



The

NRRPT NEWS

OFFICIAL NEWSLETTER of the *National Registry of Radiation Protection Technologists*

September 2019

Incorporated April 12, 1976

Chairman's Message



Congratulations!

I want to welcome each and every one of the fifty four new RRPTs that studied for, took and passed the **NRRPT** Exam. There were thirty-two successful candidates from the February 2019 Exam and twenty-two successful candidates from the August 2019 exam bringing our Registry to an incredible 5658! All of you should be extremely proud of your accomplishment! In today's hectic life there are many distractions that attempt to keep us from reaching our goals but each of you managed to keep those distractions at bay and carve out the time to study and prepare for the exam – way to go!

For those that waited for your results to come back, it may have felt like an eternity before you got your results but I can assure you that the folks that take care of getting the results out are working almost non-stop to get the exams graded, quality checked and the results out. In fact, the Exam Panel has streamlined the process so well that the results are now out in a matter of a couple weeks instead of the month or two that it used to take. Everyone on the Exam Panel should be very proud of all the hard work that you do!

How Can You Help?

If it sounds like a lot of work is going on behind the scenes that is because there is! It takes a lot of effort to publish a newsletter, plus many people to put an exam together to make sure the questions are good to go, and hours of time to grade the exams and to quality control the results. We would love to have some of the Registry folks come share their experiences, join us on the Exam Panel or work with some of the committees that work diligently behind the scenes to

Greetings fellow RRPTs!

Welcome to Fall!

Welcome to the Fall 2019 **NRRPT** Newsletter. Thank you to the Newsletter Committee and all of the authors for putting in all the effort and long hours to turn out such a wonderful edition! This edition has a great technical article from Bob Wills about Carbon-14 in PWR/ PWR solid waste, an entertaining article from Pete Darnell on movie reviews and some educational articles about past accidents also from Pete Darnell. Hopefully, there is something in this issue that everyone will enjoy reading.

Inside This Issue

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- Rad Movie Review—Deoxyribonucleic Acid
- 14C in PWR/BWR Solid Waste an Overview
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- NRRPT Blast from the Past
- Orlando NRRPT Night-Out
- Orlando NRRPT Board & Panel Annual Meeting
- NRRPT Sponsors

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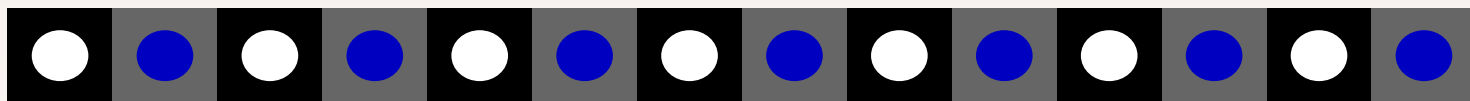
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make the **NRRPT** awesome. Sending in an article for publication in the Newsletter would be fantastic. I am always interested in hearing how people successfully prepared themselves for the exam.

Our next **NRRPT** Board Meeting will be held January 24 – 27, 2020 in Key West Florida at the Marriott Beachside Hotel just prior to the RP-ALARA Association meeting. If any of you are attending the meeting, please stop by and say hello – I look forward to meeting all of you!

Respectfully,
Rick Rasmussen
NRRPT, Chairman of the Board



Welcome New NRRPT Members

Congratulations to the following individuals who successfully passed the
NRRPT Examination on August 3, 2019:

David B. Baker
Mario A. Bettolo
Bo Brickle
Scott A. Brookshier
Richard F. Charles
John M. Corbett
Timothy A. Crawford

Shasta L. Cross
John A. Cummings III
Jennifer M. England
Michael J. Ferrentino
Roger Gard
Justin P. Gillilan
Casey P. Hayes

Paul Kontz
Dylan Long
Jansen B. Lucas
Charles Mighells
Robert A. Nocco
Joshua D. Osteen
Alan Sedacki
Reginald R. Williams

Congratulations to the following individuals who successfully passed the
NRRPT Examination on February 22, 2019:

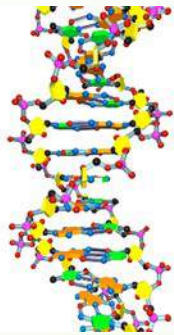
Ryan W. Bezzant
Kyle A. Blatter
Cal T. Brickle
Lucius G. Byrd
Matthew B. Cheatham
Rebecca B. Collins
Chad A. Dozier
Clay K. Elliott
Scott A. Engeman
Alan K. Franklin, II
Joshua M. Hayes

Gary T. Hinckley Jr.
David A. Hollaway
Kristina L. Holton
James J. Howell
Adam K. Howlett
Jerry D. Ingram
Emily Jackson
Anton P. Kodra
Ryan S. Larochelle
Heath M. Lucas
Brandon J. McKinlay

Kody B. Michel
Jonathan D. Nehl
Carol G. Rosaire
Charles A. Rose
Scott Shackelford
Richard J. Silcott
Ginger T. Sparks
Travis R. Stephens
Patrick J. Sullivan
Ryan E. Wilson

RAD MOVIE REVIEWS!

Deoxyribonucleic Acid



Struktura Z-DNA

Just try to picture this - it's June 1993. The science journal "Nature" publishes a story about the death of a weevil 130 million years ago. The poor thing died after feasting on wood pulp and becoming stuck in tree resin. As "Nature" tells the story, the weevil may have died where a brachiosaurus (vegetarian dinosaur) lived. Scientists were able to extract fragments of DNA (deoxyribonucleic acid - think building block of life) from the weevil.



So, the question begs - where did the scientists come up with the idea to try to find DNA in a resin-encased dead insect? Stan Lee (Spider Man)? Michael Crichton (Jurassic Park)?

Stargate SG-1 (an older TV show that uses made-up radioisotopes in some episodes)? Charles Pellegrino (author of "Dinosaur Capsule")? Well, in 1982, an entomologist named George Poinar, Jr. (and colleagues) were studying a fossilized fly found in amber. They figured it was around 40 million years old. Their research suggested that the amber was "an extreme form of mummification." What's so good about that? Mummification preserves cellular structures. Someone gets the bright idea that that it might be possible to extract DNA from the fly. Tada! The DNA of a dinosaur! Doesn't matter that DNA cross contamination makes this impossible. Doesn't matter that the half-life (yup! half-life just like Cobalt 60) of DNA is about 521 years.



You've probably been wondering how this is a movie review. It all has to do with the movies' basic plot. Mutation? Clones? Hybrid humans? Genetic engineering? All great plots for a good sci-fi flick. Here's a short list:



Spider Man (and all the remakes plus, the comic books) - the radioactive spider
Super Man - cosmic rays from our sun

X-men and sequels - genetic manipulation, some from radioactivity

Captain America - strange rays remake a 90-pound weakling to a super soldier

Jurassic Park (sequels abound!) - genetic engineering (they used a radioactive tracer to follow at least one dinosaur)

Godzilla (even more sequels) - genetic mutation from exposure to radioactive material

The Fifth Element - the aliens in this movie have super-evolved DNA

Teenage Mutant Ninja Turtles - The original characters were exposed to a glowing green goo - never said it was rad, but use your imagination!

Stargate SG-1 (a movie and three TV series) - naquida, the strange energy source, atomic bombs, space radiation and on, and on...

Star Wars - remember the clones?

Prometheus - who can resist a movie where aliens kill nearly everyone? The story is not about rad topics but there's an interesting DNA twist in the storyline

Frankenstein - okay, not radioactive but still cool

The Island of Dr. Moreau - not radioactive and a little less cool, but still a good story



There are lots more - I just can't list them all.

Pete Darnell, RRPT, CHP, amateur movie critic

^{14}C In PWR / BWR Solid Waste An Overview

Bob Wills

GEL Laboratories, LLC

Objectives

- Literature Review of ^{14}C Studies in Nuclear Reactors by: ORNL - 1977 and LUND University of Sweden 2007
- Review the transport models of ^{14}C in Light Water Reactors into solid waste
- Analysis of BWR and PWR ^{14}C data
- Analysis of ^{14}C to ^{60}Co ratios in solid waste
- Analytical methods utilized in ^{14}C analysis in solid waste

ORNL 1977 Paper on ^{14}C

- **CARBON-14 PRODUCTION In NUCLEAR Reactors : by Wallace Davis, Jr.**
- **Date Published: February 1, 1977**
- **Prepared for the U.S. Nuclear Regulatory Commission**
- **Office of Nuclear Material Safety & Safeguards**
- **Under Interagency Agreement E RDA 40-549-75**

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Highlights of ORNL Paper - Mechanisms Of Carbon-14 Formation In Nuclear Reactors

- Focused on the Neutron activation of ^{14}C in Reactor Coolant, Reactor Internals, Fuel
- Carbon-14 is formed from five reactions of neutrons with **elements that are normal To The Primary Coolant**
- Complex chemical compounds that are formed then find their way to resin and filter media

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Characterization: Hot Resin, Hot Filters and Constant Scaling Factors

- By Clint Miler : Pacific Gas and Electric
- ASME/EPRI Radwaste Workshop
- Colorado Springs, CO
- June 17-19, 2002

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Lund University of Sweden C-14 Produced in PWR & BWR Reactors

- Doctoral Dissertation by Asa Magunsson
- August 15, 2007
- Looked at BWR , PWR waste in in Sweden
- ^{14}C in solid waste (Resin and Filters) 0.5% to 10% of total ^{14}C production production
- PWR's form mostly organic ^{14}C compounds and some carbonate compounds
- BWR 's form both organic and carbonate ^{14}C compounds
- Compounds Formed H^{14}CO_3 "Bicarbonate"

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C-14 's Five Reactions That Are Most Likely To Take Place & Effect Rad Waste

- $^{13}\text{C} (n,\gamma) ^{14}\text{C}$
- $^{14}\text{N} (n,p) ^{14}\text{C} **$
- $^{15}\text{N} (n,d) ^{14}\text{C}$
- $^{16}\text{O} (n, ^3\text{He}) ^{14}\text{C}$
- $^{17}\text{O} (n,\alpha) ^{14}\text{C} **$

Note: ** Most Prominent Production in BWR, PWR Coolant

Transport models of ^{14}C in Light Water Reactors into solid waste

- As the ^{14}C compounds are formed in the primary coolant they form various chemical compounds
- BWR vent over 90% of the ^{14}C as $^{14}\text{CO}_2$ with the remainder being available to deposit on filters and resin
- PWR's vent 85% or more of the ^{14}C as organic gas compounds with the remainder being available to deposit on filters and resin (GEL testing shows 95% to 5% organic to CO_2 mix) ethane, methane, and propane

Compounds collected by resin and filters

- PWR's and BWR's form different ratios of both organic ^{14}C compounds and inorganic ^{14}C compounds
- Because of this GEL's chemistry must break down all organic compounds and the carbonate compounds mostly seen as H^{14}CO_3 - Bicarbonate
- Lets look at how ^{14}C values look through the waste media

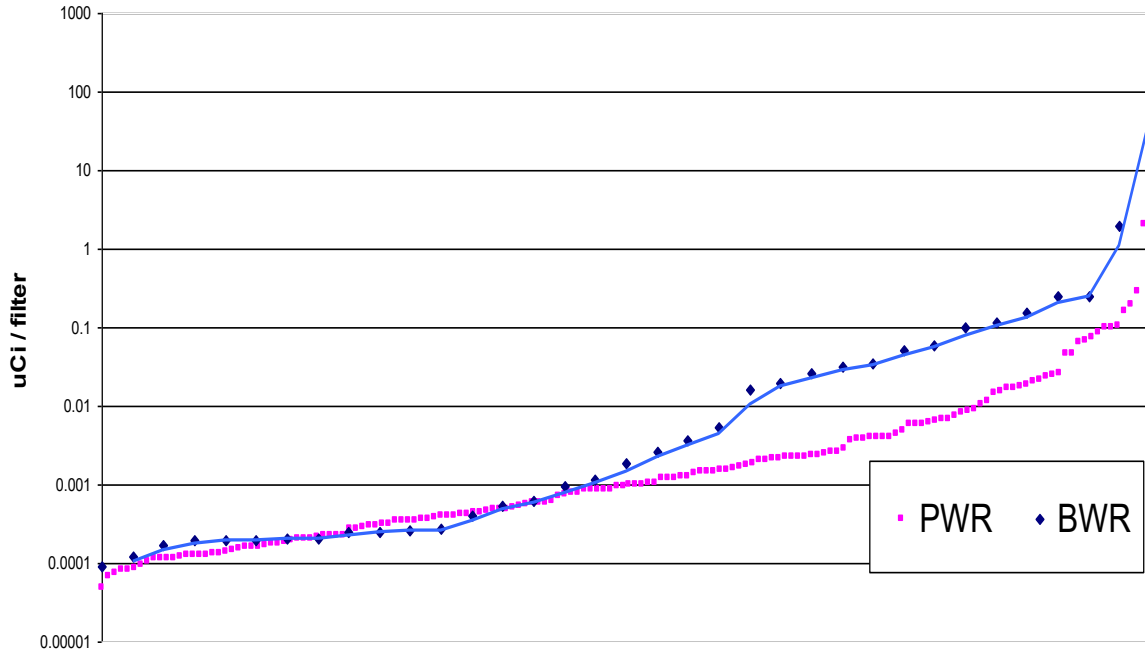
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Let's Look at Plant Data

- PWR vs BWR Filter
- PWR vs BWR Resin
- PWR vs BWR Smears "DAW"

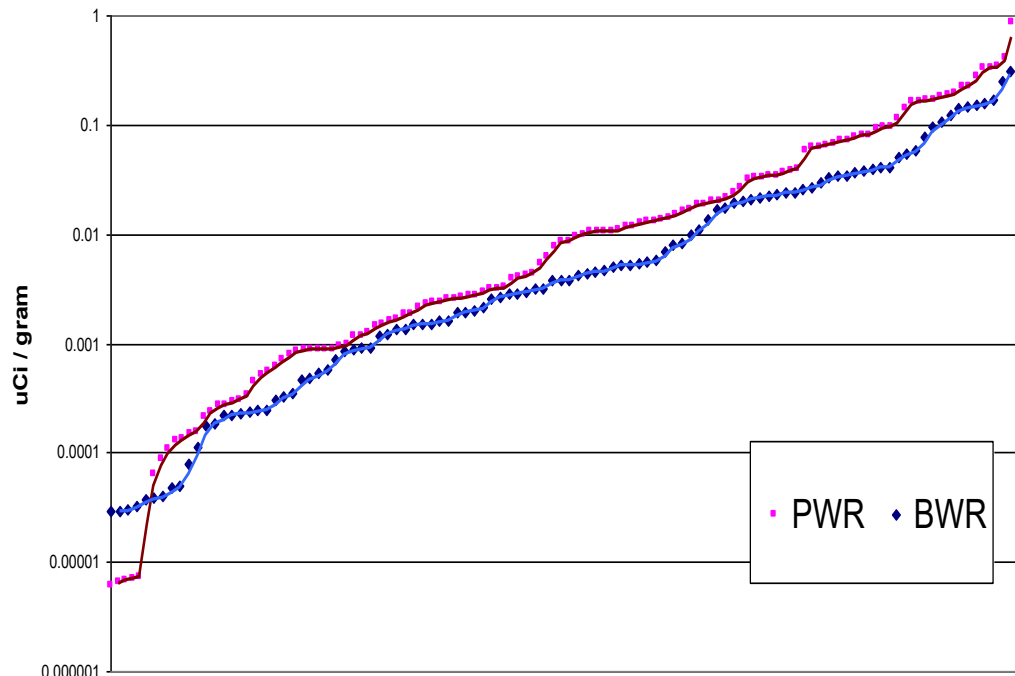
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C14 Data in Filter Media



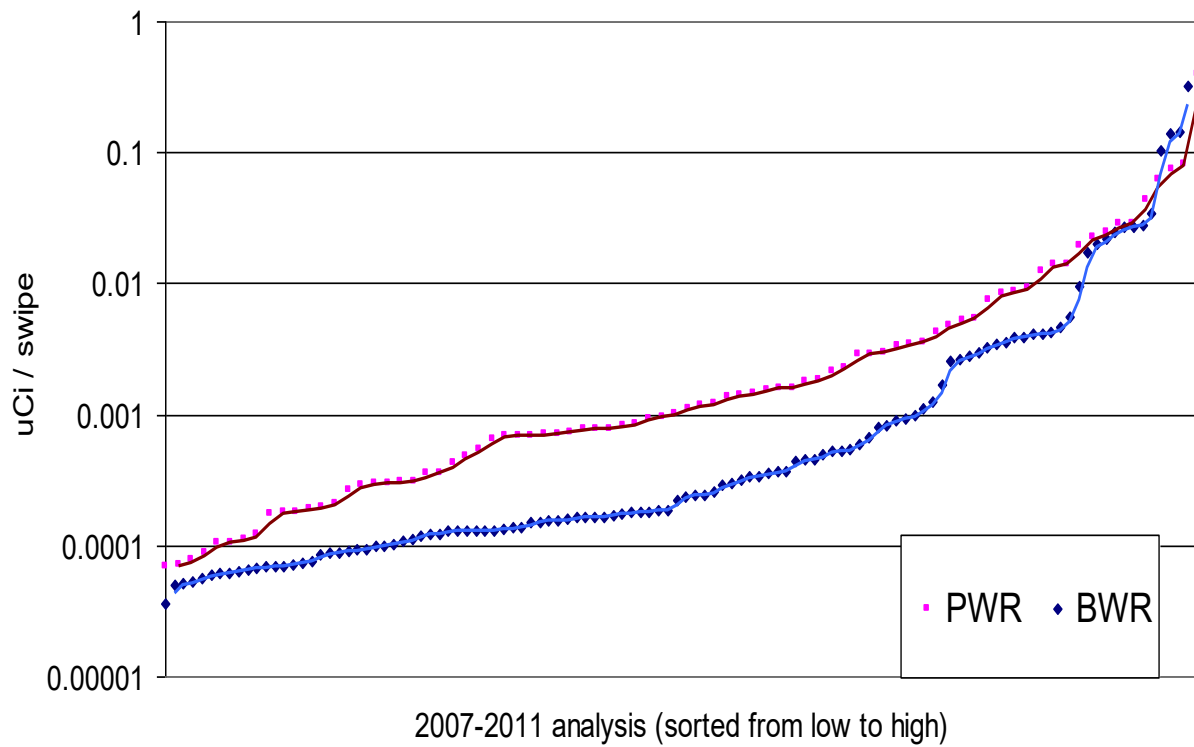
2007-2011 analysis (sorted from low to high)

C14 Data in Solid Media



2007-2011 analysis (sorted from low to high)

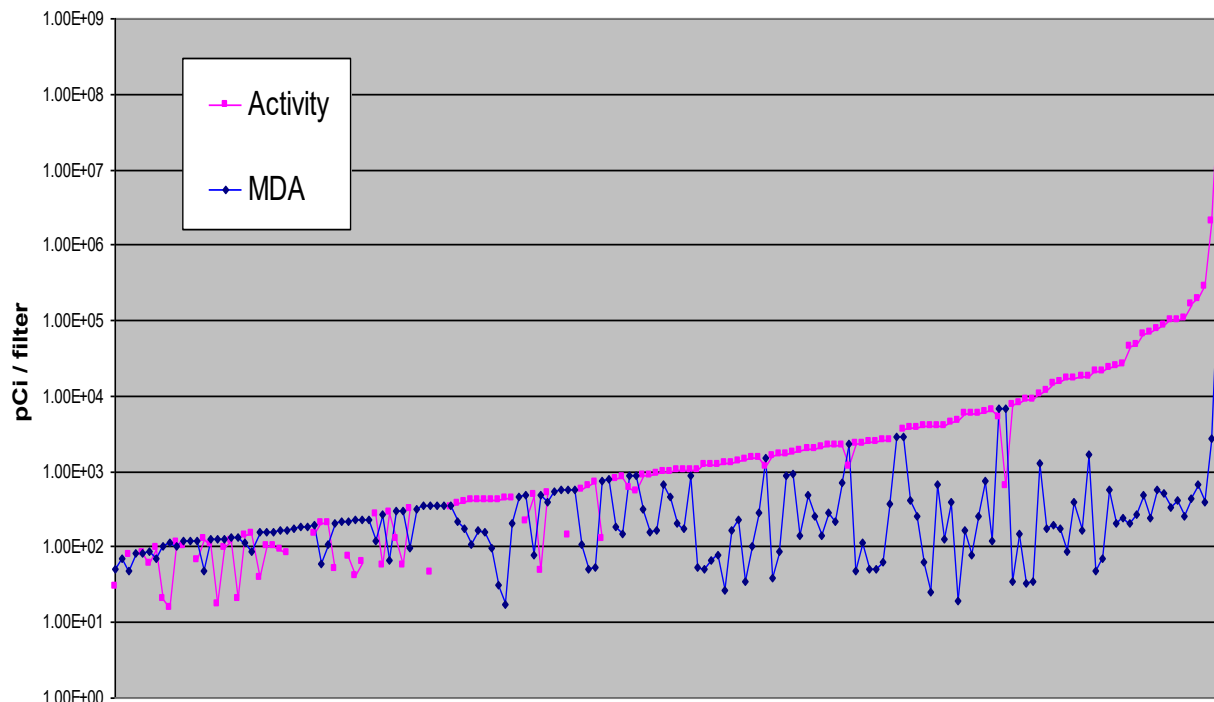
C14 Data in Swipe Media



^{14}C Results for Filters vs LLD

Analytical Support for ^{14}C in waste

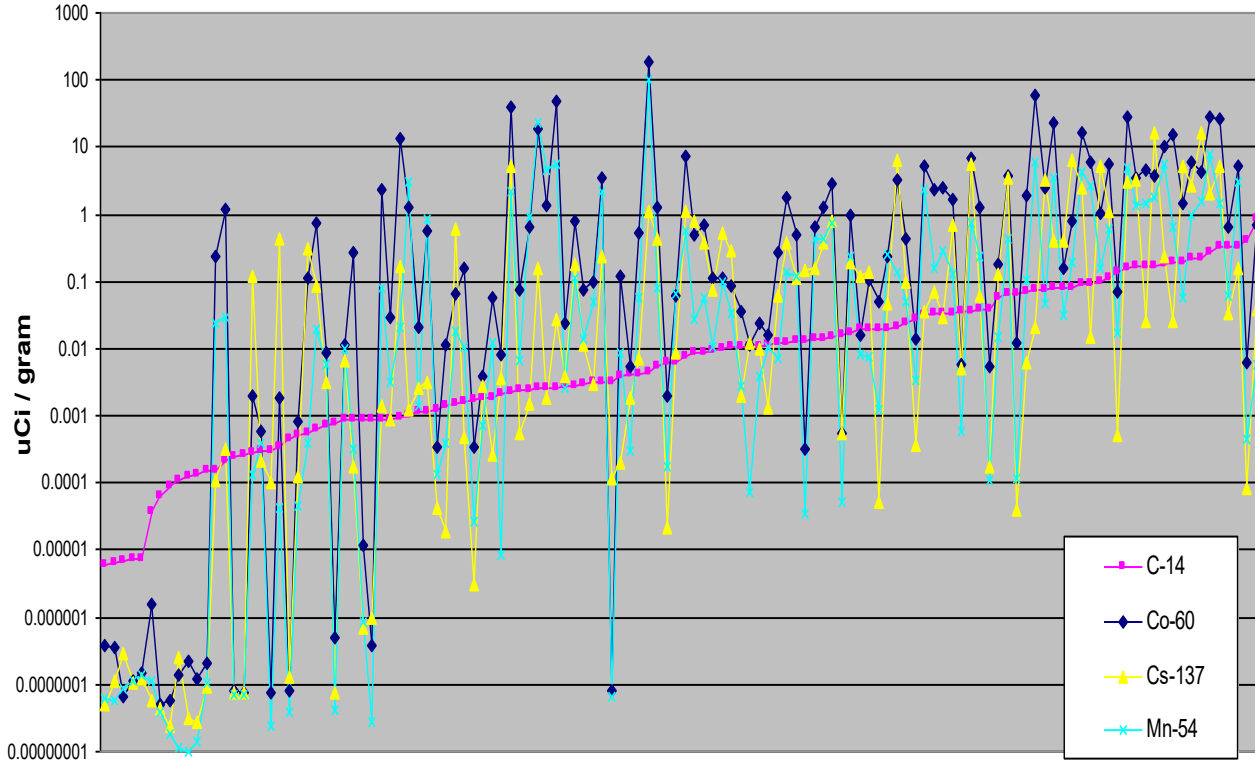
C-14 Results Compared to MDA for Filters



2007-2011 analysis (sorted low to high)

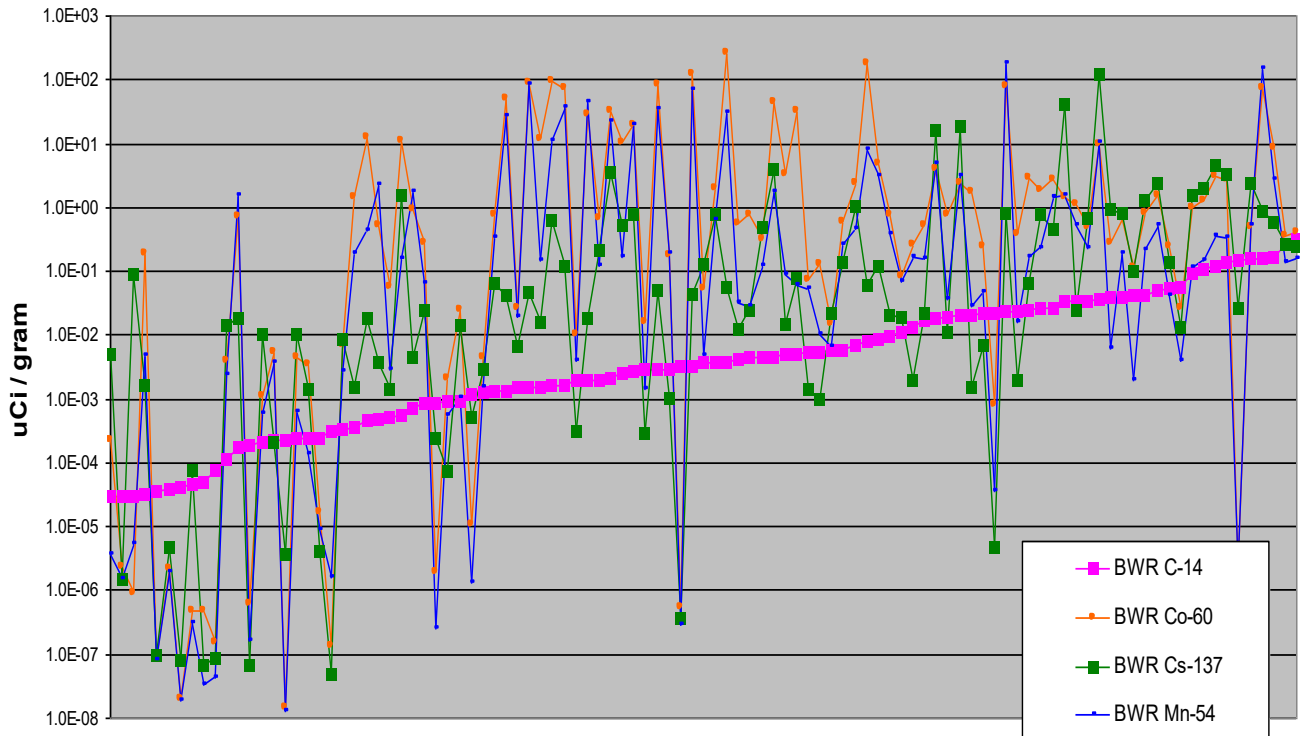
**^{14}C and Gamma Isotopes Any
Correlations ??
NO !!!!**

PWR Isotopic Comparison in Resins



2007-2011 Analysis (sorted by C14 from low to high)

BWR Isotopic Comparison in Resins



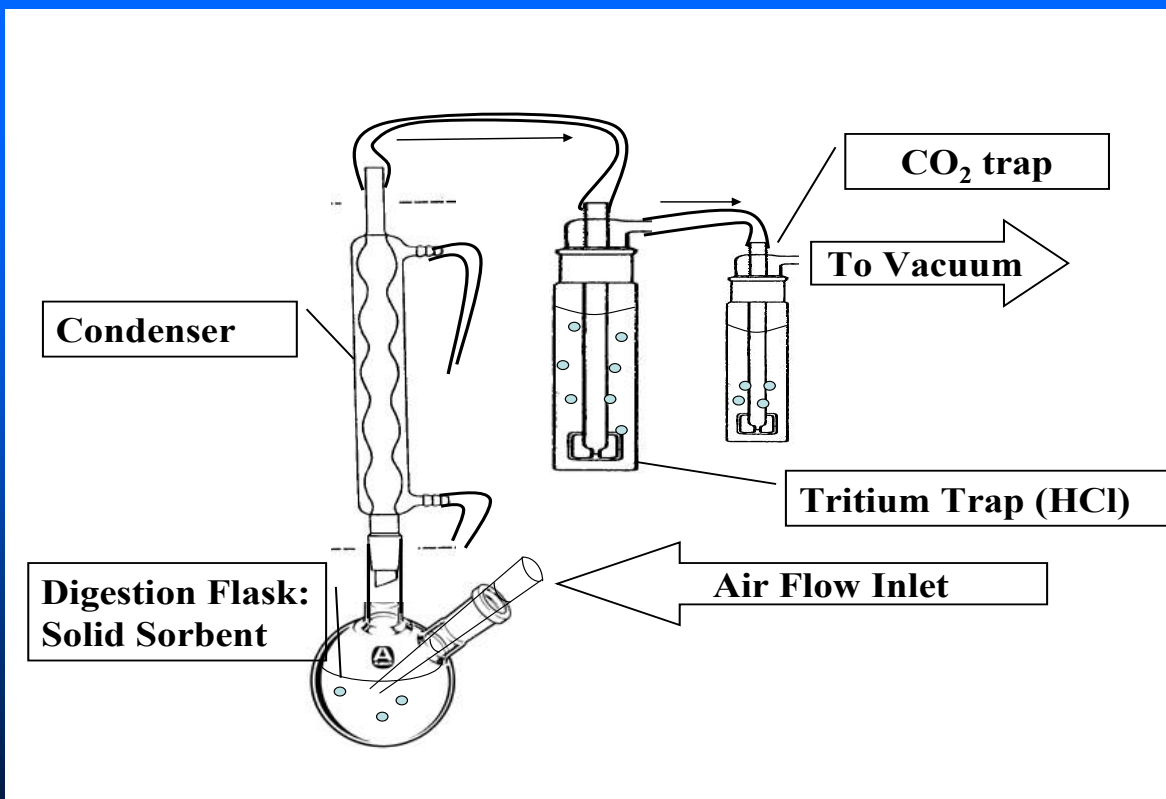
2007-2011 Analysis (Sorted by C14 low to high)

C-14 Analysis -Overview

- Sample is Digested in a Closed System
 - Acid converts inorganic carbon-14 to carbon dioxide
 - Potassium persulfate/ silver nitrate catalyst oxidizes any organic carbon to inorganic form

C-14 analysis in solid waste continued

- Carbon dioxide is distilled and trapped in an organic solvent
- The extracted carbon-14 is measured by liquid scintillation counting
- Interference Check
 - Any Positive Result is Confirmed by Gamma Spectrometry and/or Reanalysis



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How Does GEL QA C-14

- LSC has a resolution of about 100keV
 - C-14 LSC vials are counted for any gamma isotopes that are distilled with carbon
 - No Detection so far in C-14 LSC vials
- Cs-137 Beta at 513 KeV
 - Confirmed too high to tail into the C-14 spectra

Conclusions

- Carbon is Often Present in Waste Streams
- Analysis is Capable of Handling Interferences
- BWR C14 trends HIGHER than PWR
 - Water Filtration Media
- BWR C14 trends LOWER than PWR
 - Solid (Resin) and Swipe Media

Panel Member Bio

Ryan Murdock



Ryan Murdock is a Technical Service Project Manager at Waste Control Specialists LLC (WCS). Ryan has been a member of the **NRRPT** for five years and is now serving on the **NRRPT** Exam Panel. As of February 2019, Ryan was nominated and voted to be on the **NRRPT** Board of Directors, he will begin serving on the **NRRPT** Board in February of 2020. Ryan has a Bachelor of Science degree in Radiation Protection. He has experience in Decontamination and Demolition, Department of Energy, the Commercial Nuclear Power industry as well as extensive experience in private industry Radioactive Material Handling and compliance. Ryan is currently pursuing his CHP. As a Technical Service Project Manager, Ryan manages all waste being shipped to the WCS site in Andrews, Texas. He is responsible for all waste to include RCRA, CERCLA, TSCA, low-level radioactive waste, and radioactive low-level mixed waste to meet WCS' Waste Acceptance Criteria for compliance. He works closely with DOE and TCEQ/NRC regulators to make sure all waste received or shipped from WCS is within local, state and federal regulations. Ryan was born and raised in Knoxville, Tennessee and currently lives in Trenton, Michigan. His career has taken him from Tennessee to New Jersey, then to Texas and finally to Michigan. He is a husband and a father of two. Ryan enjoys traveling with his family, golfing in his spare time and riding ATVs with friends.

NRRPT BLAST FROM THE PAST!

Good evening Mr. and Mrs. NRRPT, from border to border and coast to coast and all the ships at sea. Let's go back in time...

The Date: April 21, 1957

The Event: Criticality in a chamber for the purification of uranium solutions.

The Place: Mayak Enterprise, near Kasil and Tatysh, The Urals (think Russia)

The Cause: Deviation from regulations; lack of maintenance; and, personnel errors in accounting for process vessel temperature, total uranium, and other ingredients.



Satellite Image Mayak Facility

The Setup: The staff operated without following regulations. There was no regular cleanout of the equipment. They had no idea how much total uranium or other ingredients were in the system. Temperature of the process vessel was not monitored and the condition of the filter was not checked.

The Accident: Oxalate precipitate with a mass of 3.4 kilograms accumulated in the tank and a critical state was achieved for some time. An operator finally noticed that the filter was swelled and the precipitate was discharging gases. They stood by and watched for about 10 minutes. The reaction terminated when part of the solution was forced from the tank into the trap.

The Aftermath: Bad news – the criticality achieved about 2.7×10^{17} fissions. Worse news – 5 workers developed radiation sickness. Even worse news – the operator died 12 days after the accident.

Pete Darnell, RRPT, CHP, after-the-fact reporter



NRRPT Night-Out in Orlando, FL

*** Thank you to our generous NRRPT
Night-Out sponsors ***

Ken Baugh (B&B Environmental Safety), Bill Peoples (BHI Energy),
Laura Davidson (Envirachem), Eddie Benfield (Duke Energy),
Jay Tarzia (RSCS) and Gregg Johnstone (UniTech)



DeeDee's 30th Anniversary as NRRPT Executive Secretary—Congratulations!



Some of the "Group"

NRRPT Board & Panel Meeting in Orlando, FL



Paul Harvey, one of the original members of the Panel of Examiners attended the meeting with his lovely wife Mary



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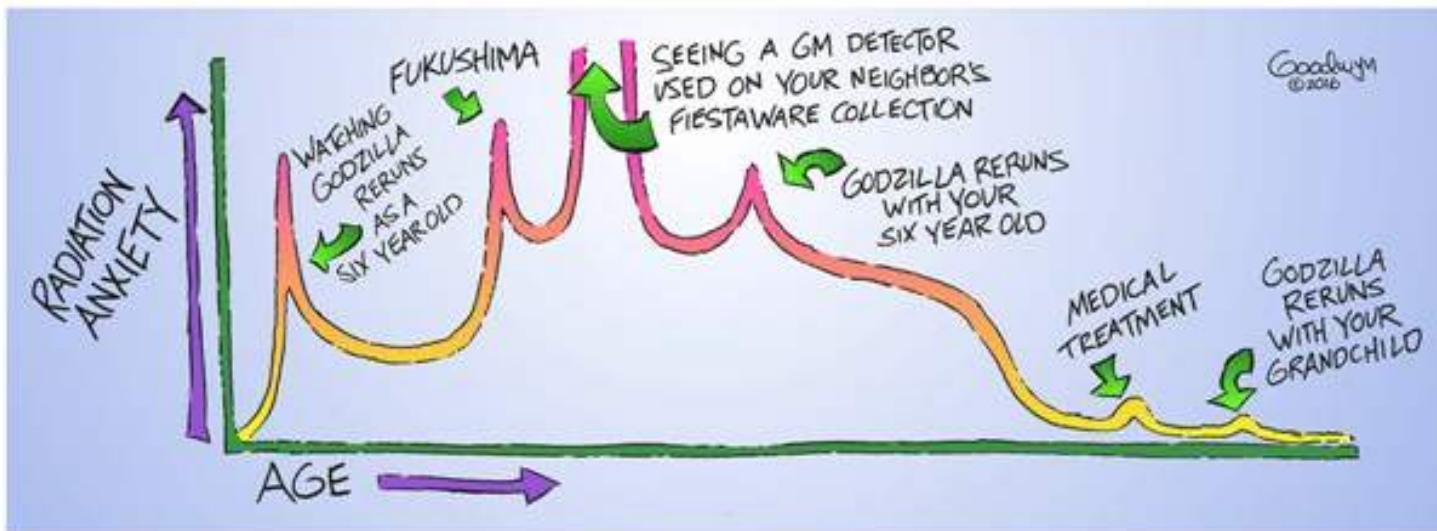
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Incorporated in 1983, Frham Safety Products, Inc. continues its sole purpose of manufacturing and distributing products to the Nuclear Power Utilities, DOE, DOD, Naval facilities as well as several industrial accounts and related users of safety supplies and equipment.

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- LCCM offers products through a systematic approach of life cycle pricing to include disposal at the purchase point.
- MOST provides onsite product storage stocked systematically specified by the customer for easy access and stringent inventory control.
- CDP consists of proven disposables for every application which includes standard and custom specifications to meet your disposable needs.

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Air Sampler product lines include; high and low volume, tritium, C-14 and battery-powered air sampling systems. Various models are available for both portable and environmental sampling systems. Consumable product line includes; filter paper, TEDA impregnated charcoal cartridges and silver zeolite cartridges. F&J provides comprehensive collection efficiency data for radioiodine collection cartridges.

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HI-Q Environmental Products Company is an ISO 9001:2008 certified designer/manufacturer that has been providing air sampling equipment, systems and services to the nuclear and environmental monitoring industries since 1973. Our product line ranges from complete stack sampling systems to complex ambient air sampling stations. HI-Q's customers include the National Laboratories and numerous Federal and State Agencies in addition to our domestic and international commercial customer base. Our product catalog includes: Continuous duty high & low volume air samplers, radiation measurement instrumentation, radiation monitoring systems, air flow calibrators, radioiodine sampling cartridges, collection filter paper and both paper-only or combination style filter holders. Along with the ability to design complete, turn-key, stack and fume hood sampling systems, HI-Q has the capability to test ducts and vent stacks as required by ANSI N13.1-1999/2011.



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