

The Need for Next Generation of Radiochemists in the USA

ANS 2011 Annual Meeting

Patricia Paviet-Hartmann
Mansour Akbarzadeh
Steven Bakhtiar

June 2011

The INL is a
U.S. Department of Energy
National Laboratory
operated by
Battelle Energy Alliance



This is a preprint of a paper intended for publication in a journal or proceedings. Since changes may be made before publication, this preprint should not be cited or reproduced without permission of the author. This document was prepared as an account of work sponsored by an agency of the United States Government. Neither the United States Government nor any agency thereof, or any of their employees, makes any warranty, expressed or implied, or assumes any legal liability or responsibility for any third party's use, or the results of such use, of any information, apparatus, product or process disclosed in this report, or represents that its use by such third party would not infringe privately owned rights. The views expressed in this paper are not necessarily those of the United States Government or the sponsoring agency.

The Need for Next Generation of Radiochemists in the USA

Patricia Paviet-Hartmann¹, Mansour Akbarzadeh², Steven Bakhtiar¹

¹Idaho National Laboratory, Materials Fuel Complex, MS 6150, Scoville, ID, 83415, patricia.paviet-hartmann@inl.gov
²URS Safety Management Solutions LLC, Carlsbad, NM, Mansour.Akbarzadeh@wipp.ws

INTRODUCTION

In 2009, the nuclear industry employed approximately 120,000 people. Nearly 38 percent of the nuclear industry force will be eligible to retire within the next five years. To maintain the current work force, the industry will need to hire approximately 25,000 more workers by 2015.¹ The federal government will also need nuclear workers in the future in its laboratories, the military and government programs. There is a need not only for the entire nuclear community to work with the academia to recruit and train students in a standardized way for employment at nuclear facilities. Several strategies are taking place in the USA, as an example, an initiative developed at the Idaho National Laboratory (INL) is the Institute of Nuclear Science and Technology (INEST) with four Centers of Research and Education (COREs) selected to address some of the most challenging issues facing nuclear energy today: 1) Fuels and Materials, 2) Space Nuclear Research, 3) Fuel Cycle, and 4) Safety and Licensing. Another example is the development of a radiochemistry program at two universities: the University of Nevada Las Vegas (UNLV) and Washington State University (WSU) to attract the next generation work force. This paper will solely focus on the next generation of radiochemists needed in the US and will give examples illustrating the needs as well as the current activities in the academia and in the national laboratories to fulfill national needs.

RADIOCHEMISTS IN THE FUEL CYCLE

The nuclear fuel cycle comprises different steps from fuel mining to uranium enrichment and fuel fabrication which can be described as the *front end* of the fuel cycle, to used nuclear fuel disposal or recycling called as the *back end* of the fuel cycle. During all these steps of the nuclear fuel cycle, radiochemists are needed. Radiochemistry, the intersection of the periodic table and the chart of the nuclides, is a scientific discipline that spans a wide range of fundamental and applied research areas. There has been a growing demand in the United States for the education and training of scientists with radiochemistry expertise. This demand is driven by differing factors stemming from a variety of research needs and personnel issues. Radiochemists are required in response to research stemming from the advanced

nuclear fuel cycle, safeguards, and uses of radionuclides; areas of importance to DOE-NE. All this comes at a time when the current radiochemistry workforce in the DOE laboratories, as well as in the nuclear industry is aging and retiring. The future scientists needed to fulfill national needs do not currently exist and must be trained at US universities, and national laboratories.

REACHING OUT STUDENTS

Summer School Program at UNLV

Only a handful of US universities exists where a student can work with and study radionuclides, greatly impacting our ability to solve current and future issues involving radiochemistry. As an example UNLV has developed a radiochemistry summer school in 2010, focusing on fuel cycle issues that can provide the necessary student pipeline for future DOE-NE needs. This school was a 6 week course focusing on undergraduate students, initially given at the University of Nevada, Las Vegas. Courses were created to provide the necessary classroom and laboratory educational opportunities for students. The proposed course leveraged a recently developed lecture series on the modern nuclear fuel cycle that provided an explanation of radiochemical separations from fundamental chemistry to engineering applications. UNLV staff formed the central core of the faculty for this program, with guest lecturers from universities and national laboratories providing background on the latest educational and research opportunities in this field. Twelve students graduated.

INEST - Fuel Cycle CORE objectives

The overarching goal of the INEST Fuel Cycle CORE is to position INL as the domestic and a global leader in key advanced fuel cycle technology areas. INL will utilize and expand its university partnerships to strengthen areas such as actinide science, separations, safeguards, and formation of radiochemists. U.S. influence and expertise in the nuclear fuel cycle is declining and could lag behind countries that are committed to and implementing closed fuel cycle technologies. A development of INL collaborative relationships with key university players is going to significantly strengthen the US and INL educational base.

Outreach trips to several universities and US regional centers are planned to explain the fuel cycle needs, the radiochemists needs, and roles of existing/new technologies. Over the next five years, in addition to continuing several research projects teaming up INL and universities, INL will establish a two to four week summer course on fuel cycle technologies, perhaps affiliated with the World Nuclear University. Its focus areas could be fundamental actinide and material science, advanced separations technologies, and integrated safeguards. It is important that this school not overlap existing summer schools but be complementary.

NO RADIOCHEMISTS – WHAT IS THE IMPACT?

The fields impacted by the loss of radiochemists will be nuclear medicine, nuclear weapon materials, radiopharmaceuticals, environmental science and technology, the nuclear power fuel cycle/waste management, isotope production and new developments. The future vigor and prosperity of American medicine, science, technology and national defense thus clearly depend on continued use and development of nuclear techniques and use of radioactive nuclides. Loss of know-how in this field or failure to develop new uses for the technology could seriously and adversely affect this country's economic competitiveness in many technological and industrial areas. The supply of such scientists has been increasingly inadequate to meet national needs in the several sectors of medicine, science and technology. The annual shortfall of scientists well prepared in nuclear and radiochemistry are impacting a wide spectrum of fields of medicine, technology and security. Since most academic chemistry departments no longer include nuclear and radiochemistry courses in their curricula, many nuclear companies and laboratories are feeling the shortages and it resorts to costly and narrower in-house training of the newly hired chemists.

CONCLUSIONS

US National laboratories and nuclear companies via summer internships, staff exchanges are attempting a stop-gap remedy with in-house courses and on-the-job training by senior staff members. This approach falls short, however, of imparting in a reasonable time "the broader skills, capabilities, and flexibility" that emerge from formal academic training. This is a reality that the nuclear energy industry will need thousands of workers for the future to replace retirees to build and operate new nuclear plants as well as to manage nuclear wastes. Only partnerships between nuclear industry, federal government, nongovernmental agencies, colleges and universities will attract a growing number of students to the nuclear energy field.

REFERENCES

1. <http://www.nei.org/resourcesandstats/documentlibrary/newplants/factsheet/nuclearindustrydevelopsworkforce/>