

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT

SUBJECT: Practical MCNP for the Health Physicist, Rad Engineer, & Medical Physicist—Software Training Course (20.01402.158)

DATE/PLACE: May 6–10, 2002, Los Alamos National Laboratory, Los Alamos, New Mexico

AUTHOR: Oleg Povetko

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AUTHOR: Oleg Povetko

PERSONS PRESENT:

Richard H. Olsher, David T. Seagraves, Instructors, ESH-4 Health Physicis Measurements Group, Radiation Instrumentation and Calibration Team, LANL.

Participants: Oleg Povetko, Southwest Research Institute, George Baily, University of Nevada, Las Vegas, Hazel Barclay, Sandia National Laboratories, Lance Bollinger, Sandia National Laboratories, Michael Bonvento, Stony Brook Universal Hospital, SUNY, Dale Boyce, NRX Acquisition Corp., Paul Demopoulos, Yale University, Eduardo Farfan, LANL, Kathleen Gruetzmacher, LANL, Bruce Heimiller, Chalk River Laboratories, Atomic Energy of Canada Limited, Anthony Huffert, U.S. Nuclear Regulatory Commission (NRC), Bryce Knight, General Dynamics, Sam Kuo, American Electric Power Nuclear Generation Group, Gregory Macievic, National Institute for Occupational Safety, Thomas McLean, LANL, HSR-4, Leslie Miles, LANL, HSR-1, Steve Myers, Eberline Services, Jerry Simiele, Washington Group International, Inc., Evaldo Simoes de Fonseca, Instituto de Radioprotetas e Dosimetria, Brazil, Jeffrey Vollmer, ABC Laboratories, Robert Winslow, Bechtel National Inc., Roger Wishau, LANL, HSR-1.

BACKGROUND AND PURPOSE OF TRIP:

MCNP is a software approved by NRC for criticality and radiation dose analyses by licensees and NRC staff. The purpose of the trip was to receive training in the application of the code to radiation dose analyses.

SUMMARY OF PERTINENT POINTS:

The training course was taught not by the code developers, but by the specialists from LANL ESH-4 Health Physics Measurements Group, Radiation Instrumentation and Calibration Team. They provided step-by-step instruction in proper application of the software to the dose analyses using practical examples from the day-to-day activities of the Health Physics Measurements Group and LANL operations.

SUMMARY OF ACTIVITIES:

Participated in one-week long training course from 8 to 5 pm daily.

Day 1: There was a half-day overview of a Monte Carlo method application for the particle transport problem and MCNP method. The method's advantages and disadvantages were covered. The second half-day was devoted to MCNP input files, material cell definitions, methods of defining geometry and materials and plotting the input.

Day 2: This portion covered cell definitions, cell geometry, coordinate transformations, tallies, source definitions. Practical exercises followed when course participants were given a chance to solve and plot some simple source and cell geometries in MCNP. Answers were presented only after most of participants completed their exercises.

Day 3: This part covered dose and exposure calculations with examples from LANL Health Physics group day-to-day activities and from some practical situations encountered in medical facilities utilizing radioactive materials. Dose calculations using Heating Number Method and KERMA approximations were presented and explained. References to various publications were provided as sources for Fluence to Dose Conversion Factors for photons and neutrons: ICRP-74, ANSI/ANS-6.1.1-1977, NCRP-38, ICRP-60.

Day 4: This day was devoted to the review of the statistical checks, variance of the tallies, variance of the variance of the tallies, efficiency of the conducted run, history score probability density functions, variance reduction techniques. Practical exercises illustrating various variance reduction techniques, followed. One complicated problem of photon skyshine was presented. It was illustrated further by the Nuclear Science and Engineering journal article described, the skyshine experiment conducted by the Kansas State University and following analyses done at LANL utilizing MCNP code.

Day 5: Three practical applications of the software were presented for class exercises with following explanations. Photon spectrum presentation that imitated Multichannel Analyzer using MCNP plot, bremsstrahlung transmission and Photon Spectrum for a NaI(Tl) scintillator were presented.

Diskettes with class exercise input/output files were distributed at the end of the class. The software manual was available for the course participants as part of the course materials although the instructors tried not to refer to the manual, but rather referred to their class presentations of the software features.

All exercises made a lot of practical sense from the point of view of Health Physicists, Radiation Engineers, Radiation Workers and Medical Physicists, although no complex problems were presented.

The leader of the code development group, Forest B. Brown, reported news on code development, such as new options, enhancements and degree of readiness for release of MCNP5 beta version, proposed changes to the Tallies Section of the MCNP4C Manual (Chapter 2, Sections V.A.-V.C.), integration of MCNP Visual Editor into the future versions. These code development news can be monitored at the MCNP website: <http://www-xdiv.lanl.gov/XCI/PROJECTS/MCNP>. Limited offer of help based on time availability was announced.

The course syllables are presented in Attachment 1.

CONCLUSIONS:

The course provided good beginner training in the application of the code to dose analyses for simplified configurations and simplified radiation sources. Instructors selected various simplified practical examples to demonstrate a wide range of the code capabilities. The course was well-structured, taught with even and balanced pace and rhythm. The instructors were readily available for help during class exercises. No complex examples with various environmental media or radiation transport inside and around complex radiation machines were presented during the course.

PROBLEMS ENCOUNTERED:

None

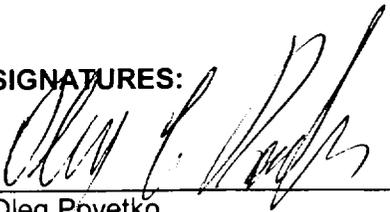
PENDING ACTIONS:

None

RECOMMENDATIONS:

Training course is recommended for other Center staff who seek a beginner course in Health Physics dose analyses applications of MCNP code.

SIGNATURES:



Oleg Povetko
Research Engineer

^{O.P.}
7/22/2002

Date

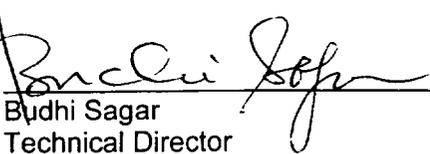
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Date