

Radiation Safety Information Computational Center (RSICC): An Information Analysis Center for Nuclear Science

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Abstract. The Radiation Safety Information Computational Center (RSICC), founded in 1962 at Oak Ridge National Laboratory (ORNL), is a specialized information analysis center under the auspices of the Office of Science and Technical Information within the U.S. Department of Energy (DOE). RSICC is the sole organization responsible for the distribution of the MCNP® Monte Carlo code that is a reference tool for testing and evaluating nuclear data libraries. MCNP® is one of the primary tools utilized by the Validation of Nuclear Data Libraries (VaNDal) subgroup under the Working Party on Evaluation and Cooperation (WPEC) of the Nuclear Energy Agency (NEA) of the Organization for Economic Cooperation and Development (OECD). Since 2010, RSICC has distributed over 23,000 copies of the MCNP® code to our Worldwide customer base. Over the past decade, RSICC has distributed over 1,000 copies of MCNP® annually to our customers located in the U.S. and abroad. Approximately 50% of the MCNP® software packages distributed have been provided to U.S. universities and sponsored organizations whereas over 27% of the packages have been provided to foreign organizations and over 22% to domestic organizations that are not supported by RSICC's sponsors. While there is high demand for the code, the distribution of the code is restricted to only approved countries because the code is regulated by the U.S. DOE. This paper provides a general overview of RSICC's activities, services, and systems; provides information regarding Federal export control regulations for codes such as MCNP®; and provides recommendations for the control and use of RSICC.

1 Introduction

The Radiation Safety Information Computational Center (RSICC) at the Oak Ridge National Laboratory is a specialized information analysis center under the auspices of the Office of

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† MCNP® and Monte Carlo N-Particle® are registered trademarks owned by Triad National Security, LLC.

Scientific and Technical Information within the United States Department of Energy. For the past six decades, RSICC has served as an official modeling and simulation (M&S) code and data repository for the United States Department of Energy (DOE) and its predecessors. RSICC collects, archives, and disseminates the M&S tools to individuals throughout the World under specific distribution restrictions and guidelines as set forth by the U.S. Federal government's export control regulations. RSICC's code and data repository includes over 2,000 software and data packages including the MCNP@[1] and SCALE@[2] that are invaluable M&S tools used by the nuclear data community.[3]

RSICC maintains close relations with software developers to make the latest updates of existing codes as well as new software packages available to our customer base. We collaborate with code developers to package the software for a variety of computing platforms and work with the developers to implement any specific controls on the software to protect their intellectual property rights or limit the distribution of the software. Some developers only provide their software for educational and research purposes, and RSICC must ensure that our customers agree to comply with these requirements. In some instances, the customer must sign specific agreements for access to certain packages.[3]

RSICC's distribution of M&S tools and data helps to promote international cooperation in nuclear science and technology, ensures the safe development and deployment of nuclear technology, and provides those countries possessing or pursuing nuclear technology access to state-of-the-art software. RSICC has over 15,000 active customers in various countries throughout the World. Students, researchers, and faculty at U.S. organizations represent the bulk of RSICC's customers; however, there is a sustained level of international interest in the codes provided by RSICC. The growth in the number of RSICC's foreign customers has presented some challenges in providing access to M&S tools that are controlled by the U.S. Federal government because these pose a greater risk of diversion from their intended purposes or could be utilized for nefarious activities. RSICC's experience in managing the ever-changing regulatory environment has ensured continued access to M&S tools for most of our customers. This paper provides an overview of the demand for software from RSICC's customers, discusses the U.S. regulatory environment for export-controlled M&S tools, provides recommendations for requesting software, and discusses the best practices for overseeing these export-controlled technologies.[3]

2 Software Demand

The demand for state-of-the-art M&S tools has remained steady over the past decade, as shown in Figure 1. This figure provides the number of packages sent for each fiscal year (for reference, fiscal year 2012 began on October 1, 2011, and ended on September 30, 2012). Over this decade, RSICC distributed approximately 4,000 software and data packages annually to our customers. The number of packages delivered to customers who are not US citizens (shown in the figure as "foreign") has remained steady as well as the number of packages provided to our customers associated with universities. Even during the COVID pandemic, the number of packages sent to our customers remained substantial and the demand for the packages has been growing over the past year.[3]

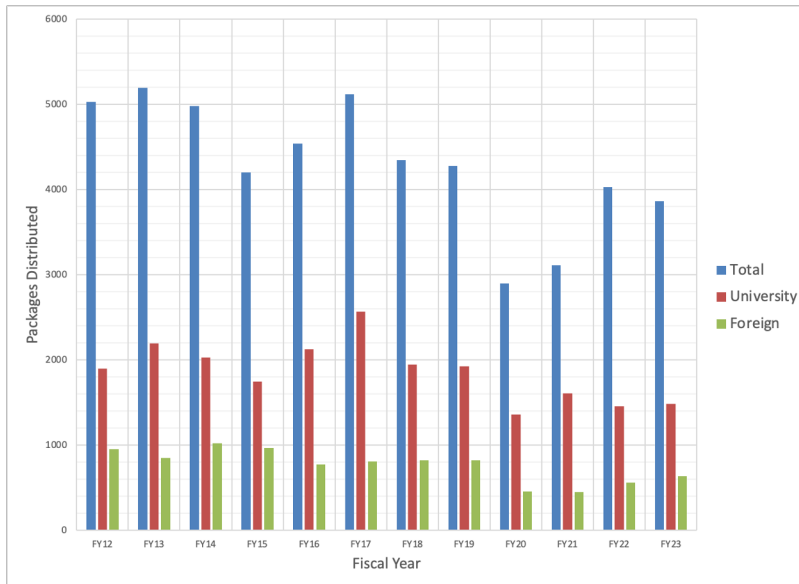


Fig. 1. RSICC's annual software package distribution statistics.

The Los Alamos Monte Carlo code MCNP® is in the highest demand by our customers for applications in nuclear data testing and evaluation. Over the past decade, RSICC has distributed over 22,000 copies of the MCNP® code. Of this total, slightly more than 40% of the MCNP® packages have been provided to individuals at U.S. universities and approximately 9% have been provided to individuals directly supported by RSICC's sponsors. RSICC's sponsors support our center to provide software to U.S. universities and persons directly working for them. More than 27% of the MCNP® packages have been provided to foreign persons outside of the U.S., and approximately 23% have been provided to U.S. domestic customers that are not supported by RSICC's sponsors. The annual distribution for these four categories of customers is shown in Figure 2.

3 Export Control Regulations

Software distributed by RSICC is controlled under U.S. Federal export control regulations. These regulations exist to balance the competing interest in open science with national security concerns. The U.S. Federal government is committed to preventing the proliferation of nuclear weapons while ensuring the safe and secure deployment of nuclear technology for peaceful purposes. Nuclear M&S tools are considered enabling technologies that can be applied across a broad range of applications for both peaceful and defense purposes. The U.S. established regulatory authority within various agencies of the U.S. Federal government related to nuclear technology. Software delivery is controlled regardless of the mechanism by which the software is provided to the end user. Under U.S. law, export is defined as the transfer of technology or assistance relating to nuclear technology to a foreign person or national or to any person physically located outside of the U.S. territories. The release of software to a foreign person in the U.S. is considered a deemed export.[3]

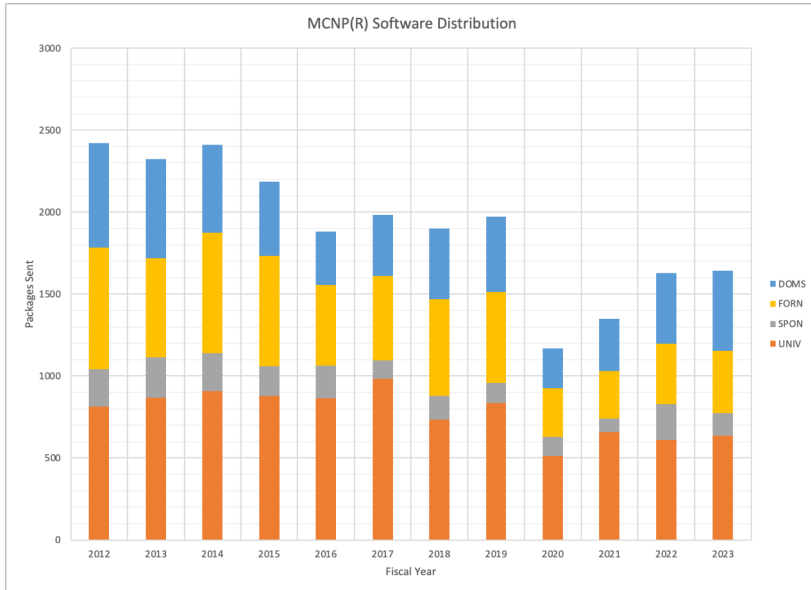


Fig. 2. Annual MCNP® distribution statistics.

3.1 Department of Commerce

The Bureau of Industry and Security (BIS) within the U.S. Department of Commerce (DOC) regulates dual use technologies through the Export Administration Regulations (EAR) under Parts 730-744 of Title 15 of the U.S. Code of Federal Regulations (15 CFR Parts 730-744) [3] based on a commodity control list (CCL). The EAR establishes licensing requirements for specific destinations, end uses, and end user controls. Dual use technologies are those that can be used for both civilian and military applications and includes software. Exports under the EAR are categorized by an export control classification number (ECCN) that describes the item and the licensing requirements. Software for neutronic calculations and modelling, radiation transport, and hydrodynamic calculations and modeling are designated as 0D999 and have controls for antiterrorism and regional stability that restricts the distribution of software to citizens of certain countries. Unless an individual is a citizen identified in the denied persons lists, the export of the software may not require an export license dependent on the end use and end user restrictions.[3]

The end use and end user restrictions for certain persons, entities, or countries may require a specific license. Under 15 CFR 744.2, there are restrictions on the use of U.S. nuclear technologies for fuel cycle facilities. Distribution of software for certain uses at facilities for reprocessing fuel, isotope production, tritium production, or plutonium-bearing fuel fabrication require a license by the DOC. Under 15 CFR 744.5, there are restrictions on the use of U.S. nuclear technologies for maritime nuclear propulsion end uses. Under these restrictions, a license would be required to obtain permission from the DOC for use related to maritime propulsion plants, their land prototypes, and facilities related to these plants. Under 15 CFR 744, there are also restrictions on military and space applications for which the distribution of software would require a license by the DOC. End user restrictions are also codified in 15 CFR 744. The U.S. Federal government maintains and updates lists of denied persons, entities, groups, and countries to whom an export license would be required. An export to citizens of North Korea, Iran, or Syria requires an export license with approval

by the U.S. Congress. Citizens of embargoed countries are in general denied access to RSICC services.[3]

3.2 Department of Energy

The U.S. Department of Energy under Part 810 of Title 10 of the U.S. Code of Federal Regulations (10 CFR 810) [4] applies controls to the transfer or assistance related to certain nuclear fuel cycle activities, research and commercial reactors, and special nuclear material production. Items controlled under 10 CFR 810 may be either generally authorized to citizens of certain countries or specifically authorized by the Secretary of Energy. The Secretary of Energy has authorized the transfer of technology to countries listed in Appendix A of 10 CFR 810 for which the U.S. has established bilateral nonproliferation agreements. In 2009, the U.S. Department of Energy (DOE) asserted control over MCNP® and in 2023, asserted control over the SCALE code under 10 CFR 810. Access to the source or executable versions of these codes is generally authorized to U.S. persons (U.S. citizens or U.S. legal permanent residents). Access to the executable version of MCNP® and SCALE are generally authorized to citizens of countries listed in Appendix A of 10 CFR 810. Access to the source code for MCNP® and SCALE by citizens of Appendix A countries requires approval by the U.S. Department of Energy. Individuals that are citizens of countries not listed in Appendix A of 10 CFR 810 are in general denied access to MCNP® and SCALE. However, in some instances, citizens of non-Appendix A countries may be granted controlled access to these codes on a secure cloud server operated by RSICC. Prior to 2023, the SCALE code was designated as 0D999 and made widely available to all RSICC customers. However, once the U.S. DOE asserts control over a code, the distribution requirements become more restrictive.[3]

Like the DOC regulations, the DOE regulations also have end use restrictions even for generally authorized countries. A specific authorization by the U.S. Secretary of Energy is required for providing technology for activities listed in 10 CFR 810.7(c) that include isotope production, plutonium fuel fabrication, tritium production, production accelerators or reactors, and fuel reprocessing facilities. Hence, it is important that the end users clearly define the intended use of software regulated under 10 CFR 810.[3]

3.3 Department of State and Treasury

The U.S. Department of Treasury (DOT) maintains lists of specially designated nationals and blocked persons lists under the Office of Foreign Assets Control (OFAC). Persons or entities on this list are denied access to RSICC's services and cannot be licensed to use U.S. nuclear technology. The U.S. Department of State (DOS) maintains lists of debarred parties under the International Traffic in Arms Control (ITAR) provisions within the Directorate of Defense Trade Controls. These restrictions bar RSICC from providing services to any individuals under OFAC or ITAR sanctions.[3]

4 Registering and Requesting Software

Due to the U.S. Federal regulations previously described, RSICC customers must register with RSICC and provide a detailed end use statement for use of the codes. RSICC customers are required to provide information about their organization as well as information about themselves when registering. It is important that customers use their organizational contact information as well as provide all information regarding their complete citizenship. Failure

to provide complete and accurate information can result in the denial of RSICC's services. Customers that are self-employed, can register with RSICC under their own company's name or as "SELF" if they do not have formed a company. Additionally, individuals that work as a subcontractor at another facility should utilize their actual employer when registering and not the organization for which they are contracting. For example, a customer working at Westinghouse under subcontract from ACME Consulting should register as an employee of ACME Consulting and not as a Westinghouse employee. Often individuals working as subcontractors support multiple organizations over their careers and being licensed under their actual employer allows one to use the software for multiple contactors for the same end use. If a customer has previously registered with RSICC and was affiliated with a different organization than their current organization, they must update their registration and provide proof of disposition of software previously obtained from RSICC. The license agreements are specific to the individual's organization, location, and end use, and when an individual changes their affiliation, prior licenses are no longer valid.[3]

RSICC customers are required to provide an end use statement that specifies the types of applications for which the software will be used. As noted in the end use restrictions described under U.S. Federal regulations, it is important that the customer describe completely the anticipated use of the codes. Customers are required to provide information about the types of nuclear systems for which the code will be used such as commercial reactors, research reactors, nuclear material storage, transport or processing, etc. It is important that the customer declare any proposed use of the codes for fuel cycle facilities, maritime nuclear applications, or space applications as these are controlled under U.S. Federal regulations and are generally not allowable for foreign persons. Customers are required to write statements in the first person when submitting their end use statement because our regulators need to know for what purposes the customer needs the code and not for what purpose the organization needs the code. An example of an appropriate end use statement is as follows: "I will use the MCNP® Monte Carlo code to perform criticality, reactor physics, and dose calculations for reference benchmarks for evaluation of nuclear data." Customers should also include a complete description of all the current or planned applications for which the code will be used. This is important for consultants or contracting engineers that support more than one organization. Consultants or contracting engineers should include end use statements that encompass all the intended uses of the software for which they would provide support. For instance, an employee of ACME Consulting that supports both Westinghouse and Southern Company should provide an end use statement that would cover the intended applications at both Westinghouse and Southern Company to ensure that the proposed end uses are permissible.[3]

5 Software Control Best Practices

RSICC software is distributed under a single user license and export control agreement. The single user license agreement (SULA) restricts access to the software to only the licensee and restricts the licensee from redistributing or exporting the software. The SULA is only valid while the individual is affiliated with the organization identified on the license, for the end use stated in the request, and for the country in which the license was issued. Changes in any of these or any changes in the customer's citizenship invalidates the license agreement, and customers would be required to update their registration and obtain a new license for the software. Because the license and export agreements are specific to the country in which the license was provided, customers are not allowed to re-export the software or use the software in a country in which they are not licensed. RSICC implemented a single user multi-organization (SUMO) license that can be used to license a person in more than one country.

This was developed to have a legal mechanism by which to license individuals to use computational resources in another country to support multi-national corporations or multi-national collaborations.[3]

Given the restrictions of the SULA and SUMO licenses, licensed persons should ensure that others are not provided access to the software including access by information technology specialists that are not users of the code. The regulations apply to access to the software as well as use of the software. RSICC can license IT professionals for access to the software and do not charge fees to those persons that are licensed only as administrators or IT professionals. Users that intend to install the software on a server/cluster are required to identify a primary system administrator who is responsible for ensuring that only licensed persons are provided access to the software. The primary system administrator is required to provide annual reporting to RSICC regarding its user access. Furthermore, RSICC software cannot be placed on computing systems that are not physically located in the U.S. or Appendix A countries under 10 CFR 810 or in facilities identified under 15 CFR 744. Users are also cautioned about placing RSICC software on cloud-based servers. RSICC may only support cloud solutions where the cloud service is physically within the jurisdiction of the U.S. and provides information security objectives/impact levels consistent with Level 4 from the current U.S. Department of Defense Cloud Computing Security Requirements Guide. Additionally, the licenses are specific to the version of the software. A license for MCNP6.2 is not valid for access to MCNP6.3. System administrators must ensure that the end user is properly licensed for the software that is installed on the server/cluster. [3]

6 Conclusions

For the past six decades, RSICC has served as an official modeling and simulation (M&S) code and data repository for the U.S. DOE and its predecessors. RSICC's distribution of M&S tools and data has helped to promote international cooperation in many areas of nuclear science and technology. Over the past decade, RSICC has distributed over 21,000 copies of the MCNP® code that is the most in-demand M&S tools for use in nuclear data evaluation and testing to customers throughout the World. Over the same period, RSICC has provided software to persons from 84 different countries in full compliance with the myriad of U.S. Federal export control regulations. With the dependency of the nuclear scientific community on these M&S tools, RSICC remains committed to its mission to provide these tools to the international community while ensuring compliance with U.S. Federal export control regulations.

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