USA CAN NRRPT

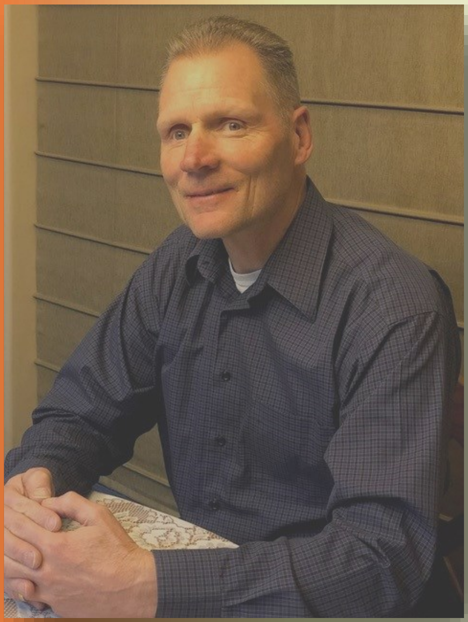
The NRRPT NEWS

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

October 2023 Incorporated April 12, 1976

Chairman's Message

Greetings fellow RRPTs!



Greetings my fellow RRPTs! As I write this fall has definitely arrived as evidenced by the beautiful colors of the leaves and the much-welcomed cooler temperatures here in the Southwest. I hope that you are enjoying nice weather and all of the fun outside activities that fall brings.

I want to take a minute to welcome in the twenty-eight new RRPTs that passed the February 25, 2023 exam and the twenty-nine new RRPTs that passed the August 12, 2023 exam. Congratulations to all of you for successfully completing the NRRPT Exam – job well done! The registry is now at 5,956 Registrants strong! So very close to the 6,000 Registrants mark. We should easily hit that milestone in 2024. If you have been reading the newsletters you have probably seen the list of RRPTs that have passed the exam 25 years ago. That extensive list demonstrates that our population is an aging one so it is fantastic that we are adding new RRPTs at a good pace.

In this newsletter there are great technical articles by Auggie Ong and Keith Welch. There is also an informative article by Michelle Kovach about restoring your practitioner status and the benefits of being a practitioner. You may want to show Michelle's article to anyone you know that may want to restore their status. There is also some information about our annual meeting held at the annual Health Physics Society meeting at National Harbor, Maryland July 21 – 25, 2023. This meeting was very special as it was the 100th meeting of the NRRPT which is quite the achievement! At the night out, the Registry welcomed James Schuler as a NRRPT Fellow.

Inside This Issue

Contacts

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Congratulations Jim! Mark Bayless was presented with a special award for filling in as Chairman of the Board. Congratulations Mark and thank you for stepping in and doing such a great job!

Finally, speaking of change, this will be last my message as the NRRPT Chairman of the Board of Directors. The Board elected Danny McClung as the next Chairman of the Board. Please join me in congratulating and welcoming Danny. He takes control of the gavel on January 1, 2024. I am positive that he will do an absolutely amazing job and the Registry will be in great hands. As I transition out of the position I would like to thank all of the Board and Panel members. Each and every one of you are amazing and it has been a huge privilege working with you to represent the Registry. The wonderful "can do" attitude you bring and the intelligence you show while getting the great amount of work completed is simply awesome! Finally, a huge thank you to our Executive Secretary DeeDee McNeill – you are the glue that keeps the Registry together and I can't thank you enough for all of the help you have given me over the last few years!

Danny, the helm is yours. May your voyage be as wonderful as the one I had!

Very Respectfully,
Rick Rasmussen
NRRPT, Chairman of the Board

Welcome New NRRPT Members

Congratulations to the following individuals who successfully passed the **NRRPT** Examination on February 25, 2023:

Blade Albertson
Brian Barron
Ismael Benavidez
Stephanie Boschert
Rebecca Bunch
Jacob Burton
Saxby Chaplin
Marc Ezra
Bradley Haggard
Alexander Hunt
Paul Johnston
Jason Jones
Scott Kirkland
Eva Klos
Victoria Messenger
Paul Meyer
Sarah Miller
Zachary Olson
Victoria Parker
Joshua Patton
Patrick Rauda
David Ruggles
Aaron Shelby
Matthew Smith
Andrew Tiemens
James Vigil
Nicholas Wehmann
Jiefu Yin

Congratulations to the following individuals who successfully passed the **NRRPT** Examination on August 12, 2023:

Derrick Bellmore
Anthony Bench
Kyle Bittner
Geri Brooks
Brian Church
Brad Denton
Jacob Ellis
Jake Fiedler
Gerald Godwin
Christopher Hamblin
Matthew Hartelius
Rawley Henson
Lisa Lemmons
Tyler Lucas
Cameron McCormick
Steven Moody
Jaren Nelson
Keith Newsted
Tracy Olson
Brian Perkins
Ian Provo
Robert Riley
Jeffrey Rose
Sean Sandoval
Joshua Selvey
Kory Sims
Alissa Swift
Jennifer Woods
Michael Worley

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

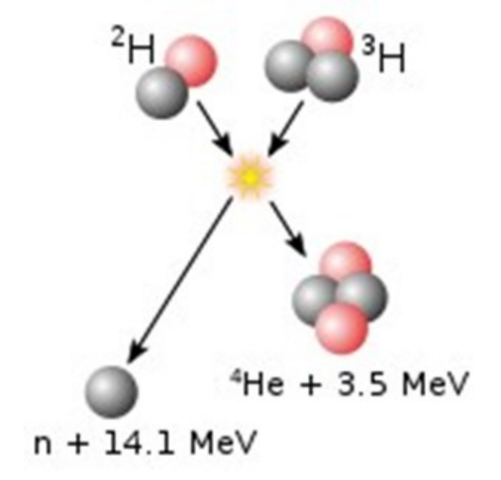
“A Milestone in Fusion Technology: So are we there yet?”

by Augustinus Ong

On December 13, 2022, New York Times headline declared, “Scientists Achieve Nuclear Fusion Breakthrough with Blast of 192 Lasers.” Scientists at the National Ignition Facility (NIF), Lawrence Livermore National Laboratory, announced they produced the first fusion reaction that created more energy than the laser beam energy took to ignite it. At 1:03 a.m. on Dec. 5th a bank of 192 powerful lasers blasted into a small cylinder about the size of a pencil eraser that contained a hydrogen fuel (a mixture of deuterium and tritium) pellet encased in diamond. The laser beams entered at the top and bottom of the cylinder, vaporizing the fuel. That in turn, generated inward intense x-rays, ultra-high temperature and pressure within the diamond to compress the fuel enough to start the fusion reaction.

So, in less than 10^{-14} second, 2.05 megajoules of energy (roughly the equivalent of a pound of TNT’s explosive energy) bombarded the hydrogen pellet. The reaction produced neutron particles, which carried about 3 megajoules of energy (roughly equivalent of energy to power a 100-watt incandescent bulb lighting for ~ 8 hours), a Q factor of 1.5 in energy gain.

So let’s unpack this milestone achievement. First, here’s the illustrated fusion reaction, yielding a total energy of 17.6 MeV:



The deuterium–tritium fusion is used in this NIF experiment because this fuel mixture not only provides advantages over other types of reactant mixtures but also it has a relatively low minimum fusion temperature of 100 million degrees Celsius. Other reactants are listed as follows:

1.	D + T	→	^{4}He (3.5 MeV) + n (14.1 MeV)
2.	D + D	→	T (1.01 MeV) + p (3.02 MeV) (50%)
		→	^{3}He (0.82 MeV) + n (2.45 MeV) (50%)
3.	D + ^{3}He	→	^{4}He (3.6 MeV) + p (14.7 MeV)
4.	T +T	→	^{4}He + 2 n + 11.3 MeV
5.	^{3}He + ^{3}He	→	^{4}He + 2 p
6.	^{3}He + T	→	^{4}He + p + n + 12.1 MeV (51%)
		→	^{4}He (4.8 MeV) + D (9.5 MeV) (43%)
		→	^{4}He (0.5 MeV) + n (1.9 MeV) + p (11.9 MeV) (6%)
7.	D + ^{6}Li	→	2 ^{4}He + 22.4 MeV
8.	p + ^{6}Li	→	^{4}He (1.7 MeV) + ^{3}He (2.3 MeV)
9.	^{3}He + ^{6}Li	→	2 ^{4}He + p + 16.9 MeV
10.	p + ^{11}B	→	3 ^{4}He + 8.7 MeV

Second, a fusion energy gain factor, expressed with the symbol Q, is the ratio of fusion power produced in a nuclear fusion reactor to the power required to maintain the plasma in steady state. The condition of $Q = 1$, when the power being released by the fusion reactions is equal to the required heating power, is referred to as breakeven.

But, (and there's always a but), according to Kim Budil, director for the Lawrence Livermore National Laboratory, he did point out that the 192 lasers required over 300 megajoules of electricity to produce an output of 2.05 megajoules of laser power to heat the pellet of hydrogen. In short, we are not there yet in terms of achieving a sustainable fusion reaction outside of the laboratory. Still, kudos to the NIF scientists for achieving the fusion net energy gain.

References for this news brief and additional reading sources for the interested readers:

(1) www.nytimes.com/2022/12/13/science/nuclear-fusion-energy-breakthrough.html and www.washingtonpost.com/science/interactive/2022/fusion-milestone-explained/

(2) PCmag.com: "Clean Power: US Achieves Fusion Energy Breakthrough With 192 Lasers," by Michael Kan, Dec. 13, 2022.

(3) For the interested reader wanting to know more about the NIF lasers, here's the URL: lasers.llnl.gov/about/how-nif-works.

(4) A deeper dive into laser induction of plasma, there're are numerous sources, in particular, URL: phys.org/tags/laser-plasma/ plasmas

(5) Free fusion physics book: www-pub.iaea.org/MTCD/Publications/PDF/Pub1562_web.pdf

WE WANT YOU—To Re-Member!
An Article About Reclaiming NRRPT Practitioner Status
by NRRPT News Editor Michelle Kovach

In 2016, the registry approved a feasible means for non-practicing registrants to become active practitioners.

Active professionals only require 20 points (previously 40 points) when completing the registration maintenance worksheet for the previous five years or retaking and passing the NRRPT exam (previously the only means to become an active practitioner when registration maintenance was not maintained). Along with one of the two professional options, an RRPT may become current on dues by paying back dues owed not to exceed five years at the current annual dues rate (this is even the case for those that haven't paid for the last 25 years).

Benefits of practitioner status are as follows:

- Nationally (and Canada) recognized as an industry benchmark of individual competency for commercial power, medical industry, universities, and state and government fields in radiation protection.
- Many entities waive practitioners from taking pre-employment exams.
- Some employers recognize the importance of having employees that are RRPTs by providing monetary incentives (hourly rate increase and/or bonuses).
- NRRPT maintains certification with the American College of Education (ACE). This provides up to 35 continuing education units (CEUs) for practitioners to use toward education in science and health physics based degrees.
- Employers seek employees that are active practitioners over those that are not. (Yes, employers do check the registry or call NRRPT's secretary to verify practitioner status.)
- Many employers weigh a portion of employee radiation protection based promotions on whether or not an employee is an active practitioner.
- Passing the exam is tremendous preparation for those practitioners desiring to take Part I of the American Board of Health Physics (ABHP) exam.
- Practitioners have access to the member's portions of www.nrrpt.org where they are able to access NRRPT's handbooks, newsletters, college credit information, job postings, scholarships, and many other "members only" portions of the website.

What are you waiting for? With the array of benefits and the minimum requirements to become active, you have nothing to lose. And, many employers pay NRRPT membership dues.

RE-MEMBER WE WANT YOU BACK!

Accelerating Particle
by Keith Welch

Greetings RRPTs! It's been quite a while since I've contributed an accelerator article to the newsletter – I think it may have been the mid 1990's. So it's about time we chatted again about some of the interesting and challenging aspects of radiation protection at accelerators.

For this article, I've chosen the topic of tritium contamination in lubricating oil. This phenomenon is fairly common at accelerators, and presents some interesting issues. Let's dive in.

Some Background

Tritiated oil generally represents a "nuisance-level" concern at accelerators; it is usually not a significant source of exposure or potential contamination, but it's one of those items that can be easily overlooked. If you don't evaluate it, you may miss a potential dose pathway or important aspect of material clearance or waste characterization. Also, tritiated oils are not unique to accelerators. Tritium facilities deal with tritium-contaminated oil at much higher concentrations than usually occur at accelerators. For this article, we'll look at common aspects of tritiated oil, and some unique aspects of accelerator-produced tritiated oil.

Where Does it Come From?

Among the most common components at accelerators are vacuum pumps. We're always pumping away on the beam pipes, keeping the vacuum as high as possible. Some of these pumps are of oil-less design, but others are lubricated with vacuum pump oil. Given the location of these pumps, some of them are subjected to high energy photon and neutron radiation fields. These radiation fields can activate the pumps, and the oil. The activation process is one of the unique parts of the issue. The tritium is formed directly in the oil (typically through interactions in carbon atoms) by photonuclear (γ-t) and high energy neutron interactions. So the tritium is initially elemental in nature.

This is different from "contaminating" the oil with tritium by introducing it from outside. In the latter case, the tritium is often in the aqueous form (as tritiated water, or HTO). As such, it is slowly incorporated into the molecular structure of the oil by chemical exchange. Such oil can sometimes be successfully decontaminated by purging clean water vapor through it. In tritium facilities, where tritium gas is handled with such pumps, the gas is in its molecular state (T_2) and again the exchange of the tritium with the hydrogen in oil is subject to chemical reactions involving several steps. Due to the high concentration of tritium, the oil in such systems can become extremely contaminated.

In our case, the tritium atoms are formed in single events; the exact process by which they are incorporated into the hydrocarbon molecules has not been thoroughly studied, but we assume the tritium is relatively rapidly bound in the oil molecules. The presence of tritium in the organically bound state is one of the issues that needs to be taken into account. More about that below.

By the way, there are other systems that utilize oil in accelerator spaces. Air compressors, HVAC equipment, pneumatic systems, to name a few. The oil in these systems also has to be considered potentially impacted.

How do You Measure It?

As with most any tritiated liquid, liquid scintillation counting (LSC) is the go-to method for measuring tritiated oil. But there's a hitch; oil or other non-aqueous liquids can present problems with LSC analysis. First, scintillation cocktail response is affected by a phenomenon called "quench". Quench is fundamentally a change in counting efficiency due to alteration of the scintillation process by factors such as the sample clarity, chemical interference, and chemical (or even biological) luminescence.

Knowing the amount of quench/luminescence in a sample is critical to an accurate measurement. Liquid scintillation counters are calibrated using standardized pre-quenched samples. And if those calibration samples don't mimic the characteristics of the actual samples, accuracy will suffer. As you can imagine, this becomes particularly important if the activity in the samples is near background levels and your measurements are for clearance/release purposes. There are many types of oil, and depending on how it was used, it will vary in color, impurities, ash content, etc. (all affecting quench).

Another issue is that oil does not mix well with LSC cocktails, and tends to form tiny globules that cling to the sides of the sample vial. Treatment with surfactants or solvents can potentially mitigate this, but adding such materials then introduces more uncertainty because of their effect on quench.

At my facility, we have introduced sample combustion as a way of attempting to deal with the above issues. In this process, small samples of oil are burned to complete oxidation in a specialized furnace, producing water vapor and CO_2. The water vapor is collected in a bubbler system, and counted as a normal water sample in the LSC.

What About OBT?

As mentioned above, the activation process produces organically-bound tritium (OBT), incorporating the tritium atoms into the oil molecule. This chemical form has significant health physics implications. Most of us are familiar with the nominal ten -day biological half-life of tritium. But OBT (particularly an insoluble form) stays in the body longer, and clearance from the lung is slow. DOE guidance on intakes of oil vapors/mists is that it should be treated like an intake of a solid, insoluble particulate, because it has to be converted to HTO in the lung to be released into body fluids. For this reason, the recommended air concentration values for oil mists are between ten and 17 times lower than the DAC values published in the CFRs[1].

Implications

I see two main takeaways from the discussion above:

First, clearance and release protocols for oil from inside accelerator enclosures need to be carefully designed to ensure the issues involved with analysis of the oil have been assessed and addressed.

Secondly, it's important to understand the potential exposure pathways for this material at a given facility. If there are pumps/compressor systems that might disperse OBT oil mists into the breathing zone of personnel, then appropriate modifications need to be made to dose assessments from any uptakes. Air sampling systems for this material need to be evaluated for their collection and/or measurement capabilities.

[1] *DOE Handbook, Radiological Control Programs for Special Tritium Compounds (DOE-HDBK-1184-2004)*

NRRPT Night-Out in National Harbor, MD
Celebrating our 100th Meeting and 6000 Members!

July 23, 2023

***** Thank you to our generous NRRPT Night-Out sponsors — Ameriphysics, Frham Safety Products, RSI-Envirachem and UniTech Group Services *****

Chairman Rick Rasmussen speaks to our group

Night-Out Photos

Karen Barcal, DeeDee McNeill & Kelli Gallion-Sholler

Night-Out Photos—continued

Drew & Rick Rasmussen

Awards Chairman Kelli Gallion-Sholler
Presents awards to Mark Bayless, Rick Rasmussen & James Schuler

Rick Rasmussen & James Schuler receive the NRRPT Fellow Award!

Mark Bayless receives the Special Chairman Award

The Special Chairman Award was presented to Mark Bayless for filling in as Chairman of the Board at the January and July 2018 meetings. The inscription on the award reads: A leader is someone who steps up and takes charge. It's a person who isn't afraid to take initiative. Thank you for stepping up!!

(left to right, front to back) Diana Biela, Dave Biela, Todd Davidson, Jason Hout, Abby Hansen, Gary Hansen, Terrie Vance, Tim Vance & Mark Bayless

Change of Chairmanship

Chairman Rick Rasmussen passes the Chairman gavel to Danny McClung.
Danny will be Chairman of the Board on January 1, 2024

Kelli Gallion-Sholler &
Rick Rasmussen

Ryan Murdock &
Tom Hansen

Keith Welch (left) and Danny McClung (right) doing a little picking

Back to Business!!

Exam Panel (and Board members) hard at work

We commemorated our 100th Board & Panel meeting with logo t-shirts and beverage containers!

RAD MOVIE REVIEWS!

(actual movie poster)

Man Made Monster (re-released as The Atomic Monster in 1953) is a 1941 science fiction horror movie. Lon Chaney, Jr. makes his horror debut in this flick. Lon Jr. is the son of famed silent film star Lon Chaney (think *Hunchback of Notre Dame* and *Phantom of the Opera*).

My favorite dialogue occurs just 6 minutes into the film:

"This theory of yours isn't science, it's black magic.

I believe that electricity is life. That men can be motivated and *controlled by electrical impulse supplied by the radioactivity of the electrons."*

Thank God that no one has figured out how to control us with radioactivity!

Good ole Dr. Paul Rigas (Lionel Atwill, seen right) wants to create an army of electro-biologically-driven zombies after hearing about Dan McCormick's (Lon Chaney Jr., seen lef) miraculous survival of a bus accident. It seems the bus hit a high power line and Dan survived it because he was immune to deadly electricity (is that like deadly plutonium?).

(the mad Dr. Rigas)

(poor old Dan)

Dr. Rigas treats poor Dan with so much electricity that his mind is ruined and he is left dependent upon addicting electrical charges. Of course, Dan gets the touch of death and is able to kill anyone by electrocution.

Another character Dr. Jon Lawrence (Samuel S. Hinds - think of Peter Bailey, father of Jimmy Stewart in *It's A Wonderful Life*) tries to stop the horror. Of course, Dan kills him. Of course, Dr. Paul gets Dan arrested and tried for murder. Of course, Dan goes to the electric chair.

It all breaks loose when Dan survives his execution. Dan goes on to kill some other characters and eventually he dies too – ran out of electrical juice.

Pretty good special effects for the time – you have got to love the movie sets!

(Dr. Jon Lawrence)

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

25 Years + as an NRRPT

The following members were registered 1992

AASAND, KENNETH E.
ABBEY, SCOTT C.
ADAMS, JOHN D.
ADDOTTA, BRIAN V.
AGREST, DON P.
AIKEN, LARRY W.
ALDERMAN, WAYNE L.
ALLARD, ROBERT D.
ALLDREDGE, JIM
ALLEN, PHILLIP W.
AMARO, CHRISTOPHER
ANDERKO, CATHERINE M.
ANDERSON, CHARLES E.
ANDERSON, KEITH D., CHP
APERANS, JOHN E.
ARGO, TERRY L.
ARMSTRONG, KIMBERLY A.
ASBELL, MOLLIE M.
AULT, MICHAEL R.
AYERS, REX G.
BALDWIN, MARK E.
BALL, KATRINA A.
BALLARD, VICTORIA L.
BARCAL, KAREN K., CHP
BARRETT, SCOTT G.
BARSY, CHARLES N.
BARTON, BARRY M.
BASHAW, JOHN N.
BAUGH, BRYAN J.
BECK, JEFFREY H.
BECK, RICHARD J.
BEEBE, ALAN K.
BEEKMAN, MARSHA L.
BELL, EDWARD L.
BELONGIA, JR., GORDON (BJ) R.
BEMENT, JAMES E.
BENNETT, ERTMAN L.
BENSEN, MICHAEL L.
BENSON, JR., RICHARD P.
BETTS, LANE B.
BIERKORTTE, TROY V.
BISHOP, DONALD B.
BLAIKIE, JOHN M
BLAIR, JONATHAN H.

BLAIS, PAUL O.
BLAKESLEE, WILLIAM E.
BLESSINGER, JAMES A.
BLIZZARD, AARON R.
BODETTE, RICHARD F.
BONTEMPO, JAMES E.
BOONE, A. MELODY
BOULER, GARY W.
BOYCE, ROGER W.
BOYER, MICHAEL J.
BOYKO, ROBERT M.
BRAATHEN, DALE A.
BRADLEY, RALPH M.
BRADY, JAMES J.
BRAGG, JR., DONALD J.
BRANHAM, DAVID L.
BRETT, HARRY MICHAEL , CHP
BRIDGE, BRIAN D.
BRINK, RICHARD L.
BRISTOL, ANGELA J.
BRITTON, DANIEL C.
BROWN, DWAINE
BROWN, RANDY L.
BROWNELL, ROBERT C.
BRUCKEL, EDWIN M.
BRUNO, JOSEPH
BRUSKY, BRIAN J.
BUCKHALTER, JEFF P.
BUCKLE, DAVID R.
BUCKLEY, ROBERT H.
BUDA, ANTHONY
BUFKIN, JON S.
BURRIS, CHARLES J.
BYERS, MATTHEW W.
BYRD, PERRY L.
BYRNES, MICHAEL T.
CALDWELL, JAY
CAMPBELL, NED A.
CAPP, JR., JAMES E.
CAPRISTO, ALDO
CARDEN, WILLIAM (DUSTY) L.
CARDWELL, RON S.
CARTER, WILLIAM A.
CHAMPAGNE, EDWARD D.
CHENIER, BRETT T.

CHILDERS, JR., BILLIE W.
CHILDRESS, RONALD L.
CHITTUM, PATRICK W.
CHOCHOMS, MICHAEL
CHRISTMAN, CLYDE E.
CHRISTOPHER, GARY R.
CHWALEK, THOMAS J.
CICALO, JOSEPH J.
CLAY, BRIAN J.
CLONTZ, RICK A.
CLOUTIER, MICHAEL L.
COBLENTZ, ROBERT M.
COLLAS, A. STEPHEN
COLLINS, GLENN M.
COMMISKEY, JOHN J.
CONN, DAVID K.
CONNELL, WILLIAM D.
CONWAY, RICHARD F.
COOPER, DAVID E.
CORBETT, KATHIE
CORNETT, ROSA LEE
COTTER, RONALD R.
COTTON, DONDI L.
COULTER, DENNIS M.
COX, PAMELA D.
CRAIG, VICTOR L.
CRANKER, ROBERT F.
CREAMEAN, ALLEN D.
CRENSHAW, KATHLEEN B.
CRIMINGER, LINDA K.
CROCKER, JR., WILLIAM F.
CROUSHORE, MARK G.
CRUMP, GERALD W.
CUBETA, GENE T.
CUMMINGS, ERIC G.
DANCER, DAVID A.
DANIELS, HERVIE L.
DASHNER, DIANA L.
DAVIS, PAMELA A.
DAY, DAVID L.
DEMAY, THOMAS M.
DEMERS, JOSEPH W., CHP
DENNE, ROBERT K.
DEVAULT, MARTIN R.
DISSINGER, JR., CHARLES H.

DIVELY, RICHARD W.
DIXON, JAMES R.
DOMINEY, JEFFREY W.
DONEGAN, BRIAN R.
DONOVAN, ANDREA B.
DORN, MICHAEL B.
DOSSETT, GARY D.
DRAWBAUGH, DENNIS
DRIESBACH, KEVIN L.
EATON, ERIC A.
ECKLER, SCOTT A.
EDWARDS, KEVIN M.
ELKIN, BRADLEY S., CHP
ELLER, PATRICIA H.
ELLER, TIMOTHY W.
ELLIS, KENNIE D.
ENGLE, JR., KENT H.
ESTESS, IV, JOHN H.
EVANGELISTA, JOHN R.
EWELL, JOHN I.
FALLS, JOHN L.
FARENGA, ANTHONY W.
FARR, HARVEY C.
FARWELL, ROBERT M.
FERGUSON, CRAIG R.
FIEDLER, FRED J.
FIELD, MICHAEL E.
FINNEGAN, MICHAEL P.
FOLDESI, LESLIE P.
FONTAINE, ARMAND A.
FRANKLIN, GREGORY L.
FRANKLIN, STEVEN K.
FRYE, DOUGLAS M.
FULGHAM, JOEL M.
FULTON, JAMES T.
GAINES, CORNELL A.
GANGLUFF, RICHARD A.
GARCIA, RUBEN F.
GARDNER, VICK L.
GASPER, RODNEY J.
GATTIS, JR., WILLIAM M.
GEORGE, GARY L.
GEYER, JOHANN S.
GEYSTER, JOHN J.
GILDEA, GEORGE D.

GINZEL, MICHAEL E.
GOEVELINGER, NICKOLAS L.
GOLOMB, EDWARD A.
GONSOULIN, ROBERT E.
GOODISON, SCOTT G.
GORDON, SCOTT
GOULD, JR., KENNETH M.
GOYER, PETER A.
GRABANIA, MICHAEL E.
GRANBERRY, GLEN D, CHP
GRAVES, O. MACK
GRAY, CLIFTON W.
GREENLEE, KENNETH E.
GRUBBS, JR., ZELOTES D.
GULBRANSEN, D. EDWARD
GUNDERSON, PETER J.
GUY, CHRIS E.
GUYNN, MILTON FRED
HAFNER, EUGENE
HAGEN, MARLON W.
HAGGARD, RANDALL S.
HAGOOD, JOHN W.
HAITHCOX, DOUGLAS C.
HALL, JOHN G.
HALVERSON, WILLIAM C.
HAMMILL, PETER R.
HARDISON, R. PATRICK
HARGROVE, BILLY G.
HARLAN, DANIEL L.
HARLOS, PAUL P.
HARMON, TERRY O.
HARRIS, LINDA J.
HARRISON, MICHAEL C.
HARTMANN, MARK E.
HASSELBACH, JAY M.
HAUG, RICHARD G.
HAYDEN, ROBERT
HEDGE, JR., HAROLD M.
HEDGECOCK, MIKE H.
HEINELT, STANFORD
HEMMANN, ROBERT K.
HERMAN, ALAN L., CHP
HICKS, TODD M.
HILL, JUDITH L.
HILT, BETH A., CHP
HILTON, RICHARD (HILTI) S.
HINKLEY, ADAM L.
HOCKING, GREGORY P.
HOLLAND, E. FRANK
HOPSON, SUSAN E.
HORVATH, JR., ALEX A.
HOSTERT, KENNETH W.
HOWELL, CHRISTOPHER J.
HUBBARD, KATHRYN S., CHP
HUFF, CAMERON L.
HURLEY, ROBERT F.
HYDER, DAVID S., CHP
JAMES, SCOTT E.
JARRETT, FRANK
JARRETT, JERRY J.
JAZWIECKI, DAVID
JENKINS, DALLAS R.
JOHNDRO, EDMUND E.
JOHNSON, DALE S.
JOHNSON, DOUGLAS R.
JONES, DANNY N.
JONES, GERALD M.
JONES, RICHARD P.
JONES, SCOTTY W.
JUDSON, AUSTIN R.
KAHAM, JERONE A.
KEARFOTT, KIMBERLEE J., CHP
KEARNEY, DONALD P.
KEBKER, DAVID F.
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KELLEY, WILLIAM A.
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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

New Faces on the NRRPT Board of Directors

Gary Hansen (Board term 2023-2026)

Tom Hansen (Board term 2023-2028)

Diana Baker (Board term 2024-2029)

Karla Rendell (Board term 2024-2029)

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: March 28, 1979

The Event: Partial melt down and the most serious accident in U.S. commercial nuclear power plant operating history.

The Place: The Three Mile Island Unit 2 (TMI-2) reactor, near Middletown, Pa.

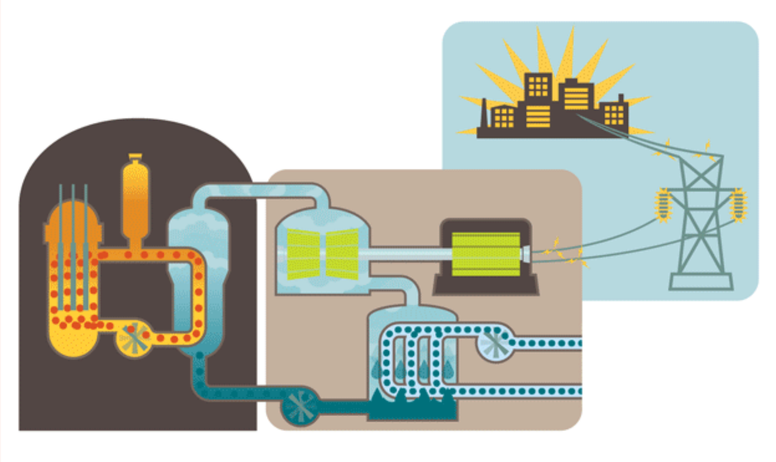
The Cause: A combination of equipment malfunctions, design-related problems, and worker errors.

The Setup: Construction of TMI began in 1968. TMI is located in Londonderry Township, Pennsylvania, on a small island in the Susquehanna River just south of the state capital in Harrisburg. Construction ended in 1978 upon completion of TMI-2. In the early morning hours of March 28, 1979, a mechanical or electric failure set off an unlikely series of events that led to a partial meltdown at the Unit 2 reactor. Water pumps that helped to cool the radioactive fuel in the reactor core malfunctioned.

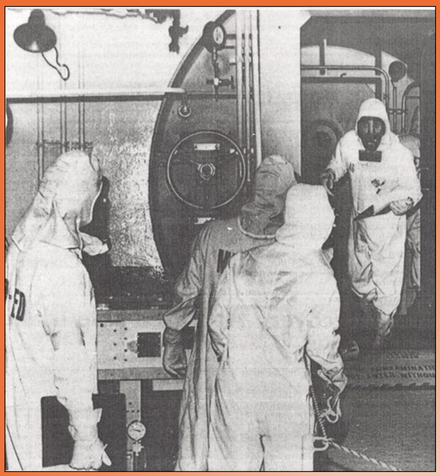
Core damage (Youtube screen grab)

The Accident: The accident began about 4 a.m. on a Wednesday. A mechanical or electrical failure occurred in the secondary, non-nuclear section of the plant. The main feedwater pumps (in green, below) failed to send water to the steam generators (light blue, below). The reactor scrammed and the turbine-generator tripped. Primary system pressure immediately began to increase. To control the pressure, the pilot-operated relief valve (orange section, below) opened on top of the pressurizer and stuck open.

Other instruments provided inadequate or misleading information. During normal operations, the pressurizer (orange section) was always filled with water and there was no level meter on the core. Operators assumed that since the pressurizer water level indicated high, the core was properly covered with water too. That wasn't the case. Drawing from US NRC.



Although operators didn't know that they didn't know the core and relief valve status, they followed procedures for corrective actions based on instrumentation readings. These corrective actions uncovered the core. Primary system pressure dropped so low that the reactor coolant pumps started to vibrate. Operators turned them off. Instrumentation indicated that emergency cooling water was about to completely fill the pressurizer (without a steam bubble, the pressurizer doesn't work), so they reduced the flow of water. Now the reactor had no coolant circulation and no emergency cooling water. Water level in the pressure vessel dropped and the core overheated.



TMI-2 First Manned Entry (Smithsonian)

The Aftermath: Chronology of events:

July 1980 – Approximately 43,000 curies of krypton were vented from the reactor building. First manned entry of reactor building.

July 1980 – The first manned entry into the reactor building took place.

November 1980 – An Advisory Panel for the Decontamination of TMI-2, composed of citizens, scientists, and State and local officials, held its first meeting in Harrisburg, Pa.

July 1984 – The reactor vessel head (top) was removed.

October 1985 – Fuel removal began.

July 1986 – The off-site shipment of reactor core debris began.

August 1988 – General Public Utilities (GPU) submitted a request for a proposal to amend the TMI-2 license to a "possession-only" license and to allow the facility to enter long-term monitoring storage.

January 1990 – Fuel removal was completed.

July 1990 – GPU submitted its funding plan for placing $229 million in escrow for radiological decommissioning of the plant.

January1991 – The evaporation of accident-generated water began.

April 1991 – NRC published a notice of opportunity for a hearing on GPU's request for a license amendment.

February 1992 – NRC issued a safety evaluation report and granted the license amendment.

August 1993 – The processing of accident generated water was completed involving 2.23 million gallons.

TMI decontamination workers (public domain)

September 1993 – NRC issued a possession-only license.

TMI Core (flickr.com)

September 1993 – The Advisory Panel for Decontamination of TMI-2 held its last meeting.

December 1993 – Monitored storage began.

The US NRC temporarily suspended the TMI-1 license following TMI-2. In 1982, a non-binding vote of citizens in the three counties surrounding the site called for the retirement of TMI-1. The US NRC voted 4 to 1 to allow TMI-1 to resume operations in 1985.

The Pennsylvania Department of Health kept a registry of more than 30,000 people that lived within 5 miles of TMI-2 at the time of the accident. The registry was kept for nearly 20 years until 1997, when no evidence was found of unusual health effects.

TMI-2 has been permanently shut down. The reactor coolant system is drained. Radioactive water evaporated waste shipped for burial. The reactor fuel and core debris were shipped off-site to Idaho. GPU continues to monitor the site.

Originally GPU planned to keep the TMI-2 in long-term monitoring until the operating license for TMI-1 expired. Then, both sites would be decommissioned. In 2009, TMI-1 was granted a license extension to operate until April 19, 2034. In 2017 Exelon Nuclear (current site owner) announced that operations would cease by 2019 due to

TMI-2 Historical Marker

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

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