INL/CON-11-23798
PREPRINT

Education and Training in Radiochemistry – The NAMP Initiative

ICONE20

Patricia Paviet-Hartmann
Mansour Akbarzadeh

August 2012

Proceedings of the 20th International Conference on Nuclear Engineering
ICONE20
July 30 – August 3, 2012, Anaheim, California, USA

ICONE 20 - 54051

EDUCATION AND TRAINING IN RADIOCHEMISTRY – THE NAMP INITIATIVE

Patricia Paviet-Hartmann
Idaho National Laboratory
995 University Place
Idaho Falls, ID 83402, USA
Phone: 208-533-7816
Patricia.Paviet-Hartmann@inl.gov

Mansour Akbarzadeh
URS Safety Management Solutions LLC
Carlsbad, NM, 88220, USA
Phone: 575-234-5516
Mansour.Akbarzadeh@wipp.ws

ABSTRACT

In 2009, the nuclear industry employed approximately 120,000 people. Nearly 38 percent of this work force will be eligible to retire within the next five years. To maintain current levels, the industry will need to hire approximately 25,000 more workers by 2015 [1]. Given that the current radiochemistry workforce is approaching the age for retirement and that a limited number of universities in the United States (U.S.) provides radiochemistry curriculum, this country is faced with a growing demand for the education and training of scientists in the radiochemistry arena. Furthermore, it is critical for the U.S. to maintain global leadership in the next generation of safe nuclear energy technology from both a national security and an environmental perspective. This will require a robust program that focuses entirely on educating and training the next generation of radiochemists in subjects such as radioanalysis of actinides and radioelements not only in the environment, but also in medium pertinent to the back end of the nuclear fuel cycle; speciation of radionuclides; detection methods; safeguards, etc. Therefore, the National Analytical Management Program (NAMP) has organized a subcommittee focused on training and education in radiochemistry [1]. Through the efforts of this subcommittee, NAMP has established collaborative associations to foster the exchange of scientific and technical information with professors in radiochemistry programs at different universities. This paper presents our accomplishments and highlights our plans for the development of a curriculum for an intermediate radiochemistry course in cooperation with the U.S. Environmental Protection Agency (EPA). Short (2-hour) webinar presentations on specific radiochemistry topics have been developed and will be offered as interactive on-line conferences. The webinars will be recorded and archived to become a library or collection of seminars for on-line access from the NAMP website.

INTRODUCTION

The U.S. Department of Energy (DOE) Office of Environmental Management (EM) authorized the Carlsbad Field Office (CBFO) to reestablish the National Analytical Management Program (NAMP) and to create a DOE Environmental Response Laboratory Network Coordination Office in support of the Integrated Consortium of Laboratory Networks (ICLN) effort to establish an effective, integrated response in a national emergency. Thereby, NAMP serves as a central focal point to coordinate analytical resources within the DOE complex and help other federal agencies or organizations, both national and international, gain access to the analytical capabilities and expertise within the participating laboratories. Furthermore, NAMP addresses national technological and resource needs and promotes training and education.

NAMP membership is open to all laboratories within the DOE complex and laboratories contracted to support DOE activities. The NAMP organization is guided by a steering committee whose members represent DOE, other federal agencies, and DOE contractors. Roles and commitments will be established through memoranda of agreement between responsible federal agencies. The chairperson, designated by the manager of the CBFO, presides at NAMP and steering committee meetings. Committee members participate as technical liaisons and actively support working groups. Separate subcommittees leverage support through collaborative working arrangements or seek input from organizations outside of NAMP, such as universities. The chairperson coordinates the work of the officers and committees in order that the objectives and NAMP mission may be promoted.

NAMP OBJECTIVES AND GOALS

The NAMP has established five objectives and associated goals designed to accomplish mission requirements and to achieve its vision.

The first NAMP objective is to provide a single source of DOE national analytical capabilities by 1) identifying and engaging laboratories not currently participating in NAMP, 2) creating and marketing a compendium of current laboratory capabilities, 3) identifying laboratories with unique expertise to support fields such as medical isotopes, radiological dispersive devices (RDD), and forensics, and 4) establishing an integrated funding mechanism that provides for auditable, legal processes.

The second objective is focused on promoting training and education in radiochemistry by 1) identifying and advertising current training courses and available radiochemistry training, 2) identifying and engaging collaboration between universities, government agencies, national labs and the private sector and establishing centers of excellence, 3) developing webinars and advertising them at the national and international level, and 4) developing accreditation.

The third NAMP objective is to address national technological and resource needs. To achieve this objective, goals have been defined to 1) evaluate national analytical chemistry needs, 2) recruit and retain a qualified workforce, and 3) identify advanced emerging technologies.

Finally, NAMP will provide assistance for informed decision making to leadership. This will be achieved through informational meetings with appropriate policy makers, identifying appropriate national committees and organizations, and seeking membership.

NAMP INITIATIVE IN EDUCATION AND TRAINING

Radiochemistry reflects the multifarious applications of radionuclides and radiochemical techniques to nuclear fuel reprocessing/recycling, life sciences, radiopharmacy, environmental studies, etc. [2] (Figure 1). The position of radiochemistry in sciences is rather complex and the achievements of radiochemistry are rarely recognizable in the existing curricula and textbooks both in physics and chemistry [3]. A decrease in opportunities for training in basic radiochemistry and nuclear chemistry may in turn affect the future of these fields. For thirty years, it has been observed that the vigor and magnitude of academic training in nuclear and radiochemistry was declining due to shrinkage in faculty, number of students, and research funding [4].

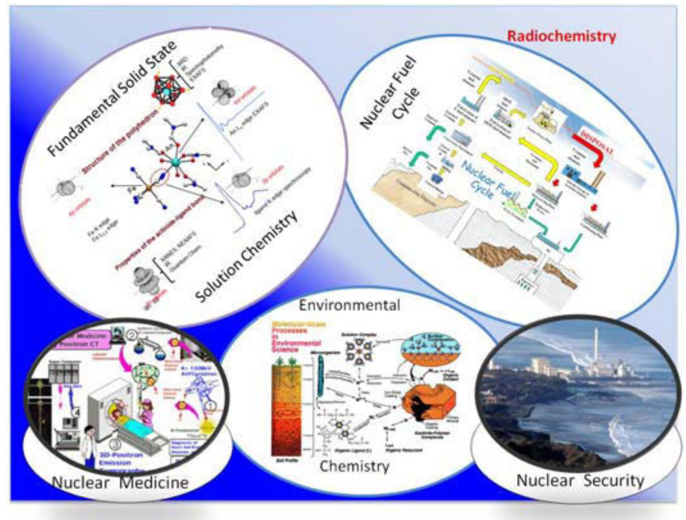

Figure 1: The multifarious applications of radiochemistry

Furthermore, as can been seen in Table 1, the average age for radiochemists at the Idaho National Laboratory (INL), is 47 years, and 21.1% of its workforce holding a radiochemistry degree (bachelor, master, and PhD level) is 55 or older. The INL workforce is typical of other national laboratories. U.S. national laboratories are losing experience in their workforce due to retirement of a substantial number of their "core" groups of radiochemists and nuclear chemists.

Table 1: INL radiochemistry workforce as of June 2011

Education / Age	Other	AA/ AS	BA/ BS	MA/ MS	PhD	Total
25-29	0	0	2	1	0	3
30-34	0	0	0	1	4	5
35-39	0	0	6	2	5	13
40-44	0	0	2	3	8	13
45-49	3	0	4	4	7	18
50-54	0	0	3	2	14	19
55-59	1	0	3	2	4	10
60-64	0	1	2	1	3	7
65+	0	0	0	1	1	2
Total	4	1	22	17	46	90
Average Age	48.75	60.00	45.64	46.71	47.65	47.17
% 55 or above	25.0	100	22.7	23.5	17.4	21.1

On the other hand, the demand for radiochemistry-trained personnel is on the rise with 1) a global demand for energy and concerns about climate change that has accelerated deployment of reactor and fuel cycle facilities worldwide, 2) a continuing build-up of nuclear waste from commercial nuclear plants and stockpile of DOE nuclear wastes stored across the country, 3) continued advances in applied radiation sciences in collaboration with industrial and medical researchers, and 4) a recognition that nuclear science and engineering, and more specifically radiochemistry, continues to be needed in national laboratories as well as in the private sector.

Fortunately, as pointed out by Nitsche [5], the number of bachelor- and master-level degrees awarded in nuclear engineering shows an upward trend for the past several years. In 2006, 31 U.S. academic nuclear energy programs awarded 346 BS degrees compared with 166 in 2003, and the number of MS degrees increased by 214 in the same time span. Award of doctorate degrees remained constant at 70 per year. This upward trend is a result of substantially increased university funding and research fellowship programs such as the Nuclear Energy University Program (NEUP). A good example of this, is the radiochemistry program developed by Prof. Czerwinski at the University of Nevada Las Vegas (UNLV), which has awarded 13 doctorate degrees since the inception of the program in 2004.

Despite efforts from academia, a serious decline in the numbers of radiochemistry, nuclear chemistry, and radiation chemistry personnel remains. It is obvious that a growing imbalance exists between the supply of qualified personnel and the demand. Failure to take appropriate steps now to develop the 21st century radiochemistry workforce will clearly jeopardize the future of safe nuclear energy technology.

Therefore, to promote training in radiochemistry and to ensure a qualified workforce is maintained, the NAMP Education and Training subcommittee, in association with the EPA, is creating and making available to the public a series of webinars on topics specific to radiochemistry. These webinars are intended to be of interest not only to students currently pursuing formal education in universities but also to those already in the workforce who may need a refresher course or a better understanding of specific radiochemistry topics. We are seeking to develop world class webinars in radiochemistry that will also be useful to quality assurance officers, data validators, chemists, laboratory technicians, managers, regulators, and others who may benefit from an enhanced understanding of radiochemistry in their work. NAMP has established collaborative associations with professors actively involved in radiochemistry programs at U.S. universities (Table 2) to foster the exchange of scientific and technical information.

Short (2-hour) webinar presentations on specific radiochemistry topics are being developed in cooperation with the EPA and university partners. The webinars will be recorded and archived to become a library or collection of information for on-line access from the NAMP website (https://inlportal.inl.gov/portal/server.pt/community/materials_characterization/698/namp/8457). The webinars will address topics such as 1) general actinide chemistry, 2) radiochemistry in the nuclear fuel cycle, 3) radiochemistry and medical applications, 4) radiochemistry and nuclear fuel fabrication, and 5) medical use of isotopes. Each series will consist of approximately five to eight webinars (Figure 2).

Table 2: University or National Laboratory Partner involved with the development/review of NAMP radiochemistry webinars (as of February 2012).

Name of University	Abbreviation
Oregon State University	OSU
University of California, Irvine	UCI
University of Nevada Las Vegas	UNLV
Idaho National Laboratory	INL
Clemson University	Clemson
University of Iowa	U Iowa
University Texas El Paso	UTEP
Illinois Institute of Technology	IIT

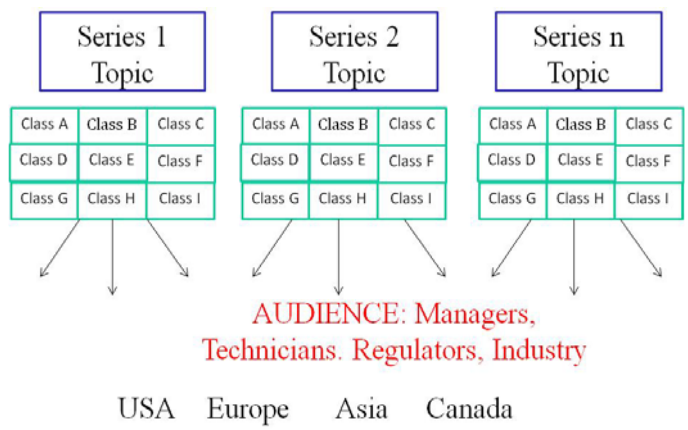

Figure 2: NAMP radiochemistry webinar series development

The first series, entitled "Actinide Chemistry," addresses various topics, and is described in Table 3. The webinars consist of lectures and provide an opportunity for the audience to comment or ask questions. The system is designed for web conferencing and includes many features such as:

- Attendee Registration
- Attendee Questionnaires (education, field of work, interests, etc.)
- Scheduled reminders for the registered participants and follow up questionnaires, if desired.
- Conferencing capabilities for 200-400 attendees at one time.

Table 3: Development of NAMP webinars- Series 1: "Actinide Chemistry"

University or National Laboratory Partner	Title of Webinar
OSU	Overview of Actinide Chemistry
UC Irvine	Uranium Chemistry (general chemical properties of uranium)
INL	Plutonium Chemistry (general chemical properties of plutonium)
UNLV	Analytical Chemistry of Uranium and Plutonium
Clemson	Environmental Chemistry of Uranium and Plutonium
UNLV	Sample Dissolution
U Iowa	Source Preparation for Alpha Spectroscopy

In connection with this activity, we are developing flyers to advertise the webinars (Figure 3).

Figure 3: Example of NAMP radiochemistry flyer to announce webinar in "General Actinide Chemistry" series.

Outreach and informational meetings have been organized with DOE Environmental Management (EM) and the National Nuclear Security Administration (NNSA). Brochures to advertise the NAMP activity in radiochemistry and education are being developed, and participation at several national and international conferences is planned. Information is accessible without restrictions via the NAMP website: https://inlportal.inl.gov/portal/server.pt/community/materials_characterization/698/namp/8457. In addition, participating laboratories and committee members share information on a restricted access web link.

CONCLUSION

"The need for trained radiochemists and nuclear chemists extends beyond the immediate high-visibility programmatic requirements and includes many areas of research for which people trained in these disciplines are required" [4] not only at national laboratories but also in the private sector. The NAMP Education and Training subcommittee, in association with the EPA, is proactive in the development of webinar series that address relevant nuclear and radiochemical topics and issues. The main objective of these webinars is to reach, interest, and educate a broad audience in the radiochemistry arena.

ACKNOWLEDGMENTS

The authors would like thank Oba Vincent from DOE-EM, Dr. Steven Bakhtiar from INL, Dr. John Griggs from EPA, and Berta Oates from Portage, Inc., for their invaluable support.

REFERENCES

[1] Paviet-Hartmann, P., M. Akbarzadeh, S. Bakhtiar, "The Need for Next Generation of Radiochemists in the USA." Transactions of the American Nuclear Society, Vol. 104, p. 101 (2011).

[2] Adloff, J. P., "Information on training in radiochemistry and nuclear techniques." Pure & Appl. Chem, 62(5), 59-1002, (1990).

[3] Macasek, F., "My Five Decades of Nuclear Chemistry in Science Education" (2009). http://biont.eu.sk/Nuclear%20Chemistry%20Education%20by%20Macasek.pdf

[4] National Research Council, "Training requirements for chemists in nuclear medicine, nuclear industry, and related areas." Workshop Report, Washington, DC, February 4-6, 1988.

[5] Nitsche H., "Is there a crisis in nuclear and radiochemistry education in the US?" ANS Embedded Topical Meeting - Isotopes for Medicine and Industry - Manpower and Education, Anaheim, CA, June 11 (2008).
http://www.slidefinder.net/n/nitsche_20ans_20anaheim_20manpower_20and/nitscheansanaheimmanpowerandeducation06-11-08/16414579/p2