Press Packet prepared by TMI Alert in Commemoration of the 40th Anniversary of the Beginning of the Three Mile Island Unit 2 Accident

March 2019

Founded 1977
THREE MILE ISLAND
TMI ALERT

315 Peffer Street
Harrisburg, PA 17102-1834

March, 2019

Hello,

2019 marks the 40th anniversary of the beginning of the accident at Three Mile Island. While we won't be celebrating the anniversary of the accident, we will observe it in an appropriate manner. Nevertheless, we in central Pennsylvania have reason to celebrate.

Central Pennsylvanians, through Three Mile Island Alert and through other individual and collective efforts, have made the world a safer place. Thanks to our continuous vigilance and determination, we can point to many advances in the last 40 years:

- Training for nuclear plant operators has been improved;
- Emergency training for first responders has been improved;
- Communication between plant operators and all levels of government has been improved;
- Security around the plants has been strengthened;
- Those in and around nuclear plants have been provided with potassium iodide tablets;
- Evacuation plans have been improved and now include day care facilities and pre-schools;
- The lessons learned from TMI have been shared and implemented world wide;
- We have on-going dialog with the plant operators and the Nuclear Regulatory Commission; and,
- We have championed the development of alternative and renewable energy sources.

Still, clouds of doubt remain and we must remain vigilant. Funds established to finance the decommissioning of these aging plants are under funded; there's still no repository for nuclear waste and each operating nuclear plant is a dangerous waste site; health issues will persist for generations to come; and political pressure is mounting to once again bail out Three Mile Island and other failing nuclear plants in Pennsylvania. While we have accomplished much, much remains to be done before we put an end to our nuclear nightmare.

If you are in central Pennsylvania covering the 40th anniversary, we invite you to attend the events listed on the enclosed calendar of events and to contact us with any questions you might have about TMIA or our mission. And, if you're in town the Saturday before the anniversary, please feel free to attend our TMI Survivors' Reunion at the Middletown American Legion at 5:00 PM on Saturday, March 23.

Sincerely,

Eric Epstein

Eric J. Epstein, Chair
Three Mile Island Alert

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TMIA: About Three Mile Island Alert

Three Mile Island Alert (TMIA) is a non-profit citizens' organization formed in 1977. Over the years, TMIA has been in the forefront, actively involved with many Three Mile Island-related issues including:

- active intervener before the Nuclear Regulatory Commission (NRC) in hearings involving safety, technical and managerial issues;
- monitoring and tracking chronic safety, technical and managerial problems at Unit-1 and Unit-2;
- tracking adverse health effects as a result of the TMI-2 accident and the normal operation of Unit-1 (since 1974);
- participating in two radiation monitoring networks;
- evaluating security problems at the Island; and,
- providing information, research, and educational materials to the general public, the news media, scholars, and elected officials.

TMIA's achievements include:

- a landslide vote in a referendum against restarting Unit I after the accident:
- relief for ratepayers from accident-related expenses;
- creation of the TMI Health Fund;
- establishment of monitoring systems around the plant;
- successfully lobbying for vehicle barriers at nuclear plants;
- the defeat of efforts to create a permanent low-level radioactive waste dump in Pennsylvania;
- successfully lobbying for potassium iodide stockpiling near nuclear facilities;
- getting day care centers and nursery schools included in evacuation plans;
- helping establish wind energy and other alternatives to nuclear power;
- maintaining a regular dialog with the utility, state government, and municipal leaders;
- staging of numerous rallies, meetings, conferences, fund raising events and the continuous publication of newsletters; and,
- a coordinating role for the many safe-energy groups and individuals who have done battle with the nuclear power establishment.

TMIA also serves as regional clearinghouse on a broad spectrum of issues relating to nuclear power production including problems at Peach Bottom-2 and -3, Susquehanna-1 and -2. The organization has enjoyed wide public and political support in its watchdog role. In the spring of 2003, TMIA was recognized by the Pennsylvania House and Senate, along with the City of Harrisburg, for TMIA's efforts on behalf of the community at TMIA's 25th anniversary.

TMIA's policy is formulated by a planning council that meets regularly. The organization relies heavily on volunteers who staff the office, maintain our web site, and write, edit, and mail TMIA's newsletter. All of TMIA's funding comes from membership dues, private contributions, and fund raising events.

TMIA's office is open by appointment. The public and all interested parties are encouraged to contact the group by phone (717-233-7897) or to visit our web site at http://www.tmia.com or the Three Mile Island Alert Facebook page.

TMIA's Planning Council

Chairperson - Eric Joseph Epstein
Mr. Epstein has been involved with research into decommissioning, decontamination, emergency planning, and nuclear safety at the Peach Bottom, Three Mile Island, and Susquehanna nuclear power plants for 35 years. He has written numerous professional papers, contributed to publications, and provided testimony regarding utility rates, electric power competition, and radioactive waste isolation.

Vice Chairperson - Bill Cologie
Bill has owned and operated Transit News, the newsstand at Harrisburg's train station, for more than 25 years. He serves as editor of *The Alert*, TMIA's newsletter.

Secretary/Treasurer - Kay Pickering
Kay, who has made a career of volunteerism, is one of the founders and organizers of TMIA. She has been TMIA's office staff person for its entire history. She also does volunteer work for the Harrisburg Center for Peace and Justice and is a Board Member of the Neighborhood Dispute Resolution Center. She has a BS in nursing from Earlham College in Richmond, Indiana.

Tom Bailey
Tom Bailey was forced to go home to Mechanicsburg, Cumberland County on March 28, 1979 when Elizabethtown College closed. An activist, he filed a contempt of court motion with Judge Sylvia Rambo in oversight of the TMIA Public Health Fund in late 1980s. The Public Health Fund's counsel had refused to release Bernd Franke's monitoring plan for Three Mile Island Nuclear Plant as Judge Rambo had ordered. Most recently, in late 2018 and early 2019, he delivered Open Letters to both the International Olympic Committee and United Nations' Economic & Social Council seeking international action to seal off the Fukushima Daiichi Nuclear Plant in Japan during the Tokyo Olympics. He and his wife reside in Scottdale, PA, near Pittsburgh.

Maureen Mulligan
Maureen is an energy consultant who specializes in renewable energy and energy efficiency issues. Before starting her own business she managed the education program of the Pennsylvania Public Utility Commission whose electric restructuring campaign was rated the best in the country by USA Today. She has a Master's Degree in Government Administration from the University of Pennsylvania and lives with her husband on an organic farm in a Perry County intentional community.

Scott D. Portzline
Scott D. Portzline has researched sabotage and terrorism protection of nuclear power plants since 1984. His research has been cited by the U.S. Department of Energy, the U.S. Department of Homeland Security (DHS), and The Center for International and Strategic Affairs. He has testified in hearings to the U.S. Senate, the PA House of Representatives, and several other governmental bodies. He received official commendations from the PA Auditor General, The PA Senate and the Dauphin County Commissioners for his research and citizen activism. His efforts have helped to resolve problems with security vulnerabilities at U.S. nuclear plants and with lost and stolen radioactive materials in the U.S. He has been featured on most of the major network television news programs and several national magazines and newspapers.

Mary Stamos
Mary, now retired, was a paralegal with an Associate's Degree. She has been a TMIA member since May, 1979, alerted to the dangers by her ex-husband and father-in-law, both of whom were construction workers at TMI. She has made dozens of presentations about the health effects of the TMI accident in Europe, Asia, and throughout America. Her collection of mutated flora from the TMI area will soon be headed to the Smitshonian Institution.

Vera Stuchinski
Vera Stuchinski, a long-time member and past Chairperson of TMIA. She is a retired educator and community volunteer.

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Four Decades of Vigilance

Events related to the 40th Anniversary of the beginning of the accident at TMI

11 March – 10:30 AM – Press conference in the Capitol's East Wing featuring TMI Alert's Scott Portzline along with nuclear engineer Arnie Gundersen of Fairewinds Energy Education and Tim Judson of the Nuclear Information and Resource Service (NIRS). TMIA Chairperson Eric Epstein will moderate.

23 March – 1 PM – The Historical Society of Dauphin County will host an event including a display of TMI-related memorablia, the release of a new book by HSDC president Erik Fasick, and a panel discussion including journalist R.B. Swift who covered the accident, and nuclear engineer, Arnie Gundersen.

23 March – 4:00PM – TMI Survivors' Dinner – American Legion Middletown. $20. For more information, see the TMI Alert website – www.tmia.com or the Three Mile Island Alert Facebook page.

25 March – 10:30AM, Rotunda, Main Capitol – Press Conference – TMI Alert's Eric Epstein, Arnie Gundersen, and Tim Judson discuss the TMI accident and its consequences.

27 March – 3:00PM, Penn State Harrisburg Library, Morrison Gallery – An event commemorating the TMI accident. Begins with a welcome, a presentation by Arnie Gundersen, a community panel, and concludes with an academic panel at 6:30PM.

28 March – 3:30AM – A vigil at the TMI plant gate.

28 March through 5 May – Susquehanna Art Museum – Exhibit of archival materials collected by artist Adam Diller including photographic, video, and audio ephemera related to the TMI accident. For more information:

http://www.susquehannaartmuseum.org/galleries/safstor/

Note: both WITF and the Pennsylvania Cable Network plan TMI related programming during March. Check the websites of both of these wonderful media outlets.

Visit the TMI Alert website (www.tmia.com) or the Three Mile Island Alert Facebook page for additional events or changes to the schedule.

Some helpful web links:

Beyond Nuclear	http://www.beyondnuclear.org
Nuclear Information and Resource Service (NIRS)	https://www.nirs.org
Union of Concerned Scientists	https://www.ucsusa.org
Natural Resources Defense Council	https://www.nrdc.org
U.S. Nuclear Regulatory Commission	https://www.nrc.gov
Fairewinds Energy Education	https://www.fairewinds.org
World Information Service On Energy (WISE)	https://www.wiseinternational.org
Nuclear Transparency Watch	https://www.nuclear-transparency-watch.eu
U.S. Department of Energy	https://www.energy.gov
Dickinson College TMI-Alert Archive	https://archives.dickinson.edu/archives-collection/tmi-alert
Solar Energy Industries Association	http://www.seia.org
Keystone Energy Efficiency Alliance	https://keealliance.org
Pennsylvania Solar Energy Industries Association	https://www.seia.org/state-solar-policy/Pennsylvania-solar
American Wind Energy Association	https//www.awea.org
Mid-Atlantic Bioenergy Council	https://www.mabec.org
Laka Foundation	https://www.laka.org/english.html

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TMI Rescue on Hill's Agenda

It appears that Exelon's million dollar plus lobbying effort is paying dividends. A 75-member bi-partisan, bi-cameral Nuclear Energy Caucus of the Pennsylvania legislature has developed four recommendations to keep the state's old, non-competitive, nuclear power plants running.

Except for one proposal that would preserve the status quo and let PJM, the regional electric grid operator, dictate the mix of electric generators selling energy to Pennsylvania, which may or may not include nuclear, the rest prop up this dangerous technology and give it advantages over sustainable energy producers. Each would hit Pennsylvanians with increased costs for energy.

The proposals include a tax on carbon-based energy sources and tax credits for every kilowatt hour of "non-polluting" electricity generated by nuclear plants. While proponents of the proposals characterize them as "job-saving subsidies," opponents see it as simply another bailout of nuclear power.

The prospect of a bailout is opposed not only by safe energy and environmental activists, but also by the natural gas industry, which sees the bailout as anti-competitive. Consumer groups who fear electricity rate hikes, large industrial users of electric power, the National Federation of Independent Business, the AARP, and other ratepayer activists also oppose a bailout.

Opponents note that the state deregulated electric utilities in the 1990s and opened the market to competition. Because of that, Pennsylvania has some of the lowest energy prices nationwide.

Bailout proponents note that once nuclear power plants close, they are gone for good and say this may lead to shortages of electricity and blackouts in the future. However, Pennsylvania's grid manager, PJM, says the state has a current reserve margin of 28%, meaning the retirement of aging nuclear plants would have no impact on electric reliability.

According to the Patriot-News, Damon Moglen of Friends of the Earth said, "Debating whether or not to give billions of dollars in handouts to a few, decrepit 1970-era nuclear reactors for a few more years of operation is nothing but a distraction from the real task at hand: We need to transform our energy economy. We need the equivalent of an Apollo program in renewable energy, not a debate about whether the Edsel should come in a hatchback model."

UCS Flips on TMI Closure

After decades of calling for the closing of TMI Unit 1, the Union of Concerned Scientists, citing the perils of global warming and climate change, has changed its tune.

In a recent report, UCS found that more than a third of America's N-plants are unprofitable or scheduled to close. "On average it would cost $814 million annually to bring unprofitable plants back to a breakeven point," the report states. It concludes that closing marginal and at-risk plants could result in a four to six percent increase in greenhouse gas emissions.

Even though UCS once argued that TMI-1—and all the reactors designed by Babcock and Wilcox—should be shut down, it now sees a bailout of TMI to be in the national interest. The B&W design, UCS said in February 1987, are "inherently more dangerous than other pressurized vessel reactors."

Before UCS finalized this policy, TMIA's Eric Epstein wrote the UCS president encouraging him to "rethink" the group's position, pointing to the burden our community has paid to build and repeatedly bail out TMI. After UCS made its position public, many safe energy groups were quick to point out how far an $814 million annual investment in renewable energy would go to address global warming.

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Four Decades of Vigilance

40th Anniversary Observance Starts With Press Conference on Nuclear Waste Crisis

TMI Alert's observance of the 40th anniversary of the TMI meltdown got underway with an October 2 Capitol press conference on the issue of nuclear wastes being transported through Pennsylvania and across America.

TMI Alert Chair Eric Epstein served as the event's moderator and introduced Beyond Nuclear's Kevin Kamps and Paul Gunter to local media. Kamps is a Radioactive Waste Specialist who addressed the safety and security risks of transporting highly irradiated nuclear fuel on America's roads and rails. His presentation included a drone's eye view of the roads and rails on which wastes from Peach Bottom would be transported through central Pennsylvania. He also showed a video produced by TMIA's security expert, Scott Portzline, which included footage of radioactive wastes moving through central Pennsylvania.

Gunter, Beyond Nuclear's Reactor Oversight Project Director, addressed the risks posed by extending Peach Bottom's license (see page 4) to close to 80 years.

Eric also addressed the as yet unsolved problem of what happens to nuclear wastes. He explained that when nuclear power was first proposed, our government promised us the solution to the problem of long-term storage of highly radioactive wastes was "just around the corner." The solution, fifty years later, is still around the corner.

Kevin Kamps & Eric

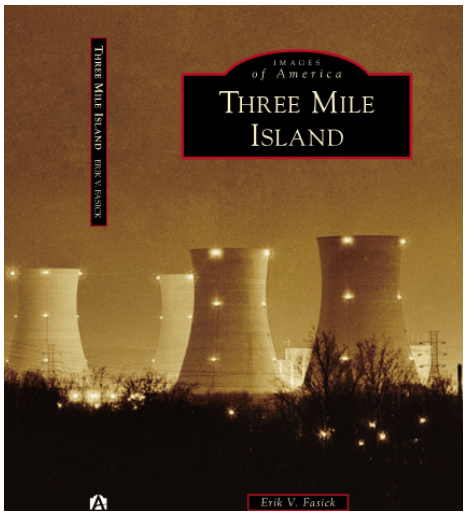
Eric concluded the event with a rather clever analogy, asking "Would anyone buy a house without a toilet?"

Book Signing, Exhibit, Banquet Set for 40th

A new Three Mile Island book will be released during an event at the Historical Society of Dauphin County (HSDC) on the afternoon of Saturday, March 23. Erik Fasick, the book's author and president of HSDC, will be on hand to sign copies of the book. The event will also include a presentation by a panel coordinated by TMI Alert to provide an historical perspective on the TMI accident.

Fasick's book is part of the "Images of America" series published by Arcadia Publishing. It contains photographs of and relating to Three Mile Island from HSDC's photo archives. HSDC obtained the files of Allied Pix, a business that provided photographic services to the Harrisburg Patriot-News from 1952 to 1994. The Allied Pix collection is the source of the photographs in the book. Sales of the book will benefit the Society.

TMIA is also working with the Society to put together a display that will continue for several months following the anniversary. It will feature blow-ups of some of the book's photos, samples of the mutated plants being supplied to the Smithsonian (see page 3), and various TMI-related historic artifacts. These will include numerous publications from the time of the accident, buttons, posters, tee-shirts, and other mementos.



That same evening as the book release, Saturday, March 23, TMIA will host an "I Survived Three Mile Island" banquet at the American Legion in Middletown. Everyone who survived TMI, or is related to a victim of TMI, is welcome to attend. In conjunction with the banquet, health surveys (see page 3) will be distributed to document any health effects experienced by those who resided in central Pennsylvania during the 1979 accident.

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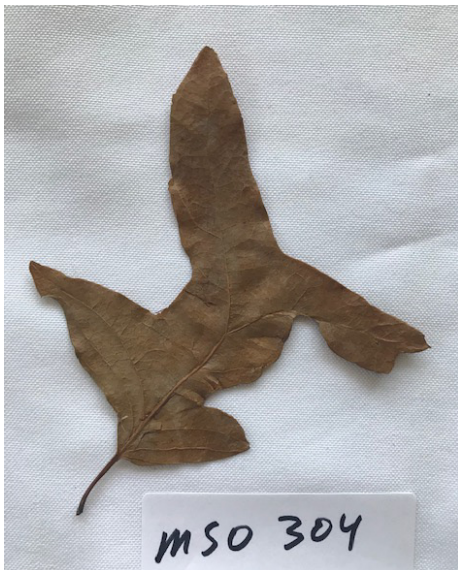
No Solution to Nuclear Pollution

Mary Stamos Collection is Going To The Smithsonian



The oak leaf on the left and the maple leaf on the right are just two examples of the mutated plants Mary collected since 1979.

Mary Stamos, a long-time member of TMI Alert's Planning Council, has been collecting samples of mutated plants since the TMI meltdown in 1979. Now the world's foremost museum and research complex, the Smithsonian Institution, has expressed interest in acquiring her collection. A small group of TMI Alert volunteers, under the leadership of Scott Portzline, spent hundreds of hours over four months documenting the collection.

There are probably more than a thousand specimens that have been grouped into 320 separate exhibits. Each exhibit was photographed and documented with information about where found, when found, a brief description, and recorded comments from Mary about unique aspects of specific pieces.

The collection is headed to the Natural History Museum's Department of Botany where the individual pieces will be analyzed to ascertain if radiation from TMI caused the cellular structure of the plants to be altered. TMI Alert plans to post the entire database on its website so the public can examine the data, see the photos, and read or hear Mary's comments about the specimens.

2019 Peace Calendars on Sale

The kitchen wall of every progressive household should not be without a 2019 Peace Calendar from the Syracuse Cultural Workers. TMI Alert has a limited supply of these union printed calendars which retail for $15.95 on sale for $10 each.

The calendar, which would be an appreciated holiday present, includes more than 200 cultural notations and will allow its proud owners to observe International Women's Day, commemorate the February 2018 massacre at Marjory Stoneman Douglas High School, note with PRIDE the 50th anniversary of the Stonewall Uprising, and observe the holidays of numerous faiths.

To reserve your copy, contact Kay Pickering at the TMI Alert office at 717-233-7897.

Health Surveys Planned for 40th Anniversary

TMI Alert is working with health care and other professionals on the design of two surveys to collect information about the health effects of the TMI accident and the facility's ongoing operation. Both a "Survivors" survey and a "Victims" survey are planned so information can be collected from those who survived the accident and from the next of kin of those whose deaths are thought to be attributable to the effects of radiation from the accident or plant operations.

While government and industry officials continue to claim no one died from TMI and the only health effect was increased stress, data gathered by epidemiologists who focused on areas around the plant have documented increases in cancer and cancer deaths that may be accident related. The work of the late epidemiologist from the University of North Carolina, Dr. Steven Wing, is well known in the TMI community. Also, a 2009 study in Germany found a 60 percent increase in cancers and a 120 percent increase in leukemia among children living within five kilometers of a nuclear power plant.

Long-time readers of the TMI Alert news may recall a two-phase study to look at cancer risks associated with nuclear power plants that the National Academy of Science undertook in 2011. Unfortunately, the Nuclear Regulatory Commission managed to kill that study characterizing it too costly and taking too long.

The goal of the TMI Alert initiative is to gather information from those who consider themselves victims of the accident and make that information available to the scientific community for further analysis.

Not before a "nuclear autopsy"

Peach Bottom Seeks New License Extension

Though it got its license renewed to operate for another 20 years in 2013, Exelon is looking for another 20-year extension of Peach Bottom's license. This would mean the plant would be licensed to operate until 2053 or '54, some 70 years after it was originally licensed to operate in 1973.

When built, most nuclear power plants were thought to have a lifespan of 40 years. Engineers assumed the metal in the containment would become brittle, after constant bombardment by neutrons over decades of operation. An aging plant like Peach Bottom is particularly susceptible to radiation-induced embrittlement, metal fatigue, cracking, and corrosion of its most critical safety related structures and systems that are irreplaceable and inaccessible, including the containment.

Interestingly, the reactor at Peach Bottom is a GE Mark 1 Boiling Water Reactor, just like the ones at Oyster Creek and Fukushima. Exelon, which owns Oyster Creek, recently shut down that plant, which, in 1969, was the first Mark 1 BWR reactor to be commercially licensed.

One might expect Exelon would harvest and analyze aged materials from this 49 year-old facility. Such tests would provide an indication of the condition of the Peach Bottom equipment. Beyond Nuclear's Paul Gunter said there should be no consideration of Peach Bottom's proposed extension in the absence of what he characterized as a "nuclear autopsy."

Beyond Nuclear has petitioned the NRC to deny the application for renewal. TMI Alert has filed comments on the Beyond Nuclear petition and requested that Peach Bottom secure a new Environmental Impact Statement (EIS). The plant seeks to use the same EIS from when the plant was originally built. TMIA believes a new EIS would reflect environmental changes in the 45 years since it opened.

Nuclear Bailouts Undermine Energy Independence

TMI Alert Planning Council members Eric Epstein and Maureen Mulligan penned a letter to the editor of the *Middletown Press & Journal* that appeared under the title above in the paper's November 28th edition.

In their letter they dispel the notion that nuclear power is "green," given all the pollution generated in its mining, milling, enriching, fabrication, and transportation, plus the tons of high-level nuclear waste on the back end. They also discuss how uneconomical nuclear plants are and all the advances being made with new, alternative energy sources. Check out this informative article on the P&J website.

TMIA Website Revamp Underway

TMI-Alert is updating and upgrading its website to make it user friendlier and to facilitate easier access to information. The plan is to have the site re-launched prior to the 40th anniversary, in part to give the international news media easy access to resources about the meltdown and its aftermath. In addition, it will be launched as a dot org instead of the current dot com. The URL is now TMIA.com, the new address will be TMIAlert.org.

Trump's on Both Sides of Yucca Mountain

Both budgets developed by the Trump administration have included $120 million for the resurrection of theYucca Mountain nuclear waste site, to the chagrin of Nevada's Congressional delegation. But when campaigning in Nevada in October, the president said, "I think you should do things where people want them to happen, so I would be very inclined to be against it. We will be looking at it very seriously over the next few weeks and I agree with the people of Nevada."

Energy Department Support for Coal & Nuclear Stalled by White House

At the President's request, Energy Secretary Rick Perry had the Department of Energy come up with some "immediate steps" to halt the loss of "fuel-secure power facilities," aimed at preventing the "premature" retirement of coal and nuclear plants under competition from natural gas and renewable energy sources. DoE developed a draft proposal for the government to buy electricity from unidentified coal and nuclear plants. Unfortunately for DoE, the proposal couldn't get by the National Economic Council in the White House. Critics mocked what they said was the bankrupt logic of a generalized plan to subsidize coal and nuclear plants whose energy wasn't required.

Three Mile Island Alert
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Who Owns the Island?
A Corporate History of Three Mile Island

Three Mile Island-1 ("TMI-1") came on line in September 1974 at a cost of $400 million. Legal intervention was conducted by the Environmental Coalition on Nuclear Power (ECNP) based in State College.

Three Mile Island-2 ("TMI-2") came on line in December 1978 and was grossly over budget and behind schedule. Legal intervention was conducted by the ECNP and Three Mile Island Alert (TMIA). The plant had been on-line for just 90 days, or 1/120 of its expected operating life, before the March, 1979 accident. One billion dollars was spent to defuel the facility. Three months of nuclear power production at TMI-2 has cost close to $2 billion dollars in construction and cleanup bills; or the equivalent of over $10.6 million for every day TMI-2 produced electricity. The above mentioned costs do not include nuclear decontamination and decommissioning or restoring the site to "Greenfield" status.

At the time of the accident in March 1979, Three Mile Island 1 and 2 were owned by three utilities operating in two states: Metropolitan Edison (50%), Jersey Central Power & Light (25%), and Pennsylvania Electric (25%). The companies were organized under the General Public Utilities (GPU) holding company umbrella. The operator of both plants was Met Ed.

Key Dates

- May, 1968 Met Ed begins construction on Three Mile Island Unit 1. ("TMI-1").

- July, 1969 Met Ed begins construction on Unit 2 ("TMI-2")

- September, 1974 - Unit 1 goes online.

- December, 1978: - Unit 2 goes online.

- March 28, 1979 - TMI-2 melts down.

- July 2, 1979 - The Nuclear Regulatory Commission (" NRC) ordered the indefinite shutdown of TMI-1 until assurances are in place that the plant can be operated safely.

- March 25, 1980 - Met Ed, blamed the plant's designer, Babcock & Wilcox (B & W) for the TMI accident, sue B&W for $500 million. The Company also filed an unsuccessful $4 billion law suit against the NRC alleging that the Agency's negligence contributed to the TMI accident.

- September, 1980 - Met Ed renamed itself GPU Nuclear in a bid to dissociate itself from itself. Met Ed continued operate, owned 50% of the plant.

• February 29, 1984 - A plea bargain between the Department of Justice and Met Ed settled the Unit 2 leak rate falsification case. Met Ed plead guilty to one count, and no contest to six counts of an 11 count indictment.

The Company also agreed to pay a $45,000 fine and establish a $1 million interest-bearing account to be used by the Pennsylvania Emergency Management Agency. The Settlement stipulated that the fines, emergency preparedness fund, and legal cost of the prosecution, would not be paid by GPU/Met Ed rate payers.

• July, 1988 - GPU settles a class action suit challenging high utility rates for $1.25 million.

• On January 18, 1994, at the NRC's Advisory Panel meeting, GPU President Robert E. Long stated that the Company had $104.7 million on hand to decommission TMI-2. GPU spokesperson, Mary Wells said, "We have a detailed plan in place to make sure that the money is going to be there."

• September 20, 1995 - The Pennsylvania Supreme Court reversed a lower court's decision, and sided with GPU in allowing the Company to charge rate payers for the TMI-2 accident.

The decision ignored the financial facts of the case: TMI-2 was built at a cost to rate payers of $700 million and had been on line for 90 days, or 1/120 of its planned operating lifetime, when the March 1979 accident began. One billion has been spent to defuel the plant, which now lays in idle shutdown, a condition referred to as Post-Defueling Monitored Storage.

• February, 1997 - In their 1997 Annual Report, GPU reported that the cost to decommission TMI-2 doubled in four years. The original $200 million projection has been increased to $399 million for radioactive decommissioning. An additional $34 million will be needed for non-radiological decommissioning. The new funding "target" is $433 million; or a 110% increase in just 48 months.

• July 17, 1998 - AmerGen Energy announced that it reached an Agreement with GPU to purchase TMI-1 for $100 million. The proposed sale includes $23 million for the reactor, and $77 million, payable over five years, for the nuclear fuel.

• July 21, 1999 - GPU Nuclear received permission form the NRC to reduce the insurance at TMI-2 from $1.06 billion to $50 million.

• December 20, 1999 - TMI-'s license was transferred from GPU Nuclear to AmerGen. TMI-2 remains a GPU possession, in Post-Defueling Monitored Storage since 1992. GPU contracts with AmerGen to maintain a skeletal staff presence at TMI-2.

• August 9, 2000 - FirstEnergy Corp. (FE) and GPU announced a planned merger expected to be finalized by August 2001. FE would acquire GPU for approximately $4.5 billion. Ownership of TMI-2 and liability for 1,990 health suits against GPU would be transferred to FirstEnergy.

• November, 2001 - TMI-2 was formally transferred from GPU Nuclear to FE. GPU Nuclear retains the license for TMI-2 and is owned by the FirstEnergy Nuclear Operating Company.

• September 5, 2002 - Exelon announced that it was putting its share (50%) of AmerGen up for sale. British Energy (BE), which is bankrupt, owns the other 50% of AmerGen, and includes the following nuclear power plants: Clinton, Oyster Creek, and Three Mile Island. The reported price tag is anywhere from $340 to $600 million.

• September 11, 2003 – FPL Group (Florida Power & Light) announced a sales agreement to buy BE's 50& of TMI 1.

• December 23, 2003 - BE COMPLETED THE SALE OF ITS 50% AMERGEN INTEREST TO EXELON GENERATION shortly after receiving shareholder approval of the deal on 12/22. Exelon was British Energy's (BE) partner in the AmerGen joint venture that bought three U.S. nuclear plants--Clinton, Oyster Creek, and Three Mile Island-1. As expected, BE received about (U.S.)$277- million prior to various adjustments. BE said it will pay a break fee of $8.29- million to FPL Group, following termination of the original sales agreement between BE and FPL after Exelon exercised its right of first refusal and matched FPL's offer to become the sole owner of the AmerGen plants. (Platts Nuclear News)

• December 31, 2007: The TMI-2 site summary on the NRC website contains the most current information (as of 12/31/07) on the decommissioning cost estimate and funds: "The current radiological decommissioning cost estimate is $805 million and $27 million for non-radiological funds. The current amount in the decommissioning trust fund is $601 million, as of December 31, 2007."

• In 2008, according to the NRC, the radiological decommissioning cost estimate was $831.5 million. The amount in the decommissioning trust fund was $484.5 million as of December 31, 2008.

• According to the NRC, the cost to decommission TMI-2 has **increased by $26.5 million in less than three years** while FirstEnergy decommissioning trust fund's assets have **decreased by $116.5 million** during the same period.

• August 2008 - AmerGen applied to transfer the licenses for its nuclear power plants, including TMI-1, Oyster Creek and Clinton, to Exelon. If approved, the transfer would mean that Oyster Creek would officially be part of the Exelon fleet as opposed to a plant operating under the separate AmerGen corporate entity.

• On or about January 8, 2009: AmerGen ceased to exist a corporate entity. The transfer of the funds will occur at the time of the merger.

• January 8, 2010 – According to Exelon, "In the past five years, Exelon Nuclear has invested more than $500 million into plant equipment to ensure continued safe operations and to ensure essential electricity is supplied to the region. This year, TMI will complete its largest capital project to date, when new replacement steam generators are installed in the plant. The steam generators are an essential system to the future reliability of TMI."

• September 30, 2010: "According to the NRC, (1) FirstEnergy's Decommissioning Trust Fund for TMI-2 is grossly underfunded: "The current radiological decommissioning cost estimate is $831.5 million. The current amount in the decommissioning trust fund is $484.5 million, as of December 31, 2008."
(2) However, the **level of rate recovery** for the Trust Fund has been set by the Pennsylvania Public Utility Commission ("PUC"). The proposed merger with Allegheny Energy will endanger an already fragile funding protocol.

2015 through 2018 – For four years in a row, TMI failed to sell the power it generates at the PJM auction. PJM manages the transmission of electricity and coordinates the wholesale marketing of electricity in all or parts of 13 states, including Pennsylvania, and the District of Columbia. The inability of TMI to compete with companies that generate electricity with gas, wind, and solar make it clear the plant is uneconomical.

• May 30, 2017 – TMI-1's owner, Exelon, announces plans to close the plant by September 2019.

• September 2019 – Unit-1 shutdown?

• 2034 – TMI1's license expires.

TMI Rescue on Legislature's Agenda

It appears that Exelon's million dollar plus lobbying effort is paying dividends. A 75-member bi-partisan, bi-cameral Nuclear Energy Caucus of the Pennsylvania legislature has developed four recommendations to keep the state's old, non-competitive, nuclear power plants running.

Except for one proposal that would preserve the status quo and let PJM, the regional electric grid operator, dictate the mix of electric generators selling energy to Pennsylvania, which may or may not include nuclear, the rest prop up this dangerous technology and give it advantages over sustainable energy producers. Each would hit Pennsylvanians with increased costs for energy.

The proposals include a tax on carbon-based energy sources and tax credits for every kilowatt hour of "non-polluting" electricity generated by nuclear plants. While proponents of the proposals characterize them as "job-saving subsidies," opponents see it as simply another bailout of nuclear power.

The prospect of a bailout is opposed not only by safe energy and environmental activists, but also by the natural gas industry, which sees the bailout as anti-competitive. Consumer groups who fear electricity rate hikes, large industrial users of electric power, the National Federation of Independent Business, the AARP, and other ratepayer activists also oppose a bailout.

Opponents note that Pennsylvania deregulated electric utilities in the 1990s and opened the market to competition. Because of that, Pennsylvania has some of the lowest energy prices nationwide.

Proponents note that once nuclear power plants close, they are gone for good and say this may lead to shortages of electricity and blackouts in the future. However, Pennsylvania's grid manager, PJM, says Pennsylvania has a current reserve margin of 28%, meaning the retirement of aging nuclear plants would have no impact on electric reliability.

According to the *Patriot-News*, Damon Moglen of Friends of the Earth said, "Debating whether or not to give billions of dollars in handouts to a few, decrepit 1970-era nuclear reactors for a few more years of operation is nothing but a distraction from the real task at hand: We need to transform our energy economy. We need the equivalent of an Apollo program in renewable energy, not a debate about whether the Edsel should come in a hatchback model."

Reprinted from TMI Alert Newsletter - January 2019

Three Mile Island-2:
Still Waiting to Be Cleaned Up 40 Years Later

Three Mile Island Unit-2 was built at a cost to rate payers of $700 million and had been on-line for just 90 days, or 1/120 of its expected operating life, at the time of the core melt accident on March 28, 1979. One billion dollars from rate payers, taxpayers, and the nuclear industry was spent to defuel the facility.

A mere three months of nuclear power production at TMI-2 has cost close to $2 billion dollars in construction and cleanup bills; or the equivalent of over $10.6 million for every day TMI-2 produced electricity. The above-mentioned costs **do not** include nuclear decontamination and decommissioning, nor restoring the site to "Greenfield" status. In 2018 the Nuclear Regulatory Commission (NRC) estimated that cost to be $1.266 billion.

At the time of the accident, TMI's owners had no monies put aside for decommissioning. General Public Utilities' ("GPU") customers contributed three times as much for the defueling effort than the corporation that caused the disaster, $246 million to $82 million (GPU Nuclear Press Release, January 10, 1985). In January 1993 the Public Utility Commission ("PUC") refused GPU's request to hand their customers the TMI-2 decommissioning bill then estimated to be at least $200 million.

However, several months later the PUC reversed itself and gave GPU permission to pass the cost of decontamination and decommissioning TMI-2 onto the rate payers. This decision to financially assess GPU rate payers for the accident was upheld by the Pennsylvania Supreme Court. In 1995, GPU hired a consultant to conduct a site-specific decommissioning study for TMI-2. The "retirement costs" for TMI-2 were estimated to be $399 million for radiological decommissioning and $34 million for non-radiological removal (**GPU**, 1997 Annual Report, **Nuclear Plant Retirement Costs**, p. 52).

Although the plant was scheduled to be decontaminated and decommissioned in 2014, a twenty-year license extension was granted to Three Mile Island-1 in 2009, pushing the start date of decommissioning back to at least 2034, 55 years after the loss of coolant accident.

Cleanup problems at TMI-2

In July 1980, Met Ed (GPU) vented 43,000 curies of radioactive Krypton-85 and other radioactive gasses directly into the atmosphere. TMI-2 was designed to release approximately 770 curies of Krypton-85 per year. Four months later, in November 1980, the United States Court of Appeals for the District of Columbia ruled the krypton venting was illegal.

On August 12, 1982, cleanup worker William Pennsyl was fired for insisting he be allowed to wear a respirator while undressing men who entered highly radioactive areas. Pennsyl filed a complaint with the U.S. Department of Labor and, on April 11, 1984, settled out of court two days before an administrative law judge was scheduled to hear his case.

On March 22, 1983, TMI-2 senior-safety, startup engineer Richard Parks publicly charged GPU and Bechtel Corporation with deliberately circumventing safety procedures and harassing him and other workers for reporting safety violations. Parks filed a complaint with the U.S. Department of Labor. On August 12, 1985, GPU and Bechtel were fined $64,000 for the incident by the NRC.

From July 24-27, 1984, during the reactor head lift, which was delayed due to brake failure on the polar crane, GPU vented radioactive gasses into the atmosphere. The venting occurred despite pledges by GPU and the NRC that no radioactive releases would take place during the head lift operation. GPU was fined $40,000 for the violation by the NRC.

In May 1987, a non-licensed plant employee was suspended after he was found sleeping in the radioactive waste control room. Two months later, ten employees working at TMI-1 and TMI-2 tested positive for drugs. Eight individuals were suspended for 30 days without pay and one resigned. Thirty-three people were arrested in all. Since March 1986, 16 employees tested positive for drugs at TMI.

On December 1, 1987, GPU announced the firing of a shift supervisor for sleeping on the job. Although the employee had a record of sleeping on the job dating back to the early 1980s, GPU did not issue a warning until October 1986. Edwin Stier, former director of the New Jersey Division of Criminal Justice, reported that 21 witnesses saw the shift supervisor asleep on the job.

In December 1990, GPU began evaporating 2.3 million gallons of accident-generated radioactive water (AGW) into the atmosphere. In April-May 1991, the evaporator was shut down for most of this period so GPU could "rewrite the main operating procedure." A Notice of Violation was issued by the NRC. In January 1993, GPU "discovered" they failed to take periodic samples of approximately 221,000 gallons of AGW in the borated water storage tank. Evaporation was completed in August 1993; six months behind schedule.

In August 1993, Dr. Michio Kaku, Professor of Nuclear Physics, City University of New York, evaluated studies conducted or commissioned by GPU and the NRC on the amount of fuel left in TMI-2. Dr. Kaku concluded, "It appears that every few months, since 1990, a new estimate is made of core debris, often with little relationship to the previous estimate...estimates range from 608.8 kg to 1,322 kg...This is rather unsettling...The still unanswered questions are therefore: precisely how much uranium is left in the core, and how much uranium can collect in the bottom of the reactor to initiate re-criticality?"

In February, 1997, GPU announced in its *1997 Annual Report* that the cost to decommission TMI-2 doubled in four years. The original $200 million projection had been increased to $399 million for radioactive decommissioning. An additional $34 million was needed for non-radiological decommissioning. The new funding "target" was $433 million; or a 110% increase in just 48 months.

On July 21, 1999, GPU Nuclear received permission from the NRC to reduce the insurance at TMI-2 from $1.06 billion to $50 million.

On December 20, 1999, TMI-1's license was transferred from GPU Nuclear to AmerGen. TMI-2 remains a GPU possession and the facility was placed in Post-Defueling Monitored Storage in 1992. GPU contracts with AmerGen to maintain a skeletal staff presence at TMI-2.

In November, 2001, TMI-2 was formally transferred from GPU Nuclear to FirstEnergy, an Akron, Ohio based company. GPU Nuclear retains the license for TMI-2 and is owned by FirstEnergy Nuclear Operating Company.

On March 26, 2018 the NRC released an analysis saying decommissioning will have a $1.266 billion price tag from 2018 to 2053.

Three Mile Island By the Numbers

What Exelon Won't Tell You

Zero: Number of apologies issued for the core meltdown at Three Mile Island, and the amount of taxes paid by TMI-2 each year.

One: Number of crippled reactors at TMI that have not been decontaminated or decommissioned.

Two: Number of unguarded entrances to TMI.

Three: Number of security chiefs at TMI since 2004, and also number of site vice presidents since 2001.

Five: Number of counties within ten miles of Three Mile Island, yet the NRC does not require emergency planning for the cites Harrisburg, Lancaster, Lebanon or York.

Eight: Minimal number of full-time, registered lobbyists employed by Exelon in Harrisburg as of July, 2007.

10%: Exelon announced it would eliminate about 1,900 positions--10% of its workforce--by 2006 as part of its restructuring. Exelon plans to cut 1,200 positions by 2004 and another 700 by 2006.

12 miles: Distance between Three Mile Island and the Emergency Operations Facility in Susquehanna Township before Exelon bought TMI.

15%: On January 29, 2002, Exelon announced it would cut 3,400 jobs, or 15% of its work force, by the end of 2002.

Three Mile Island Alert, Inc. *is a safe-energy organization based in Harrisburg, Pennsylvania and founded in 1977. TMIA monitors Peach Bottom, Susquehanna, and Three Mile Island nuclear generating stations.*

http://www.tmia.com.

21 years: Three Mile Island has failed to include child care facilities in their Radiological Emergency Plans for the past 21 years. The NRC, FEMA, PEMA, and Governor Rendell refuse to adopt dedicated plans, designated transportation routes, or provide vehicles for these children.

30 metric tons: Amount of high level radioactive waste generated annually and stored on site.

50 miles: Distance between Three Mile Island and the Emergency Operations Facility in Coatesville, Pennsylvania.

80%: The enrichment of uranium at the Paducah Gaseous Diffusion plant releases massive amounts of chlorofluorocarbons (CFCs) which are more damaging as a global warmer than carbon dioxide. Nuclear fuel production in America creates at least 800,000 pounds of CFCs annually, or 80% of all CFC's released into the atmosphere by the USA. CFCs remain the primary agent for stratospheric ozone depletion.

90: Number of days TMI-2 operated before it melted down.

$120: The price for uranium oxide. The fuel used in nuclear plants rose from $7 a pound in 2001 to $120 pound in May, 2007. Most of this "energy independent" fuel is supplied from dependable foreign "allies" like Russia, Kazakhstan, and Australia (when their mines aren't flooded).

Hundreds to thousands: Number of fish, fish eggs, and aquatic life killed each day at TMI including stripers, bass, walleye, and gizzard shad.

200+: Number of "job losses" at TMI since Exelon bought TMI.

600 tons: Amount of of additional high-level radioactive waste TMI is proposing to store on TMI.

#610: Exelon Nuclear's area code in Kennett Square.

#630: Exelon's area code at their head quarters in Warrenville, Illinois.

#717: Central Pennsylvania's area code.

520: According to the "Top 50" list published by the *Patriot News* on July 2, 2006, Exelon's staffing numbers were listed at 520; TMI now says the number of employees is closer to 600.

804: Numbers of employees working at TMI prior to their purchase of the plant by Exelon.

840 tons: Amount of high-level nuclear garbage currently stored onsite at TMI.

2,000: Exelon Vice President and CFO, Robert Shappard, boasted that the Exelon Way "can cut 2,000 heads from our head count by the year 2006."

8,500 gallons: One Emergency Diesel Generator at TMI-1 running 100 hours in a year consumes 8,500 gallons of diesel fuel.

28,285 gallons of oil: Minimum inventory to supply two operating emergency diesel generators for at least seven days.

144,000: Number of Central Pennsylvanians who evacuated the TMI meltdown in 1979.

$360,016: The amount in the reduction of taxes TMI is paying to Dauphin County, or a $506,956 vs. $146,940 per year loss since Exelon came to town.

$2.2 million: Nuclear security budget increased to $2.2 million annually in 2002 or $550,300 less than John W. Rowe's, Exelon's CEO, base salary.

2.3 million gallons: Amount of radioactive water from the Accident that was evaporated directly into the atmosphere.

$5 million: TMI's "fair market value" according to Exelon in 2004.

$15 to $18 million: Cost to replace and install a new reactor vessel according to Exelon in 2004.

$29.8 million: Amount of Corbin McNeill's, ex-chairman and co-CEO of Exelon, compensation package for 2002.

Millions: Millions of gallons of water are consumed by TMI each day and *not* returned to the River; even during periods of drought.

$1 billion: The amount tax payers and rate payers have spent to remove the damaged fuel from TMI -2 since its meltdown in 1979. The plant still needs to be cleaned up and decommissioned.

What's Wrong With the NRC Fact Sheet on the 1979 Accident
by Three Mile Island Alert

Because the Nuclear Regulatory Commission (NRC) continues to publicize false information about the TMI accident, we correct the record once again.

The NRC fact sheet claims the problems started when: (NRC quotes are Italicized)

> ***1.*** *"The main feedwater pumps stopped running, caused by either a mechanical or electrical failure, which prevented the steam generators from removing heat."*

The problems did not start with the feedwater pumps, the trouble began in the condensate polisher system. The NRC reported this in 1979 but also states they don't need to know the exact cause of the condensate polisher valves failure. No one knows why the accident began to this day.

> ***2.*** *"Signals available to the operator failed to show that the valve was still open… In addition, there was no clear signal that the pilot-operated relief valve was open."*

Because TMI had been falsifying reactor leak rates to the NRC in the months leading to the accident, operators had become conditioned to ignore the high temperature of the leaking valve known as the Pilot Operated Relief Valve (PORV). It sits on top of the reactor, specifically, on top of the pressurizer. On the night of the accident, the high temperature reading of the PORV drain line should have been an obvious sign that the PORV was stuck open and that reactor coolant was being lost through this pathway. In effect, falsifying the records made the operators blind to the fact that a small break loss of coolant accident was occurring.

It should be noted that if the company had operated lawfully, the plant would have been shut down for repairs and there would have been no accident on March 28, 1979. On May 22, 1979, former control room operator Harold W. Hartman, Jr. told NRC investigators that Metropolitan Edison-had been falsifying primary-coolant, leak rate data for months prior to the accident. At least two members of management were aware of the practice.

On February 29, 1984, a plea bargain between the Department of Justice and Met Ed settled the Unit 2 leak rate falsification case. Met Ed pleaded guilty to one count, and no contest to six counts of an 11-count indictment.

> ***3.*** *"In a worst-case accident, the melting of nuclear fuel would lead to a breach of the walls of the containment building and release massive quantities of radiation to the environment. But this did not occur as a result of the Three Mile Island accident."*

Fifteen million curies of radiation which were admittedly released during the accident is a "massive quantity." It was only by luck that the reactor walls were not breached. The industry conjectured that voids in the reactor prevented molten fuel from burning through the reactor walls. Had that occurred, we would have found out if the 5000^{F} degree core would burn through the walls or the floor of the containment building. One can conclude that the floors of the containments at the Fukushima triple meltdown have been breached since an estimated total of 300 tons of ground water enter the containments every day.

> ***4.*** *"The accident caught federal and state authorities off guard."*

State officials had no means to measure radiation at the scene. They had to take field samples and return to their laboratories. This was not an effective way to acquire real-time data or collect data on gaseous releases. Their data collection abilities were insufficient to determine release rates. The NRC no longer monitors radioactive releases at reactor sites.

It should also be noted that the NRC was caught off guard believing that a small break loss of coolant accident could not lead to a meltdown

> ***5.*** *"They did not know that the core had melted, but they immediately took steps to try to gain control of the reactor and ensure adequate cooling to the core."*

Reactor core measurements taken during the first morning showed that fuel had likely melted. This data was cast aside because operators believed it was not possible and therefore erroneous. During the first day, the NRC in fact distanced itself from the company by stating it did not tell licensees how to run their plants and that they were only overseers of regulatory matters. Initially, the NRC was more interested in hiding from responsibility than offering advice to the company. Making matters worse, the NRC had only one employee with a reactor operator's license at the time of the emergency.

6. *"Helicopters hired by TMI's owner, General Public Utilities Nuclear, and the Department of Energy were sampling radioactivity in the atmosphere above the plant by midday. A team from the Brookhaven National Laboratory was also sent to assist in radiation monitoring."*

By mid-morning, citizens (many who had not heard about the accident) were reporting a metallic taste in their mouths. Because the reactor had been leaking for several weeks, the reactor drain tank was full and a pathway to the environs had already been created by aligning valves to handle the leaking coolant. This also facilitated the falsification of the leak rates by disguising the volume of water passing through the drain tank.

The GAO reported "Two of four radiation monitors were not working at the time of the accident, and more than half of the radiation survey instruments were not operational. There was no licensee plan to review quality assurance. The NRC knew of the problems associated with the radiation survey instruments but took no action to ensure that the problems were resolved."

At the time of the accident, GPU reported that radiation monitors went off-scale, filters were clogged and other monitoring devices "disappeared." Therefore, we do not know how much radiation escaped undetected into the atmosphere. Still, the Columbia Study found an increased cancer incidence, including lung cancer, from 1975-1985.

7. *"In an atmosphere of growing uncertainty about the condition of the plant, the governor of Pennsylvania, Richard Thornburgh, consulted with the NRC about evacuating the population near the plant. Eventually, he and NRC Chairman Joseph Hendrie agreed that it would be prudent for those members of society most vulnerable to radiation to evacuate the area. Thornburgh announced that he was advising pregnant women and preschool-age children within a five-mile radius of the plant to leave the area."*

The NRC's previously agreed-upon conditions inside a reactor having an accident requiring an evacuation of nearby communities had already been met two days earlier on Wednesday, Nov. 28th. Governor Thornburgh complained often about the conflicting and confusing data coming from the plant and the NRC.

8. "...even though it led to no deaths or injuries to plant workers or members of the nearby community."

In August 1996, a study by Dr. Steven Wing, University of North Carolina-Chapel Hill, reviewed the Susser-Hatch study (Columbia University; 1991). Dr. Wing reported that "...there were reports of erythema, hair loss, vomiting, and pet death near TMI at the time of the accident. Accident doses were positively associated with cancer incidence. Associations were largest for leukemia, intermediate for lung cancer, and smallest for all cancers combined... Inhaled radionuclide contamination could differentially impact lung cancers, which show a clear dose-related increase."

Findings from the re-analysis of cancer incidence around Three Mile Island is consistent with the theory that radiation from the accident increased cancer in areas that were in the path of radioactive plumes. "This cancer increase would not be expected to occur over a short time in the general population unless doses were far higher than estimated by industry and government authorities," Wing said. "Rather, our findings support the allegation that the people who reported rashes, hair loss, vomiting and pet deaths after the accident were exposed to high level radiation and not only suffering from emotional stress."

Even under normal operating circumstances nuclear plants release radiation. The NRC acknowledged that 12 people are expected to die as a direct result of normal operation and releases for each commercial nuclear reactor that is granted a license extension of 20 years.

The admission came in a correction to its relicensing regulation, which the NRC published in the Federal Register on July 30, 2001. According to the Federal Register notice, each relicensing is expected to be responsible for the release of 14,800 person-rems of radiation during its 20-year life extension. The figure includes releases from the nuclear fuel chain that supports reactor operation, as well as from the reactors themselves. The NRC calculates that this level of radiation release spread over the population will cause 12 cancer deaths per reactor.

9. *"But new concerns arose by the morning of Friday, March 30. A significant release of radiation from the plant's auxiliary building, performed to relieve pressure on the primary system and avoid curtailing the flow of coolant to the core, caused a great deal of confusion and consternation."*

This was not by accident or design. The release was perpetrated by a lone operator acting on his own and without permission or consultation with

anyone else. There were no regulatory repercussions resulting from his actions.

> ***10.*** *"Today, the TMI-2 reactor is permanently shut down and defueled, with the reactor coolant system drained, the radioactive water decontaminated and evaporated, radioactive waste shipped off-site to an appropriate disposal site, reactor fuel and core debris shipped off-site to a Department of Energy facility, and the remainder of the site being monitored."*

The reactor was destroyed. No one knows how much fuel remains in the reactor core debris. Some estimates have placed it at 20 tons of uranium. Deadly amounts of radiation remain in the water in the basement of the containment building. No one is able to go into the basement. The plan is to let the radiation decay for decades.

Unit #2 is still releasing small amounts of radiation into the air and water. In 2013 when TMI Alert asked the NRC about the amount of radiation being released, after a ten minute delay and two NRC huddles we were incorrectly told zero.

> ***11.*** *"The accident was caused by a combination of personnel error, design deficiencies, and component failures."*

Add to the list: criminal activity, the NRC's failure to disseminate safety data, NRC inspection and enforcement failures, inadequate training, failure to fix problems noted by control room operators, sloppy control room housekeeping and economic gain placed above safety.

> ***12.*** *"Upgrading and strengthening of plant design and equipment requirements. This includes fire protection…"*

As the Union of Concerned Scientists stated in a 2016 report titled *Preventing an American Fukushima*, "For decades, the nuclear industry has been making promises to take certain actions to address severe accident risks in order to ward off imposition of new regulatory requirements by the NRC — promises the industry has not always kept."

A reactor safety division specifically created to spot problem trends in the wake of the TMI accident was abolished by NRC executives in 1999. According to a 2003 report by the NRC's Office of Inspector General, only half of NRC employees feel it is safe to bring up new safety concerns. One former NRC employee stated those who do present their concerns have their careers harmed by NRC executives.

For more than a decade, the NRC was aware that the fire protection material Thermolag was defective and burned at the same rate as plywood. The NRC was also aware that the manufacturer has falsified test results yet did nothing to fix the problem. Finally the NRC asked TMI to remove Thermolag. Two years after that request, TMI was again asked to remove Thermolag. The NRC and TMI were very slow to act.

> ***13.*** *"Expansion of NRC's resident inspector program - first authorized in 1977 -whereby at least two inspectors live nearby and work exclusively at each plant in the U.S to provide daily surveillance of licensee adherence to NRC regulations…"*

At Davis Besse, there was no chief inspector for a year. Inspectors find fewer than two percent of problems identified at the plants. The NRC has decreased total inspection man-hours.

> ***14.*** *"The installing of additional equipment by licensees to mitigate accident conditions, and monitor radiation levels and plant status…"*

The NRC has allowed plants to do away with their hydrogen recombiners. These emergency systems were added to prevent another hydrogen explosion like the one at TMI. The NRC has stated that hydrogen recombiners would be "ineffective at mitigating hydrogen releases from risk-significant beyond design-basis accidents." Instead of requirements to fortify recombiners, the NRC has allowed utilities to disregard them altogether.

The NRC no longer monitors radiation at the plants. On occasion, the communication lines from the control room computers to the NRC are found to be inoperable.

> ***15.*** *"Employment of major initiatives by licensees in early identification of important safety-related problems, and in collecting and assessing relevant data so lessons of experience can be shared and quickly acted upon…"*

Oh, if this were only true. Drastic employee cutbacks and overburdened workers and engineers have little time and are reluctant to raise new safety issues. TMI Alert has learned of TMI employees who simply "up and quit" due to the excessive work load.

16. *"July 1980 Approximately 43,000 curies of krypton were vented from the reactor building."*

For eleven days in June and July of 1980, Met Ed illegally vented 43,000 curies of radioactive Krypton-85 (beta and gamma; 10 year half life) and other radioactive gasses into the environment without having scrubbers in place. In November 1980, the United States Court of Appeals for the District of Columbia **ruled that the krypton venting was illegal**.

By 1993, TMI-2 evaporated 2.3 million gallons of accident-generated radioactive generated water, including tritium, a radioactive form of hydrogen (half life; 12.5 years), into the atmosphere despite legal objections from community-based organizations.

Postscript:
The NRC fails to point out that for more than a year prior to the accident it had ignored a newly discovered safety problem which did occur at TMI. Voids in the coolant created by poorly designed piping caused reactor pumps to cavitate and vibrate violently. These vibrations threatened to destroy the pumps. The coolant pumps had to be turned off during the height of the accident.

The NRC's role in the accident is one of tacit permissiveness. The attitude of the industry was criticized by the President's Commission above all other factors. Three Mile Island Alert has observed that safety conditions and attitudes are returning to the level evidenced by the industry in 1979. Many of the so called "permanent" changes have been downgraded since the time of their installation.

The NRC inspectors have little confidence in the new regulatory process according to a January 2000 Government Accounting Office (GAO) investigation. The new regulatory process handcuffs the ability of inspectors to pursue safety problems at the plants. Unless a suspicious condition is deemed clearly dangerous, the new process doesn't allow for the enactment of special inspections.

The Davis Besse near-miss is a prime example. The NRC did not have a resident inspector there for one year. Although there was clear evidence of a

leaking reactor, the NRC initially denied possession of the "smoking gun" – a picture of the red crud which had formed on the outside of the reactor vessel. The NRC had in fact ignored the problem to allow the plant to continue operating. Determining that something is clearly dangerous is apparently still a subjective skill at the NRC.

There are outstanding safety issues identified by the NRC following the TMI accident which have still not been corrected. One example is the vulnerability of electrical cables during an accident which can electrically short circuit. Another example is the PORV valve which released the coolant during the accident – it is still not rated as a "safety item."

(This paper was updated in 2019 for the 40th anniversary of the TMI Meltdown.)

Evacuating Three Mile Island:
A Parent's Perspective 40 Year's Later

By Eric J. Epstein

On March 30, 1979, Governor Richard Thornburgh recommended an evacuation for preschool children and pregnant women living within five miles of the Three Mile Island. Out of a target population of 5,000, preschool children and pregnant women, over 140,000 Central Pennsylvanians fled the area. We became the first American community to leave our businesses, homes, farms and friends due to a nuclear power plant accident.

Central Pennsylvania is middle America. We enjoy holiday parades, Friday night football, and old fashioned everything. We welcome the change of seasons and pretty much stay put from generation to generation. We're used to America coming to us to visit Gettysburg, marvel at the Amish, and smell Hershey chocolate.

My father admired the technology that was Three Mile Island. Driving towards the nuclear power plant he confidently welcomed the billowing steam clouds. Many residents boated, fished, or water skied around the island. School students routinely were paraded through the plant to greet their future. My dad assured me that an accident at Three Mile Island was "not possible." I believed my dad. We believed the nuclear industry and the government.

The last week of March 1979 was unseasonably warm. Central Pennsylvanians stepped outside for their first, prolonged post-winter break. While Gov. Richard Thornburgh was acclimating to Harrisburg, the "new" reactor in Middletown was struggling to stay on line. On Wednesday, March 28, 1979, TMI became a household name. Two days later, while school was in session, area residents fled the area not knowing if or when they would return. America now knew Central Pennsylvania for all the wrong reasons.

Evacuation plans in 1979 were little more than an afterthought, stashed in a drawer. The problem is that people are not hypothetical numbers that conform to abstract modeling. People don't want to leave their homes. Farmers don't want to desert their animals. And Coatesville (where the emergency planning center is now located) isn't Middletown.

I was away at college during the evacuation. My sister was bussed home from Northside Elementary School. My brother was in his first trimester. The family furniture store, which had survived three floods and a fire, remained open. Hershey still made chocolate, the Amish continued to plow Lancaster County's fertile earth, and the battlefield at Gettysburg still attracted visitors.

But in Middletown, Mayor Robert Reid directed traffic out of town as fleeing residents asked him to protect their homes while they were gone. To the north, streams of citizens from Harrisburg flowed down Market Street to line up for busses heading anywhere.

Across the river, Goldsboro became a ghost town while dairy cows continued to graze in Etters. And the City of York, like Harrisburg and Lancaster, had no evacuation plan for a nuclear accident.

The TMI community remains a living case study of how not to evacuate. For those of us who live, work, and parent in the shadow of Three Mile Island, the Accident continues to exact a toll. Many residents still keep an overnight bag packed, a stash of “TMI money,” and make sure their cars have a full tank of gas at all times.

No reactor community should have to endure another nuclear nightmare. At the very least, we should stop pretending that emergency evacuation planning for the infirm, preschool children, and senior residences are adequate.

I need to be able to get in my car, drive past Three Mile Island, and tell my daughter that adults are doing everything humanly possible to make sure there is no “next time.”

Beyond Nuclear Opposes License Extension for Peach Bottom

WASHINGTON – Scientific knowledge gaps in the management of reactor safety issues caused by aging, and acknowledged by the nuclear industry, have prompted Beyond Nuclear to challenge an application to extend the operating license for two nuclear reactors in Pennsylvania.

Beyond Nuclear, an environmental advocacy group based in Takoma Park, MD, is opposing an application from Exelon Generation, owner of the Peach Bottom nuclear power plant in Delta, PA, to extend the operating lifetime of its two reactors there for another 20 years.

Exelon has submitted a Second License Renewal (SLR) application for an additional 20-year extension of the operating license for Peach Bottom units 2 and 3.

Beyond Nuclear submitted a request on Monday asking the US Nuclear Regulatory Commission (NRC) for a public hearing and intervention before the NRC's Atomic Safety Licensing Board.

The hearing would address the application's failure to comply with NRC regulations that require Exelon to demonstrate how it will manage increasing wear and tear caused by the combination of extreme heat, pressure, radiation and vibration on Peach Bottom safety systems throughout the requested 60- to 80-year extended period of operation.

Both units are GE Mark I boiling water reactors and are already operating within their first approved 20-year license extension to the original 40-year license which expired in 2013 and 2014, respectively. Exelon is now seeking NRC approval to extend the operation of Peach Bottom Unit 2 from 2033 to 2053 and Unit 3 from 2034 to 2054.

"According to NRC regulations, the onus is on Exelon to demonstrate in its application how Peach Bottom operators will manage the destructive effects of aging on safety systems and the material reliability of structures and components for the extension period," said Paul Gunter, Director of the Reactor Oversight Project with Beyond Nuclear. "This application fails to satisfy NRC regulations that require Peach Bottom to have effective age management programs throughout the next license renewal period," he said.

Presently, there are as many as 16 known significant age-related degradation mechanisms (i.e. radiation and thermal induced embrittlement, stress corrosion cracking, fatigue) attacking the base metals, welds, concrete and entire systems including more than 1,200 miles of control, instrumentation and power cables at the two-unit reactor site. The industry, the regulator and national laboratories publicly acknowledge an abundance of gaps, deficiencies, and uncertainties in their present understanding of how these aging degradation mechanisms and their synergies destructively impact reactor safety and performance.

Analyzing a sufficient amount of information on the material condition of reactor systems, structures and components collected from reactor operating experience is essential, in fact required, to reasonably project Peach Bottom's safety performance into the future.

However, reactors in the US are closing due to a variety of economical, technological and political challenges. Several reactors have closed in just the past few years, more upcoming closures have been announced, and others could possibly close before Peach Bottom enters

the proposed second license renewal period in 2033 and 2034. As currently trending, the amount of operating experience could be significantly reduced, consequentially reducing age management insights needed for the requested license renewal period.

“Exelon fails to acknowledge just how dependent its age management programs are on evidence gathered internally from Peach Bottom’s operating experience and externally from other reactors of like design and materials,” said Gunter, citing from expert testimony submitted with the legal filing to the NRC.

“Further, the application fails to address when the number of reactor closures and the associated reduction in the amount of external operating experience impairs the effectiveness of its age management programs,” he continued.

“Of more concern, the application is silent on how Exelon would provide the required operating experience gathered from alternate sources including strategic autopsies on the growing number of decommissioning reactors like Exelon’s Oyster Creek plant in New Jersey,” Gunter added.

According to Beyond Nuclear’s expert witness, David Lochbaum, a widely recognized independent nuclear engineer on reactor safety, “In order to comply with NRC relicensing regulations and protect public health and safety, Exelon needs to address several factors. First, how much of Exelon’s age management programs depends on operating experience of other reactors; second, how will Exelon determine what amount of operating experience information is sufficient to assure safety, and finally; how the required operating experience will be augmented if it is found to be insufficient,” Lochbaum said.

Beyond Nuclear concludes that without Exelon first demonstrating how it will reliably manage the increasing effects of aging during the second renewal, Peach Bottom cannot be relicensed.

PA Not Living Up To Potential on Renewables

Renewable energy in Pennsylvania needs a boost to regain the state's early position as a renewable energy friendly state. Even though some growth has taken place in recent years, the primary legislation that requires utilities and electric generation suppliers to purchase renewable and alternative energy is in dire need of an update. Yet, the risk of adding non-clean, non-renewable resources like nuclear power in the form of what nuclear advocates have dubbed "Zero Emissions Credits" (ZECs) is looming with potential nuclear bail out legislation due to be introduced ironically around the time of the fortieth anniversary of the accident at TMI.

Bailing out this industry again would send the wrong market signals, needlessly increasing consumers' electricity bills to prop up outdated technology and postpone further development of sustainable renewable energy policies that the renewable energy industry can rely on for years to come. Newer, safer technologies like solar and wind have come into their own over the last twenty years while nuclear power, once "too cheap to meter" is now more expensive. Keep in mind that consumers will be forced to pay more, even though neither company is based in Pennsylvania. Both TMI and Beaver Valley, two nuclear plants that are not economical, have a long history of cost over-runs. Of course that is not to say they won't be back begging for another handout as other nuclear plants lose their economic edge. In fact, that is just what happened on February 08, 2019. Exelon company, partial owner of TMI, warned the Securities and Exchange Commission it may shutter three more nuclear power plants in Illinois only two years after the state agreed to bail out two reactors.

When competitive markets are allowed to function as intended, the most efficient plants run while more expensive plants wait in line. Cheaper, more efficient plants bring consumers the best value on their electricity bills. Renewable energy delivered on its promise of lower consumer costs by lowering the cost of solar, for example, by almost 80% over the past 20 years. This is a remarkable fact that often gets overlooked. Nuclear is going in the opposite direction. It's not time to retire all nuclear plants, but its hard to see why it doesn't make senses to retire old, uneconomical dangerous ones. There is nothing "advanced" about nuclear technology. The technology in these plants hasn't improved in decades and does not belong in an Advanced Energy Portfolio Standard.

Over the past year, pro-renewable energy and energy efficiency legislation has been introduced, but rarely do these bills move out of their assigned committees. The exceptions are bills that "closed the borders" to out of state solar projects (Act #40) and Act #30, the Commercial Property Assessed Clean Energy Investments (C-PACE), which both were enacted this year. Act #30 allows commercial property owners to finance up to 100% of energy efficiency and solar projects through their property tax bills, allowing owners to pay for those improvements over time. The program is voluntary. Currently there is a stakeholder process to develop tools and infrastructure so municipalities can offer C-PACE financing options.

The Pennsylvania Public Utility Commission has undertaken a proceeding to examine alternative forms of rate making which could change the way utilities are compensated. Depending on the outcome, renewable resources and energy efficiency could either be better incentivized or disadvantaged. For example, if performance incentives that support renewable energy are allowed, one of the economic barriers to its growth could be reduced. At the same time, if fixed customer charges continue to increase, rooftop solar and energy efficiency are disincentivized because fixed charges front-load customer's costs, discouraging consumers committed to reducing their energy usage or self-generating.

Another positive development is the Department Of Energy (DOE) grant administered through the state Department of Environmental Protection to explore increasing solar energy to 10% by 2030. Currently the goal is .5% by 2021. The project, which has been working for 2.5 years and has over 500 stakeholders, conducted independent modeling of benefits and costs for distributive and grid scale solar. If Pennsylvania gets 10% of its electricity from solar, emissions will be reduced by over 9.3% for the electricity sector, which in turn reduces the state's total greenhouse has emissions by 2 to 3%. The final report, which integrates 184 public comments, is available on www.dep.gov/PASolarFuture. The Report, and its companion Strategy Support Guide can serve as a roadmap to advance solar energy in the state.

Pennsylvania has over 1300 MW of wind power generation coming from 25 wind farms, enough to power nearly 350,000 homes, according to the Governor's Clean Energy Week Proclamation (September 24-28, 2018). Transmission limitations, inability to develop on public lands, numerous local ordinances in the Commonwealth's 2000+ municipalities, and the lack of long term contracts, particularly for solar, plague large scale development of these resources. There is currently a wind project under construction in the Scranton area. Long term contracting for both solar and wind would allow for steady and sustained development instead of gambling on short term solutions that make dangerous trade-offs to the nuclear power industry.

Biomass energy ("bioenergy") is energy generated from a biologically derived material from a living or recently living organism (animal or plant). Biomass provides about three-tenths of Pennsylvania's renewable electricity. Pennsylvania is among the top 12 states in the nation using biomass for electricity generation (EIA, July 2016).

Hydropower provides 892 MW of generation capacity in Pennsylvania and 1583 MW of pumped storage hydro capacity.

The Department of Environmental Protection's Climate Change Advisory Council (CCAC) currently has 28 members representing a broad spectrum of interests who develop and debate strategies for reducing greenhouse gas emissions. The Pennsylvania Climate Change Act (Act #70) requires DEP to prepare and update the Climate Change Action Plan every three years in consultation with the CCAC. The most recent plan is due to be released soon.

Replace Aging, Dangerous Nukes

With Safe, Efficient Renewables

By Maureen Mulligan

As members of Three Mile Island Alert, a watchdog group, we are resolutely opposed to the efforts of utilities in Pennsylvania and Ohio to secure huge subsidies to keep their aging and financially failing nuclear power plants operational well beyond their "expiration dates." Such a decision would have national implications. The diversion of billions of dollars into nuclear subsidies would distort markets and state regulatory decisions, resulting in lower investment in renewable resources and energy efficiency. This in turn would prolong the uneconomic existence of a resource that is not clean energy.

The Union of Concerned Scientists, in its new report, argues that the trajectories of existing renewable energy and efficiency standards are insufficient to prevent a dangerous increase in CO^2 emissions, and that a tax on carbon could serve to better mitigate carbon emissions *so long as nuclear reactors remain operational.*

This latter requirement is roundly contradicted by reports over the last several years that show that, even in Pennsylvania, a state with one of the highest greenhouse gas (GHG) emissions rates, GHG reduction goals can be met under the Environmental Protection Agency's Clean Power Plan targets through planned power plant retirements.

Nuclear power is a well-funded, controversial industry that embodies hazards at all points along its fuel cycle. There is no room for both renewable energy development and continued, subsidized operation of nuclear power plants.

UCS proffers the notion that a subsidy for both nuclear and renewables will cause "all boats to rise," but this has not played out in Pennsylvania and is unlikely to be the case in the future. If Pennsylvanians are forced to foot the bill for these plants, many of which are already 45 years old, we will be perpetuating uneconomic plants at the expense of newer, cleaner, safer technology options.

In addition, if nuclear power plants continue to be the beneficiary of bailouts time and time again, this distorts free markets and sends mixed signals to investors as to whether or not to consider new nuclear power projects.

Further, both Pennsylvania and Ohio have time to develop renewable energy. For example, Pennsylvania is in the final stages of completing a "Solar Future Plan," finding that Pennsylvania can support up to 10% solar by 2030.

Pending legislation supports increasing our Alternative Energy Portfolio Standard. The Pennsylvania Public Utility Commission is in the advanced stages of developing alternative ratemaking rules that could support further development of renewable energy/energy efficiency.

The Governor recently signed into law Commercial Property Assessed Clean Energy legislation making financing of these projects easier. Bipartisan legislation is pending to remove our two percent cap on mandated utility energy efficiency spending.

In addition, energy grid manager PJM's current reserve margin is 28%. By PJM's own staff analysis, a 15.8% reserve margin is acceptable, meaning that the planned retirements of aging nuclear plants have no impact on electric reliability. As recently as October 11, 2018, PJM CEO Andy Ott, speaking before the US Senate Energy and Natural Resources Committee, emphasized the importance of fuel diversity for grid resilience and warned against distorting energy markets through government subsidies.

We should permit the forces of economics and technology to phase out the oldest and most dangerous nuclear plants, as we would with any outdated technology, and invest in the future which is clean energy jobs and the economic development that accompanies growth.

The two plants in Pennsylvania likely to be subsidized — Three Mile Island and Beaver Valley, harbor growing, on-site nuclear waste storage inventories. Waste generation would be curtailed if these two plants close as anticipated. The volumes involved are far beyond anything envisioned when the plants were constructed and no safe, permanent storage solution has been found for high-level radioactive waste.

We also have to consider safety issues when considering where to spend ratepayer money. There is a history of missteps and errors at the two Pennsylvania nuclear plants that will continue with extended plant operations. Each of these facilities presents risks to local populations.

Plants in Ohio and Pennsylvania have a history of on-site security and safety breaches that are often kept away from public scrutiny. Such lapses make continued nuclear power plant operation a dangerous gamble. Indeed, all along the fuel chain, nuclear power poses risks we no longer need to take as society advances into next generation energy solutions.

Our organization is fully supportive of the need for a comprehensive carbon reduction plan, but we do not support trading one dirty energy source for another. Until we solve the nuclear waste challenge, inherent safety issues, and transport risks, we must remain focused on truly clean, safe energy solutions, meaningful worker protections, and realistic job re-training options. Proposed nuclear subsidies stand in the way of such progress.

Maureen Mulligan, owner of Sustainable Futures Communications, is a volunteer and member of the Three Mile Island Alert Planning Council.

Scientific American

Should We Subsidize Nuclear Power to Fight Climate Change?

That's what some are advocating, but the arguments in favor of doing so are flawed

By M. V. Ramana on December 3, 2018

Credit: Getty Images

Last month, the Union of Concerned Scientists (UCS) put out a report entitled *The Nuclear Power Dilemma: Declining Profits, Plant Closures, and the Threat of Rising Carbon Emissions* that calls for offering subsidies to unprofitable nuclear power plants. Not surprisingly, it has been widely welcomed by nuclear advocates, who interpret the report as essentially saying "yes to nuclear power" in order to reduce carbon emissions.

But that interpretation misses the many important but less prominent insights in the UCS report.

Nuclear power plants are associated with significantly less carbon dioxide emitted per unit of electricity produced when compared to fossil fuel plants, even when including the emissions associated with the fuel chain required to generate nuclear energy. Therefore, the report's basis for argument—if utilities were to replace "existing nuclear plants with natural gas and coal

rather than low-carbon sources," then it would compromise "our ability to achieve the deep cuts in carbon emissions" (p. 1)—is obvious. Whether nuclear plants would be replaced by fossil fueled plants is questionable.

Nuclear plants are hugely expensive, and it has been known for a while that they are not an economically competitive choice. Thus, building new nuclear plants makes no sense. In the UCS report too, the power planning model used does not recommend constructing new nuclear plants, even at the highest assumed price of carbon. The authors, unfortunately, do not highlight this outcome of their modeling, sidestepping its implications by not "assessing the potential role of new nuclear plants in meeting long-term emissions reduction targets" (p. 12).

For decades, nuclear advocates had a comforting response: although expensive to build, nuclear plants are cheap to operate and profitable in the long run. That is no longer true. Several nuclear plants have been shut down because the utilities operating them are losing money. As shown by the UCS report and similar studies, many more are likely to be shuttered.

So, the question in essence is how to deal with a *dying* source of electricity generation in the United States. Globally, the share of nuclear energy in the world's electricity generation has been declining continuously since 1996. The UCS report is a plea to keep the nuclear industry on life support by states providing subsidies to nuclear power plants that are not profitable, *provided the operators of the nuclear plants and the states play by some rules*. Regardless of these subsidies, it remains the case that over the next few decades, the reactor fleet will have to be retired. Some of these reactors are nearly half a century old, and some have a checkered past.

Many others have demanded that states subsidize nuclear plants, and there is even a tool kit to help plant owners to continue profiting at public expense. It is the imposition of various requirements that distinguishes the UCS report from the rest of the chorus—and unfortunately the media has by and large highlighted the call for subsidies without the conditions. The conditions are: "Require plant owners to open their financial books and demonstrate need"; "make financial support for distressed plants temporary [and] periodically assess whether continued support is necessary and cost effective"; "Ensure that qualifying plants maintain strong safety performance"; "Strengthen renewable energy and efficiency standards"; "Develop transition plans for affected workers and communities"; and state "requirements [on resources subject to state jurisdiction, such as the use of local water supplies for cooling and the impact of cooling-water discharges] need to be vigorously enforced".

These requirements are not easy to meet, and other proponents of nuclear subsidies are, in some cases, undermining them. The Nuclear Energy Institute "has proposed merging the highest and second-highest safety ratings"—measures of plant safety produced by the Nuclear Regulatory Commission—which "would effectively render the rating meaningless" (p. 24). In Connecticut, the Millstone nuclear plant's "owner refused to make a disclosure" when seeking subsidies (p. 41).

These subsidies are being offered to an industry that has profited enormously in the past from direct and indirect subsidies. As the Illinois attorney general explained, current subsidy demands "amount to a third round of subsidies for these plants."

Let us return to the most basic assumption needed for the argument for subsidies to stick, namely that utilities would replace shut down nuclear plants with fossil fueled plants. This is possible but by no means necessary, especially with continued falling costs for renewable energy and storage technologies. The energy industry is changing so rapidly that what the UCS report attempts, to forecast costs and plan over multi-decadal periods, is all but impossible to do with any degree of certainty.

Further, the report's inputs to the electricity planning model are already outdated. For example, the central cost figures it uses for nuclear reactor costs are *significantly lower* than the costs of the two reactors currently being constructed in the state of Georgia. In contrast, costs of solar PV plants and wind turbines are significantly higher than the most recent numbers. Renewables are not just getting cheaper, they are also quick to construct.

All these factors undermine the report's central assumption that nuclear plants will be replaced by fossil fueled plants. To be fair, the UCS report does call for periodically assessing whether continued support is necessary and cost effective. But such support might already not be cost effective. All told, the economic basis for subsidies is uncertain at best; more likely, it is flawed. Either way, it may be best to get onward with the transition from fossil fuels and nuclear power to renewables.

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The Perils of Bailing Out Aging Nuclear Stations

In the aftermath of the Three Mile Island accident, policy makers were consumed with our ability to keep pace with energy demand and at the same time foster diversity. We were dependent on coal and nuclear for electrical generation in Pennsylvania. Part of the goal of diversification was to focus on "energy efficiency." A dramatic increase in alternative and renewable energy led to a decline in demand impacting all classes of customers. Together with the re-emergence of Pennsylvania as a gas producing state, the Commonwealth has a more balanced portfolio, and electric prices well below the national average.

Ratcheting up our dependence on old, uneconomical nuclear reactors is like putting our energy policy in reverse. The margin of error in nuclear reactor operations narrows with age. Plants become more vulnerable after operating in harsh conditions for decades, parts wear out, institutional memory decreases, and backup emergency systems are susceptible to degraded reliability.

As Pennsylvania rate payers and taxpayers know well, nuclear comes with huge financial and safety risks, as evidenced by the meltdown at TMI-2 in 1979, the temporary closure of Peach Bottom in 1987, and $9 billion in stranded costs for uneconomical nuclear power plants.

Policy makers elected to protect the health and welfare of the public should consider the following factors prior to again bailing out TMI :

1. Steam generator defects at Three Mile Island

In early 2010, Exelon Corporation completed installation of new steam generators as part of a $300 million dollar upgrade to extend the life of Unit-1 at the Three Mile Island Nuclear Generating Station. The steam tubes inside the original steam generators had worn thin, and needed to be replaced.

After only 22 months of operation, premature wear was discovered inside the new steam generators. Some of the steam tubes had been vibrating and banging against each other. A few of them had worn through the tube walls more than half of the acceptable limit of 40 percent.

- A new metal alloy, an aggressive design, and a manufacturing defect in the new steam generators are allowing some tubes to bang together and wear thin.

- Unexpected thermal expansion was cited as the root cause.

- Data indicates a reactor transient could cause sufficient thermal expansion of the tubes to cause them to self-destruct by banging together. Should the steam generators fail in this manner, the internal damage would destroy the radiation barrier function of the steam tubes, releasing radiation directly to the environment in what is called a "containment bypass accident." These rapid releases would allow no time for an evacuation and represent a dangerous challenge. That is why this is no "small" matter.

- There has been no testing of the steam generators under these higher temperatures as required by Nuclear Regulatory Commission regulations.

- The San Onofre nuclear plant closed in 2013 due to the failure of its newly designed steam generators. This was caused by a design error similar to that of TMI's new steam generators.

- Three Mile Island Alert requested that the NRC address this problem four years ago but the problem has been ignored.

TMI-Alert will pursue legal action in early 2019.

2. The twin issues of additional expenses and containment of radioactive waste are significant

TMI has unique risks due to its proximity to an airport, lack of storage capacity, earthquake vulnerabilities (TMI is the 10th most vulnerable plant in the nation), and risk of flooding. This is costly and dangerous.

TMI is one of the last reactors entirely dependent of spent fuel pools. These pools often become de facto long-term storage sites with fuel assemblies "re-racked" thus increasing the heat load of the pools. At Rancho Seco, fuel removed from reactors in 1984 is still cooling in wet spent fuel pools. The TMI-1 site needs to accelerate waste transfer to dry cask storage to protect the public.

3. Odds become greater as reactors age increasing the likelihood of an accident.

TMI-1 is a 44-year-old plant using 1960s technology.

In 1974, one of the the "best automobile purchases" was a Ford Pinto. *Consumer Guide* stated, "The car has not been involved in a serious callback campaign." Four years later, 1.5 million Pintos were recalled, and the number of deaths attributed to fuel tank fires ranged from 27 to 180.

The same year the Pinto was rolled out, TMI-1 came on line. Nuclear technology was also viewed in high regard. Five years later, TMI's sister reactor melted down after being on line for for less than 90 days.

Everyone supports jobs, but at what price to hardworking taxpayers who have to support Exelon's bottom line? In Illinois it was calculated that each job saved in Exelon's latest bail out was over $1 million dollars per job.

Technology advances impact jobs. It happens in every industry. Car companies that have not increased their auto's efficiency over 40 years are selling fewer cars than their competitors. Local telephone companies are selling people fewer land lines. The list goes on and on.

4. We need to apply the lessons learned from "nuclear autopsies" at permanently closed reactors like Oyster Creek and relicensed reactors like Peach Bottom prior to bailing out old and uneconomical reactors in Pennsylvania

Presently, there are as many as 16 known significant age-related degradation mechanisms (i.e. radiation and thermal induced embrittlement, stress corrosion cracking, fatigue, etc.) attacking the base metals, welds, concrete, and entire systems including more than 1,200 miles of control, instrumentation, and power cables at the Peach Bottom two-unit reactor site.

The industry, the NRC, and national laboratories publicly acknowledge an abundance of gaps, deficiencies, and uncertainties in their present understanding of how these aging degradation mechanisms and their synergies destructively impact reactor safety and performance.

A thorough analysis on the overall reactor systems, including both the structures and components of the reactor operations is essential, in fact, obligatory, to reasonably project safety performance into the future at a minimum before keeping any nuclear plant open.

5. Most financial incentives are intended to encourage new industries for a cleaner environment

Financial incentives are intended to encourage new industries and promote a cleaner environment. The nuclear bailout scheme punishes rate and taxpayers, and rewards a fading industry instead. Nuclear plants emit hundreds of thousands of pounds of chemicals into the Commonwealth's waterways every year. The nuclear wastes created by nuclear reactors will require untold billions of dollars to safeguard for thousands of years to come. With those two facts in mind, nuclear energy can hardly be viewed as an emission free electrical generator.

Investment in alternative energy, energy efficiency, and renewable generation is increasing as production costs decline, reliability margins increase, and we continue to build a more diverse energy portfolio. For example, the solar industry has reduced its costs by 80% in the last twenty years while nuclear costs increase, making them uncompetitive.

Home grown Pennsylvania options create a desired localized electrical resiliency while nuclear plants go off-line in response to grid disturbances. Moreover, it is a resiliency that does not rely on foreign sources of nuclear fuel or oil.

Union of Concerned Scientists

Nuclear Power and Water

FACT SHEET

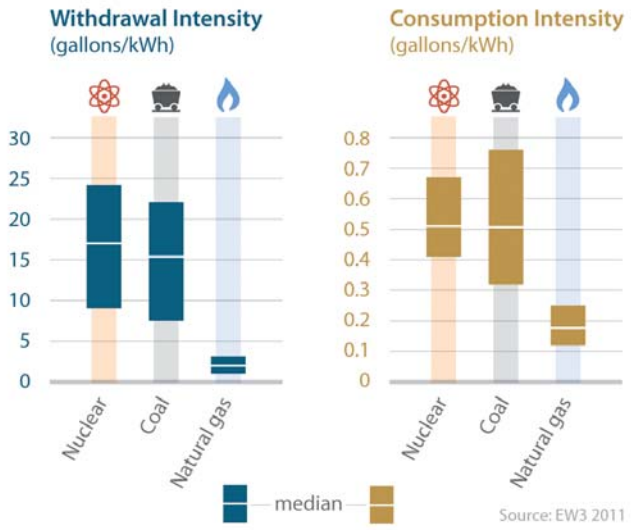
QUICK FACTS ON NUCLEAR POWER GENERATION AND WATER USE

The United States produces roughly 4 trillion kilowatt hours of electricity annually, 90 percent of which is generated by thermoelectric power plants.[i] Plants fueled by coal, natural gas, oil, nuclear fission, and some renewable energy technologies boil water to produce steam, which then turns a turbine to generate electricity. After it passes through the turbine, more water is needed to cool the steam back into water to reuse for generation; this steam-cooling step accounts for virtually all of the water used in most power plants. Nuclear fission is the most water intensive method of the principal thermoelectric generation options in terms of the amount of water withdrawn from sources. In 2008, nuclear power plants withdrew 8 times as much freshwater as natural gas plants per unit of energy produced, and up to 11 percent more than the average coal plant. [ii]

Water use in cooling systems

Nuclear power plants are about 33 percent efficient, which means that for every three units of thermal energy generated by the reactor core, one unit of electrical energy goes out to the grid and two units of waste heat go out into the environment through cooling systems. [iii] Of the 104 nuclear reactors in the United States, 35 are boiling water reactors (BWR) and 69 are pressurized water reactors (PWR). About 60 percent of these nuclear power systems use recirculating cooling; the remainder use once-through cooling.[iv]

Variations in Water-Use Intensity across the Fleet



Turning the Corner on Global Warming Emissions. July 28, 2004. Among power plants using freshwater for cooling in 2008, nuclear power plants used more water per unit of electricity produced. The average nuclear plant withdrew nearly eight times as much freshwater as the average natural gas plants, and 11 percent more than the average coal plant. Nuclear plants also consumed three times as much freshwater as natural gas per unit of energy produced, and about 4 percent more freshwater than coal plants. Sources: EW3 2011 Report.

Once-through cooling

Since a large nuclear power plant that utilizes a once-through cooling system may withdraw 800 million to 1 billion gallons of water a day, these plants are usually built next to rivers, lakes, or oceans.[v] As the name implies, once-through cooling uses water a single time to cool and condense steam produced for electricity generation. Water produced from the condensed steam is reused in the generation process, but the water used for cooling is discharged back into the lake, river or ocean, with a temperature increase of up to 30 degrees.[vi]

The temperature increase in the bodies of water can have serious adverse effects on aquatic life. Warm water holds less oxygen than cold water, thus discharge from once-through cooling systems can create a "temperature squeeze" that elevates the metabolic rate for fish.[vii] Additionally, suction pipes that are used to intake water can draw plankton, eggs and larvae into the plant's machinery, while larger organisms can be trapped against the protective screens of the pipes. Blocked intake screens have led to temporary shut downs and NRC fines at a number of plants.

Recirculating cooling

While once-through cooling systems withdraw 25,000 to 60,000 gallons of water for each megawatt-hour of electricity produced, recirculating cooling systems, also known as closed-cycle cooling systems, withdraw only 800 to 2,600 gallons per megawatt-hour and are used when nearby water sources lack sufficient volume to allow once-through cooling. After water is withdrawn from a source to cool steam, it is then cooled and pumped back into the condenser for reuse. Though plants with closed cycle cooling systems withdraw far less water than once-through cooling systems, they consume (through evaporation) about 600-800 gallons per megawatt-hour, roughly half the amount they withdraw.

Other water uses for nuclear power

While cooling systems account for the vast amount of water withdrawn by nuclear power plants, fuel extraction and refining have also impacted water sources. Uranium fuel extraction, for example, requires 45-150 gallons of water per megawatt-hour of electricity produced and uranium mining has contaminated surface or ground water sources in at least 14 states.[viii] Additionally, nuclear power plants intake water to cool service equipment, such as chillers for air conditioning units or lubricating oil coolers for the main turbine. Service water system flow rates can range from 13,500 to 52,000 gallons per minute depending on the season and the power plant.[ix]

Nuclear power in a warming world

Water cooling systems can also pose significant problems from an economic standpoint. When water is warmed, either by plant discharge or ambient temperatures, cooling requires even more water and power plants operate less efficiently. Moreover, if water cannot be cooled, it can neither be recirculated nor returned to the river, lake or ocean without threatening aquatic life. Therefore, during hot summers or heat waves, the problem compounds: during times of extreme heat, nuclear power plants operate less efficiently and are dually under the stress of increased electricity demand from air conditioning use. When cooling systems cannot operate, power plants are forced to shut down or reduce output. The combination of high electricity demand and reduced output can result in higher energy prices for ratepayers. Droughts can have a similar effect as heat waves, limiting the amount of water available for cooling.

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[i] U.S. Energy Information Administration. *Electricity in the United States,* 2009.
[ii] Averyt, et al. *Freshwater use by U.S. Power Plants: Electricity's Thirst for a Precious Resource.* Union of Concerned Scientists, EW3, 2011.
[iii] Lochbaum, David. *Got Water?* Union of Concerned Scientists, 2007.
[iv] Union of Concerned Scientists. *How it Works: Water for Nuclear,* 2010.
[v] Palo Verde nuclear power station buys treated wastewater to use in its recirculating cooling system. It is the only nuclear power station not located near a body of water.
[vi] UCS. 2007.
[vii] UCS,EW3. 2011.
[viii] UCS. EW3. 2011.
[ix] UCS. 2007.

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Consolidated "Interim" Storage

Consolidated/Centralized "Interim" Storage (CIS) **Nuclear Waste Dumps** would be sites to which high level nuclear power waste (in the form of irradiated nuclear fuel) would be moved before being shipped to a currently non-existent permanent repository.

Such facilities would allow the storage of commercial irradiated fuel (sometimes called "spent" or "used" fuel) from all the US nuclear power reactors across the country to an additional nuclear sacrifice area. As of 2018, there are two proposed Consolidated "Interim" Storage Dumps—one in Texas and one in New Mexico. There have been suggestions for locations in other states and one site was licensed in Utah but never operated.

Why are supposedly "Interim" Dumps a BAD IDEA? They are dangerous for several reasons:

- Unnecessary transport of deadly waste spreading and multiplying risks and hazards
- Failure to improve existing vulnerability of nuclear waste storage technology
- Increases the number of radioactive sites
- Supposedly "interim" sites could become permanent by default
- Consolidating waste in one place can lead to Reprocessing
- Reprocessing makes worse waste, spreads contamination and leads to proliferation of nuclear weapons.

If consolidated sites are opened, the irradiated fuel would move multiple times through our communities–from the reactors that made it to the supposedly temporary site and again to a permanent repository. The transport of irradiated nuclear fuel is extremely risky. (See NIRS **Hot Cargos** factsheet.)

An accident or attack on a high-level waste shipment could permanently contaminate a huge area and spread radioactivity very far. Land, water and air within 50 miles or more of the accident site could be contaminated with uninhabitable radiation levels. Even with no incident, routine shipments legally emit radiation.

It is likely that an "interim" site could become a de-facto permanent storage site if a morally and scientifically sound permanent system to isolate the waste is not developed.

Consolidated waste sites are not designed to store irradiated nuclear fuel for the millions of years it remains radioactively dangerous.

Consolidating irradiated nuclear fuel could lead to **reprocessing** which makes the nuclear waste problems much worse and leads to increased nuclear weapons proliferation dangers. No reprocessing sites have ever been cleaned up…they are costing billions to prevent from getting worse.

*Photo courtesy of **No Nuclear Waste Aqui***

Consolidated "Interim" Storage is ILLEGAL

The current federal law, 1982 Nuclear Waste Policy Act and 1987 Amendments, states that consolidated "interim" storage is allowed ***only if*** a permanent repository is operating. Moreover, the provision of the law allowed a "temporary" site ***expired***, making any such facility ***illegal***.

Despite the illegality, two private corporations applied to open such sites and the NRC is proceeding with their applications.

Application 1: **Waste Control Specialists (WCS) Orano USA and NAC International** seek to store **40,000** metric tons on their TX site bordering NM. The Nuclear Regulatory Commission (NRC) determined the WCS original high level waste application ready for legal review in January 2017, but later suspended the process. WCS was sold to J.F. Lehman in 2018 and announced they will resume the application. WCS operates a "low-level" radioactive waste and hazardous treatment and disposal site for nuclear power and weapons waste in Andrews County, Texas.

Application 2: The **Eddy Lea Energy Alliance** in conjunction with **Holtec International** is applying for a license to "temporarily" store **100,000 metric tons** (with **potential for 120,000**) of irradiated nuclear fuel in holes in the ground in SE New Mexico, east of Carlsbad. The application is expected to be declared complete in May 2018, opening it to public comments and intervention. ***Comments on the Environmental Impact Statement scope are due 29 May 2018.***

There are legal opportunities to comment and intervene in both licensing proceedings.

These corporations want to change the law to allow them to make money while all liability is borne by the public. They want:

- Legalizing consolidated "interim" storage before there is a permanent repository.
- Shift of liability for and ownership of the high-level waste from nuclear power companies that generated and own it to the US Department of Energy aka US taxpayers.
- Use of Nuclear Waste Fund money collected for permanent isolation to be redirected to them for so called "interim" storage.

New Mexicans and Texans with local, regional and national allies are working to prevent the proposed parking lot dumps. Such dumps and the 40 years and thousands of shipments to them not only threaten safety, security and economics; they violate the principles of environmental justice. People of color would be affected disproportionately if nuclear waste were brought to the Eddy Lee/Holtec or the WCS sites.

New Mexicans and Texans do not consent to either of the proposed parking lot dumps and are fighting to avoid the environmental injustice and the unnecessary shipment of irradiated high level nuclear waste through and to their communities.

What Should Be Done? The amount of waste should be limited and efforts focused on isolating that which has been generated. As of 2018 there are ~ 80,000 metric tonnes of commercial irradiated fuel in the US with ~2,000 more generated every year. Rather than move waste thousands of miles back and forth across the country, it should be stored more securely in Hardened On-Site Storage, HOSS, in containers that can be monitored, a concept supported by organizations in every state. Better storage containers and systems are needed no matter where the waste is located, since it must be isolated for literally millions of years.

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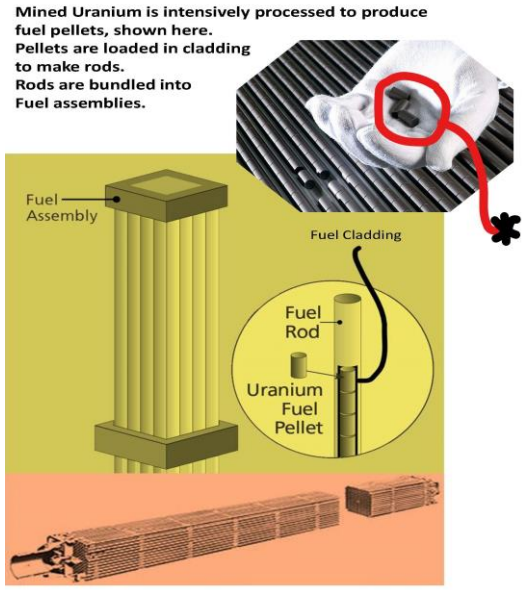
Nuclear Basics: High Level Radioactive Waste

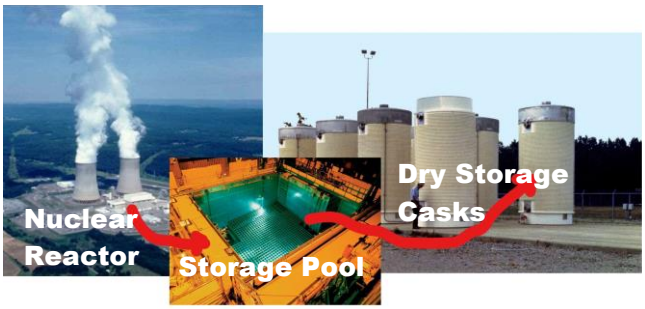
Nuclear power generates electricity using the heat released by splitting atoms (fission). In this process new radioactive atoms are made. Fission in a nuclear reactor and an atomic bomb are the same, though slower in a reactor. Since a power reactor operates "24/7," over a year it will produce as much heat and radioactivity as 1,000 nuclear detonations of the size that destroyed Hiroshima, Japan in 1945.

Fuel rods are millions of times more radioactive when they are removed from the reactor than when they go in. This *irradiated* or "*spent*" nuclear fuel is called **High-Level Radioactive Waste.**



Note: Only fresh uranium can be held unshielded; after use (fissioning) in the reactor, irradiated fuel pellets give off a *lethal* dose of radiation in seconds. This waste must be shielded and handled robotically. Also thermally hot, it is cooled in pools by circulating water for years before it can be stored in dry containers.

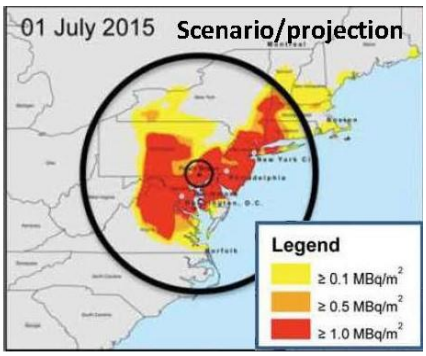
Nuclear Energy creates deadly waste that can harm life on Earth for more than a million years.



For decades High-Level Radioactive Waste has accumulated at reactor sites where it is made. There is no credible plan to permanently isolate it. Continuing to operate reactors makes even more waste (~2,000 tons/year in the US). Storage pools have been re-racked to pack waste tightly, creating new problems.

Unfortunately, the pools have no robust containment. Temperatures rise quickly if cooling pumps stop or water drains out, as began to happen at Fukushima in Japan. Loss of coolant from boiling off or leaks can result in a fuel pool fire dispersing huge amounts of radioactivity to the wind. The projected radioactive release from burning fuel is the worst possible nuclear accident scenario and would result in great harm to the immediate community and those downwind and downstream. Consequences depend on the weather.
The accident scenario pictured below uses weather conditions on a day in July 2015 to project impacts from a theoretical fuel fire at nuclear reactors at Peach Bottom, PA. A plume of highly radioactive fuel particles would have

Source:
Von Hippel and Schoeppner 2016 [1]



caused burns, radiation sickness, immune problems, cancers, heart problems, infertility, miscarriage, birth defects and scores of other health and economic impacts ($ in the billions) as well as long-term interdiction of land and water.

Reducing the amount of radioactive waste in fuel pools is a top priority. Reactor owners and the federal Nuclear Regulatory Commission have refused to reduce the risks of fuel pools and transfer waste to dry containers. The waste would not be completely safe in dry storage, but independent engineers have testified that it would be *safer*. [2] (See Cask Issues below.)

Hardened On-Site Storage (HOSS) is supported by organizations in all 50 states. It would provide better security at reactor sites with robust dry storage and community oversight, including real-time monitoring of heat and radiation.[3] HOSS is rooted in values of community protection and environmental justice. By contrast, every waste proposal by the federal government and the nuclear industry has targeted communities that are disproportionately low-income, indigenous, or people of color.

High Burn-up Fuel and Waste

The industry's decision to use high burn-up fuel has made nuclear waste dramatically more dangerous. High burn-up fuel has a much higher level of U-235, the main form of uranium that makes the atomic chain reaction and generates nuclear power.

High burn-up waste puts out more heat, more radioactivity and has a higher percentage of plutonium and other dangerous radioisotopes, all more carcinogenic than naturally occurring radioactivity, especially if inhaled or ingested. The fuel cladding, the thin metal tube that forms the fuel rod and holds the uranium fuel pellets, is not tough to begin with, but heat and radioactivity cause it to become brittle. Shaking (in transportation) may cause cladding to break or shatter.

Container / Cask Issues

Removing the waste from the pools is an important step. Unfortunately, the US nuclear industry is now almost exclusively using dry casks that are far more vulnerable to failure and more difficult to inspect than those used in other countries. Casks in the U.S. are subject to a number of unacceptable flaws in their design, manufacturing, and usage:

- Thin containers made from weak types of steel are subject to cracking.
- There is no reliable method of inspecting the full surface of the containers.
- Some environmental factors can accelerate cracking, such as salty coastal air.
- There is no easy way to transfer the waste from one container to another.
- There is no on-site emergency protocol for this procedure at reactor sites.

The same casks that are used at reactors are intended to be used at consolidated waste sites, if such a site were to open.

Unnecessary Transport

Most of the nearly 70,000 metric tons of commercial nuclear High Level Radioactive Waste (as of 2017) is at reactors where it is being made. In a few cases, some[4] has been transported but nowhere near the many thousands of shipments envisioned to move if one or more Consolidated or Centralized "Interim" Storage parking lot dumps are opened.

The waste would move on roads, rails and waterways once, and then again when a permanent site is found, doubling the transport risks. Or the supposedly "interim" site(s) could become de-facto permanent dumps—with waste staying forever at sites never planned or intended for long-term waste isolation.

Transport casks are not required or designed to meet real road, rail and waterway conditions, and the current designs have never been physically tested.

There are a great many problems with nuclear waste that will last far longer than human civilization has existed, or is likely to exist.

Sources:

(1) Von Hippel and Shoeppner, November 2016. Dangers of Spent Nuclear Fuel in Science and Global Security. Posted: http://scienceandglobalsecurity.org/archive/sgs24vonhippel.pdf

(2) Testimony has been written by Dr. Marvin Resnikoff (Radioactive Waste Management Associated); Dr Edwin Lyman, Union of Concerned Scientists; Dr Gordon Thompson, Institute for Resource and Security Studies; among others.

(3) Principles for Safeguarding Nuclear Waste At Reactor Sites, posted: https://www.nirs.org/wp-content/uploads/radwaste/policy/hossprinciples3232010.pdf

(4) Melted fuel from the 1979 Three Mile Island meltdown was moved to a federal facility in Idaho (INL). Nuclear submarine fuel has been stored in Idaho. Irradiated fuel has rarely been moved to other nuclear reactors (transshipped).

See also NIRS FACT SHEETS on proposals for Consolidated Storage, Yucca Mountain and nuclear waste transport posted at www.nirs.org

Mary Olson (maryo@nirs.org); Winter, 2017

Principles for Safeguarding Nuclear Waste at Reactors

The following principles are based on the urgent need to protect the public from the threats posed by the current vulnerable storage of commercial irradiated fuel. The United States does not currently have a national policy for the permanent storage of high-level nuclear waste. The Obama administration has determined that the Yucca Mountain site, which has been mired in bad science and mismanagement, is not an option for geologic storage of nuclear waste. Unfortunately, reprocessing proponents have used this opportunity to promote reprocessing as the solution for managing our nuclear waste. Contrary to their claims, however, reprocessing is extremely expensive, highly polluting, and a proliferation threat, and will actually complicate the management of irradiated fuel. Nor will reprocessing obviate the need for, or "save space" in, a geologic repository.

The United States has a unique opportunity to re-evaluate our nuclear waste management plan. We can make wise decisions about safeguarding radioactive waste or go down the risky, costly, and proliferation prone path towards reprocessing.

The undersigned organizations' support for improving the protection of radioactive waste stored at reactor sites is a matter of security and is in no way an indication that we support nuclear power and the generation of more nuclear waste.

- **Require a low-density, open-frame layout for fuel pools:** Fuel pools were originally designed for temporary storage of a limited number of irradiated fuel assemblies in a low density, open frame configuration. As the amount of waste generated has increased beyond the designed capacity, the pools have been reorganized so that the concentration of fuel in the pools is nearly the same as that in operating reactor cores. If water is lost from a densely packed pool as the result of an attack or an accident, cooling by ambient air would likely be insufficient to prevent a fire, resulting in the release of large quantities of radioactivity to the environment. A low density, open-frame arrangement within fuel pools could allow enough air circulation to keep the fuel from catching fire. In order to achieve and maintain this arrangement within the pools, irradiated fuel must be transferred from the pools to dry storage within five years of being discharged from the reactor.

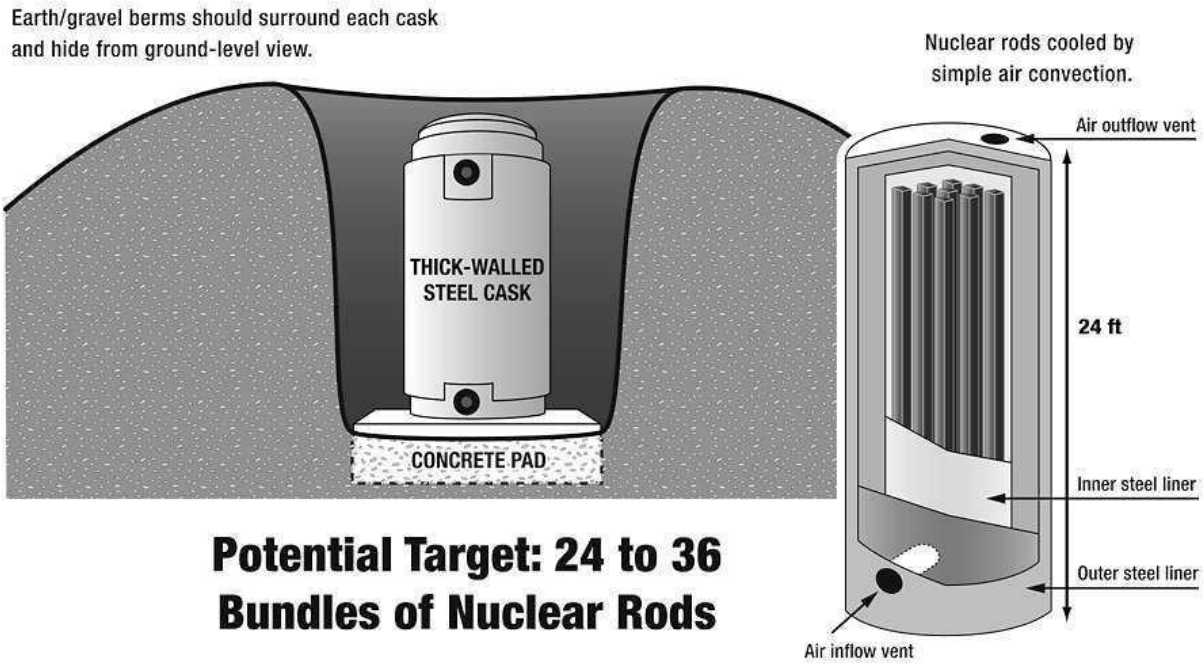
- **Establish hardened on-site storage (HOSS):** Irradiated fuel must be stored as safely as possible as close to the site of generation as possible. Waste moved from fuel pools must be safeguarded in hardened, on-site storage (HOSS) facilities. Transporting waste to interim away-from-reactor storage should not be done unless the reactor site is unsuitable for a HOSS facility and the move increases the safety and security of the waste. HOSS facilities must not be regarded as a permanent waste solution, and thus should not be constructed deep underground. The waste must be retrievable, and real-time radiation and heat monitoring at the HOSS facility must be implemented for early detection of radiation releases and overheating. The overall objective of HOSS should be that the amount of releases projected in even severe attacks should be low enough that the storage system would be unattractive as a terrorist target. Design criteria that would correspond to the overall objective must include:
  - Resistance to severe attacks, such as a direct hit by high-explosive or deeply penetrating weapons and munitions or a direct hit by a large aircraft loaded with fuel or a small aircraft loaded with fuel and/or explosives, without major releases.
  - Placement of individual canisters that makes detection difficult from outside the site boundary.

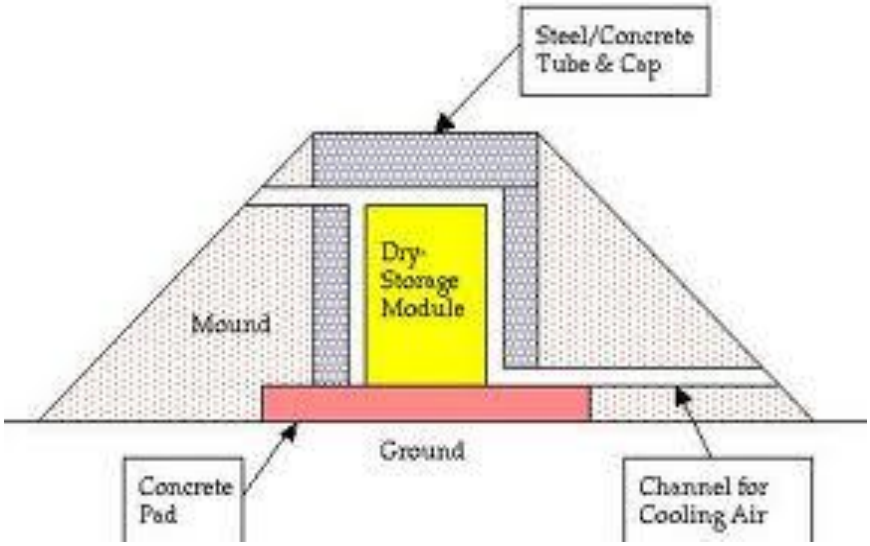
- **Protect fuel pools:** Irradiated fuel must be kept in pools for several years before it can be stored in a dry facility. The pools must be protected to withstand an attack by air, land, or water from a force at least equal in size and coordination to the 9/11 attacks. The security improvements must be approved by a panel of experts independent of the nuclear industry and the Nuclear Regulatory Commission.

- **Require periodic review of HOSS facilities and fuel pools:** An annual report consisting of the review of each HOSS facility and fuel pool should be prepared with meaningful participation from public stakeholders, regulators, and utility managers at each site. The report must be made publicly available and may include recommendations for actions to be taken.

- **Dedicate funding to local and state governments to independently monitor the sites:** Funding for monitoring the HOSS facilities at each site must be provided to affected local and state governments. The affected public must have the right to fully participate.
- **Prohibit reprocessing:** The reprocessing of irradiated fuel has not solved the nuclear waste problem in any country, and actually exacerbates it by creating numerous additional waste streams that must be managed. In addition to being expensive and polluting, reprocessing also increases nuclear weapons proliferation threats.

Schematic representation of HOSS





This diagram is from the Jan. 2003 report, "Robust Storage: A Neglected Issue of Homeland Security" by Dr. Gordon Thompson of the Institute for Resource and Security Studies (IRSS), which was commissioned by the Citizens Awareness Network of the Northeast (CAN).

National

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Lynn Thorp, Clean Water Action

Erich Pica, Friends of the Earth

Michele Boyd, Physicians for Social Responsibility

Jim Riccio, Greenpeace

Diane Kreiger, Nuclear Peace Age Foundation

Kevin Martin, Peace Action

Tyson Slocum, Public Citizen

Susan Gordon, Alliance for Nuclear Accountability

Arjun Makhijani, Institute for Energy and Environmental Research

Ken Bossong, SUN Day Campaign

Michael Mariotte, Nuclear Information and Resource Service

Anna Aurilio, Environment America

Winona La Duke, Honor the Earth

Dan Becker, Safe Climate Campaign

Dave Hamilton, Sierra Club

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Betty Winholz, SAVE THE PARK

Jacqueline Cabasso, Western States Legal Foundation

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Georgia Donovan, Izaak Walton League-Dwight Lydell Chapter

Terry Miller, Lone Tree Council

Patricia Gillis, Voices for Earth Justice

Alice Hirt, Don't Waste Michigan

Nancy Seubert, IHM Justice, Peace, and Sustainability Office

Lynn Howard Ehrle, International Science Oversight Board-Organic Consumers Association

Kay Cumbow, Citizens for Alternatives to Chemical Contamination

Ronald and Joyce Mason, Swords Into Plowshares Peace Center and Gallery

David Gard, Michigan Environmental Council
Steve Senesi, Kalamazoo Non-Violent Opponents of War

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Glady Schmitz, Mankato Area Environmentalists

George Crocker, North American Water Office

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Mark Haim, Missourians for Safe Energy

Kat Logan Smith, Missouri Coalition on the Environment

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Florence Chessin, Missoula Women for Peace, a branch of Women's International League for Peace and Freedom

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Jim Haber, Nevada Desert Experience

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Will Hopkins, New Hampshire Peace Action

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Scott Kovac, Nuclear Watch of New Mexico

Greg Mello, Los Alamos Study Group

Don Hancock, Southwest Research and Information Center

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Anne Rabe, Center for Health, Environment, and Justice

James Rauch, For a Clean Tonawanda Site (FACTS)

Barbara Warren, Citizen's Environmental Coalition

Phillip Musegaas, Riverkeeper NY

Tim Judson, Central New York Citizens Awareness Network

Manna Jo Greene, Hudson River Sloop Clearwater, Inc.

Marilyn Elie, IPSEC (Indian Point Safe Energy Coalition)

Susan Shapiro, Public Health and Sustainable Energy (PHASE)

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Nina Bell, Northwest Environmental Advocates

Kelly Campbell, Oregon Physicians for Social Responsibility

Gerry Pollet, Heart of America Northwest

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Katherine Dodge, Northwest Pennsylvania, Audobon Society

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Donald B. Clark, Network for Economic and Environmental Responsibility, United Church of Christ

Rev. Charles Lord, Caney Fork Headwaters Association

Rev. Douglas B. Hunt, Interfaith Power & Light

Ralph Hutchinson, Oak Ridge Environmental Peace Alliance

Rev. Walter Stark, Cumberland Countians for Peace and Justice

Ann Harris, We the People, Inc.

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Gary Stuard, Interfaith Environmental Alliance

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Judy Miner, Wisconsin Network for Peace and Justice

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Gary Zuckett, West Virginia Citizens Action Group

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Mary Woolen, Keep Yellowstone Nuclear Free

The original statement of ***Principles for Safeguarding Nuclear Waste at Reactors*** was published in Sept., 2006. It was then updated in March, 2010 and again in 2016. Diagrams were added for the **Congressional Briefing on Decommissioning Nuclear Power Plants: What Congress, Federal Agencies and Communities Need to Know,** held Monday, July 16 2018; Room HC-8, U.S. Capitol Building, Washington, DC .

The Accident Continues

Today, 40 years after the accident at TMI began, its impacts are still being felt.

A "TMI Survivors" Facebook page started in mid-November 2016 has attracted 3500 members. There are almost daily posts from people experiencing health problems that they believe may be related to the accident and on-going operation of TMI.

A study released by the Penn State College of medicine in 2017 shows that Pennsylvania has the highest incidence of thyroid cancer in the nation. The study showed a possible correlation between increased levels of thyroid cancer in the counties around the plant which may be attributable to radiation releases during the accident.

Three Mile Island Alert's telephone logs in the aftermath of the accident listed a full-range of radiation symptoms: the buring or irritation of eyes, nose and throat; reddening of skin; breathing difficulties; headaches and joint aches; mestrual irregularities; nausea; vomiting, diarrhea; and subsequent hair loss were precursors of the nightmare to come.

Former Harrisburg Mayor Stephen R. Reed, who was then a member of the state House of Representatives representing the city, wrote to the NRC asking why they refused to look into these health effects.

The late Harold Denton, the NRC's point man for TMI during the accident, issued the now classic response, still echoed today, that not enough radiation escaped to cause any of the effects reported.

Since so many of the journalists covering the 40th anniversary are unfamiliar with the history of TMI, here are some individual stories as they appeared in the press packet TMI Alert put together during the observance of the 25th anniversary:

•Living on the west bank of the Susquehanna River, Bill Whittock was startled by the roar of the steam blowing out of TMI around 4:00 a.m. Bill had the metallic taste, developed skin cancer, and now his wife has breast cancer. They were plaintiffs in the consolidated personal injury lawsuit until dropped by the attorneys. Bill died of cancer.

•While preparing to milk the cows, Marie Holowka of Zions View, was engulfed by strange blue air, choked, and could hardly breathe. She fell to the ground, was sick for days. Many of her cows died after the accident and the Guinea fowl eggs would not hatch. Marie developed a thyroid problem, breast cancer, and later cancer around her heart. Marie died of cancer.

•Louise Hardison had many problems after the accident. Goats, chickens, cats and rabbits died on her farm across the road from TMI. Stillborn lambs and some rabbits were deformed - they didn't have all their legs. Louise has also died. Her farm was sold and mutated dandelions still grow in the unfarmed pasture.

•On a hill eight miles northwest of TMI, dentists Klein and Malchodi found all the dental X-ray films taken of their patients' teeth those first two days were fogged or banded. They taped new film on the front door for the next week and found nothing wrong with those - so they concluded they got their highest doses on the first two days.

•Ruth and Clair Hoover both had the metallic taste in their mouths, they saw "white fallout" and had little red spots on their arms. After the accident they lost seven cows and 12 calves, their St. Bernard dog, and their pony. Ruth developed reproductive problems and Clair was diagnosed with an inoperable brain tumor. They had already received settlement in the first round of lawsuits in 1985, prior to Clair's diagnosis of the brain tumor. Ruth's problems appeared to be similar to those reproductive problems in their cattle.

•Fran Cain, who still lives across the river from the cooling towers at TMI, had the metallic taste and later that year a poodle puppy was born with no eyes. She received a settlement inthe first lawsuit.

•Darla & Bill Peters had that bitter metallic taste so strong they couldn't drink enough water to get rid of it. They had burnt skin and noses, and Bill got blisters on his nose and lips. Their dog and cats and kittens died. Later he found enough dead birds to fill a hydraulic bucket half full of dead birds. Bill died during his deposition for the lawsuit. One of the attorneys said, "It's OK, because we still have Darla."

•Charlie Conley's cows died, the hop toads disappeared, as did the bumble bees that pollinated his clover. The cooling tower drift from the plant would drift over his trees and at times the leaves would turn black - desiccated. Many trees just died about five years ago. So did Charlie.

•On Herb Myers' farm in New Cumberland, the sheep would not dilate during birthing to deliver their young. Some time later a stillborn double-headed calf was born and the vet told Herb to have it stuffed and mounted, which he did. Herb died of thyroid cancer shortly after the 10th anniversary of the accident. His family did not sue.

•"A wave of hot air" engulfed Jean Trimmer as she leaned over her porch railing calling for her cat. Shortly thereafter, her skin tingled and started to itch and later her skin appeared reddened "like a week at the beach." She got tiny white bumps on her skin and her beautiful black hair started falling out. When her hair grew back, it had white hairs growing in a salt and pepper effect. Jean developed a rare kidney illness.

•During the evacuation, Nurse Becky Mease's baby had projectile vomiting and severe diarrhea. The hospital in Ocean City said it could be radiation poisoning and suggested she have her car checked for contamination. She did. It was, and so was her purse. Later, her child developed cataracts and other health problems.

The late Dr. Steve Wing of the University of North Carolina said, "The cancer findings, along with studies of animals, plants and chromosomal damage in Three Mile Island area residents, all point to much higher radiation levels than were previously reported. If you say that there was no high radiation, then you are left with higher cancer rates downwind of the plume that are otherwise unexplainable. Our findings support the allegation that the people who reported rashes, hair loss, vomiting and pet deaths after the accident were exposed to a high level of radiation and not only suffering from emotional stress."

The accident at TMI was not a one day or one week disaster. The poisons vented upon the local population during the accident and through the years since have had genuine, documented consequences for accident survivors.

In that spirit, TMI Alert is undertaking a health study that will look at the impact of TMI on its survivors and victims. We admit, we are not professionals, but we sought the advice of professionals in putting the survey together. The results will only be shared with serious medical and academic researchers who promise to protect the privacy of responders and to freely share their findings with the public.

Penn State College of Medicine Research Correlates TMI Accident & Cancer

By Matt Solovey
May, 1917

Penn State College of Medicine researchers have shown, for the first time, a possible correlation between the partial meltdown of the Three Mile Island Nuclear Generating Station and thyroid cancers in the counties surrounding the plant.

Three Mile Island (TMI), located near Harrisburg, Pennsylvania, had a partial meltdown accident on March 28, 1979. During the accident, radiation was released into the environment, which the United States Nuclear Regulatory Commission said was in small amounts with no detectable health effects.

Looking at tumor samples from people verified to have lived in the areas around TMI at the time of the accident, remained in the area and subsequently developed thyroid cancer, researchers observed a shift in cases to cancer mutations consistent with radiation exposure, from those consistent with random causes.

In this retrospective cohort study — meaning the patients in the study already had thyroid cancer and were known to have been exposed to the TMI accident — lead researcher David Goldenberg, professor of surgery, and colleagues identified 44 patients who were treated at the Penn State Milton S. Hershey Medical Center for the most common type of thyroid cancer — papillary thyroid cancer — between 1974 and 2014. The patients were then divided into two groups: at-risk and control groups.

Patients in the at-risk group were those who developed cancer between 1984 and 1996, consistent with known latency periods of radiation-induced thyroid cancer, and who lived in at-risk geographical areas — based on reported weather patterns — at the time of the accident.

“This definition was designed to allow us to identify relatively acute effects of radiation exposure from the accident,” said Goldenberg.

Patients who developed cancer outside of the expected latency period were placed in the control group.

Researchers searched through all thyroid cancer tumor samples in the hospital’s possession from the study period for patients who lived in at-risk regions Dauphin, York, eastern Cumberland, Lancaster and western Lebanon counties. They used genealogical software to verify that the patient was in an at-risk area during the accident, remained until cancer developed and was treated at the Medical Center. The tumor samples of those patients who were positively linked to the TMI accident area were then processed through the Penn State Institute for Personalized Medicine to determine genetic makeup of the cancer.

While most thyroid cancers are sporadic, meaning they happen without clear reasons, exposure to radiation has been shown to change the molecular makeup of the cancer, according to the researchers.

The researchers observed an increase in the genetic mutation caused by exposure to low-dose radiation in the at-risk group and a decrease in the incidence of sporadic thyroid cancer, identified by a specific genetic mutation known as BRAF. The BRAF mutation is typically not present in the radiation-induced types of thyroid cancer.

The study, which appeared in the May 29 supplement to the journal Laryngoscope, indicates that these observations are consistent with other radiation-exposed populations.

In the control group, 83 percent of patients had the BRAF mutation. The BRAF mutation was found in only 53 percent of patients in the at-risk group. In the at-risk group, there was also a rise in other molecular markers seen in radiation-induced thyroid cancer, the researchers added.

“While no single marker can determine whether an individual tumor is radiation-induced, these data support the possibility that radiation released from TMI altered the molecular profile of thyroid cancers in the population surrounding the plant,” Goldenberg said.

A limitation of this study is the small sample size, limited to tumor samples from patients treated for thyroid cancer at Penn State Health Milton S. Hershey Medical Center. The next step in the research is a study with a larger number of patients from other regional hospitals to determine if the correlation continues in a larger sample.

“All patients were screened extensively to ensure that they lived in the vicinity of TMI from the date of the accident until they developed thyroid cancer,” Goldenberg said. “We used an extensive vetting process to ensure that patients included in the study were present in at-risk counties at the time of the accident and to confirm, to the greatest extent possible, that patients resided in affected areas for their entire lives. Our study represents a static population, which increased our ability to detect radiation-induced cancers.”

Past studies about thyroid cancer and TMI have showed variable results, mainly because they were demographic studies that looked at the entire population and not just those who met the criteria of the current study.

“Much of the variability associated with these studies is likely due to the relatively small size of the population surrounding the TMI plant relative to the large population required to detect statistically significant increases in cancer incidence following low-level radiation, combined with a high degree of mobility in the local population,” Goldenberg said.

The George Laverty Foundation funded this research.

Date: Fri, 21 Feb 1997 15:56:25 -0800 (PST)
X-Sender: pgunter@pop.igc.org (Unverified)
To: nirsnet@igc.apc.org, afscnatl@igc.apc.org,

Researchers find chromosomal damage and more cancer than previously reported near Three Mile Island. See attached press advisory and information sheet.

PRESS ADVISORY
New Study Shows Higher Cancer Rate near

Three Mile Island Nuclear Power Reactor Meltdown

Embargoed until Monday, February 24.

Researchers at University of North Carolina at Chapel Hill have published, in the journal Environmental Health Perspectives (February 24, 1997), a reevaluation of the health effects near Three Mile Island. They have found chromosomal damage and higher cancer rates than previously reported, suggesting radiation levels were higher than official estimates.

Copies of the study may be requested at 919-541-3345.

THE WING STUDY RE-EXAMINES TMI ACCIDENT CANCER

Steve Wing, associate professor of epidemiology at University of North Carolina at Chapel Hill, has conducted a reevaluation of the Columbia University Three Mile Island study. The Columbia study is often cited as evidence that the TMI accident has caused no ill effects in the exposed population. However, Wing discovered that people living closer to the path of the escaping radiation cloud developed all cancer types more frequently, especially lung cancer and leukemia. For example, among the 20,000 people who lived near the plant and close to the plume's path, lung cancer and leukemia rates were two or more times higher than what they were near the plant but upwind from the plume. Among those in the most direct path of the plumes, lung cancer incidence was elevated by 300 to 400 percent, and leukemia rates were up by 600 to 700 percent. "A Reevaluation

of Cancer Incidence Near the Three Mile Island Nuclear Power Plant: The Collision of Evidence and Assumptions" can be found in the January 1997 issue of Environmental Health Perspectives. Since the piece below summarizes his findings the reader is encouraged to obtain a copy of the actual study for more detail and further research.

Three Mile Island nuclear power station, near Harrisburg PA, was originally comprised of two Babcock & Wilcox pressurized water reactors (PWR) operated by Metropolitan Edison, now General Public Utility Nuclear. The PWR produces electricity by superheating highly pressurized water in a "primary loop" that circulates around the highly radioactive fuel core. This heat is exchanged in a series of steam generators which boils water into steam that is transferred into a "secondary loop" to propel the blades in a turbogenerator for the production of electricity.

At 4:00 a.m. on March 28, 1979, the newly operational Three Mile Island Unit 2 was at 97% full power. Two pumps that feed water through the secondary loop suddenly shutdown for undetermined reasons and initiated a cascade of equipment failures and operator errors resulting in severe damage to the reactor's radioactive core. A partial meltdown of the TMI reactor core released significant yet unknown quantities of radioactive gas and particulate as the result of the failure of the reactor's multiple barrier system designed to protect the public health and safety. A breach of the fuel rod cladding, the first barrier, occurred as the result of the high temperature melting of the radioactive fuel. This was followed by the failure of the second barrier system, the reactor coolant boundary system and ultimately the failure of the third and final barrier, the containment building itself. A number of escape routes for radiation from the reactor and auxiliary buildings then existed into the atmosphere. While the exact quantity of noble gases of krypton and xenon released from the reactor core cannot be determined due to the absence of adequate radiation monitoring equipment, it can be concluded that significantly more noble gases than currently accounted for were released to affect downwind populations with exposures by the inhalation and ingestion of harmful radiation.

Subsequent to the partial meltdown of the reactor, the TMI Public Health Fund was established to fund research into radiation heath effects and radiation protection. The Fund,

under supervision of Federal Court Judge Sylvia Rambo, hired investigators from Columbia University to see if "risks from specified cancers may have been raised by exposure to radiation emanating from the Three Mile Island Nuclear power plant". Data on cancer cases were gathered for the years 1975-1985 and evaluated. Even though the data showed all cancers and lung cancer were significantly associated with accident doses, there was a lack of strong association for childhood and highly radiosensitive cancers. This, in addition to confounding factors, led the Columbia team to conclude that the documented cancer increases did not result from the radioactivity released by the partial core melt.

However, Wing concludes that there are several shortcomings in this original study. First, the outcomes of primary interest for the Columbia researchers were selected leukemias, childhood cancers, non-Hodgkin's lymphoma and Hodgkin's disease. However, analyses of childhood cancers failed to consider birth cohorts. Therefore the Columbia analyses counted among the exposed, many children who were not conceived at the time of the accident, diluting the exposed group.

Second, Hatch and colleagues began with the assumption that the maximum dose level was 1 mGy, which is less than average annual background. However, the TMI Public Health Fund was governed by a court order which limited the scope of the health study by 1) prohibiting upper limit or worst case estimates of radioactive releases to the population, and 2) requiring that nuclear industry insurers concur on the nature and scope of the dosimetry projects.1

Further, radiation readings used to estimate doses were incomplete because of inoperable, missing or poorly placed radiation measuring instruments. Little information was available about releases occurring early in the accident. Plume dispersion paths did not account for low dispersion pathways. Therefore the study failed to address the potential for greater human doses resulting from more concentrated packets of radioisotopes traveling with the weather patterns. To quote Wing, "If the premise that maximum doses were no higher than average annual background levels is not open to question, then no positive association could be interpreted as evidence in support of the hypothesis that radiation from the accident led to increased cancer rates." However, in 1994-95, cytogenetic

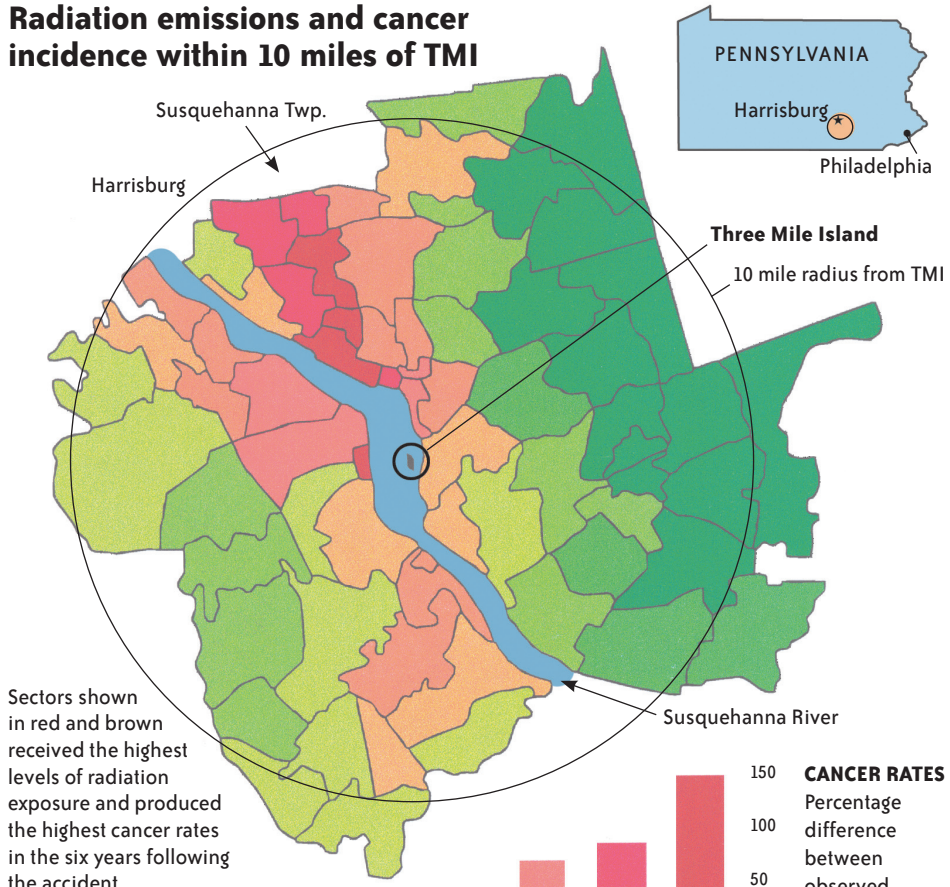
analyses of individuals near TMI who experienced vomiting, erythema, diarrhea and other symptoms of radiation poisoning at the time of the accident showed genetic damage equivalent with 600-900 mGy of exposure, substantially more than 1 mGy used as maximum dose in the Columbia study.

Documenting the inadequacies of the Columbia study, Steve Wing reevaluated and reinterpreted the data collected by Columbia researchers, addressing problems of incorrectly reported cancer count data for 1975, and incorrectly handled data for the period 1981-85. Wing, et al. recognize that dose accuracy was compromised by inadequate monitoring and the eradication of high dose levels by the court order. Still, they found dose-response relationships between radiation exposure and cancer incidence: the data show that the higher the radiation exposure, the higher the incidence of cancer.

A 10-mile study area was divided into 69 tracts, each assigned radiation dose estimates based on monitor readings and atmospheric dispersion models. Using various models, Wing et al. adjusted for age, sex, socioeconomic characteristics, preaccident variation in cancer incidence and the medical detection bias so that these factors would not interfere with a true result. The routine releases from TMI unit one and their effects on the population were also accounted for by adjustment for baseline cancer rates before the accident.

1 Judge Sylvia Rambo, responsible for this court order (Civil Action # 79-0432), later dismissed the suit brought by more 2000 litigants against the utility that operated the reactor citing a "paucity of proof" to substantiate their claims. This action was subsequent to Rambo's disallowal of much of the scientific evidence presented by the plaintiffs, including some, but not all, of the analyses in the study summarized here.

Radiation emissions and cancer incidence within 10 miles of TMI



Radiation doses resulting from the 1979 nuclear accident

SOURCE: *ENVIRONMENTAL HEALTH PERSPECTIVES*, VOL. 5, NO. 1, JAN. 1997. GRAPHIC BY JULIA R. BRYAN, *ENDEAVORS*, FALL 1997, AND JP TROSTLE

Physical & Cyber Security 2019

40th Anniversary of the Three Mile Island Meltdown

Three Mile Island's (TMI) astounding security track record is one that should not be forgotten. Incidents such as Al Qaeda threatening to crash a cargo jet into the TMI reactor on October 17, 2001,[1] or when an intruder was heard singing from atop the reactor building in 1976 highlight a colorful history. Then there's the security breach where a mentally ill man crashed a station wagon through TMI's security fencing and into the Turbine Building where he disappeared and hid inside the plant for four hours on February 7, 1993.[2]

In the summer following the meltdown (1979), The Los Alamos National Laboratory reported disturbing findings of unlocked doors and unguarded areas. The report stated "there was very little or no control of the whereabouts of people inside the vital area" and "there was very poor protection against the sabotage actions of the insider." In fact, there were concerns from official investigators that sabotage had triggered the 1979 TMI nuclear emergency. The Los Alamos Laboratory proclaimed that "it cannot be said sabotage to the auxiliary feedwater system was impossible." Surprisingly, the NRC reported that it never did find the exact cause of the triggering event.

The President's Commission Investigation of the TMI meltdown sent a letter to the FBI requesting a sabotage investigation because of suspicious circumstances surrounding the meltdown. The Government Accounting Office (GAO) reported "a bizarre sequence of events" followed the initial problem. Additionally, U.S. Senate investigators suspected sabotage had occurred at the reactor. Eleven months after the meltdown a local newspaper reporter who used bogus identification to get a job as a security guard reported: "Three Mile Island - It's a Paradise Island for the Saboteur." He described entering the control room by pulling on a knotted clothesline where the doorknob should have been. [3]

Security concerns at our nation's nuclear plants actually began at TMI in 1975 when two of the guards along with Ralph Nader (known for his consumer protection actions as an attorney) called for an investigation of what he called "porous security." The federal government proceeded to confirm their allegations and responded with a scathing GAO report in 1977 titled "Nuclear Powerplant Security, Inadequate at Best." [4]

Following the vehicle intrusion event of February 7, 1993, the chairman of a federal hearing labeled nuclear plants as "soft targets." Three Mile Island Alert testified to that hearing and later presented testimony to the Nuclear Regulatory Commission describing how easy it would be for an average person to use publicly available documents to formulate a nearly foolproof plan to sabotage a nuclear plant. That story appeared in the NY Times (April 23, 1993).[5] We

made many suggestions for new defenses and regulations in our testimony. These were ignored until after the 9/11 attacks.

Later that year we learned that year that Al Qaeda had a training camp located in Perry County just 30 miles from TMI. Men associated with terrorist Ramzi Yousef practiced a night-time mock assault on an electrical power substation as if planning to attack a nuclear plant.[6]

The performance of the Nuclear Regulatory Commission (NRC) has been quite disappointing over the years. The biggest fiasco was when the NRC decided not to require security guards at the outer entrance of TMI and all nuclear plants. Three Mile Island Alert filed legal documents on September 12th, 2001 requesting that the NRC create a new regulation to make that happen. We had been planning to file the proceedings for six weeks prior to the 9/11 attacks because TMI had removed the guards posted at the north entrance earlier that year. However after docketing our filing, the NRC broke its own rules and guidelines on the handling of our "petition for rulemaking" on more than 40 occasions and ultimately made it simply vanish. The promised formal decision never came despite regulations that mandate one must be made.[7]

Another vanishing act took place in 2011 when the NRC was defining its new regulations for Emergency Preparedness. Three Mile Island Alert once again participated in the rulemaking and informed the NRC that in order for TMI to comply with a proposed regulation for maintaining control of the "main and alternative entry routes for law enforcement or other offsite support agencies," the two bridges at TMI would have to be guarded. Rather than address this issue, the NRC dropped that portion of their proposed Emergency Preparedness Rule. This retraction means that the objectives of the new regulations cannot be ensured at TMI.

Decreasing Security

In October 2018 the Sandia National Laboratories released a report[8] looking for ways for utilities to save money by reducing security at our nation's nuclear plants. The report states the following:

What NRC regulations could be changed for economic relief such as;

- Reconsidering the concept of 'vital areas'
- Reconsidering the concept of 'perimeter intrusion detection system
- Reconsidering DBTs for 'defend' vs. 'defeat'

New Security Threats

Now the nation is facing new security threats which require constant defensive updating. Despite assurances from the NRC and the nuclear plant owners, a cyber defense test made popular by Forbes Magazine in August 2007 showed just how easily cyber defenses could be defeated.[9] The tester said, "It turned out to be one of the easiest penetration test I'd ever done." He said that he got in on the first day and had control of the plant within a week.

Cyber security is an enormous and expensive challenge because hackers are becoming more sophisticated with each passing month. The Department of Homeland Security and the FBI have reported that hackers have already penetrated nuclear power networks and may be laying ground for damaging attacks.

Three Mile Island Alert's suggestions for specific cyber security regulations have been ignored. Below are the four important regulations we have submitted for consideration by the NRC:

- Situational Awareness: Order each nuclear reactor licensee to report any cyber trouble(s) within 15 minutes of its discovery. The NRC needs a clearinghouse to ascertain if a concerted attack on multiple reactors is occurring. Cyber problems take time to evaluate as to their cause, however multiple reactors experiencing cyber problems concurrently raise suspicions of a terror attack.

- Passwords: Order all nuclear reactor licensees to change all original default access passwords tied any component.

- Passwords: Order all nuclear reactor licensees to take specific preventive password control actions as soon as an employee learns of his or her pending dismissal, and immediately upon the dismissal of that employee.

- Require yearly outside and independent probing and testing of cyber security at each reactor. The testers should not be the same people or organization who created the defenses.

It is a common practice that a licensee's team which creates the cyber defenses for the reactor, are the same personnel who test it. This is a fundamental problem whereby a "blind-spot" for any design weakness in the cyber defense also means that the team won't know to look for the "hole" which it has no clue exists.

Cyber Attack at a Pennsylvania Corporate Nuclear Headquarters

In June 2017, Homeland Security revealed that hackers have been penetrating nuclear plants and nuclear manufacturing companies in the U.S. The N.Y. Times stated the report did not indicate whether the cyber attacks were an attempt at espionage — such as stealing industrial secrets — or part of a plan to cause destruction.[10]

Now, the indictment of seven Russians military officers on October 4, 2018 revealed a new level of nuclear power threats when we learned that Westinghouse Nuclear near Pittsburgh PA was hacked once again.[11] (In 2010, Chinese hackers stole confidential and proprietary technical design specifications from the company.) Until informed by the federal government, Westinghouse Nuclear was unaware of the most recent hacking at their headquarters.

They will painstakingly have to forensically examine all of their software tools, coding and actual design blueprints and drawings. Hackers could have altered important designs and even the very software tools used to create and simulate the design functions without the company's knowledge. Approximately half of the world's nuclear plants utilize designs from the now bankrupt Westinghouse Nuclear.

The hazard is one where a reactor component could be dangerously faulty if hackers have made one small change in a line of computer coding in designing software or in a computer simulation tool. An example of this danger is the 2012 steam generator failures at the San Onofre nuclear plant in California. Mitsubishi, the manufacturer of the steam generators unknowingly used the wrong computer simulation coding that ended up causing the failure of the steam generators resulting in releases of radiation. Ultimately, the reactor was permanently shutdown costing the utility $4 billion in premature shutdown costs.

The Russian military hackers combined "on the ground technical reconnaissance " via Wi-Fi intercepts with "spearphishing" techniques. Wi-Fi equipment was set up in the trunks of rented vehicles near company property. This enabled the hackers to intercept data and hack into the network. The hackers also sent e-mails to Westinghouse Nuclear employees with a clickable link. The link appeared very similar to the one employees had previously been utilizing. By changing the letter "g" in Westinghouse to a "q" (westin**q**housenuclear.com) the hackers were able to lure employees to log onto the hacker's spoofed website and capture their login credentials and passwords. Then the employees were re-routed back to the company's real website.

Meanwhile Westinghouse Nuclear claimed “We have found no evidence that the phishing campaigns against employees to breach Westinghouse’s systems were successful.” The U.S. Attorney backed that claim. However it is common practice to deny the success or extent of

cyber penetrations due to financial and national security reasons. Reuters reported that two employees had clicked on the malicious link.

Transporting Nuclear Waste

There is one other security concern that TMI Alert is reluctant to discuss - the transporting of spent nuclear fuel rods. The security vulnerabilities of high level reactor waste is worrisome. These spent fuel rods will be put into casks and then loaded onto trucks and trains. The shipments are so radioactive that some gamma rays and X-rays will penetrate the protective shielding. Hundreds of shipments will pass through Pennsylvania. In fact, there are two routes which pass right through Harrisburg PA. We have made two suggestions for improved security of the shipments, but frankly, these transports remain vulnerable to terrorist attacks and represent a very dangerous dirty bomb. TMI-Alert is circumspect about discussing or sharing detailed information on this issue and limits such discussions to secure venues with authorized personnel.

Radioactive Waste Transport Risks in PA http://www.tmia.com/node/2204

Eye-Witness to Rule-Breaking http://www.tmia.com/node/2203

Nuclear Waste Transports http://www.tmia.com/node/2202

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[1] see https://www.cfr.org/backgrounder/targets-terrorism-nuclear-facilities
[2] see https://www.nytimes.com/1993/02/11/us/gate-crasher-shakes-up-nuclear-debate.html
[3] "Security and Loss Prevention" textbook 1984
[4] see https://www.gao.gov/assets/120/118251.pdf
[5] see https://www.nytimes.com/1993/04/23/us/us-examining-ways-to-protect-nuclear-plants-against-terrorists.html
[6] see http://www.tmia.com/old-website/threat.html
[7] see http://www.tmia.com/sites/tmia.com/files/Bungled%20Entrance%20Guard%20PRM%202008%20TMIA.pdf
[8] see https://www.osti.gov/servlets/purl/1481516 to download the pdf file
[9] see https://www.forbes.com/2007/08/22/scada-hackers-infrastructure-tech-security-cx_ag_0822hack.html#3220cc606819
[10] see https://www.nytimes.com/2017/07/06/technology/nuclear-plant-hack-report.html
[11] see http://www.post-gazette.com/news/crime-courts/2018/10/04/Westinghouse-russian-hacking-doping-gru-pennsylvania-indictment-justice-department-scott-brady/stories/201810040109

The Similarities and Differences of the Fukushima and Three Mile Island Emergencies

The crippled Fukushima reactor is a grim reminder of the March 28, 1979 Three Mile Island (TMI) crisis. It has some common technical and safety aspects, and brings to mind broken promises by the industry to resolve open safety issues. The Japanese crisis also demonstrated the propensity for obfuscation by the industry while the public is left sifting through hundreds of media reports.

The first indication that the Fukushima reactor was in serious trouble came from reports that the Japanese military was flying batteries to the plant. This clue made it clear that the operators were having more problems than just trouble with circulating reactor coolant. It revealed that the operators were losing or had lost electrical control of the reactor systems and that the emergency diesel generators were not working. But the Japanese government and the industry continued to downplay the dire conditions facing them.

This same pattern of denial happened here at Three Mile Island leaving the citizens and their governor bewildered and confused. In fact, radioactive releases at TMI were being reported as a miniscule amount of radiation. At least 13 million curies of radiation were released. So it is easy to see how the Japanese crisis repeated various occurrences and mistakes of the TMI meltdown including public relations and access to accurate information.

Safety Issue	Fukushima	Three Mile Island	comments
Threat of a loss of coolant accident.	Inadequate cooling allows the water level to drop as water boils away.	A small break in the coolant loop combined with operators shutting off the high pressure injection pumps.	While this is happening, the companies are claiming that all is well.
Pressure in the reactor building reaches dangerous levels.	Reports state the pressure is 210% times higher than normal and venting is necessary.	Pressure levels increase and then a hydrogen explosion takes place. Radioactivity is being released.	The pressure is a result of climbing temperatures combined with loss of coolant.
Radioactive release to vent the high pressure.	A radioactive release is planned but cannot be performed due to lack of electrical control of the vents. The reactors are in a fearful condition known as a "station blackout."	A lone rogue operator is blamed for taking it upon himself to vent radiation.	Many other releases occurred at TMI including both “planned” and “unplanned.” One that is never reported is the one that occurred as a result of the hydrogen explosion.

Safety Issue	Fukushima	Three Mile Island	comments
Failed coolant pumps.	Failed due to loss of electrical power.	Turned off when cavitation (destructive vibrations) threatens to destroy the pumps.	Without the main source of coolant circulation, controlling the reactor gets even more difficult.
Deadline.	Projections are made about a meltdown in 2 days.	Projections are made about another hydrogen explosion in 2 days.	The original hydrogen explosion at TMI was not revealed publicly by TMI until months later.
Poor instrumentation.	With electrical problems, the operators might be in the dark to varying degrees.	Poor control panel layouts, poorly designed controls, misleading gauges and a faulty alarm printer.	Even the best planning is foiled when electrical circuits short from sea water or from melted wires.
Communications.	Everything is under control.	Everything is under control.	Code for were having trouble shutting down.
Evacuation order.	When the reactor reaches the set conditional threshold, a precautionary evacuation is ordered. As the conditions worsen, the evacuation zone increases in size.	When the reactor reaches the set conditional threshold, Nuclear Regulatory Commissioners (NRC) commissioners ignore the protocol to evacuate the population.	When the evacuation is suggested by the Governor of PA, it is only a precautionary evacuation for pregnant women or young children. In both incidents, evacuations are only "cautionary."
Obfuscation.	Radiation might have "seeped out" or "leaked out."	NRC Commissioners argue for two hours how to write a press release without using the word "release."	Both nuclear accidents avoid the word "release."
Assurances before the crisis.	Following previous earthquakes, the industry repeated the lie that these robust plants were designed to handle an earthquake and tsunami.	The industry told us that a meteor would hit your house before a nuclear accident would ever occur. They claimed to have backup after backup.	Without properly functioning emergency diesel generators, an accident is only a step or two away.

Safety Issue	Fukushima	Three Mile Island	comments
Military Assistance.	Electrical equipment and radiation shielding is being transported to the scene.	A secret plan called “Operation Ivory Purpose” is prepared by the PA National Guard to evacuate the area.	Ironically, the U.S. claimed to be providing military assistance to the Japanese accident, while at TMI, the U.S. hid the shipments of Potassium Iodide and lead block radiation shielding to the area.
Governmental Assistance.	The U.S. NRC sends a team to offer advice including how to handle public relations.	The NRC ran the other way at first stating that they don’t tell licensees how to operate their plants.	Only one NRC official had a reactor operator's license at the time of the TMI meltdown.
Potassium Iodide.	No orders are given to take the thyroid protection pill before the planned releases.	No thyroid protection pills are available.	The NRC promised to provide these pills following the accident. It took more than 20 years to activate that plan.
Radioactive Contaminated Water Storage.	More than 900 huge tanks hold water with radioactive contaminates. Plans are to dump this water into the Pacific Ocean after some filtering.	2.23 million gallons of radioactive contaminated water were stored in two huge tanks. The water was evaporated into the air after some filtering.	Fukushima groundwater becomes contaminated as it comes into contact with the melted cores and then leaks into the ocean at the rate of 300 tons per day.
Robotic Filming of Melted Core.	It took 6 years to spot the melted fuel which escaped the reactor unit #3 - the first reactor where a sighting occurred.	It took 5 years to spot the melted fuel.	At TMI, the industry was still in denial that a meltdown had occurred until images proved that fuel had in fact melted twice.

Safety Issue	Fukushima	Three Mile Island	comments
Cheating During Cleanup.	Allegations are made of workers using fake names to secure more man-hours in radioactive areas and many are not wearing dosimeters.	Allegation of cheating on quality assurance procedures and intimidation of workers trying to follow regulations.	Cheating is common throughout the history of both nation's nuclear power programs.
Reactor Restart.	Japan shut down all reactors and then restarted its first 15 months later. In 2013 all reactors were shutdown again until one reactor restarted in August 2015. Currently nine reactors are operating.	Unit #1 was allowed to restart in 1985 despite objections from many quarters including one NRC Commissioner and the people and Governor Thornburgh of PA.	At TMI and Fukushima the people objected to a restart but only by a small margin.
Admission of Meltdowns Delay.	5 years - Tokyo Electric admits that it knew of evidence of a meltdown three days into the event.	5 years - Despite evidence including extremely high temperatures, the industry did not want to believe a meltdown had occurred	Tokyo Electric confesses to a cover up and apologizes.
Post Traumatic Stress Disorder.	Some displaced Japanese citizens have committed suicide. Fukushima refugee children are bullied.	There are U.S. citizens still suffering the effects of PTSD from TMI.	The U.S. nuclear industry tried to blame early health effects from TMI on PTSD instead of radiation.
Industry Attitudes.	A Japanese panel concluded that a "culture of complacency" for nuclear safety and poor crisis management led to the nuclear disaster.	The President's Commission stated that fundamental changes would have to be made "and above all - in the attitude of the NRC."	Both countries' nuclear programs believed that nuclear meltdowns just would not occur.

Knowing that station blackout is the leading cause of accident conditions in hypothetical analyses, the Japanese nuclear industry failed miserably by allowing the placement of emergency diesel generators at an elevation which allowed flooding or washout by a tsunami. The same was true for the Fukushima seawater pumps providing coolant as a heat sink. They were not flood-proof and were destroyed.

In 1999 Scott Portzline of TMI Alert performed a study on emergency diesel generator at U.S. nuclear reactors. He found that more than half of U.S. reactors had problems with their generators.

Portzline has urged the Nuclear Regulatory Commission (NRC) to require U.S. nuclear plants to have an extra set of diesel generator which can be driven to the reactor and connected to the electrical bus if the primary set is lost. The NRC responded with their FLEX program, but the regulations governing those emergency electrical generators are very weak and therefore the effectiveness of the extra diesel generators are in doubt.

NRC Ignoring "Lessons Learned"

The NRC has not learned an important lesson from Fukushima that U.S. emergency evacuation planning zones (currently 10 miles) need to be expanded around U.S plants. Instead U.S. emergency response plans rely upon hypothetical data and not the real world data. This is a fact which Three Mile Island Alert emphasized during a 2012 public meeting with the NRC on the "State-of-the-Art Reactor Consequence Analyses" (SOARCA) report. (See https://www.slideshare.net/scottportzline/soarca-2-2212-post)

The NRC has rejected the need for nuclear plants to add filters to containment vents or implement alternate release reduction strategies.

The NRC has rejected the need for hydrogen control and mitigation equipment inside containment and other buildings.

The NRC has rejected the need to assess the risk of seismically induced fires and floods following the Fukushima tsunami and disaster.

The NRC has also rejected the need distribute potassium iodide to residents beyond 10 miles.

The NRC has rejected the need for reliable hardened vents for containment buildings like those used by other nations. Instead, as a Union of Concerned Scientists report states, "in the event of a severe accident, the NRC is leaving plant operators with a horrible dilemma, either open the vents and deliberately release radioactivity into the environment, or allow the reactor containment to over-pressurize and potentially rupture resulting with an even greater release of radiation."

(This paper was updated in 2019 for the 40th anniversary of the TMI Meltdown.)

1977 - 2019

THREE MILE ISLAND

ALERT

There is

No Solution to Nuclear Pollution