CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT

SUBJECT: Genie-PC System Operation, Canberra Industries Short Course
20-5704-063
20-5704-073

DATE/PLACE: September 12–16, 1994
Meriden, CT

AUTHOR(S): Paul Bertetti (CNWRA)
James D. Prikryl (CNWRA)

DISTRIBUTION:

CNWRA	NRC-NMSS	NRC-RES	SwRI
J. Latz	J. Linehan	B. Morris	S. Rowe (Contracts)
W. Patrick	S. Fortuna	F. Costanzi	
Directors	B. Siltenpole	W. Ott	
Element Managers	B. Meehan	J. Randall	
GS Group	M. Federline	L. Kovach	
	D. Brooks	G. Birchard	

100068

4/26.1
WM-11
NH15

delete all distribution except: CF, PDR + NUDOCS full text

CENTER FOR NUCLEAR WASTE REGULATORY ANALYSES

TRIP REPORT

SUBJECT: Genie-PC Systems Operation
Canberra Industries Short Course

DATE/PLACE: September 12-16, 1994
Meriden, CT

AUTHOR(S): F. Paul Bertetti (CNWRA)
James D. Prikryl (CNWRA)

PERSONS PRESENT: See attached list

BACKGROUND AND PURPOSE OF TRIP:

To support Center for Nuclear Waste Regulatory Analyses (CNWRA) Natural Analogs and Sorption Projects, a gamma spectrometry system was acquired through Southwest Research Institute (SwRI) capital equipment program. Because gamma spectrometry is suitable for a wide range of sample types (solids, liquids or gasses in a variety of geometries), it is particularly flexible in the analysis of radionuclides. Additionally, gamma spectrometry requires little sample preparation and no chemical pretreatment. Fortunately, most radionuclides relevant to high-level waste (HLW) research emit photons as part of their decay schemes. It is anticipated that the gamma spectrometry system purchased will provide a means to measure uranium (U) and thorium (Th) decay series isotopes in natural samples and aid in the characterization of isotope standards. The gamma spectrometry system is a Canberra Nuclear Industries product and is comprised of a low energy germanium detector with cryostat and shielding, ethernet based data acquisition and electronics modules, and an OS/2 based operating and analysis software package. Training in the system software and hardware was arranged as part of the purchase agreement.

Canberra Industries offers several courses related to the nuclear industry. The "Genie-PC Systems Operation" (course no. SU-450-5) course provides instruction and training in the operation of the OS/2 based software that is part of the integrated gamma spectrometry system as purchased by CNWRA. Class size is typically limited to no more than six persons. The course covers the fundamentals of gamma spectrometry, details of software operation, and laboratory exercises designed to illustrate the practical aspects of utilizing the software with a variety of equipment setups. As taught, the five-day course content provides flexibility to concentrate on areas of particular interest to students. J. Prikryl and P. Bertetti attended the course in support of the Natural Analogs (20-5704-063) and Sorption Projects (20-5704-073), respectively.

SUMMARY OF PERTINENT POINTS:

The course consisted of a combination of lectures and laboratory sessions. Lectures focused on details of Genie-PC software operation including companion packages such as a quality assurance application and the counting procedure program known as ProCount. Laboratory sessions consisted of equipment setup, file management, calibration, analysis of samples, and report generation. The course also included

material on hardware/software features specific to Canberra germanium detectors and electronics. A guided tour of the Canberra production facilities was also provided. Copies of the course notes and agenda are available from the authors.

SUMMARY OF ACTIVITIES:

Monday, September 12

Following a quick overview of OS/2 and Presentation Manager, the class briefly reviewed the basics of photon emission and photon interactions with matter. Principles of system operation including detector operation and performance, pulse processing circuitry, and sources of background were covered. An overview of the Genie-PC software was presented. Genie-PC excels in the multi-tasking environment provided by OS/2 and is particularly suited to germanium detectors. The software consists of several subprograms including editors for definition of hardware, certificate files and nuclide libraries. The main portion of Genie-PC is contained within the spectroscopy assistant subprogram. Spectroscopy assistant is comprised of a gamma analysis application, an multi-channel analyzer (MCA) control application, and an optional quality assurance application. These applications form the core of the operation of Genie-PC.

Following the software overview, acquisition hardware was setup and optimized for counting. Four different hardware setups were available. These setups covered a range of hardware configurations. Manual and programmable high-voltage sources, MCAs and analog to digital converters (ADCs) and both PC-board based and ethernet based systems were utilized.

Tuesday, September 13

Day two consisted of fine-tuning the hardware setup and completing an energy and efficiency calibration for each detector. Certified multi-element gamma sources were used to perform the calibration. Once a certificate file is created for a calibration source, Genie-PC automatically corrects for decay. For each geometry, a calibration file is created which contains both energy and efficiency calibration information. Calibration of the detector using the system software is straightforward and provides a number of user defined options. A number of peak locate and curve-fit algorithms are included.

Wednesday, September 14

Day three focused on data collection and analysis. After collecting sample and background spectrums, analyses were run to determine peak location, apply the calibration, and correct for efficiency, background, and interference to identify nuclides of interest and determine the quantity present in the sample. Each of these tasks can be user defined and customized as well as edited for automatic processing. Included in the analysis lab were methods of report generation and hardcopy printout.

In the afternoon Mike Barnowski gave an overview presentation on the operation of the ProCount program and its relationship to Genie-PC. Essentially, ProCount is a "shell" that provides easy access to routine sample counting and analysis procedures. ProCount also acts as a mechanism to limit user access to certain tasks, thus minimizing the chances of inadvertent changes to the system's programmable hardware parameters.

Thursday, September 15

The morning session consisted of a review of the calibration and analysis procedures developed the previous day. The quality assurance applications package was also reviewed. The laboratory focused on setup of appropriate QA databases and generation of QA tracking reports for the system. Additionally, the class covered topics such as report customization, editing of batch programs for automated analysis, and detailed operation of the MCA control application.

During the afternoon session, the class toured the detector fabrication facilities at Canberra. There was ample opportunity to discuss benefits of the different detector and cryostat types available. Methods to minimize interference and background signals were also discussed. As a result of the tour and subsequent discussions with the Detector Products Manager, Mr. James Colaresi, we were able to modify the selection of material for our detector window to better suit our needs.

Friday, September 16

Work on the last class day consisted of the measurement of unknown samples. The class practiced the identification and quantification of single and multiple isotope standards supplied by the instructor.

IMPRESSION/CONCLUSIONS:

The class was attended to provide training with the Genie-PC system prior to delivery of the system. The course adequately covered the basic operation of the hardware and software to the extent that we feel comfortable with the capability to be "up and running" as soon as possible after delivery of the gamma spectrometer. The class covered a number of topics including some reserved for other courses (Canberra offers separate courses for ProCount operation and batch file programming) which were of significant help. By enabling us to resolve questions and experience problems beforehand, the training should eliminate many of the typical hardships associated with new equipment setup and operation.

Unfortunately, the class was a bit slow paced and some aspects could have been covered in more detail. An area that could have been enhanced was the analysis and interpretation of collected gamma spectrums. For instance, the types of pitfalls that can occur and natural background signals that are likely to be present were discussed in lecture but not adequately emphasized during the lab sessions. Also, material regarding report template editing should have been expanded. Some work is needed by Canberra to ensure that hardware/software/manual errors are corrected. These and other comments were forwarded to the instructor and training coordinator.

Overall, the course provide a more detailed and thorough review of the system operation than could have been accomplished, for about the same cost, in one or two days of on-site training after delivery. This is especially true since hardware similar to that purchased by CNWRA was available in-class. Discussions with experienced Canberra personnel also aided in the adjustment of our system to reduce natural background from U and Th. As a result, a carbon fiber window was substituted for the beryllium (Be) window originally planned for delivery.

PROBLEMS ENCOUNTERED:

None.

RECOMMENDATIONS:

Proper training in the operation of newly acquired equipment is essential. Even if the persons involved have a strong theoretical background and prior analysis experience, the nuances of hardware or software operation can result in setup or communication problems that degrade the usefulness of the acquired equipment (within SwRI and CNWRA we could cite several examples). It is recommended that investigators make an effort to include adequate training with the purchase of new equipment and ensure that this training is accomplished as near as possible to the expected delivery date.

REFERENCES:

None

SIGNATURES:

Paul Bertetti
Research Scientist

20 Sep 94
Date

Jim Prikryl
Scientist

9/20/94
Date

CONCURRENCE SIGNATURES:

H. L. McKague
Manager, Geologic Setting

9/26/94
Date

Budhi Sagar
Technical Director

9/27/94
Date

COURSE ATTENDEES

P. Bertetti (CNWRA)
J. Prikryl (CNWRA)

W. Minor
Department of Health
Commonwealth of Virginia
Richmond, VA

R.B. Smith
Canberra Industries
Field Service Representative
2 South Mars Drive
Sewell, NY 08089

L. Johnson
Canberra Industries
Field Service Representative
333 LaFayette
Apt. 18A
Brooklyn, NY 11238

D. Drop
Canberra Nuclear
800 Research Parkway
Meriden, CT 06450

Instructor

E. Masswood
Applied Systems Division
Canberra Nuclear Industries
800 Research Parkway
Meriden, CT 06450