Once simulation is complete, the computed organ dose values are extracted from the MCNP® output file, displayed, and exported as an ASCII file.

#### *Training objectives*

This training will guide the student through the use of PiMAL from installation to simulation with emphasis on use cases, methods, materials, sources, and tallies. A detailed tutorial on a simple modeling technique will conclude the training session.





# THANK YOU FOR ATTENDING

STAY TUNED FOR THE  
FALL USERS' GROUP HYBRID MEETING  
OCTOBER 2023 NEAR NRC HEADQUARTERS



For additional information

Email:

[ramp@nrc.gov](mailto:ramp@nrc.gov) | [ramp.admin@pnnl.gov](mailto:ramp.admin@pnnl.gov)

RAMP Website:

[ramp.nrc-gateway.gov](http://ramp.nrc-gateway.gov)