NRRPT® NEWS

National Registry of Radiation Protection Technologists

Fall 2005 Edition

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INSIDE THIS ISSUE

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Chairman's Message

Kelli Gallion

Greetings fellow RRPT's! I would like to congratulate and welcome our newest members that successfully passed the **NRRPT** exam in August. Your hard work has paid off! Our membership total now stands at 4833!!

Does the date **November 8th, 1895** ring a bell? It was the day that Wilhelm Conrad Roentgen discovered X-rays. On October 14th, 2005, The Conference of Radiation Control Program Directors **(CRCPD)** Board of Directors approved November 6-12, 2005 as the week to recognize Radiation Protection Professionals. This week is dedicated to recognizing Radiation Protection Professionals for their contributions to public safety. In addition, on November 6th, **Keith Dinger** of the Health Physics Society **(HPS)** assisted in enhancing the recognition of the CRCPD's initiative by having a tribute read into the Congressional Record by Senator Domenici (R-NM), Chair of the Energy and Natural Resources Committee. The tribute honored radiation protection professionals and recognized the CRCPD's designation of National Radiation Protection Professionals Week. The tribute includes recognition of the **NRRPT** as a professional organization. On behalf of the entire Registry I would like to thank CRCPD and HPS for their efforts taken to publicly recognize the **NRRPT** and all Radiation Protection professionals. As the tribute reads: "**Thank you to all of the members of the Radiation Protection Profession who make it their life's work to allow government, medicine, academia, and industry to safely use radiation by**

providing the necessary leadership in protecting the public from the hazards of using radiation while reaping its benefits". For more information regarding CRCPD go to http://www.crcpd.org.

"Save the date!!!" Next summer marks the celebration of our **30th** Anniversary in Providence, Rhode Island.

Best wishes, Happy Holidays, and thank you for your continued support!!

Sincerely,
Kelli Gallion

Welcome New Members

Congratulations to the following individuals who successfully passed the **NRRPT** August 13, 2005 examination:

Lea Ann Allen
John R. Arrowood
Jeremy L. Blumenthal
Randy E. Briggs
Doug L. Caldwell
Laurence Casey
Gregg R. Cohn
Anthony M. Durban, III
John R. Ferguson, Jr.
Brian T. Ferris
Gregory A. Garrett
Robert A. George
Daniel K. Gleaves
Rowena M. Gonzalez
Kurt T. Hillmer
John W. Hobbs
Peter E. Hussey
Kenneth D. Irwin
James L. Jaspersen
Frank J. Le Person
Steven P. Leibig
James M. Matz
Bobby A. McDaniel, Jr.
Dustin G. Miller
Warren G. Mortensen
Debra L. Motteshard
Robert K. Newberry
Erin S. Niven
Thomas F. Ricotta
Shane M. Rogers
Jeffrey D. Sandstrom
Daniel S. Simpson
Jason E. Smith
Robert W. Taylor
Jeffrey L. Tidwell
Lawrence E. Towner
Christopher J. Tubman
Donald B. Turpin
James A. Van Dyke
Robert E. Wade

New Members: If you do not have access to the private side of the web page please contact the Executive Secretary (nrrpt@nrrpt.org). She must have your email address on file in order for you to gain access.

NRRPT Board of Directors and Panel of Examiners Mid-Year Meeting

ALL MEMBERS ARE INVITED TO ATTEND THE BOARD OF DIRECTORS MEETING ON JANUARY 14, 2006 !

Please join us in Orlando, FL on January 14, 2006 for our 65th Board & Panel meetings. We will convene our meeting in conjunction with the EPRI Radiation Protection Conference/NATC ALARA Symposium, January 16-18, 2006. To register for the conference go to www.ToPlanAhead.com, click on register for meeting, type in username "tpa" and password "meeting". The conference will be held at the Hilton in the Walt Disney Resort. For hotel reservations call (407) 827-4000. The group rate is: $150 per night.

NRRPT PEP Course information is provided on pages 6 & 7. Hope to see many of our valued members in January!

A General Review of Radiocarbon Dating

By Augustinus Ong, Dartmouth College

The purpose of this paper is to reacquaint ourselves with and to remind ourselves how to apply simple methods from health physics' radio-analytical notes to determine the age of organic sample by the C-14 dating method. In 1952, this method was developed by Willard F. Libby (1908 - 1980), who later won the 1960 Nobel Prize in Chemistry.

The basis for radiocarbon dating relies on the C-14 uptake by a living specimen and its cessation upon death; therefore, the age of an organic specimen can be determined from its residual C-14 fraction. The relative abundance of C-14 at the time of death of a once-living specimen has been estimated, and the change in this C-14 / stable C-12 ratio, can be used to determine the age of material up to several C-14 half-lives (T1/2 = 5730 years). The underlying assumptions are that: (1) the intensity of the source for C-14 production, i.e., the cosmic rays, has been constant over time; and (2) that specific activity of C-14 in the exhangeable carbon reservoir in the environment has also been relatively constant.

Specifically, C-14 is produced in the upper atmosphere through collision of neutrons with nitrogen nuclei, according to the following reaction:

$$\text{N-14} + \text{neutron} \rightarrow \text{C-14} + \text{proton}$$

The C-14 decays by beta emission, according to the following reaction:

$$\text{C-14} \rightarrow \text{N-14} + \text{beta} + \text{antineutrino}$$

Thus, a small fraction of carbon atoms in the atmospheric carbon dioxide molecules will become C-14 in place of non-radioactive C-12. Living plants will take up both radioactive and non-radioactive carbon dioxide in order to make useful organic compounds; and in turn, animals ingest these plants for food. In short, the C-14 materials are circulated and recirculated within the natural food chain. Since living organisms continually exchange carbon dioxide with the atmosphere, the ratio of C-14 to C-12 in a living organism is the same as the equilibrium ratio, which has been estimated to be 1.3 x 10**(-12), in the atmosphere. When that organism dies, it no longer takes in C-14; as a result, the C-14 / C-12 ratio in the dead organism continuously decreases over time.

The number of carbon-14 atoms is determined by measuring their activity in the specimen by using the following equation:

$$\text{Decay Rate} = \lambda\ (\text{N})$$

where, λ is the decay constant (or 0.693 / half life) and N is the number of radioactive nuclei.

I. For example,

An archeological bone containing 500 grams of carbon has a detectable radioactivity of 400 dpm. How old is this bone specimen?

Number of Carbon atoms = [6.02 x 10**23 atoms per mole] divided by 12 grams of carbon per mole

= 5.0 x 10**22 atoms per gram

And, according to the following:

Decay Rate = λ x [(N)] where λ for C-14 = 0.693 / 5730 years,

= (0.693 / 5730 years) x [(1.3 x 10**-12 C-14 to C-12 ratio) x
(5.0 x 10**22 atoms per gram) x (1 year / 3.16 x 10**7 sec) x
(60 sec / min)]

= 15 dpm per gram

Since, the bone sample has 500 grams of carbon:

Total decay rate = 15 dpm per gram x 500 grams = 7500 dpm

To find the age of the bone, we note that after n half-lives, the decay rate decreases by a factor of (0.5)**n. Therefore, find n from

(0.5)**n = sample activity / total decay rate

(0.5)**n = 500 dpm / 7500 dpm

or 2**n = 7500 dpm / 500 dpm = 15

To find n, take natural log to both sides of the above equation to yield:

n ln 2 = ln 15

n = ln 15 / ln 2 = 3.91

The age of the bone is, therefore,

t = n x half-life = 3.91 x 5730 years = 22,400 years.

II. The next example uses another set of equations for determining the date of an archeological sample:

Charcoal samples were discovered in a long-buried ancient campfire. The charcoal contained 100 gram of carbon. The radioanalytical results indicated the charcoal had a C-14 activity of approximately 1000 dpm per 100 gram of carbon or 10 dpm per gram. It is know that in 1 kg of carbon from living specimen yields a C-14 activity of 9.0 x 10**5 dpm or 9.0 x 10**2 dpm per gram of carbon. Use these data to calculate when the campfire was built.

$$N(t) = N(0) \times e^{**}(-\lambda t)$$

where, N(0) is the number of C-14 at time zero, and l is the decay constant for C-14 :

10 dpm per gram = 9 x 10**2 dpm per gram x e ** (- 0.693 / 5730 years) x (t)

111.1 = e ** (- 0.693 / 5730 years) x (t)

ln 111.1 = (- 0.693 / 5730 years) x (t)

4.7 = 1.21 x 10**(-4) per years x (t)

t = 3.9 x 10**(4) years ago.

In conclusion, dating using C-14 radiocarbon has been an important tool for geologists and archaeologists. A case in point is the use of this method to determine the age of the Shroud of Turin, which is purported to be Jesus' burial shroud (see www.mcri.org/shroud.html). There is a limitation of the radiocarbon dating method's lower limit of detectable C-14 activity: The general consensus is approximately 50,000 years, which corresponds to a lower limit of detectable specific activity of 0.03 dpm per gram of carbon.

Message from the Exam Panel Chairman

By Dave Biela

I would like to take this opportunity to talk about the August 2005 exam. This was the first exam that was developed, administered, graded and analyzed totally within the **NRRPT** organization. Several aspects of previous exams were handled through testing centers. The benefit to the registry with the new system was an overall cost savings and a turn around of test results of approximately three weeks. At times in the past, final test results took up to two months. There were some learning curves with the process. The exam responses and answer sheets were always numerical, but the August 2005 exam had the exam responses numerically and the answer sheet alphabetically. This has already been fixed for future exams.

This will be my last news article as the Exam Panel Chairman. I am retiring after six years in this position on December 31, 2005 and Karen Barcal will be taking my place. There is no doubt in my mind that Karen will do an excellent job with moving the Exam Panel forward.

The past six years have really flown by. Looking back at what the Exam Panel has accomplished over these six years has made me feel pretty good. We started out installing a new numbering system for all of our exam questions. The new system allows for a quicker method of identifying a question with the topic that it covers. With the ever expanding exam bank, this turned out to be very useful. Next the expansion of the exam bank became a high priority and it grew over the next few years to a level that allows us to change out all of the questions for every exam given. Prior to this approximately 20% of the questions were changed from one exam to the next. Over the last two years, two major changes took place. The first was an effort to perform all exam functions in house. As mentioned above, the initial cost of equipment will be covered in less than two years and after that there will be a savings to the registry each year. Exam results turn around have also improved. The second

Continued on page 7

PEP Courses
To be provided by the NRRPT

At the 2006 EPRI - ISOE/International ALARA Symposium, the **NRRPT** will provide two PEP courses for your enrichment.

PEP #1 – **A Straight-Forward Approach to Radioactive Material Shipping**

The International Atomic Energy Agency estimates that between 18 and 38 million packages containing radioactive materials are transported each year throughout the world. This material may be radioactive waste, medical isotopes, industrial radiography sources, well logging sources, research materials, and of course nuclear fuel cycle materials. These shipments are made by land transport, air, or by sea.

There are various agencies that regulate the commercial movement of radioactive materials and with minor variations primarily related to how a shipment is documented. The requirements are consistent for the control of exposure to radiation between the International Civil Aviation Organization (ICAO) as implemented through the International Air Transport Association (IATA) regulations, the International Maritime Organization (IMO) as implemented through the International Maritime Dangerous Goods (IMDG) Code, and specific country regulations that address the ground transportation of radioactive materials such as the United States Department of Transportation (USDOT).

Each agency has adopted requirements for the control of package contents and external radiation levels based on the criteria presented in IAEA Safety Standards Series, Requirements, No. TS-R-1 (ST-1 Revised) and it is the basis of these Regulations that will be discussed in this document.

Prior to 1959 the United States Interstate Commerce Commission regulations served as the basis for the various national and international controls for the transport of radioactive materials. The rapid growth of the nuclear industry made the development of controls for the transport of all types and quantities of radioactive materials the highest priority of the IAEA shortly after its formation.

This session will address:

- Properly identify the material to be shipped
- Properly classify a package containing radioactive material
- Properly label and mark a radioactive materials package for shipment
- Properly prepare shipping documentation

Dwaine Brown, RRPT, Lead Radiation Safety Office for Halliburton Energy Services will present this session

PEP #2 – **Basic Shielding Calculations and Understanding Field Applications**

The course will take the student through basic gamma, beta and neutron shield calculation with and without build-up. We will also look at shielding for some of the most common medical isotopes and how the student can reduce weight in shielding for high energy beta emitters. The student will also learn basic half and tenth value calculations for point sources as well as field calculations for line and plane sources.

This course is designed to provide a working level of shield calculations for ALARA personnel, field radiation protection technicians, and provide the basic for the individuals preparing for the NRRPT exam.

Bob Wills, RRPT, Manager of Nuclear Industry Programs at General Engineering Laboratories will present this session.

Each course costs $40.00 if advanced registration is received prior to January 2, 2006. After that time the cost will be $50.00. Questions about each course should be directed to:

Tim Kirkham
Calvert Cliffs Nuclear Power Plant
410-495-6885

Send Registration to:

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P.O. Box 6974
Kennewick, WA 99336
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PEP Course Registration Form

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Total Cost $_____ (to pay by credit card, please call the **NRRPT** office at the number listed above)

Continued from page 5

change came about rather un-expectantly. In 2004, members of the Canadian nuclear industry, Dave Tucker and Jeff Schaefer met with the **NRRPT** Board and Panel in order to establish a Canadian version of the **NRRPT** exam. They wanted to develop the exam and have it ready as soon as possible, and thanks to the efforts of these individuals and the Exam Panel, the exam was ready to go for the August 2005 test date.

I want to thank everyone that has been part of the **NRRPT** Board and Panel over the last six years and DeeDee for all the support you have given. At the summer 2005 meeting, I was elected to the **NRRPT** Board so you have not gotten rid of me yet.

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Harvard School of Public Health, Center for Continuing Professional Education's upcoming programs: Occupational and Environmental Radiation Protection – Basic Principles in Safety, April 24-27, 2006; Radiation Safety Officer Training for Laboratory Professionals, spring 2006; Comprehensive Industrial Hygiene - Practical Applications of Basic Principles, June 19 – 23, 2006; Radiological Emergency Planning: Terrorism, Security and Communication, August 8 – 11, 2006. For more information or to register, please visit our website at www.hsph.harvard.edu/ccpe or call us at 617-384-8692.

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Future NRRPT Exam Dates

February 11, 2006

Deadline for application: December 16, 2005

August 12, 2006

Deadline for application: June 16, 2006

Application Fee: $200

Retake Fee: $100
Late Fee: $30

** Exam applications may be downloaded from our web page **

www.NRRPT.org

**** BIO ON OUR CO-VICE-CHAIRMAN OF THE EXAM PANEL ****

Dave Wirkus

Dave Wirkus is a Radiological Controls Supervisor/Retrieval and Shipping at Idaho National Laboratory with responsibility for oversight of Radiological Safety team associated with retrieval, packaging and shipping of transuranic waste to the Waste Isolation Pilot Plant in New Mexico.

In 1997, Dave became a Registered Radiation Protection Technologist and has been a member of the **NRRPT** Panel of Examiners since 1999.

Dave is married to wife Mary Kay and has 3 beautiful daughters, Aubrey, Lauren, Ashlynn. His hobbies include 4-wheeling, traveling and spending time with his family, especially watching movies, eating pizza and playing games as a family.

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Book

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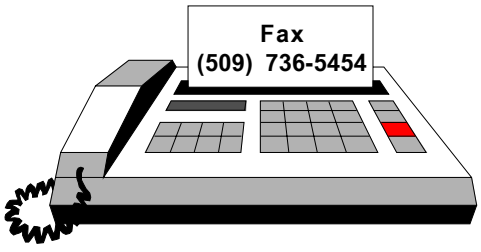

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