POLICY ISSUE

(Information)

October 24, 2014 SECY-14-0117

FOR: The Commissioners

FROM: Mark A. Satorius
Executive Director for Operations

SUBJECT: THE RADIATION PROTECTION COMPUTER CODE ANALYSIS AND MAINTENANCE PROGRAM

PURPOSE:

The purpose of this information paper is to describe the staff's integrated plan for developing, maintaining, and distributing the U.S. Nuclear Regulatory Commission's (NRC's) radiation protection, dose assessment, and emergency response computer codes. This new initiative is called the Radiation Protection Computer Code Analysis and Maintenance Program (RAMP).

SUMMARY:

The NRC has, over the years, developed numerous radiation protection, dose assessment, and emergency response computer codes. These codes are used by NRC staff, other Federal agencies, Agreement States, licensees and international partners. This paper summarizes the history and current status of these codes, the value of RAMP, and the benefits to both the NRC and its stakeholders. This paper also discusses alternatives to RAMP, current activities, and future plans for the program.

RAMP is a new Office of Nuclear Regulatory Research (RES) initiative that is patterned after similar successful cooperative code-sharing programs for thermal hydraulic and severe accident computer codes. The thermal hydraulic program is called the Code Application and Maintenance Program (CAMP) (SECY-97-0134, "Commercial Use of NRC Developed Thermal Hydraulic Codes by Non U.S. Organizations," dated June 24, 1997), and the severe accident

CONTACTS: Stephanie Bush-Goddard, Ph.D. RES/DSA
301-251-7528

John Tomon, RES/DSA
301-251-7904

computer code program is called the Cooperative Severe Accident Research Program (CSARP). All NRC codes to be included in the RAMP program and their descriptions are listed in the Enclosure.

DISCUSSION:

History of Radiation Protection Code Development

Radiation Protection (RP) codes are used for a wide variety of purposes, such as the calculation of dose to personnel resulting from unplanned exposures, and the calculation of radiological consequences of planned or accidental releases of radioactive material to the environment. Most codes are written in older versions of the FORTRAN and BASIC programming languages, and use parametric data which was state-of-the-art at that time. In many cases, both the computer programming languages as well as the parametric data are no longer current and therefore present challenges that need to be addressed.

Historically, RP code development has not been integrated because these codes span a wide range of stakeholders (e.g., NRC, other Federal agencies, and Agreement States) and most licensee categories (e.g., reactor, materials, and decommissioning). Some codes are actively developed and maintained by staff and/or contractors, while others are not as actively maintained, and sometimes may not be updated until there is an immediate programmatic need (such as a licensing action), or to conform to an operating system change (e.g., upgrading to Windows 7). Additionally, the degree of implementation of software quality assurance (SQA) among the RP codes tends to differ, based on the needs of stakeholders. These practices, over the years, have resulted in codes that may not be completely compatible or consistent, even though they calculate very similar endpoints (e.g., doses).

Additionally, RP codes have evolved over the years based on various international events. For example, lessons learned from the Fukushima Dai-ichi event provided the impetus for high priority enhancements to the Radiological Assessment System for Consequence Analysis (RASCAL) emergency preparedness code. As a result, RASCAL now has more advanced atmospheric dispersion inputs and outputs than other radiation protection/atmospheric dispersion codes in RAMP.

Many of these RP codes have been transferred to RES under User Need Requests to update, develop and maintain these codes. Because of this, the staff has identified the benefit of a consolidated RP code program that will provide systematic and consistent SQA, code maintenance and distribution with input from many stakeholders (e.g., NRC, other Federal agencies, Agreement States, industry and International users) and across all licensee categories.

RAMP Vision and Mission

RAMP will establish an integrated NRC program to prioritize, maintain and update all of the NRC's RP codes, establish a more robust SQA program, control distribution of the codes to users outside of the NRC, and maintain user forums in which users may discuss the use of the codes and seek answers to specific problems that they may encounter with the codes. This will enable the NRC to maintain the integrity of the RP codes and control the future code development. RAMP will be implemented in phases.

Phase I will include RP computer codes that have been fully developed and maintained with NRC funds. Consistent with resource considerations, specific goals of RAMP are to ensure that:

- computer models and data are appropriately updated (e.g., atmospheric and dosimetric models and International Commission on Radiological Protection coefficients) and systematically incorporated into codes while maintaining the ability to evaluate doses based on models and/or parametric data recognized by NRC regulations and/or guidance,

- each code will have a software modernization plan that includes rewriting the code to reflect computer programming language updates, ensure short- and long-term planning for proper code operation under newer operating systems (e.g., Windows 7 and Mac OS), and ensure the consideration of compatibility and security requirements,

- code updates are in accord with NRC regulations and guidance documents,

- codes are updated based on lessons learned from events such as Fukushima and other international or domestic events,

- there is consistency with other NRC computer code programs and policies (e.g., policy on distribution of codes and software quality assurance),

- costs are shared among users of the codes, and

- there is a centralized management structure within RES to address reporting, prioritizing, and resolving code issues and code updates. This structure will be described in a RAMP charter and code development plan.

Phase II will expand RAMP to include atmospheric dispersion computer codes that support dose assessments, as well as computer codes and other partially sponsored RP codes used by the NRC. The phases of RAMP are also listed in the enclosure.

Participation in RAMP

RAMP, like CAMP and CSARP, will seek the participation of both domestic and international members as a part of the NRC's cooperative research program. International and domestic members of RAMP will be expected to contribute funds and/or "work-in-kind" to support the program. The funds collected from RAMP members will help to off-set the cost of the program for the NRC. However non-commercial domestic members, such as Agreement States, universities and Federal agencies, will be generally exempted from contributing funds.

For international members, contributions will be negotiated individually with each entity through international research agreements specific to RAMP. For domestic members, contributions will be negotiated with each organization through non-disclosure agreements and domestic RAMP agreements.

The benefits to RAMP members include:

- access to the most current versions of each code within RAMP,
- code maintenance, development, benchmarking, and uncertainty studies,
- a cooperative forum to resolve code errors and inefficiencies,
- technical basis documents and user guidelines for applying the codes, and
- periodic meetings to share experiences, discuss code development, and to be trained on the codes.

Alternatives Considered and Path Forward

During the development of RAMP, the staff considered several alternatives. The staff considered expanding the well-established CAMP and CSARP programs to include RP codes, but because RAMP involves a significantly different group of stakeholders, incorporation of the RP codes into these existing programs would be difficult. The staff also considered asking RP professionals at Federal agencies, such as EPA and DOE, or international agencies, such as the Nuclear Energy Agency, to share in control of the program. However, the staff decided not to pursue these alternatives because most of the codes within RAMP were developed by the NRC to support the agency's mission, and for this reason, the staff concluded that control of RAMP should remain with the NRC. Finally, the staff considered continuing the current RP code development practices where only NRC resources are expended. The staff decided that this was an inefficient use of the NRC's resources. Therefore, the staff has concluded that the establishment of a systematic and centralized cooperative program is warranted.

To implement RAMP, the staff is carrying out the following activities:

- Outreach Activities: The staff presented RAMP to a number of internal and external stakeholders, including International partners, Agreement States, participants at the Regulatory Information Conference, and to participants at various Health Physics Society and other RP forums. So far, fifteen stakeholders have expressed interest in joining RAMP.
- International Research Agreements: The staff is currently developing international research agreements with four countries (i.e., the Republic of Korea, South Africa, Canada, and the United Arab Emirates) and the Taiwan Economic and Cultural Representatives' office that have expressed interest through our outreach activities. Staff anticipates the first five agreements to be signed at the beginning of calendar year 2015. Other countries that have shown an interest in joining RAMP are Switzerland, India, Finland, and Brazil.
- Domestic Agreements: The staff is developing nondisclosure agreements, user forums, and training for eight domestic members of RAMP.

- Financial and Procurement Plans: The staff is actively transitioning and modifying current contracts that develop and maintain the RP codes that will be included in RAMP to align them with the RAMP goals. In addition, the staff will be procuring a contract for the overall administrative management of RAMP. This RAMP contract will provide for invoicing and receipt of funds from international RAMP agreements, coordinating with all the individual RP code development contractors for code distribution and coordinating the semi-annual RAMP meetings.

Future plans for RAMP include incorporating other partially sponsored NRC codes (see Enclosure). Other plans include combining codes, where possible, for greater efficiencies and taking advantage of modern programming to allow for common application frameworks. These frameworks will allow for the programming of flexible input and output modules that make code updates easier. The staff will inform the Executive Director for Operations (EDO) of the implementation of RAMP international research agreements through EDO Daily Notes and will update the Commission on the status of RAMP once the program is well established.

RESOURCES:

Resources for RP code development and maintenance have varied over the years, but on average, are approximately $500,000 per year and 2.5 full-time-equivalents (FTE). Resources for startup of the RAMP infrastructure are included in the fiscal year (FY) 2015 budget for $200,000 and 0.25 FTE. We anticipate that the infrastructure funding needed to manage the RAMP in the future will be funded primarily by RAMP member fees. Resources for FY 2016 and beyond for both the RP code development and RAMP infrastructure will be addressed in the Planning, Budgeting, and Performance Management process.

COORDINATION:

The Office of the General Counsel has reviewed this Commission paper and has no legal objection. The Office of the Chief Financial Officer has reviewed this Commission paper for resource implications and has no objections.

/RA/

Mark A. Satorius
Executive Director
for Operations

Enclosure:
Codes in the Radiation Protection
Computer Code Analysis and
Maintenance Program (RAMP)

Codes in the Radiation Protection Computer Code Analysis and Maintenance Program (RAMP)

Computer Code Name	Purpose/Description	Language and Platform	Uses (e.g. Routine/ Design Basis/Severe Accident/Emergency Response)
RAMP – Phase I Codes – NRC fully sponsored with active contracts (except where noted)			
RASCAL Radiological Assessment System for Consequence Analysis	Makes dose projections from atmospheric releases during radiological emergencies	Language: Visual Basic and Fortran Operating System: Windows	Emergency Response
RADTRAD Radionuclide Transport and Removal and Dose Estimation	Assesses occupational radiation exposures, typically in the control room, to estimate site boundary doses and to estimate dose attenuation due to modification of a facility or accident sequence	Language: JAVA Operating System: Windows, OS X	10 CFR Part 50 Design Basis Accidents
VARSKIN Computer Code for Skin Contamination Dosimetry	Makes confirmatory calculations and/or independent analysis of licensees' events regarding skin dose (from both beta and gamma sources) estimates at any skin depth or skin volume	Language: C/C++ Operating System: Windows, OS X	10 CFR 20.1301 Skin Dose Requirements
HABIT Computer codes for evaluation of control room HABITability	Evaluates control room habitability in the event of an accidental release of toxic chemicals	Language: Fortran 77, Basic Operating System: Precursor to Windows	Design Basis Accident

Computer Code Name	Purpose/Description	Language and Platform	Uses (e.g. Routine/ Design Basis/Severe Accident/Emergency Response)
PIMAL Phantom with Moving Arms and Legs, (This is a graphical user interface, not a computer code)	A phantom model for developing exposure models and performing dosimetry calculations for radiation workers and exposed members of the public	Language: JAVA Operating System: Windows, OS X	Used for all types of dose calculations
Radiological Toolbox (this is a database, not a computer code)	A database of dose coefficients, interaction coefficients for alpha, electron, photon and neutron radiations, nuclear decay data, biological and physiological data, and supplemental information on various topics	Language: Visual Basis Operating System: Windows	Used for all types of dose calculations
DandD Decontamination and Decommissioning	Makes dose projections from residual soil or building contamination following decontamination and decommissioning	Language: FORTRAN, C++ , and Visual Basis Operating System: Windows	Decommissioning
GALE Gaseous and Liquid Effluents	Calculates the releases of radioactive material in gaseous and liquid effluents	Language: Fortran 77 Operating System: Windows	Routine Licensing
LADTAP (Legacy Code – Not Active)	Calculates radiation doses to humans from routine liquid effluent releases	Language: Fortran 77 Operating System: Precursor to Windows	Routine Licensing
GASPAR (Legacy Code- Not Active)	Calculates radiation doses to humans from routine gaseous effluent releases	Language: Fortran 77 Operating System: Precursor to Windows	Routine Licensing

Computer Code Name	Purpose/Description	Language and Platform	Uses (e.g. Routine/ Design Basis/Severe Accident/Emergency Response)
RAMP – Potential Phase II codes – NRC Atmospheric Dispersion Codes and Partially Sponsored NRC codes			
XOQDOQ	Atmospheric Dispersion code for routine operational releases	Language: Fortran Operating System: IBM	Routine Licensing
PAVAN	Atmospheric Dispersion for design-basis accident releases to the exclusion area boundary and outer boundary of the low population zone	Language: Fortran Operating System: IBM	Design Basis Accidents
ARCON96	Atmospheric Dispersion for design-basis accident releases to the control room and technical support center	Language: Fortran, Visual Basic Operating System: IBM	Design Basis Accidents
RADTRAN	Calculates doses for normal and accident transportation scenarios	Language: Fortran Operating System: Windows	Transportation
RESRAD Family of Codes	Calculates dose from residual contamination for compliance determination with Subpart E of 10 CFR Part 20	Language: Fortran Operating System: Windows	Decommissioning
MILDOS-AREA	Calculates doses to members of the public from conventional uranium mills and uranium in-situ recovery facilities during operations	Language: Fortran Operating System: Windows	Uranium Mills
VSP	Describes Visual Sampling Methods	Language: Fortran Operating System: Windows	Decommissioning

Computer Code Name	Purpose/Description	Language and Platform	Uses (e.g. Routine/ Design Basis/Severe Accident/Emergency Response)
Legacy NRC sponsored codes distributed by the Department of Energy's Radiation Safety Information Computational Center			
RABFIN (legacy code – not active for over 20 years)	Calculates Doses from noble gases of gaseous effluents	Language: Fortran Operating System: Precursor to Windows	Licensing
PARTS (legacy code – not active for over 20 years)	Calculates Doses from iodine and particulate portions of gaseous effluents	Language: Fortran Operating System: Precursors to Windows	Licensing
RATAF (legacy code - not active for over 20 years)	Calculates Doses of Radioactive liquid tank failures	Language: Fortran Operating System: Precursors to Windows	Licensing
NRC – Sponsored Dose Assessment Codes in CSARP			
MACCS2	Used to calculate doses for severe accidents	Language: Fortran Operating System: Windows	Probabilistic Risk Assessment