NRRPT® NEWS

National Registry of Radiation Protection Technologists

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Chairman's Message

Dave Biela

I am writing this on the first full day of Summer knowing that the August exam is rapidly approaching. I want to take this opportunity again to ask all the registered technicians reading this to look at the non registered technician at your facility and see what you can do to help them prepare for the upcoming exam. If they are not sitting for the August exam, encourage them to prepare for the February 2009 exam and help them prepare for that. Remember that the better trained the work force is the safer it is for all of us. If you do help prepare a technician for the upcoming exam, let me know how they did and let me know what you did to prepare them. I can be contacted at davidbiela@hotmail.com for any training information.

As this newsletter issue reaches you, we are convening our Board and Panel meeting in Pittsburg, PA in conjunction with the HPS annual meeting (from July 12th to the 17th). The meeting is taking place at the Westin Pittsburgh Hotel. Remember that any NRRPT Board and Panel meetings are open to the registry and visitors are welcome. If you are interested in becoming a Board or Panel member, submit your resume and a letter of support from your manager to DeeDee McNeill at NRRPT@NRRPT.org. I will give you an update on our meeting in the Fall newsletter.

What is the most interesting activity going on at your facility? What are you most proud of? Let everyone hear about it. I would like to invite you to write an article for all our readers. We want all of us to share experiences so that everyone can learn from what is taking place in the radiological community. Articles can be submitted through the web site at www.nrrpt.org or by sending it to DeeDee McNeill at the e-mail address above.

Below is an article I found regarding changes in public opinion about nuclear power over the last few years. Momentum everywhere is growing in favor of our industry and I want all of us to be leading the push. We need to bring new talent into the field, participate in the development of those in the industry and don't forget about your own development.

Enjoy the summer and I'll talk to you again in the fall.

Sincerely,
Dave Biela
NRRPT, Chairman of the Board

PUBLIC OPINION

Public opinion has generally been fairly positive, and has grown more so as people have had to think about security of energy supplies. A May 2005 poll showed continuing increase in public opinion favorable to nuclear power in the USA. Some 70% favored continued use of nuclear energy, 58% said that new nuclear plants should definitely be built, and 74% wanted the option to build new plants to be kept open. More than three times as many strongly supported nuclear energy than strongly opposed it. Two thirds of self-described environmentalists favor it.

In March 2006 a national survey revealed that 68% of people favored the use of nuclear energy, while 86% believed nuclear would be important to meeting electricity needs in the years ahead. Some 73% would find a new reactor at the nearest nuclear power plant acceptable.

In mid 2007 a survey of 1150 people living within 16 km of nuclear power plants in the USA, but without any personal involvement with them, showed very strong support for new nuclear plants. Over 90% thought nuclear energy was important for future supply, 82% favored it now, 77% said that new plants should definitely be built and 71% said they would accept a new plant near them. There was an overwhelmingly favorable view of local nuclear plants, notably their safety. On nuclear waste, 71% said it was safe being stored at the plant and 78% said the federal government should get on with developing the Yucca Mountain repository. Regarding reliable sources of information about nuclear energy, various nuclear plant sources were rated 68-74% compared with environmental groups 45% and anti-nuclear groups 22%. The researcher concluded that "Nimby (not in my back yard) does not apply at existing plant sites because close neighbors have a positive view of nuclear energy, are familiar with the plant, and believe that the plant benefits the community."

An August 2007 poll of 1000 people across the country showed opposition to any kind of new thermal power plant to be located in the local community: 65% against nuclear and 58% against fossil fuel plants. However 76% would support new wind turbines.

An April 2008 survey (N=1000) found that overall 82% said nuclear power will be important in meeting the nation's electricity needs in the years ahead. In a change since October 2007, most now put economic growth ahead of climate change and energy security as a prime concern, with air pollution trailing in a list of four. Public support for building new nuclear power plants strengthened three points to 78% since October.

Continued on page 4

Tales from the Atomic Age

By Paul W. Frame

Alsos and the Nazi Thorium

This story is adapted from the book Alsos, written by Samuel Goudsmit, H. Schuman Inc., New York, 1947. It appeared in the December 1996 issue of the Health Physics Society Newsletter.

In the early 1940s, the U.S. was at war and extraordinary efforts were underway to build an atomic bomb. The government even went so far as to confiscate the uranium oxides used by ceramics manufacturers to produce red/orange glazes. More than a few collectors must have been upset at the disruption in their supply of red dinnerware. Still, sacrifices were required. Similar confiscations occurred in occupied Europe to supply the Nazi A-bomb project, and keeping track of Germany's atomic research was an allied intelligence effort code-named Alsos (the Greek word for grove, as in General Leslie Groves).

In the fall of 1944, the Alsos team learned that Auer Gesselshaft, a German chemical company involved in securing and processing uranium, had taken over the French company Terres-Rares during Nazi occupation. Ominously, Auer had shipped Terres-Rares' massive supply of thorium to Germany. That the Germans wanted thorium suggested that their atomic research was further advanced than previously thought. Shortly after Paris was liberated, the Alsos team converged on the Terres-Rares office. They found it empty. Petersen, the Auer company chemist involved in securing the uranium and thorium supplies, had fled the allied advance (in Now It Can Be Told, Leslie Groves gives this man the name Jansen).

Petersen had gone to a town on the French-German border searching for some missing railroad cars carrying the thorium. And, as luck would have it, the area was captured by the allies shortly after Petersen arrived. Alsos had their first prisoner—and a suitcase bulging with documents! Among these was a dossier on a businesswoman who plied the world's oldest profession sur les rues de Paris. Petersen's explanation for having the dossier was that the woman had charged him an exorbitant 3000 francs although "in Berlin . . . it is only seven marks and a half per fling." He said he was hoping to contact the proper authorities (whoever they would be) to recover some of his money. When the Alsos investigators took to the streets, they found that all aspects of Petersen's implausible story proved true. However, the suitcase's most shocking document revealed that Petersen had recently visited Hechingen, a town rumored to be a center for atomic research. Later it would be learned that the Germans had a lab there with an isotope separation unit and, in a nearby cave, an experimental pile. When the site was eventually captured, a ton and a half of metallic uranium cubes from the pile (likely produced by the Auer company) were found buried in a nearby field. Petersen's explanation for his trip to Hechingen: he was visiting his mother (no doubt seeking advice on how to recover his 3000 francs). Darn thing was, his mother actually lived there.

Ultimately, Alsos' hard work paid off and they discovered the true reason why Terres-Rares' thorium supplies had been confiscated: the Auer Company, recognizing that the end of the war was near, and concerned about the consequent loss of business, concluded that there was no better future for their company than in cosmetics and related consumer products! Radium had already been used in toothpaste (Radiogen), why not use thorium instead? Auer had the patent, and with the thorium in hand they were ready to hit the ground running. They even formulated the following potential advertisement: "Use toothpaste with thorium! Have sparkling, brilliant teeth—radioactive brilliance!"

A Test for Light Leaks in Mylar Covered Scintillation Detectors

By Jim Rolph, RRPT

Has this happened to you? You select an alpha/beta scintillation count rate meter, perform the pre-operational check, conducted your source response check and then found that you have a light leak after going outdoors to conduct a survey. If it has, there is a great way to test your Mylar® covered scintillation detectors for light leaks before you go through all this effort. This particularly useful test for those detectors that only becomes apparent that they have a light leak when you go outdoors. This test method is also a good check following repair and before going through your calibration only to discover the detector has a light leak.

Go purchase yourself an economical party strobe lamp. These lamps, when plugged in and pointed toward the detector face, are an excellent way to detect light leaks. Just be careful that you don't place the strobe too close to the detector as some detectors are sensitive to EMF from the pulsing current. Keeping a distance of at least two inches away usually eliminates this problem. You might be surprised to see how well this works in checking your detectors and at what distance. This is a useful tip I obtained from a past co-worker and friend, Dave Lettau.

As an important safety note. When ordering one of these lamps make sure they are safe by verify that they are labeled by a Nationally Recognized Testing Laboratory (NRTL).

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The survey also showed clear public support for government incentives to reduce CO_2 emissions - 79% approve of providing tax credits "as an incentive to companies to build solar, wind and advanced-design nuclear power plants," and 37% strongly approve. Only 20% do not approve. When asked about providing federal loan guarantees to companies that build solar, wind, advanced-design nuclear power plants "or other energy technology that reduces greenhouse gases, to jump-start investment in these critical energy facilities" 77% approved.

A May 2008 survey (N=2925) by Zogby showed 67% of Americans favored building new nuclear power plants, with 46% registering strong support; 23% were opposed. Asked which kind of power plant they would prefer if it were sited in their community, 43% said nuclear, 26% gas, 8% coal. Men (60%) were more than twice as likely as women (28%) to be supportive of a nuclear power plant.

Article from the World Nuclear Association

A General Review of Biological Effects of Ionizing Radiation and Radiation Protection

By Augustinus Ong, Dartmouth College

The purpose of this review, in the format of questions and answers, is to remind readers of some of the basic aspects biological effects of ionizing radiation and radiation protection.

(1) Because radiation interaction is random, a dose equal to D_{37} (based on the single-target, single-hit model) is expected to kill what percentage of cells?
- a. 0
- b. 37
- c. 63
- d. 100

(2) In general, when evaluating cellular radiosensitivity,
- a. cells with a large D_0 are more sensitive.
- b. cells with larger target sites are more sensitive.
- c. cells with a smaller D_Q are more sensitive.
- d. hypoxic cells are more sensitive.

(3) Radiation-induced chromosomal aberrations are scored during which phase of the cell cycle?
- a. G1
- b. G2
- c. S
- d. M

(4) What dose-response relationship describes the effect of radiation on human cells with high-LET radiation?
- a. single-target, single-hit
- b. single-target, multiple hit
- c. multiple target, single-hit
- d. multiple target, multiple hit

(5) Radiation-induced chromosome aberrations are scored during which phase of the mitosis?
- a. prophase
- b. metaphase
- c. anaphase
- d. telophase
- e. interphase

(6) In the linear portion of the multiple target, single-hit radiation dose-response relationship:
- a. no critical targets have been hit.
- b. one critical target in each cell has been hit.
- c. all but one critical target in each cell have been hit.
- d. all critical targets in each cell have been hit.

(7) In general, when evaluating cellular radiosensitivity,
- a. cells with a small D_0 are more sensitive.
- b. cells with larger target numbers are more sensitive.
- c. cells with a larger D_0 are more sensitive.
- d. cells with a larger a larger D_q are more sensitive.

(8) A stochastic effect of radiation exposure occurs when:
- a. the incidence of biological response is dose-independent..
- b. the severity and incidence of biological response are dose-independent.
- c. the incidence of biological response is dose-dependent.
- d. the severity of biological response is dose-dependent.

(9) Which of the following is considered an early-radiation response?
- a. moist desquamation
- b. epilation
- c. lymphocytic depression
- d. cataract

(10) A deterministic effect refers to
- a. early effects of biological responses to radiation exposure.
- b. late effects of biological responses to radiation exposure.
- c. acute high-dose radiation exposure.
- d. fractionated low-dose radiation exposure.

(11) The $LD_{50/60}$ for humans is approximately
- a. 1 Gy
- b. 3.5 Gy
- c. 5 Gy
- d. 7 Gy

(12) Which of the following blood cell types is most sensitive to radiation exposure?
- a. red blood cells
- b. neutrophils
- c. platelets
- d. lymphocytes

(13) The minimum dose of low LET radiation will produce a skin erythema when delivered acutely is approximately
- a. 0.5 Gy
- b. 1 Gy
- c. 2 Gy
- d. 4 Gy

(14) Which of the following describes a stochastic effect of radiation?
- a. a low-threshold dose
- b. no threshold dose
- c. a whole-body dose
- d. an organ dose

(15) During which period of pregnancy will high irradiation of the fetus most likely result in a congenital abnormality?
- a. the first two weeks
- b. weeks 3 to 10
- c. the second trimester
- d. the last trimester

(16) The radiation weighing factor W_R is described as
- a. the radiation characteristic used to determine equivalent dose.
- b. being equal to LET.
- c. being equal to RBE.
- d. the radiation characteristic used to determine effective dose.

(17) When does the equivalent dose equal the effective dose?
- a. When the whole body is irradiated.
- b. When the target organ is irradiated.
- c. When the radiation is delivered acutely.
- d. When the biological end point is $LD_{50/60}$

(18) Recommended dose limits are based on
- a. stochastic radiation responses.
- b. deterministic radiation responses.
- c. both stochastic and deterministic radiation responses.
- d. neither stochastic nor deterministic radiation responses.

(19) A stochastic radiation response is one that
- a. occurs following only low doses.
- b. occurs following only high doses.
- c. follows a threshold-type dose-response relationship.
- d. is an all-or-nothing type of response.

(20) Recommended dose limits are based on which type of radiation dose-response relationship?
- a. linear, threshold
- b. linear, no threshold
- c. nonlinear, threshold
- d. nonlinear, no threshold

(21) Quality factor, Q, is most analogous to
a. linear energy transfer (LET)
b. oxygen enhancement ratio (OER)
c. effective dose equivalent (H_E)
d. relative biological effectiveness (RBE)

(22) Dose equivalent (H_E) is
a. Absorbed dose x LET
b. Absorbed dose x Q
c. Absorbed dose x Q x LET
d. Q x LET

(23) The relative radiosensitivity of tissues and organs is represented by
a. RBE
b. LET
c. Q
d. W_T

(24) The recommended dose limit for frequently exposed members of the public is
a. 50 mrem / month
b. 50 mrem / year
c. 100 mrem / month
d. 100 mrem / year

(25) Once a pregnancy is declared, the recommended dose limit for the
a. fetus is 50 mrem / month
b. fetus is 500 mrem / month
c. pregnant worker is 500 mrem / month
d. pregnant worker is 5000 mrem / year

(26) The recommended dose limit established for the lens of the eye is based on
a. stochastic effects
b. deterministic effects
c. age-related effects
d. deep organ-dose effects

(27) Effective radioactive waste disposal includes segregation of such waste by
a. form (liquid or solid)
b. emission energy
c. half-life
d. volatility

(28) Discharge of patients undergoing radionuclide therapy must wait until the internal burden of radioactive material is less than
a. 5 mCi
b. 10 mCi
c. 20 mCi
d. 30 mCi

(29) Which of the following is considered short-lived radioactive waste?
a. Tc-99m
b. Ga-67
c. I-131
d. In-111

(30) Radionuclide therapy patients should not be discharged from the hospital until the exposure rate at 1 meter from the patient is less than
a. 1 mR/hr
b. 2 mR/hr
c. 5 mR/hr
d. 25 mR/hr

ANSWERS: (1) c; (2) c; (3) d; (4) a; (5) b; (6) c; (7) a; (8) c; (9) c; (10) a; (11) b; (12) d; (13) c; (14) b; (15) b; (16) d; (17) a; (18) a; (19) d; (20) b; (21) a; (22) b; (23) d; (24) d; (25) a; (26) b; (27) c; (28) d; (29) a; (30) c.

We will continue with more questions and answers next time.

Should Mylar® Window Replacements Invalidate the Calibration on Alpha/Beta Scintillation Detectors?

Jim Rolph, RRPT

Introduction

A common problem encountered with HPTs using alpha/beta scintillation detectors in outdoor or industrial environments is how easily the Mylar® window can be damaged with punctures or tears creating light leaks. The standards are clear that this condition requires repair and recalibration of the instrument, while an instrument manufacturer suggested when asked that it is acceptable to replace a damaged Mylar® window with manufacturer's replacement Mylar® window without recalibrating. Should it be an acceptable practice to permit Mylar® window replacements without recalibration? In this article we will review what the standards say, review some of the potential problems of this practice and examine some test data taken to come to a conclusion.

Review of the Standards

We will review both the older and newer ANSI N323 standards, as both are currently in use, as some government contracts continue to require the use of the older standard. ANSI N323-1978 clearly states in paragraph 4.7.1 that recalibration is required following any maintenance or adjustment. ANSI N323A-1997 states in section 4.9 that calibration shall be scheduled after any maintenance or adjustment that can affect instrument performance.

The newer standard provides some flexibility in regards to recalibration following maintenance. With this flexibility a calibration program must determine whether replacement of the Mylar® window can affect the instrument performance if recalibration is not going to be required.

Review of Potential Factors that Might Affect the Original Calibration

What factors does one need to consider when considering whether it would be an acceptable process for replacing Mylar® windows without recalibration? Some possible factors that I thought of to consider include:

1. When the Mylar® was punctured or torn, was the scintillation material damaged?
2. Did the detector sustain sufficient force that other components in the detector might have been damaged?
3. Is the replacement Mylar® of the same areal density?
4. What are the radiation types being monitored and their energies?
5. Was the cable damaged?
6. During the repair were all the detector components installed properly and in the same orientation as when it was previously calibrated?

Perhaps you can think of other factors that might influence the calibration. As you can see from this list there are several factors to consider besides just the Mylar® window itself. Using the logic that as long as the window areal density is the same that the calibration would not be affected is probably not sufficient to avoid recalibration.

Mylar® Testing Results

A test was conducted to see if replacement of Mylar® of reportedly the same areal density from a manufacturer would have negligible effect on the calibration. For this experiment an alpha/beta scintillation probe constructed of an aluminum housing, with the dimensions of 29cm long, 9.1 cm wide, and 8.9 cm in height was used. The detector has an active area of 100 cm^2. The probe uses a metallic screen to provide some protection to the fragile Mylar® window, and uses a ZnS coated plastic scintillation material for detection of both alpha and beta particle radiation. The window areal density is 1.2 mg cm^{-2}.

For this test a single detector was calibrated to a survey meter and then the intrinsic detection efficiency was determined for four different radionuclides, see table below. The sources used were calibrated for the geometry of the test.

Radionuclide	Decay	Energy in MeV (branching %)	Activity (dpm)
^{239}Pu	α	5.155(.73) 5.143(.15) 5.105(.12)	50,200
$^{90}Sr/^{90}Y$	β-	0.546/2.27 E max.	116,000
^{99}Tc	β-	0.292 E max.	122,000
^{137}Cs	β-	0.511 (95)/1.173 (5) E max.	121,000

For each evaluation, three sets of readings were taken and averaged for each radionuclide and the intrinsic detection efficiency calculated to three significant digits. Twelve different Mylar® windows were tested and the detection efficiency, standard deviation, and error bar results were tabulated. This data appears to support the manufacturer's claim that when only considering the Mylar®, that there is not a significant impact to the calibration. However, there is more to consider than just the Mylar®

Radionuclide	Average	Std. Dev	Error Bar
^{239}Pu	28.2	0.16	±1.4
$^{90}Sr/^{90}Y$	14.5	0.12	±1.4
^{99}Tc	24.2	0.11	±0.8
^{137}Cs	15.3	0.11	±1.3

We then decided to collect data with actual instruments that were being used and returned for light leaks from damaged Mylar® windows. In this test we collected detection efficiency data following Mylar® window replacements and if the detection efficiency was within ±10% of what it was on all four radionuclide we considered that no significant impact to the calibration was observed. From a population of 343 detectors, 31 detectors failed to be within the 10% criteria, a 9.3% failure. Assuming the previously conducted test was valid, the changes in detection efficiency for these failures were likely caused by something other than the Mylar®. It was interesting to observe that the alpha detection efficiency was relatively unaffected, whereas beta was somewhat more affected, which seems to point to the electronic circuitry. The specific reason for this observation was not determined in this testing. However, it does demonstrate, in my opinion, the need to recalibrate the detectors following instrument repair or Mylar® replacement.

Radionuclide	# that Failed the 10% criteria	Max observed % difference
^{239}Pu	1	10.8
$^{90}Sr/^{90}Y$	14	38.1
^{99}Tc	29	53.5
^{137}Cs	14	34.3

Can Check Response Checks be Used?

To ensure proper operation of the instrument between calibrations most radiological protection programs check instrument response is within ±20% as a daily source response check. If this criteria is not meet, then the instrument is send to a calibration facility for maintenance, repair, and recalibration, as required. Could the Mylar® window be replaced and a source response check be used to validate the calibration? The standards point out that there is a distinction between source checks and calibration. In addition to the detector response, calibration verifies that the instruments are setup properly to perform the desired monitoring and involves more checks and verifications and documentation than a check response source check.

Conclusion

In a review of the standards and test data I would conclude that it is not an acceptable practice to replace Mylar® window without recalibrating the instrument. Although the sample of 12 Mylar windows demonstrated that consistency between the windows in this sample were essentially the same, there are other factors to consider. Out of a population of 343 instruments in actual use, we observed that approximately 10% of the instruments required adjustments or additional repairs beyond Mylar® window replacements. Thus this validates the guidance provided in the standards.

Acknowledgements

I would like to recognize and thank Jeff Breault who collected and assembled the test data that I used for this article. I also would like to thank Jon Hanni for reviewing and editing this article.

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2008 USA NRRPT Exam Dates

August 2, 2008

Deadline for application: June 13, 2008*

February 2009 - To be determined

Application Fee: $250

Retake Fee: $125

Late Fee: $50

* An applicant may apply for an exam after the deadline by submitting the $50 late fee *

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

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On June 23, 2006, LES made history when the Nuclear Regulatory Commission, for the first time, issued a license to construct and operate a gas centrifuge uranium enrichment plant to be known as the National Enrichment Facility, located in Lea County, New Mexico.

LES is owned by Urenco, an independent, global energy and technology group with plants in Germany, The Netherlands and the United Kingdom. LES will use the world's most advanced, energy-efficient and cost effective uranium enrichment technology developed by Urenco. The technology has been used in Europe for over 30 years. The National Enrichment Facility will be on-line in 2009, and will be the only facility of its kind in North America.

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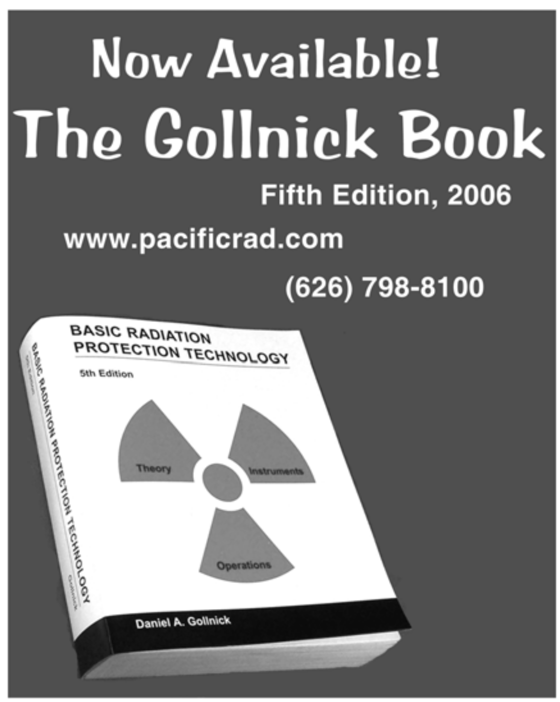

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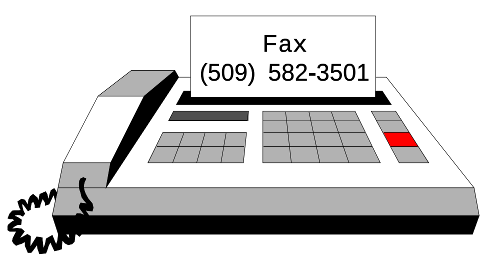

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