NRRPT

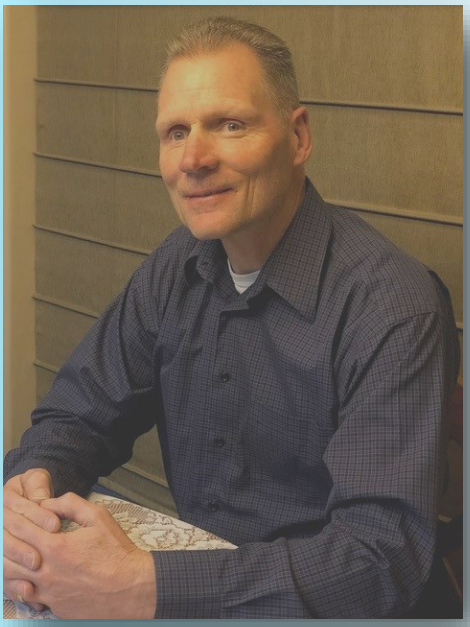
# The NRRPT NEWS

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

**February 2023** **Incorporated April 12, 1976**

## Chairman's Message

**Greetings fellow RRPTs!**



Greetings my fellow RRPTs! As I write this most of us are still in the middle of the cold weather that winter brings. I am anxiously awaiting the longer days, the warmer weather and all the fun of being outside that is coming. It was just a few days ago the Board of Directors and the Exam Panel were busy carrying out Registry business during the Winter meeting in sunny and warm Key West, Florida. I am always amazed at the quantity and quality of work that the members get done at each meeting! One of the highlights of the meeting included having the distinct privilege of introducing the newest NRRPT Fellow Keith Welch. Keith has served the Registry for many many years as both a Board Member and Exam Panel member. He has always been a steady presence for the Board of Directors and Exam Panel. Congratulations Keith! Another highlight was our night out where we got to enjoy some great food and each other's company. Thank you to the night out sponsors – Ameriphysics, Envirachem and Frham Safety Products for allowing us to have a little fun after a hard day of work.

I also have the pleasure of welcoming the thirty-three new RRPTs who passed the August 2022 exam. We are now 5,899 Registrants strong and steadily making our way to having 6000 RRPTs. Speaking of new RRPTs, I was approached by Jason Hout asking about joining the Exam Panel so we put him right to work at the meeting. You can learn a little more about Jason in this newsletter as he had the highest score on the August 2022 exam. Jason, well done and welcome to the Exam Panel!

## Inside This Issue



## Contacts

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Our next meeting will be at the Annual Health Physics meeting in National Harbor, Maryland. The Exam Panel will meet on Sunday July 23rd and Monday July 24th sandwiched by Board meetings on Saturday July 22nd and Tuesday July 25th. This meeting will have real significance as it will be the 100th meeting of the NRRPT. If you are going to be in the area I would love for you to stop by and say hello.

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 2, 2022:

| | | |
|---|---|---|
| William Akre | Ireneusz Fogt | Phillip Meeks |
| Gerard Barron | Gaylene Fred | Nicholas Parker |
| Jeramy Barry | Clayton Gilbert | Charles Quinn |
| Daniel Brooks | Steven Goodrich | Ethan Redlund |
| James Carswell | Darian Green | Dakota Rosal |
| John Caudle | Joshua Griffis | Ross Saunders |
| William Chilen | Jason Hout | Joshua Towns |
| Barry Clayton | Samuel Hurst | Jim Triplett |
| Kayla Cruse | Stephen Kennell | Charles Trueax |
| Robert DeSiders | Ryan Knox | Morgan Weckbacher-Robeck |
| Morgan Ferguson | Jenna LaPierre | Charles Zumpano |

**If you'd like to join the Panel of Examiners please contact one of the following:**

**Exam Panel Chairman—Scott Engeman—scottengeman@gmail.com**

**Executive Secretary—DeeDee McNeill—nrrpt@nrrpt.org**

Slide Presentation provided by Robert Stueve,
NRRPT Panel of Examiners Member

Presentation was compiled by

CH2M-WG Idaho LLC

at the Idaho Cleanup Project

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## Separations Process Research Unit (SPRU)

### Contamination Event – Lessons Learned

Niskayuna, New York Sep 2010

Demolition of Building H-2

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## Learning Objectives

- Discuss the activities and conditions that preceded, contributed to, and exacerbated the event
  - Discuss the event timeline
- Identify key programmatic failures that led to the event
  - Work Control, Work Authorization
  - RadCon, ConOps, ISMS
- Identify the Integrated Safety Management core function failures that led to the event
- Discuss investigation board findings/observations, conclusions, and board-identified contributing causes
- Discuss selected "Lessons Learned"

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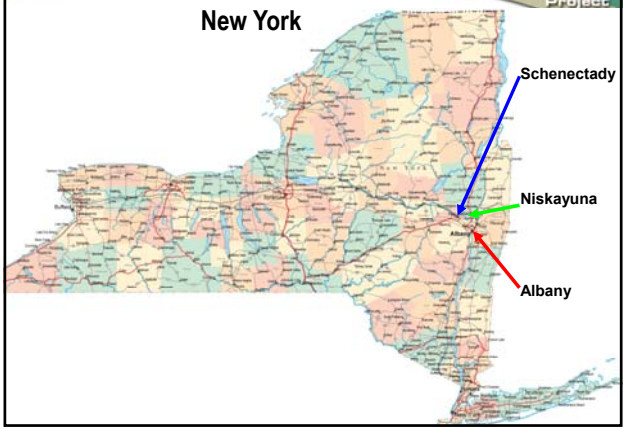
## New York

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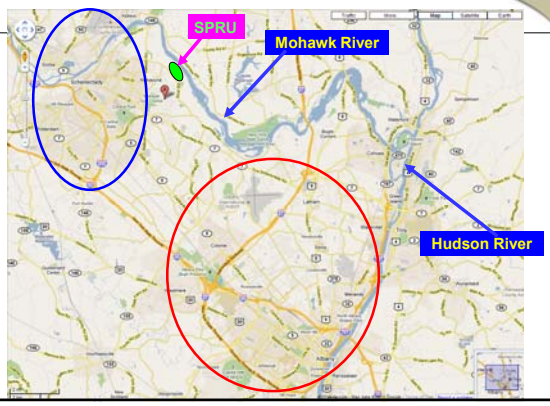
## Schenectady – Albany Area

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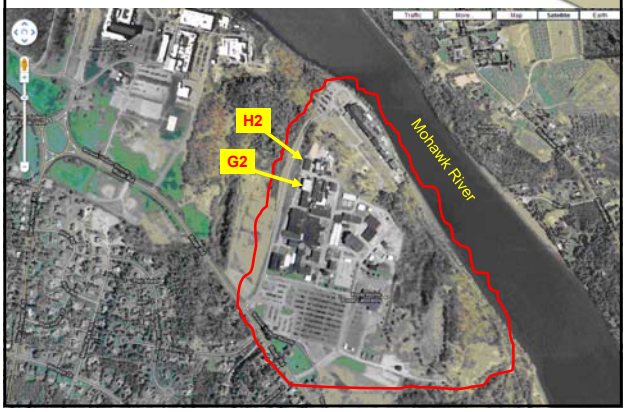
## Niskayuna/SPRU/KAPL

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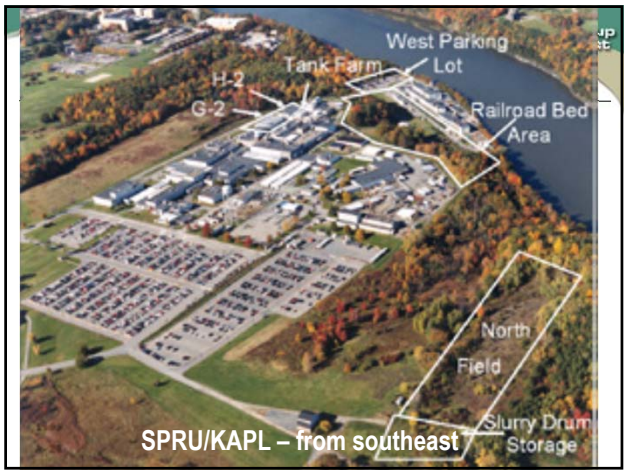
West Parking Lot
Tank Farm
H-2
G-2
Railroad Bed Area
North Field
Slurry Drum Storage
SPRU/KAPL – from southeast

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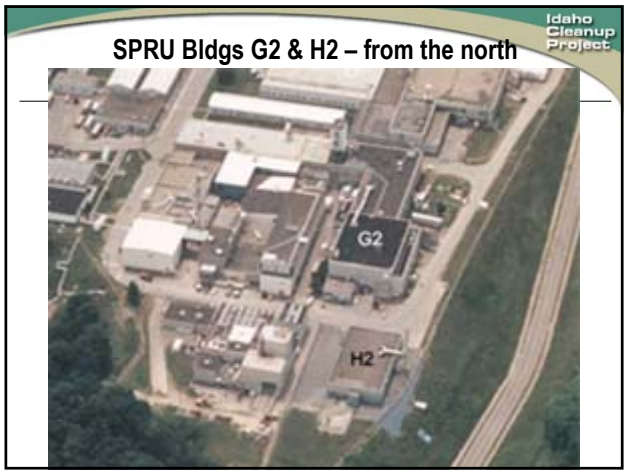
Idaho Cleanup Project
SPRU Bldgs G2 & H2 – from the north
G2
H2

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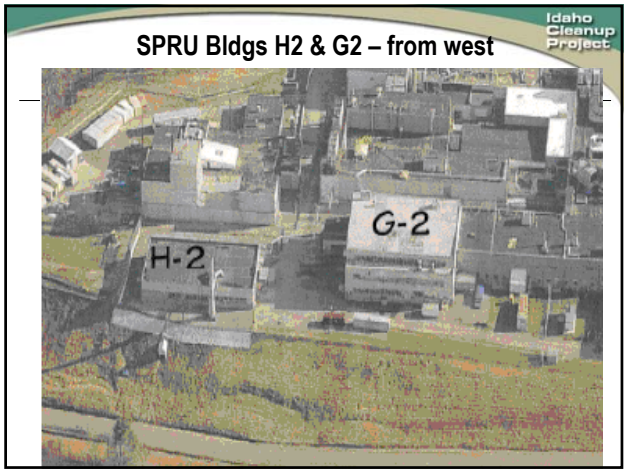
Idaho Cleanup Project
SPRU Bldgs H2 & G2 – from west
G-2
H-2

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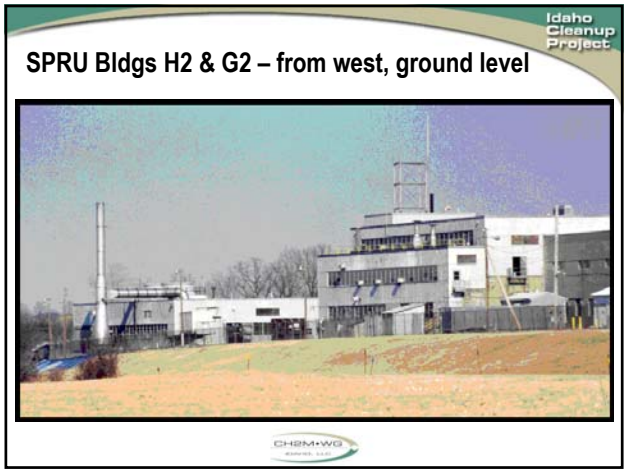
Idaho Cleanup Project
SPRU Bldgs H2 & G2 – from west, ground level

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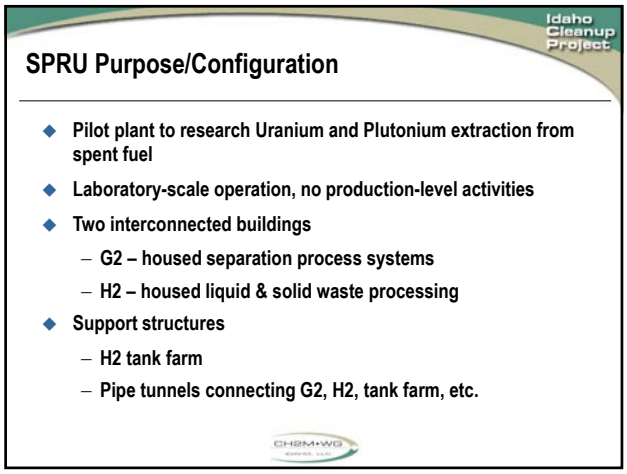
Idaho Cleanup Project
SPRU Purpose/Configuration
Pilot plant to research Uranium and Plutonium extraction from spent fuel
Laboratory-scale operation, no production-level activities
Two interconnected buildings
– G2 – housed separation process systems
– H2 – housed liquid & solid waste processing
Support structures
– H2 tank farm
– Pipe tunnels connecting G2, H2, tank farm, etc.

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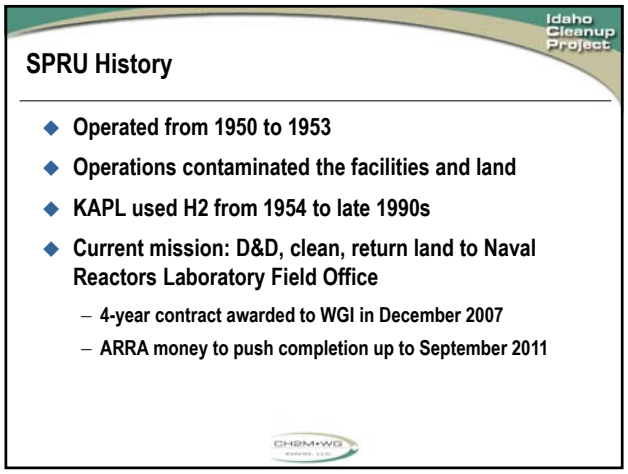
Idaho Cleanup Project
SPRU History
Operated from 1950 to 1953
Operations contaminated the facilities and land
KAPL used H2 from 1954 to late 1990s
Current mission: D&D, clean, return land to Naval Reactors Laboratory Field Office
– 4-year contract awarded to WGI in December 2007
– ARRA money to push completion up to September 2011

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## Event Timeline – Setting the Stage

- 9/23/10 – begin demo of H2
  - Open-air
    - Water hoses staged for dust suppression
  - Start at south end, proceed to north
- 9/28/10 – most of H2 is demo'd
  - Walls on north & west sides remain
  - Crews are extracting 6 evaporator system "columns"
    - 2 columns (vessels) in west cell, 4 in east
    - Columns extend above and below grade (332')

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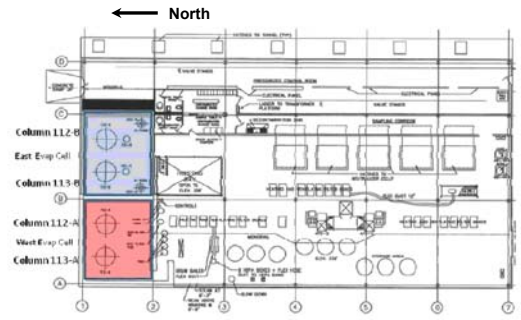
## Bldg H2, 332' Elevation

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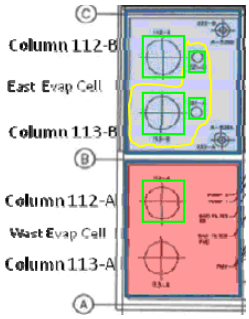
## Event Timeline – Event Day – 9/29/10 (morning)

- Crew "size reduces" 113-B and small columns in east cell (yellow)
  - RCT & electrician notice white "puff" from a column
  - RCT checks for explosive gasses, but no RAD survey – work resumes
- Crew removes five columns (green)
- Bolt is ejected, has fixed contamination
  - No documentation of survey results
  - Safety fence area is enlarged

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## Event Timeline – Event Day – 9/29/10 (morning, cont'd)

- Bolt ejection
  - Week later, phone interview between RCT and RadCon Spvr
    - Spvr records contamination @ 5000 dpm β/γ
      - All survey results are per 100 $cm^2$
    - Spvr records wrong type instrument
    - Correct instrument makes results 24,000 dpm β/γ

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## Event Timeline – Event Day – 9/29/10 (lunch)

- Crew breaks for lunch
  - Hear alarming frisker
- RCT
  - Finds contaminated dust on frisker & elevated background
  - Decons frisker probe
  - Directs crew to lower background area for frisking
    - Highest level > 11,000 dpm β/γ under 15 $cm^2$ probe
      - Below ORPS reporting threshold
  - No evaluation for why elevated background
- Waste Superintendent attributes alarm to "shine"

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## Event Timeline – Event Day – 9/29/10 (post-lunch)

- Subsequent surveys
  - Nasal smears – results are negative
  - Perimeter air samples show elevated readings
    - WGI says below reportable
    - Later analysis shows >> 1 DAC-hour
      - Follow-up assessment uses gamma spec., looks for Cs-137, but dominant isotope was Sr-90
  - Surveys conducted outside the demolition area

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## Event Timeline – Event Day – 9/29/10 (1300)

- RCT enters work area for contamination survey
  - ~1/2 of 30 smears indicate > 1000 dpm β/γ or 20 dpm α
  - Highest reading near 500,000 dpm β/γ and > 10,000 dpm α
  - Fails to sign in on RWP, PPE does not comply with RWP
  - Later reviews find other RCTs not signing in

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## Event Timeline – Event Day – 9/29/10 (1400)

- KAPL is informed, starts extensive surveys
  - ~ 60 people participate
  - Numerous small areas of contamination over > 104,000 sq. ft.
  - Average readings: 20,000 - 40,000 dpm β/γ
  - One area ~150,000 dpm β/γ
  - Evidence contamination reached Mohawk River
  - Bio surveys of > 100 people, no measurable dose

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## Event Timeline – Event Day – 9/29/10 (late afternoon)

- Posting adjustments for CA and ARA
- RCT surveys debris pile
  - Up to 500,000 dpm β/γ and > 10,000 dpm α
  - 16,000 dpm β/γ on processor shear
- Work resumes pending further investigation
- RCTs reduce size of CA and remove ARA postings

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## Event Timeline – Event Day +1 – 9/30/10

- Surveys show entire east side of H2 bldg/pad is contaminated
  - No baseline data available for comparison
- Tropical storm Nicole is approaching
  - Debris pile at south end of pad is pushed onto pad
  - Fixative liberally applied to debris and "columns"
  - Temporary berm constructed to control runoff
  - Additional surveys, contamination found, postings adjusted
  - Preparatory actions and rainfall results
    - Exacerbate contamination
    - Accident scene is not preserved

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## Event Timeline – Event Day +2 – 10/1/10

- Tropical Storm Nicole passes
  - Rainfall ≥ 7", > 4 X normal daily, > 100-year storm records
  - Excess runoff overflows collection tank
    - Operations assumed adequate capacity in 1st tank
    - No operator posted to monitor pumps, switch discharge to second tank
  - Excess runoff overflows berms – flows over posted soil contamination areas
  - Some water analyses show activity levels ~100 X discharge limit for SPRU treatment system
- System openings are covered

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## Event Timeline – Event Day +3….

- Contamination on H2 slab 1.5-1.7M dpm β/γ and > 11,000 dpm α
- Contamination on processor 677,000 dpm β/γ
- Debris pile is covered with tarps, sandbagged
- Perimeter air samples from 9/29 re-evaluated
  - Determination that uncontrolled release had occurred
- 10/25/10 – another release of contaminated water (~630 gallons) onto KAPL property
- 10/28/10 – DOE Accident Investigation Board arrives

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## Investigation Board Findings/Observations - 1

- Evidence examination focus on
  - Work Control Documents
  - Work Authorization
  - Records
  - RadCon
  - ConOps
  - Integrated Safety Management

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## Investigation Board Findings/Observations - 2

- Work planning documents, in detailed work steps, frequently used phrases:
  - As needed
  - As applicble
  - As appropriate
  - If necessary
- Work Control
- Work Authorization
- RadCon
- ConOps
- ISM
  - Scope
  - Identify
  - Mitigate
  - Perform
  - LEssons

WC WA RC CO ISM I-S I-I I-M I-P ILE

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## Investigation Board Findings/Observations - 3

- Process columns were not considered to need decon or fixative prior to removal or size reduction
  - Columns had inaccessible voids, baffles, etc
- Where fixative called for, no subsequent steps to verify coverage, conduct surveys
- Unreasonable expectations placed on fixative effectiveness
  - Treated surfaces referred to as "locked down"
- Work Control
- Work Authorization
- RadCon
- ConOps
- ISM
  - Scope
  - Identify
  - Mitigate
  - Perform
  - LEssons

WC WA RC CO ISM I-S I-I I-M I-P ILE

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## Investigation Board Findings/Observations - 4

- No surveys of overhead structures, component internal surfaces
- 9/16/10 surveys below 332' show > 900K dpm β/γ, 45mR/hr on contact with duct work
- No requirements for surveys to ensure compliance with CA, HCA, ARA postings
- Many surveys w/ errors, pen/ink changes AFTER signoff
  - No record of who, when, why
- Work Control
- Work Authorization
- RadCon
- ConOps
- ISM
  - Scope
  - Identify
  - Mitigate
  - Perform
  - LEssons

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## Investigation Board Findings/Observations - 5

- 12 hold point sigs missing from "Demo-Ready Checklist" at time of approval
  - Sigs obtained 6 weeks later
- One person signed off work package in 3 places
  - D&D supervisor
  - RadCon supervisor (COI w/ D&D)
  - Rad Engineer
- Two separate Work Package Status Logs found in use
  - Broken chronologies
- Work Control
- Work Authorization
- RadCon
- ConOps
- ISM
  - Scope
  - Identify
  - Mitigate
  - Perform
  - LEssons

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## Investigation Board Findings/Observations - 6

- Column demo not performed under an engineered mister, as spec'd in technical basis doc.
  - Fire hose used for dust suppression
    - Diverted to washing mud off truck tires during column demo
  - RWP not require use of a Dust Boss during demo of contaminated struct's
- Work Control
- Work Authorization
- RadCon
- ConOps
- ISM
  - Scope
  - Identify
  - Mitigate
  - Perform
  - LEssons

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## Investigation Board Findings/Observations - 7

- Last step in WO for above-grade demo of H2 addressed the stack.
  - Stack was demo'd BEFORE process columns
- Work package was written for H2, G2, H2/G2 tunnel demo
- Package was released for work 19 days before the event
- Removal of columns was not on POD, not required to be added to POD, not discussed at POD
- Columns removed w/o knowledge of several key managers
- Only generic pre-job brief forms used, no detail of discussion

- Work Control
- Work Authorization
- RadCon
- ConOps
- ISM
  - Scope
  - Identify
  - Mitigate
  - Perform
  - LEssons

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## Investigation Board Findings/Observations - 8

- Work step says: "Radiological Engineering shall determine whether additional radiological characterization is necessary"
  - WO provides no criteria for making determination
- Rad sampling during vent & drain process used only for characterizing waste, not for assessing conditions of components/internals

- Work Control
- Work Authorization
- RadCon
- ConOps
- ISM
  - Scope
  - Identify
  - Mitigate
  - Perform
  - LEssons

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## Investigation Board Findings/Observations - 9

- Pre- vs. Post-event isotope inventories show some large changes
  - Cs-137 within G2/H2
    - Originally 2.4 Ci, now 13.5 Ci
      - Off by factor of 5.6
  - Pu-239 within G2/H2
    - Originally 0.24 Ci, now 1.58 Ci
      - Off by factor of 6.6
  - Total SPRU activity
    - Originally 87.01 Ci, now 103.4 Ci
      - Off by > 18%

- Work Control
- Work Authorization
- RadCon
- ConOps
- ISM
  - Scope
  - Identify
  - Mitigate
  - Perform
  - LEssons

WC WA RC CO ISM I-S I-I I-M I-P ILE

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## Investigation Board Conclusions - 1

- WGI placed over-reliance on application & effectiveness of fixative to control contamination during demolition.
- The Radiation Protection program was ineffective in evaluating and controlling contamination.
  - Execution of work packages did not result in identification and control of contaminated components.
  - Radiological data used did not result in appropriate characterization and control of the hazard

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## Investigation Board Conclusions - 2

- WGI's process for authorizing work did not ensure the work was reviewed by appropriate SMEs and the POD before proceeding.
- Oversight programs were ineffective in identifying and correcting deficiencies in ES&H programs.
- Some workers perceived schedule pressure and were reluctant to bring up issues that might slow progress.
- Use of terms "as needed", etc. contributed to a failure to complete work steps as intended, and led to individual decision-making regarding H2 components

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## Board-Identified Contributing Causes -1

- No plan for application of fixative. Configuration of vessel internals unknown to workers.
- Work package did not integrate hazard controls identified in JHA and rad calculations
- Work package execution did not assure process vessel identification and characterization
- RWPs written in generic vs. task-specific terms
- Responsible SMEs approved documents without fully ensuring hazard controls were identified

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## Board-Identified Contributing Causes -2

- Work plans were inadequate to implement appropriate rad controls
- The use of water for DUST control vs. CONTAMINATION control
- Project did not recognize importance of understanding historical process and system knowledge
- Requirement to fully characterize SPRU for D&D was not completed

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## Board-Identified Contributing Causes -3

- Lack of rigor in executing the characterization plan
- Procedures allow work to be conducted outside the POD review and discussion process
- Neither WGI nor DOE SPRU Oversight assured that programmatic deficiencies were identified and corrected

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## Lessons Learned – Work Control

- As needed, as required, etc. should be linked to specific criteria
- Work control steps must cover the entire scope of work
- Work control steps must include sufficient detail for criteria-based decisions

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## Lessons Learned – Work Authorization

Authorization must be granted ONLY with:

- Knowledge of actual facility conditions
- Timely inputs from supervisors, crafts, technicians, engineers, etc.
- Approval of discipline-specific SMEs

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## Lessons Learned - RadCon

- Characterization must be sufficient to allow development of adequate work controls
- Postings and surveys must reflect current conditions

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## Lessons Learned - ConOps

- Work must be accomplished according to work control document's scope AND sequence
- Records must be complete
  - Work control document/logs
  - Hold-point signatures
  - RadCon Surveys

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## Lessons Learned – Perceived Schedule Pressure

Needs to be addressed with

- Open communication
- Stop Work / Step Back

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## Lessons Learned – ISMS

- Work Scope – must be derived from review of historical information AND current conditions
- Hazard Identification – must be in-depth, beyond the merely obvious needs
- Hazard Mitigation
  - Must address ALL the hazards identified
  - Must not assume unproven capabilities of methods and processes
- Performance – must comply with ConOps

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## Lessons Learned – ISMS cont'd

- Lessons Learned - must be incorporated on the front end as well as the back
- Feedback & Improvement – Management must be in the field to assess work and provide feedback for continuous improvement

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## Learning Objectives

- Discuss the activities and conditions that preceded, contributed to, and exacerbated the event
  - Discuss the event timeline
- Identify key programmatic failures that led to the event
  - Work Control, Work Authorization
  - RadCon, ConOps, ISMS
- Identify the Integrated Safety Management core function failures that led to the event
- Discuss investigation board findings/observations, conclusions, and board-identified contributing causes
- Discuss selected "Lessons Learned"

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# NRRPT Night-Out in Key West, FL

## January 29, 2023

***** Thank you to our generous NRRPT Night-Out sponsors — Ameriphysics, Envirachem, Frham Safety Products *****

Chairman Rick Rasmussen addresses our group

Jason Hout (red shirt) is the recipient of the Exam Achievement Award—highest scorer of the August 6, 2022 exam

Keith Welch (teal shirt) receives the NRRPT Fellow Award!

Back to Business!!

Exam Panel (and Board members) hard at work

# RAD MOVIE REVIEWS!


Serial Movie Poster

If you're a fan of dated serial movies, then this one is for you! And Dave Tucker.

Filmed in March and April 1953, the story takes place in a snowy region of northern Canada. The evil foreign power – lead by agent Marlof attempts to set up secret missile bases in the *Taniak* region of Canada. Oh, the horror! Nuclear missiles pointed at the good ole USA. Sorry to say this, but this is not a sci-fi flick. It's a cold war adventure brought to you in 12 breath taking episodes.

1. Arctic Intrigue
2. Murder or Accident?
3. Fangs of Death
4. Underground Inferno
5. Pursuit to Destruction
6. The Boat Trap
7. Flame Versus Gun
8. Highway of Horror
9. Doomed Cargo
10. Human Quarry
11. Mechanical Homicide
12. Cavern of Revenge

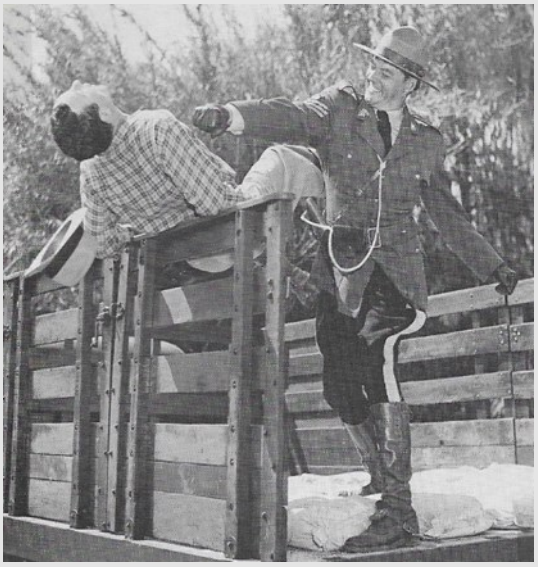
Republic Motion Pictures re-released Canadian Mounties vs. Atomic Invaders as part of 26 serials in a 100-minute feature film for television. The movie was released as *Missile Base at Taniak* in 1966.

Who can resist the spine tingling action of your smiling Canadian Mounty punching out the bad guy?

For you movie-philes - Canadian Mounties vs. Atomic Invaders uses film from the 1938 feature *Call of the Yukon* and 2 other *'Mounties* serials *(King of the Royal Mounted* and *King of the Mounties).*

The Serial stars Bill Henry and was directed by Franklin Adreon.

The late Pete Darnell, RRPT, CHP, amateur movie critic



(serial publicity photo)

# 25 Years + as an NRRPT

## The following members were registered 1990—1991

1990

ACHTEMEIER-HASKELL, LONDA K.
AKERS-MCDOWELL, KAREN
ALLEN, DAVID E.
ANDERSON, MARLYN P.
BAUMGARDNER, BRADLEY J.
BEDNAR, JOSEPH A.
BERGER, STEVEN R.
BIANCO, FREDERICK J.
BIEZE, KEITH R.
BLACK, RICHARD B.
BOWMAN, HARVEY A.
BRIAR, KERRY D.
BRITTEN, GARY W.
BROWN, TAMMY
BROWN, TERRY J.
BROWNLEE, CHRIS A.
CAIN, JOHN W.
CALEY, DOUGLAS P.
CAMPBELL, MARCY L.
CANTWELL, ROBERT D.
CARR, STEPHEN L.
CARROLL, TIMOTHY J.
CARTER, MITCHEL A.
CATHEY, DEBRAY O.
CHANDLER, GARY T.
CHRISTENSEN, MICHAEL B.
CHROSTOWSKI, JOSEPH J.
CHUBON, R. SCOTT
CLARK, MONTGOMERY L.
CLARK, ROBERT N.
COLE, JOHN R.
COLLINS, JERRY
CONLEY, THOMAS A., CHP
CRANFIELD, GARY F.
DAER, GARY R.
DAMPF, MICHAEL H.
DANSBERGER, BENJAMIN W.
DAY, WALTER
DEANGELIS, PETER A.
DEFOGGI, PHILIP A.
DEHART, GARY L.
DICKEY, JOSEPH N.
DIEHL, DANIEL H.
DONOVAN, DENNIS P.
DOUGHERTY, DANIEL P.
DRESIOS, RICHARD W.
DUSKIN, JOHN L.
EARLEY, JACK N.
EDWARDS, CALVIN W.
EDWARDS, LARRY L.
ERVIN, DOUGLAS J.
FENCIL, ROBERT R
FIKE, BRIAN K.
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**Please contact the Executive Secretary if you have a**

**"Greater than 25 Years as an RRPT" story to share!**

**Executive Secretary—DeeDee McNeill—nrrpt@nrrpt.org**

# Exam Achievement Award

**By Kelli Gallion-Sholler, Awards Committee Chairman**

The **NRRPT** Exam Achievement Award is given to the individual with the highest score on each scheduled **NRRPT** examination for becoming a Registered Radiation Protection Technologist. In addition to a letter of recognition, the individual receives a complimentary "high scorer" membership plaque and is featured in an article in the **NRRPT** Newsletter. It is a great accomplishment to pass the exam and even a greater feat to achieve the highest score. Congratulations to our high scorers!

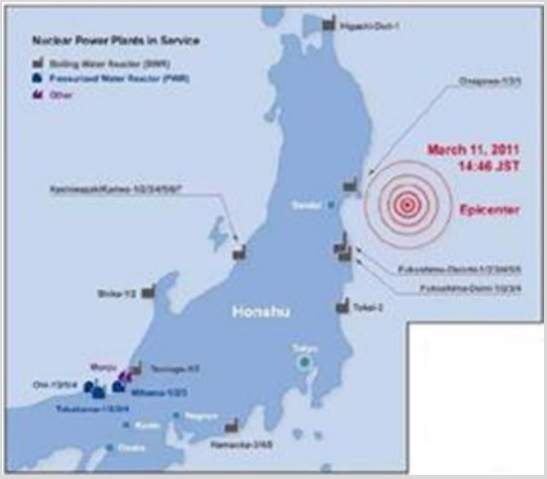
## High Scorer—August 6, 2022 Examination

## Jason Hout


I prepared for the NRRPT exam while concurrently preparing for both parts of the ABHP exam. Starting in January (8 months before the exam), I implemented a study regimen of 10-20 hours per week on average until I took the exam. I utilized a non-credit exam review course at a college (Colorado State University) and practice exam software (Datachem) to aid my studies and benchmark where my knowledge and weaknesses were. I also believe that my work experience played a large part in my familiarization with different subject areas; I have worked with just about every area of radiation protection at a commercial nuclear power plant, as well as manufacturing gauging, x-ray, radioactive material shipping, and laser and non-ionizing programs. I would recommend that candidates pursue a wide range of experiences while they gain their years of work experience as they would have to learn less new information while preparing for the exam.

# 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…*




US NRC

The Date: March 11, 2011 at 2:46 p.m.

The Event: A 9.0-magnitude earthquake struck Japan about 231 miles northeast of Tokyo, 80 miles off the Honshu Island coast, and about 18.5 miles deep in the ocean. The quake generated a tsunami with a height of about 9 – 38 feet traveling at about 435 miles per hour. More than 15,000 people were killed, over 6,000 were injured and, around 2,500 people were reported to be missing. The quake moved Japan about 8 feet east and dropped the northeast coast about 2 feet. All of this leading to a nuclear melt-down in 3 boiling water reactors.

The Place: Eleven reactors at four sites (Fukushima Dai-ichi, Fukushima Dai-ni, Onagawa, and Tokai) along the northeast coast of Japan. The melt-down occurred at Fukushima Dai-ichi.

The Cause: After the earthquake, all the reactors automatically shut down. Fukushima Dai-ichi lost all electrical power from the grid. They were using diesel generator back-ups for about 40 minutes. An estimated 38-foot-high tsunami (think huge wall of water) hit the site. Four of six Fukushima Dai-ichi reactors lost all power.

(AP Photo/Yomiuri Shimbun, Masamine Kawaguchi)

The Setup: Fukushima Dai-ichi units 1, 2 and 3 were in operation at the time of the earthquake. Units 4, 5 and 6 were either in refueling or maintenance. All shut down after the earthquake. The tsunami destroyed almost all the diesel generators, battery back-ups, and electrical switchgear. One of Unit 6's diesel generators survived and, provided power to Units 5 and 6.

Steam-driven and battery-powered safety systems at Units 1, 2 and 3 provided some power for several hours but they eventually failed causing the cores to melt down.

The Accident: The damaged reactors leaked radioactive gas and hydrogen. The hydrogen exploded inside the reactor buildings of Units 1, 3 and 4. The initial release of radioactive material came from Units 1 and 3. The explosions spread more contamination and large areas of Japan were affected. Japan relocated tens of thousands of people.

The Aftermath: March 18, 2011 – 100% of the spent fuel released from Unit 4; 50% from unit 3, and 25% from Unit 1. All 6 units had core damage. All units but number 3 were cooling with injected sea water. Spent fuel water levels were low in 5 units but the conditions in Unit 1 pool were unknown

Fukushima Dai-ichi post accident
(US NRC report)

March 20, 2011 – Elevated environmental radiation measurements discovered outside the 30 kilometers (km) exclusion zone. Containment integrity for units 1 – 3 unknown.

March 21, 2011 – Containment integrity for units 1 – 3 remain unknown. US citizens told to evacuate 50 miles.

Tsunami damage (Daily Express)

March 22, 2011 – Containment integrity for units 1 – 3 remain unknown. Smoke or steam venting from units 2 and 3. US nuclear plants Ginna and Nine Mile report elevated I-131 levels.

March 24, 2011 – Containment integrity for units 1 – 3 remain unknown. 3 workers exposed (173 to 180 mSv). More US nuclear plants report elevated I-131 levels.

March 25, 2011 – Japanese government ask residents to voluntarily evacuate 20 – 30 km from the site.

March 29, 2011 – Tokyo Electric Power Company (TEPCO) considers spraying Zeolite in and outside of reactor buildings to reduce re-suspension. Highly radioactive water found outside Unit 2 – source unknown.

March 31, 2011 – The International Atomic Energy Agency (IAEA) reports elevated I-131 and Cs-137 levels in soils in an Iitate village, 40 km NW of Fukushima.

April 4, 2011 – Unit 1 containment pressure decreasing from leaks.

April 12, 2011 – The Japan Nuclear and Industrial Safety Agency (NISA) raises the International Nuclear and Radiological Scale (INES) from 5 to 7 (major accident).

April 13, 2011 – A 6.6 magnitude earthquake occurred. Further core damage expected.

April 17, 2011 –NISA considering release criteria to allow liquid and solid radioactive waste into municipal systems.

ndtv.com

April 21, 2011 – site status:

Unit 1 – 70% core damage with fuel exposed and containment damaged.

Unit 2 – 30% core damage with fuel exposed and containment damaged. Contaminated water leak stopped.

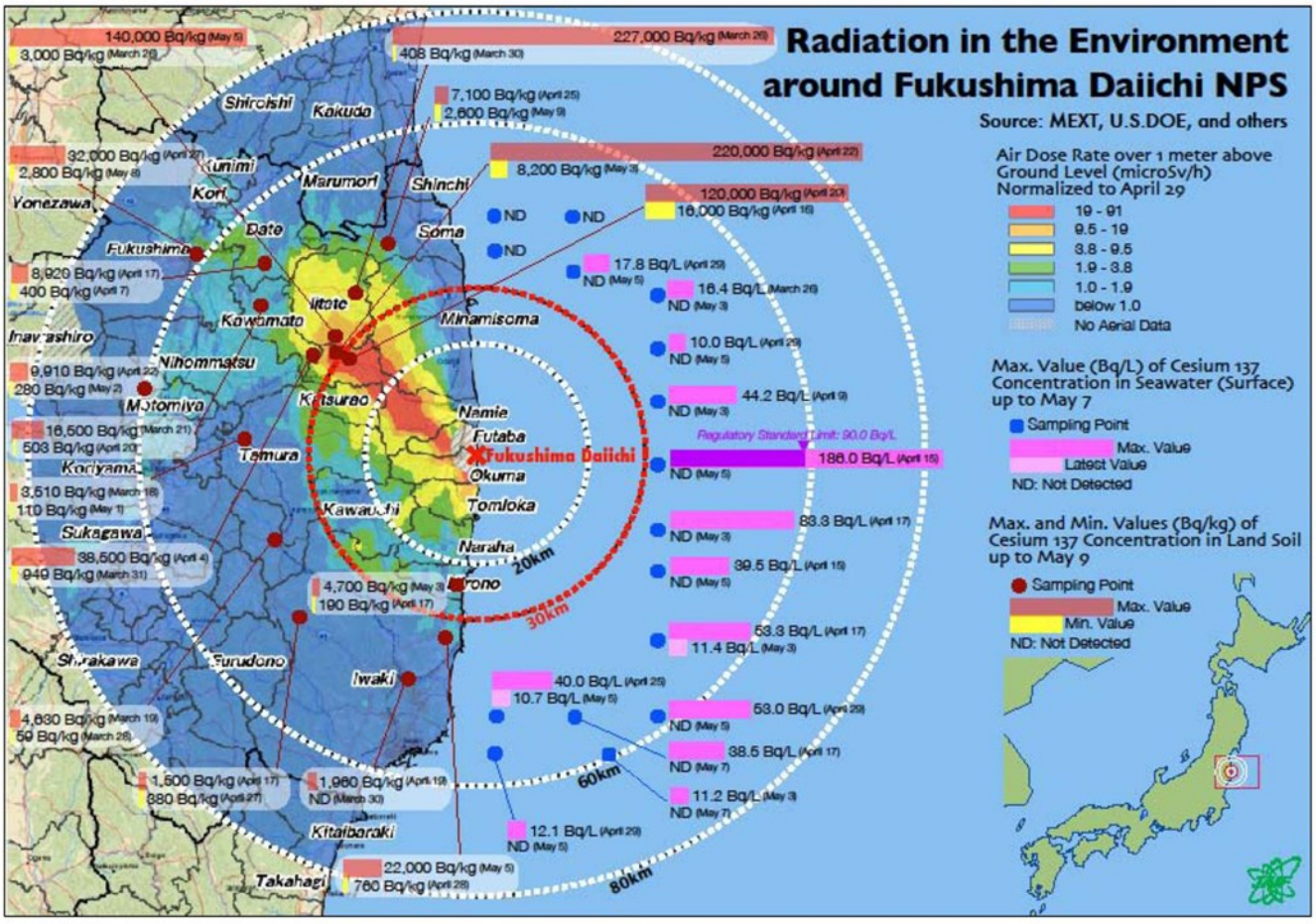
Unit 3 – 25% core damage with fuel exposed. Primary and secondary containments damaged.

Unit 4 – Fuel off-loaded 105 days at time of the accident. Secondary containment damaged from hydrogen explosion.

Fukushima Damage (Union of Concerned Scientists)

April 28, 2011 – TEPCO announced highly radioactive water that leaked into the Pacific Ocean from the Daiichi nuclear plant in early April contained an estimated 5,000 terabecquerels (20,000 times the annual allowable release limit). TEPCO reported total leakage of 520 tons. TEPCO estimates the leakage to have lasted for six days through April 6.

December 15, 2011 – environmental radiation levels (sources as noted):




No early radiation induced health effects were observed among workers or members of the public that could be attributed to the accident.

The Japanese government has reopened limited areas for residents to return to, but many communities remain off-limits.

The late Peter Darnell, RRPT, CHP, after-the-fact reporter

# Mirion Technologies

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**Mirion Technologies is a leading provider of innovative products, systems and services related to the measurement, detection and monitoring of radiation. The company delivers high quality, state of the art solutions that constantly evolve to meet the changing needs of its customers. With the addition of the Canberra brand in 2016, Mirion expanded its portfolio and the breadth of its expertise to bring a new standard of solutions to the market. Every member of the Mirion team is focused on enhancing the customer experience by delivering superior products, exceptional service and unsurpassed support. Mirion Technologies: Radiation Safety. Amplified.**

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Among the nation's top utility companies in size and sales, Ameren is the parent of Ameren Missouri, based in St. Louis, MO, and Ameren Illinois, based in Springfield, IL. Ameren is also parent to several nonregulated trading, marketing, investment and energy-related subsidiaries. Ameren employees, totaling approximately 7,400, provide energy services to 1.5 million electric and 300,000 natural gas customers over 44,500 square miles in Illinois and Missouri.

## Cabrera Services

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Cabrera is a trusted integrator for radiological remediation and munitions response solutions. We bring world class expertise in health physics and munitions response along with a broad base NRC radioactive materials license to solve our client's toughest challenges. As an integrator, we bring our clients:

- Expertise in securing site closure/release;
- Smart design of characterization, sampling and FSS programs; and
- Innovative technologies that expedite closure, ensure compliant Material Control and Accountability, minimize remediation footprints and waste quantities for off-site transport and disposal, and achieve schedule and cost efficiencies.

## Duke Energy Corporation

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The new Duke Energy, which is the product of a merger with Progress Energy, is the largest electric power holding company in the United States with more than $100 billion in total assets. Its regulated utility operations serve more than 7 million electric customers located in six states in the Southeast and Midwest. Its commercial power and international business segments own and operate diverse power generation assets in North America and Latin America, including a growing portfolio of renewable energy assets in the United States. Headquartered in Charlotte, N.C., Duke Energy is a Fortune 250 company traded on the New York Stock Exchange under the symbol DUK.

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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.

From the creators of proven products such as the Totes Overshoe and the Frham Tex II, Frham continues their objective to provide products and services which meet or exceed the specifications set forth by customers and the industries that it serves. These revolutionary new concepts include Life Cycle Cost Management (LCCM), Mobile Outage System Trailer (MOST) and Certified Disposable Products (CDP).

- 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.

Among these services and products, Frham also supplies chemical, biological and radiological equipment which will support applications for domestic, biological, nuclear, radiological or high explosive incident sites. This equipment is able to sample, detect and identify chemical warfare agents and radiological materials as well as provide safe-barrier, personal protection from chemical warfare, biological warfare, radiological and TIC/TIM environments.

## F&J Specialty Products, Inc.

Frank M. Gavila
404 Cypress Road
Ocala, FL 34472
352.680.1177/352.680.1454 (fax)/fandjspeciaty.com

ISO 9001:2008 certified manufacturer of traditional and advanced-technology air sampling instruments, airflow calibrators, filter holders, consumables and accessories.
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.
F&J manufactures the premier line of small lightweight emergency response air samplers which can operate from line power, on-board batteries or an external DC power source. Battery powered units have on-board charging systems.

## HI-Q ENVIRONMENTAL PRODUCTS COMPANY, INC.

*Air Sampling & Radiation Monitoring Equipment, Systems & Accessories*

Marc A. Held
7386 Trade Street
San Diego, CA 92121
(858) 549-2820 (phone) / (858) 549-9657 (fax)
marc@HI-Q.net
www.HI-Q.net

HI-Q Environmental Products Company is an ISO 9001:2008 certified designer and manufacturer that has been providing Air Sampling & Radiation Monitoring Equipment, Systems and Services to the nuclear and environmental monitoring industries since 1973. Hi-Q's product line ranges from complete stack sampling systems to complex ambient air sampling stations. HI-Q's 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 unique capability to test ducts and vent stacks as required by ANSI N13.1-1999/2011.

## Pastime Publication

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The 40 hour NRRPT Exam review class is based on the 372 new Knowledge Objectives issued by the Board in June of 2020.

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## STP Nuclear Operating Company

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Name: _____

Old Address: _____

_____

_____

New Address: _____

_____

_____

Effective Date: _____ New Phone Number: _____

Email Address: _____

If you have moved, please complete this form and return via email, fax or USPS mail.

nrrpt@nrrpt.org

(401) 637-4822

P.O. Box 3084
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