
Radiation Safety Information Computational Center



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“You have to believe in yourself.” – Sun Tzu

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CHANGES TO THE RSICC CODE AND DATA COLLECTION

There was one update to the RSICC catalog for those individuals that may be interested.

CCC-872/KRAKEN 1.2

VTT Technical Research Centre of Finland, has contributed the latest release of KRAKEN, KRAKEN1.2. The Kraken computational framework is a new modular calculation system designed for coupled core physics calculations. The development started at VTT Technical Research Centre of Finland in 2017, with the aim to replace VTT's outdated legacy codes used for the deterministic safety analyses of Finnish power reactors. In addition to conventional large PWRs and BWRs, Kraken is intended to be used for the modeling of SMRs and emerging non-LWR technologies.

The main computational modules include the Ants nodal neutronics solver, the FINIX fuel behavior module and the Kharon thermal hydraulics code, all developed at VTT. The core physics solution can be further coupled to system-scale simulations. In addition to development, significant effort has been devoted to verification and validation of the implemented methodologies. The reduced-order Ants code has been successfully used for steady-state, transient and burnup simulations of PWRs with rectangular and hexagonal core geometry. The Ants–Kharon–FINIX code sequence is actively used for the core design tasks in VTT's district heating reactor project.

A complete description of the project is found at the Kraken website:
https://serpent.vtt.fi/kraken/index.php/Main_Page

Ants is a modern multi-group nodal neutronics solver capable of performing steady state, burnup and transient calculations in rectangular and hexagonal fuel geometry. The solution is based on a combination of the analytic function expansion nodal method (AFEN) and the flux expansion nodal method (FENM), used for solving the diffusion equation. Ants has been specifically developed for the Kraken framework since 2017 and to utilize Serpent-generated group constant data. The main advantage of using the continuous-energy Monte Carlo method for group constant generation is that the same Serpent–Ants calculation sequence can be applied to a wide range of fuel and reactor types without application-specific limitations.

FINIX is a fuel behavior module developed at VTT since 2012 for the purpose of multi-physics simulations. The code was originally designed for internal coupling, for example, to replace outdated fuel models in VTT's legacy transient analysis codes or to provide temperature feedback for Serpent simulations. The code has a small user base, with most of the users applying it as an internally coupled fuel behavior solver with Serpent. FINIX solves the thermo-mechanical behavior of a single fuel rod under neutron irradiation conditions, taking into account both thermal effects and changes in rod geometry. The thermal and mechanical models are coupled by internal pressure and fuel-cladding gap heat conductance, which are functions of rod temperature and dimensions. Both the heat equation and the mechanical behavior are solved radially in one-dimensional cylindrical geometry independently for several axial nodes. The node-wise solutions are coupled together via internal pressure, which is solved simultaneously for the entire rod. This approach is generally referred to as

the 1.5-dimensional model. The dependence of physical quantities on local parameters, such as temperature and burnup, are based on publicly available material correlations.

Kharon is a closed-channel two-phase steady-state thermal hydraulics module based on the porous-medium approximation. Being a closed-channel steady-state solver implies its applications are limited to time-independent simulations with a closed assembly geometry or no appreciable cross-flows. The original motivation for developing Kharon was to have a light-weight TH solver to complete the multi-physics coupling during the early development stages of the Kraken framework. Even though Kharon was essentially designed as a placeholder for a more advanced methodology, the code has shown good results in routine fuel cycle simulations coupled to Ants and SuperFINIX. The module has been used, for example, in the core design analyses of VTT's LDR-50 district heating reactor concept.

Communication between the solver modules is handled using the Cerberus Python package. Cerberus is essentially a high-level code-agnostic interface that provides the methods for socket-based communication, exchange of field data, iteration algorithms, etc. The Python-based functionality is complemented by a reactor simulator module, which provides a user interface for reactivity control, core reloading operations and other features needed to perform routine fuel cycle simulations. The simulator also collects the relevant output data and evaluates several safety-related parameters, such as reactivity feedback coefficients, control rod worths, shutdown margins and power peaking factors.

RESTRICTION: RSICC is authorized to distribute KRAKEN 1.2 for research and education purposes only. Commercial use is prohibited. Commercial use is prohibited. RSICC can only distribute KRAKEN 1.2 to citizens of "pre-approved" countries and that are in the following "pre-approved" countries: member states of European Union, Australia, South Korea, Canada, Iceland, Japan, New Zealand, Switzerland, the United Kingdom, and the United States.

RSICC can only license and authorize the use of KRAKEN for peaceful and legal purposes. KRAKEN cannot be used in connection with the development, production, handling, operation, maintenance, storage, detection, identification, or dissemination of chemical, biological, or nuclear weapons or other nuclear explosive devices or the development, production, maintenance, or storage of missiles capable of delivering such weapons. The use of KRAKEN for any military purpose is strictly prohibited.

SINGLE USER MULTI-ORGANIZATION LICENSE AGREEMENT

(Last updated July 1, 2018)

To support the use of RSICC software by multi-national organizations and international collaborations, RSICC now offers our customers the option to request a Single User Multi-Organization Software License Agreement. The Single User Multi-Organization Software License Agreement addresses issues regarding the "re-export" of software and data packages obtained from RSICC because under Federal export control regulations our customers cannot "re-export" the code to another person in another country.

This agreement is intended to allow our customers to specify additional foreign locations for which they may be approved to utilize RSICC software. In general, the default option will be the standard single user license agreement for the country in which the customer resides and is employed. The following defines the requirements for use of this license agreement.

This SUMO software license agreement is only available for individuals that receive software directly from RSICC. In addition, the point of contact (host or system administrator) at the additional foreign location(s), must be licensed directly from RSICC and must agree to abide by the policies associated with host/server/cluster systems that are summarized following this announcement.

To apply for this license the customer must first register with RSICC and provide full and complete information. When submitting their request, the customer must provide the following information in the COMMENTS section of the request form for each applicable package:

- full name and email address of the point of contact (POC),
- the full name of the organization at which the software will be used, and
- the complete address (no post office boxes) of the organization under which additional access is being requested.

Individuals that would like to utilize this service must have a valid reason for needing this access and provide such justification to RSICC in the END USE statement as well. If this information is not included in the END USE statement, then the customer's request will only be considered for the standard single user license agreement.

When processing the request, RSICC staff will verify that the designated POC(s) has a valid license for the same version of software that is being requested by the applicant and verify that the POC obtained the package directly from RSICC. If the POC, did not obtain the package directly from RSICC, the POC will need to register with RSICC, apply and be approved for the package before the applicant's request can be processed.

The requests will be reviewed for each designated location and a decision will be rendered as to whether a license is granted. If an organization or location is denied, then the customer will be notified and may be limited to the standard single user license agreement for their own organization.

Exceptions:

Persons that have any citizenship of or are in countries that are not listed in Appendix A of 10 CFR 810 are not permitted to utilize the Single User Multi-Organization License Agreement.

Fees:

The customer making the request for the single user multi-organization software license will be required to pay the cost recovery fee for each location at which they are approved. In addition, the POCs at the other foreign locations that have not obtained the software directly from RSICC will have to obtain the software from RSICC and pay the applicable fee.

HOST/SERVER/CLUSTER GUIDANCE

(Last updated November 1, 2022)

Software obtained from RSICC is export controlled under the jurisdiction of the U.S. Department of Energy, 10 CFR 810, or the U.S. Department of Commerce, 15 CFR 730-744. Additionally, RSICC distributes this software under guidance issued by the U.S. Department of Energy's Office of Nonproliferation and Arms Control. The distribution and use of RSICC software is restricted and controlled under these regulations and guidelines. Individuals that request the software must be cleared through both an export control and a nonproliferation review process prior to the individual being granted a license to receive software for a specific end use.

The software distributed by RSICC is licensed to individual requestors (Licensee) under a single-user license agreement while employed at the organization listed on the license forms and cannot be transferred to any other individual or entity. The Licensee is responsible for the control, management and protection of the software. The Licensee is responsible for compliance with U.S. export control requirements (laws and regulations) and the terms of the license agreement. This includes preventing access to the software by any individual or entity (including IT staff) as such access may be deemed an export control violation. Individual Licensees should protect the software, documentation, and installation accordingly. Neither the software nor manuals should be posted to the Internet or otherwise be made publicly available. Any and all system administrators that are assisting with the installation and maintenance of a licensed code(s) or that would otherwise have access to a licensed code(s) that is placed on a stand-alone system and/or server/cluster must also be licensed for the exact version of the software that is placed on these systems. Individuals whose duties are only that of a System Administrator are not authorized to be users of the licensed codes(s). **Those individuals serving only as system administrators are NOT charged the cost recovery fee for processing their requests.**

System administrators and/or hosts should implement standard and customary account access and/or file permissions such that only the licensed individuals may access the program. This should include identity and access management, such as multi-factor authentication, to ensure software is kept secure from unauthorized access. Please note that the single-user license agreement is code and version specific. The Licensee must be licensed for the specific version to which they are granted access. For example, an individual with a license only for MCNP5 should not be permitted access to MCNP6.1. Additionally, some individuals are only licensed for the executable versions of the code(s), and the system administrator(s) must ensure that such individuals do not have access to the source code. Therefore, it is recommended that the source code be removed after installation of the program(s) and furthermore procedures must be implemented such that control software is not lost via decommissioned storage media.

Network, server, parallel, cluster, or similar installations outside of the United States may not be within a country NOT listed in Appendix A of 10 CFR 810 nor occur at facility identified as an entity under 15 CFR 744.

RSICC software may be hosted on a server, cluster or high-performance computing system with the following conditions:

1) Each server/cluster operator must designate one individual responsible for oversight of the use of RSICC software on the server/cluster. This individual will be responsible for communicating and reporting to RSICC on an annual basis regarding the users of the cluster/server.

2) Each and every system administrator that would have access to any form (source or executable) must register, request, **and** be approved for the software with RSICC for the version to which they would have access.

3) An authorized and approved system administrator may install and maintain the software and must ensure that the software is not distributed or shared with those who do not have a specific license for the version to which they would have access. System administrators are required to utilize protocols that limit access to the software. Users should only be granted access and use of software to which they have a specific license, e.g. users that have a license for SCALE 6.1 should NOT be granted access to SCALE 6.0 or SCALE 6.2.

4) System administrators are not permitted to provide access to RSICC software to individuals **NOT** located within the same country as the server/cluster **unless the Licensee has an approved Single User Multi-Organization License Agreement from RSICC.**

5) Individuals with citizenship or multiple citizenships that include a country not listed in Appendix A of 10 CFR 810 may be granted access to RSICC software on a server/cluster, if the

individual has been approved for access to the software by the U. S. Department of Energy's Office of Nonproliferation and Arms Control.

6) Under no circumstances should an individual with citizenship or multiple citizenships that include a country NOT listed in Appendix A of 10 CFR 810 be granted access to RSICC software on the server/cluster, if that individual has NOT been approved by the U.S. Department of Energy's Office of Nonproliferation and Arms Control. Additionally, under no circumstances should an individual located at an entity identified under 15 CFR 744 be granted access to RSICC software on the server/cluster.

7) Individuals that have been only granted access to RSICC's secure cloud server MAY NOT be granted access to any other server/cluster.

8) When a Licensee requests access to RSICC software on a server/cluster, the system administrator must follow the following process:

(a) The system administrator will require that the Licensee provide proof of a license by requiring that the Licensee provided an electronic copy of either the Single User License Agreement or the Single User Multi-Organization License Agreement. **System administrators cannot provide access to anyone located in another country unless that individual has an approved Single User Multi-Organization License Agreement from RSICC and the organization of the system administrator is listed on the SUMO License Agreement.**

(b) The system administrator must ensure that the Licensee's current installation/affiliation is the same as that on the license agreements.

(c) If the Licensee's current installation is NOT the same as that on license agreements, then access should be denied until the Licensee has updated license agreements with RSICC. This will require the Licensee to update their registration with RSICC and submit a new request with RSICC. The Licensee should not be granted access to the software until they have been authorized. Please note that some approvals are location and organization specific.

9) The system administrator will maintain records of the Licensees that are utilizing the server/cluster and send a record to RSICC (rsic@ornl.gov) that include the Licensee's full name, RSICC customer identification number, installation, and the codes to which the Licensee has access on the system. This information must be provided when the system administrator makes the first request to RSICC to provide such services and must be updated annually by sending updated information to RSICC no later than November 30 of each calendar year. The record should include the customer's full name, RSICC customer number, customer installation as well as request numbers and software package name and identifier for which they are accessing on the cluster.

Server/cluster operators that agree to comply with these conditions may install RSICC software on the server/cluster that are within their corporate/institutional ownership, physical control, and the individual country identified.

END USE STATEMENT

(Last updated September 24, 2021)

Customers are strongly encouraged to provide full and complete information regarding the intended end use of the software being requested. End use statements that specify that the code is for research, training or educational activities are not sufficient. RSICC's regulators need to know explicitly for what purpose you intend to use the codes and detail needs to be provided. Requests that lack sufficient detail will be rejected. Please include the type of calculations that you intend to perform e.g., criticality,

reactor physics, shielding, dose, etc. and for what types of applications e.g., reactor shielding design, fusion shield design, nuclear medicine, reactor design, etc.

Students that submit requests to RSICC are strongly encouraged to consult their professor or academic advisor as to what purpose they intend to use the codes for their classes and/or their research. Professors are also encouraged to provide such guidance to their students since the professor is responsible for identifying the activities of the students under their tutelage. Professors are encouraged to write an end use statement for their students that describe both the intended use of the code and the applications for which the code will be applied. Providing this information will help expedite the processing of the request and speed up delivery of the software.

REGISTRATION REQUIREMENTS

(Last updated September 13, 2023)

During the registration process, individuals are required to provide the name of the institution at which they will use the software, an institutional mailing address and an institutional e-mail address. RSICC's regulators require us to obtain an address associated with the individual's organization. If you are working remotely, you may include an alternate mailing address as a comment during the registration process. Please note that you cannot provide an alternate mailing address that is in a country different than that for the organization with which you are affiliated. RSICC cannot register a customer for access to software in a country different than that of the organization with which the individual is affiliated as the single user license and export control agreements are specific to the country in which the organization is located.

CONFERENCES, TRAINING COURSES, SYMPOSIA

CONFERENCES

Best Estimate Plus Uncertainty International Conference 2024

BEPU is a leading international meeting on the use of best estimate and uncertainty analyses methodologies for nuclear reactor safety analyses. The last BEPU meeting was held in May 2018 in Lucca, Italy. The BEPU2018 conference demonstrated that:

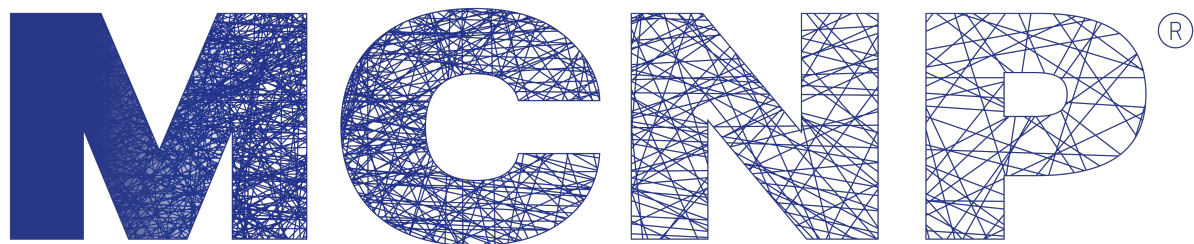
- BEPU applications in licensing are limited and their increase is foreseen to be slow;
- there is a need for comprehensive guidelines for use of BEPU technologies, and the availability of mature tools was questioned;
- consistency in all steps of BEPU needs to be ensured, however it was identified that there is a need to reduce shortcuts in BEPU applications and to focus on exploitation of the full BEPU process;
- experimental data is central to the BEPU processes and methodologies; thus the use the available of experimental data in an efficient and consistent way is required; and
- BEPU is at first a methodology that increases the knowledge and understanding of uncertainties

and biases embedded in any deterministic safety analysis.

Given the outcomes of the BEPU2018 conference, the community recognized the need to address some of the identified shortcomings and initiated the planning for BEPU2024. The BEPU2024 Conference is planned to be organized in two main Tracks devoted to Industrial Applications and Licensing (Track-1) and to Research and Development (Track-2). Plenary Sessions, Regular Sessions, and Panel Discussions Sessions to promote intensive interactions among all conference participants. Poster and student sessions are also envisioned.

Those interested can find additional details at www.nineeng.com/bepu2024.

TRAINING COURSES



MONTE CARLO N-PARTICLE

LANL MCNP6 Class Schedule

Individuals interested in attending or that have registered for these classes are encouraged to contact the organizers regarding any delays or cancellations.

Website: <https://mcnp.lanl.gov/classes.html>

May 20 – 24, 20204 Los Alamos, NM	Practical MCNP® for Health Physicist, Radiological Engineer, and Medical Physicist Non-US citizens must register by 2024-03-01	\$1,800
June 3 – 7, 2024 Los Alamos, NM	Criticality Calculations with MCNP6 Non-US citizens must register by 2024-03-15	\$1,800
June 17 – 21, 2024	Introduction to MCNP6 Non-US citizens must register by 2024-03-29	\$600

See the website for more information.

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MCNP® 2024 Users Symposium

We are pleased to announce that the MCNP® 2024 Users Symposium will be held as a hybrid event from August 19 – 22, 2024. The in-person event will be held at the Los Alamos J.R. Oppenheimer Center while the virtual event will be on the Cvent platform. The symposium will include presentations from developers focusing on recent and planned capabilities. Additionally, users of MCNP® are encouraged to propose presentations that highlight unique and challenging applications of the code. The hosts intend to utilize a flexible format to accommodate presentations of varying duration.

Everyone that wishes to participate in the symposium must register at the event website: <http://www.lanl.gov/mcnp2024>. The fee for the in-person attendance is \$200 while there is no registration fee for virtual attendees; however, registration is required of all who want to participate.

Non-U.S. citizens must register and provide the required information by June 14, 2024 whereas U.S. citizens must register by August 12, 2024. Early registration is encouraged of all participants to allow the organizers to optimally plan the lectures and presentations. Please email mcnp2024@lanl.gov for any related question or suggestion.

Individuals that wish to make a presentation at the symposium must submit an abstract no later than June 28, 2024. Please see the event website for more information about the abstract submission and required content. Individuals will be contacted regarding their submission by July 26, 2024.



8th Annual SCALE Users' Group Workshop

We are pleased to announce that registration is open for the 8th SCALE Users' Group Workshop that will be held as a hybrid meeting on June 5–7, 2024. You can register on the meeting website at <https://scalemeetings.ornl.gov>.

The meeting is offered free of charge to participants. Certain portions of the workshop will be hybrid or virtual only. Registration is unlimited for virtual participation. In-person participation is limited to a total of 75 people per day due to room capacity.

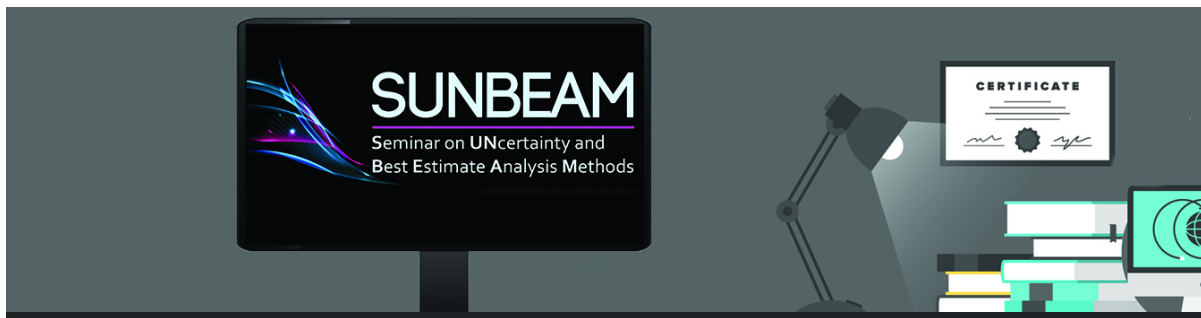
You are invited to participate in the meeting and contribute with presentations and discussions on impactful and innovative applications of SCALE. Under the SCALE Open Mic technical session, users are invited to discuss their work challenges and achievements, with no formal presentation required, however, presentation slides are welcome. Contributions to the SCALE Model Contest session require only a single page showing one or more images of a SCALE model. Participants will have 5–10 minutes during the session to provide background on the

model, present additional information as desired, and answer questions. The best models will be showcased in a 2025 SCALE calendar. In-person participants will have the opportunity for individual user support from SCALE developers and expert analysts during a SCALE one-on-one session. Additionally, three technical tours are offered to in-person participants.

Fifteen hands-on tutorials will be presented: twelve virtual only and three hybrid, as specified on the agenda at <https://scalemeetings.ornl.gov/agenda/>. Virtual tutorials have unlimited participation. The hybrid tutorials are limited to 75 in-person participants with unlimited virtual participation. To be able to participate in these tutorials, registrants must have a user license for SCALE 6.3.1 or 6.2, as required for the tutorial. Before registering for any tutorial, please verify that you have or are eligible to request the SCALE license that is required for that tutorial. See <https://www.ornl.gov/content/how-order-scale> on details on how to request a SCALE license.

For details on the sessions organized in 2023 and other previous years, please see <https://scalemeetings.ornl.gov/previous-workshops/>. Please email scalehelp@ornl.gov for any related question or suggestion.

Seminar on Uncertainty and Best Estimate Analysis Methods (SUNBEAM)



The **Seminar on UNcertainty and Best Estimate Analysis Methdods (SUNBEAM)** course platform will take place from **June 10 to June 21, 2024** at the NINE headquarters in Lucca (Italy).

The seminar course provides a transfer of experience and know-how from recognized experts from different organizations (industrial experts, regulators, researchers and university professors) in the fields of Best-Estimate Plus Uncertainty approach including uncertainty methodologies and application in licensing framework, Scaling Analysis, Validation Process of Evaluation Models, development and applications of Multi-physics & Multi-scale tools.

SUNBEAM will address the following subjects for a total of about 70 hours of lecturing:

- Licensing Framework and Best Estimate Plus Uncertainty
- Best Estimate System Thermal-Hydraulic Codes and V&V

- Scaling Issue and Scaling Analysis
- Sensitivity Analysis
- Uncertainty Analysis
- Procedures for a Consistent Application of a BEPU Method in Licensing
- BEPU Applications in Safety Analysis and Licensing Framework
- Reactor Physics and Fuel Performance Experiments and Uncertainty Analysis
- Multi-Physics Multi-Scale Simulations and BEPU

The detailed program of the seminar course and the registration form as well as additional information about the venue, transportation and the hotels can be obtained from the Seminar's home page: <https://www.nineeng.com/courses/sunbeam>

The **Early Registration Deadline is April 19, 2024** and you can register online at: http://www.nineeng.com/courses/index.php?option=com_chronoforms5&chronoform=SUNBEAM_Registration

SYMPOSIA

2024 CALENDAR

May 2024

Nuclear and Emerging Technologies for Space (NETS-2024), May 6 – 10, 2024, Santa Fe, New Mexico, USA. Website: <https://www.ans.org/meetings/nets2024/>

Best Estimate Plus Uncertainty 2024, May 19 – 24, 2024, Lucca, Italy. Website: <https://www.nineeng.com/bepu2024/>

15th International Particle Accelerator Conference, May 19 – 24, 2024, Nashville, Tennessee, USA. Website: <https://ipac24.org/>

International Conference on Nuclear Security: Shaping the Future, May 20 – 24, 2024, Vienna, Austria. Website: <https://www.iaea.org/events/icons2024>

International Conference on Decommissioning Challenges: Role and importance of innovations, May 27 – 29, 2024, Avignon, France. Website: <https://www.sfen.org/evenement/dem-2024/>

June 2024

Nuclear Innovation Conference (NIC 2024), June 5 – 6, 2024, Amsterdam, Netherlands. Website: <https://www.nuclearinnovationconference.eu/>

2024 ANS Annual Meeting, June 9 – 12, 2024, Las Vegas, Nevada, USA. Website: <https://www.ans.org/meetings/view-ac2024/>

3rd Global Forum for Nuclear Innovation, June 24 – 28, 2024, Miami Beach, Florida, USA. Website: <https://www.globalnuclearinnovation.com/>

July 2024

26th Technology of Fusion Energy (TOFE 2024), July 22 – 25, 2024, Madison, Wisconsin, USA.
Website: <https://www.ans.org/meetings/view-tofe24/>

IEEE Nuclear & Space Radiation Effects Conference, July 22 – 26, 2024, Ottawa, Ontario, Canada. Website: <https://www.nsrec.com/>

August 2024

Utility Working Conference and Vendor Technology Expo (UWC 2024), August 4 – 7, 2024, Marco Island, Florida, USA. Website: <https://www.ans.org/meetings/view-388/>

31st International Conference on Nuclear Energy (ICONE 31), August 4 – 8, 2024, Prague, Czech Republic. Website: <https://event.asme.org/ICONE>

14th International Topical Meeting on Nuclear Reactor Thermal-Hydraulics, Operation and Safety (NUTHOS-14), August 25 – 28, 2024, Vancouver, British Columbia, Canada. Website: <https://nuthos-14.org/>

September 2024

Plutonium Futures – The Science 2024, September 8 – 12, 2024, Charleston, South Carolina, USA. Website: <https://www.ans.org/meetings/view-418/>

International Conference Nuclear Energy for New Europe, September 9 – 12, 2024, Portoroz, Slovenia. Website: <https://www.djs.si/nene2024>.

TopFuel 2024, September 29 – October 3, 2024, Grenoble, France. Website: <https://www.euronuclear.org/topfuel-2024/#Registration>

October 2024

GLOBAL 2024, October 6 – 10, 2024, Tokyo, Japan. Website: <https://www.ans.org/meetings/view-434/>

Pacific Basin Nuclear Conference 2024 (PBNC), October 7 – 10, 2024, Idaho Falls, Idaho, USA. Website: <https://www.ans.org/meetings/view-pbnc2024/>

Joint International Conference on Supercomputing in Nuclear Applications + Monte Carlo (SNA + MC) 2024, October 20 – 24, 2024, Paris, France. Website: <https://www.ans.org/meetings/view-414/>

2024 Nuclear Science Symposium, Medical Imaging and Room-Temperature Semiconductor Conference, October 26 – November 2, 2023, Tampa, Florida. Website: TBA.

November 2024

2024 ANS Winter Conference and Expo, November 17 – 21, 2024, Orlando, Florida, USA. Website: <https://www.ans.org/meetings/view-347/>