NRC Chairman Allison M. Macfarlane
U.S. Nuclear Regulatory Commission
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March 31, 2014

Dear NRC Chairman Macfarlane,

LIMERICK NUCLEAR PLANT needs your immediate attention. There is no way to reduce the extraordinary risks for multiple meltdowns that could be triggered by an earthquake at Limerick Nuclear Plant. We are submitting evidence that shows that Limerick's earthquake risks are so high that it must be closed immediately to avoid unnecessary health and financial devastation to millions of people in the Greater Philadelphia Region.

We contact you because NRC officials for Limerick have long been either incompetent or dishonest by not acknowledging Limerick's extraordinary earthquake risks. NRC is jeopardizing the health, safety, and financial interests of over 8 million people living within 50 miles of Limerick Nuclear Plant.

Fukushima was enough justification for preventive measures to be taken immediately, given Limerick's "HIGH RISK" status, yet after three years NOTHING has been done to reduce risks. Attached correspondence shows how one NRC official after the other down-played and/or covered up absolutely unacceptable risks at Limerick.

Now we learned earthquake risks at Limerick are far worse than we thought. We just discovered evidence on 2-18-14 which proves that:

- **Limerick Nuclear Plant's Reactors and Spent Fuel Pools Were Built Directly On Top of Earthquake Fault Fractures.**

A September 3, 1974 report reveals that Limerick Nuclear Plant's (1) Reactors, (2) Control Room, (3) Turbine Building, and (4) Rad-Waste Storage Building were all built directly on top of earthquake fault fractures. (Limerick's fuel pools were not listed in the report, presumably because Limerick's fuel pools are above its GE Mark II reactors, similar to those at Fukushima.) **The 1974 report titled: "Report on Treatment of Fracture Zones for PECO by Bechtel Power Company", shows how fault fractures under Limerick were prepared prior to construction**.

This shocking report includes photographs and a diagram to scale showing:

1. A fault zone fracture after it was filled in with cement (called dental concrete) in 1973, BEFORE Limerick's Geological Survey was completed in 1974
2. A fault zone fracture directly under Limerick Unit 1 reactor
3. A fault zone fracture filled with cement that supports a column for Limerick Unit 2 reactor
4. A fault zone fracture being filled with cement directly under the support wall between the control room and turbine building
5. The location of Limerick Nuclear Plant buildings and how they are positioned over the fault zone fractures
6. Spent fuel pools are not shown in the diagram, since Limerick is a Mark II GE design, with its fuel pools on top of its reactors.

Graphics referenced above are attached (See Attachments)

Risks were clear before Limerick was constructed, yet hidden from the public until now. Limerick's vital structures were built directly over fault fractures to save PECO costs. In the 1972 Environmental Impact Statement for Limerick, the Atomic Energy Commission (AEC now NRC) considered alternative sites, which were then eliminated due to industry costs. (See Attachment)

Nothing can fix this. Limerick Nuclear Plant can't suddenly be declared safe as the result of any NRC study or regulation. NRC must own up to the real dangers and close Limerick immediately, BEFORE there are meltdowns. In addition, Limerick's deadly radioactive wastes must be removed from the fuel pools as soon as possible and placed into hardened on-site casks.

We compiled a body of evidence showing that the earthquake risks at Limerick Nuclear Plant are both extraordinary and unacceptable. As stated before, this evidence clearly supports the need to close Limerick now and remove high-level radioactive wastes from Limerick's fuel pools as soon as possible and placed into safer hardened cask storage.

Serious Problems and Concerns That Should Not Be Ignored: Major Threats That Dramatically Compound and Intensify Possible Damage To Limerick's Vital Structures Built Directly Over Earthquake Faults:

- Four earthquake faults (one considered active) are within 17 miles of Limerick, in addition to the earthquake fault directly under Limerick's vital infrastructure.

- Limerick's decades old reactor containment and fuel pools were built with substandard cement, increasing earthquake risks for Limerick Nuclear Plant.

- Limerick's fuel pools, located above Limerick's reactors (similar to Fukushima's), are packed far beyond design capacity with some of the most deadly materials on earth.
  - Limerick's fuel pools were constructed with substandard cement, a fact confirmed by 9-22-11 Limerick EIS testimony.
  - Limerick's fuel pools are corroding and thinning at rates up to 10 times faster than anticipated, a fact confirmed by NRC staff in letters to Exelon.

- Miles of aging and deteriorating pipes and cables buried under Limerick, vital to supplying energy and water to prevent a meltdown can be disrupted and damaged from an earthquake, yet they cannot be inspected. Limerick relies on monitors and gauges that are often inoperable.

- An earthquake at Limerick could trigger multiple meltdowns in fuel pools, unleashing far more radioactivity than Hiroshima, Nagasaki, or even Chernobyl, because of Limerick's enormous on-site accumulation of spent fuel.

- The 8-23-11 earthquake in Virginia jolted Limerick Nuclear Plant, showing that Limerick can be impacted by an unpredicted earthquake.

- Earthquakes are becoming stronger and more frequent.

- Earthquake risks have increased dramatically due to massive fracking in PA and nearby states. USGS states that fracking can trigger earthquakes. Since 2007, well over 4,200 natural gas wells were approved in PA.

- In 2012, the local newspaper reported that:
  - Some Limerick systems, structures, and components could be unreliable in an earthquake
  - Limerick's fire prevention seals may not tolerate a "seismic event".

- Given recent earthquake events and discoveries it is clear that, in reality, Limerick's earthquake risks go far beyond Limerick's "so-called" earthquake design basis.

- Limerick is considered a "High Risk" nuclear plant for earthquakes, and reported to be 3rd on the nation's earthquake risk list.

- The 8-23-11 earthquake in Virginia jolted Limerick Nuclear Plant, including the control room. Limerick's infrastructure was uninspected after the Virginia earthquake, despite the risk.

- Limerick's earthquake monitors were inoperable 8-23-11. Limerick had to contact USGS for verification of the Virginia earthquake.

- Limerick's seismic monitors had remained inoperable for over a year (documented in NRC records).

- If the Virginia earthquake jolted Limerick Nuclear Plant, it can be assumed that a similar earthquake could originate in one of the many nearby faults and could be devastating.

- Recently, two small earthquakes originated in Philadelphia, only 21 miles away.

ERRORS WERE MADE DURING LIMERICK NUCLEAR PLANT'S CONSTRUCTION, WHICH CANNOT BE CORRECTED NOW

Dan Ely, A Bechtel Quality Assurance Inspector During Limerick Construction, Testified On 9-22-11 That Failures, Deviations, and Non-Conformances, Including Materials Monitoring, Plagued Limerick Construction From the Beginning.

Mr. Ely said that a number of errors were made and in light of what we know about earthquakes now, the deviations made during the construction of Limerick should be revaluated.

- **"We need to go back and take a look at all of those mistakes and make sure that they're not written off because a layer in a structure under load caused by an earthquake, that's an issue."**

Mr. Ely witnessed a very low-strength sand mix that was erroneously pumped into the fuel pool girders in a layer. There was only supposed to be the very highest quality of cement used in that 36-hour pour, but an engineer (not him) said, "Well, boy, that was a terrible mistake, but it'll be okay".

Ely said he now sees a big problem created by that deviation: A layer like that, he said, in a structure under load in an earthquake, is an issue... In regards to catching fire because it's going to catch fire if the fuel pool girders fail. It's a very hot situation and the consequences of the released material could be life-threatening.

This was only one of a number of errors on that pour, Ely said. He was concerned because he saw no review of those early deviations in Exelon's relicensing application. He testified that:

- Errors were made during the pour of the cement for Limerick's fuel pools, resulting in substandard cement.
- He said non-conformances such as this need to reviewed in light of what we understand and know today about earthquakes or other anomalies.
- The rebar concrete-reinforced supports were supposed to be filled with the very highest grade of concrete.
- The engineer didn't pay attention and said a terrible mistake had been made, but it would be ok.

Dan Ely stated that when Limerick was being constructed, things were passed over back then that would not be allowed now that earthquake risks at Limerick are better understood, because at that time Limerick's earthquake risk was considered low. He expressed concern, because he felt that they need re-evaluation in light of limerick's increased earthquake risk.

Mr. Ely's testimony shows why NRC's generic review for earthquake risk and Exelon's self-serving analyses are not enough to keep us safe. They are absolutely meaningless in relation to Limerick's safety.

Limerick's construction flaws clearly present unacceptable risks, especially in combination with Limerick's extraordinary risk for damage from an earthquake. Yet, NRC has ignored Dan Ely's 9-22-11 testimony, inexplicably refusing to require an independent updated site-specific earthquake risk analysis at Limerick Nuclear Plant.

Ironically, Diane Screnci, NRC senior public affairs officer for the Region 1, stated in a 5-20-12 Mercury news article that, *"in many ways, the key to nuclear safety when earthquakes are involved is less about predicting earthquakes than designing plants that can withstand them".*

- That statement clearly does not apply to Limerick when Limerick's vital structures were built directly on top of an earthquake fault in an active earthquake region and when errors occurred during Limerick's construction that can't be fixed.

LIMERICK IS CLEARLY NOT A WELL-DESIGNED PLANT AND MAY NOT REMAIN SAFE

ALARMING LIMERICK NUCLEAR PLANT DESIGN FLAWS

LIMERICK'S REACTOR FLAWS

- **Both Limerick's Reactors are GE Mark II BWRs, Similar to Those That Melted Down at Fukushima**
  - Fukushima reactors failed. Units 1,2,and 3 suffered multiple explosions with massive land contamination and groundwater contamination.
  - Limerick's GE Mark II reactor design has a high probability of failure under severe accident conditions leading to massive land and groundwater contamination.
  - According to NRC's own staff, document 2012 - 0157 - GE BWR for Limerick states that both Limerick units are in violation of General Design Criteria #16.
  - Reactors must have a leak-tight barrier for as long as required, yet Limerick 1 and 2 are likely to fail in an accident.
  - During core damage there is only a 50-50 chance of recovery - 50-50 chance vessel will fail
  - There is a 75% chance it will not recover. Significant radiation will be released into the environment.
  - There is a 90% chance meltdown of core will by-pass the system and burn through seals with catastrophic unfiltered radiation released downwind, impacting millions of people in a heavily populated region.
  - NRC estimated necessary design, structure, systems, and components...in violation of system for safety.

  For further explanation or clarification refer to the June, 2014 testimony to NRC of Paul Gunter, (Beyond Nuclear) regarding Limerick's 2nd Environmental Impact Statement public hearing

- **Limerick's Reactors Vibrate Too Excessively During Routine Operations**
  - Limerick's reactors vibrate too excessively for their design (Wurgassen effect - NRC issued Bulletin 74-14 to all BWR owners)
  - Containment may fail despite PECO's experimental piping to stabilize the reactors, which may not hold up in an earthquake.

- **GE Hitachi does not Guarantee Safe Shutdown At Limerick:**
  - GEH repeatedly warned Exelon (2010 and 2011) that its inherently defective BWRs may not shut down safely if Limerick is operating at low power when an earthquake hits.
  - Fortunately, Limerick was operating at 100% power when the Virginia earthquake impacted Limerick Nuclear Plant.
  - It is not clear that Exelon has tested both reactors or if testing achieved safe shutdown at all low power increments. NRC has been evasive in its responses about this testing. NRC actually told us they don't see test results unless they ask for them. How is that possible or protective? Why wouldn't NRC oversee testing and scrutinize results, given the potential consequences of failure?

LIMERICK'S FUEL POOLS - AT HIGH RISK FOR MELTDOWNS

- **DANGEROUS UNFIXABLE DESIGN FLAWS: Limerick's Spent Fuel Pools:**
  - **Limerick's spent fuel pools were built on top of Limerick's defective reactors, on top of earthquake fault fractures**
  - Similar to Fukushima's, they are **highly vulnerable to meltdowns through loss of power and cooling water from earthquakes,**
  - **Limerick spent fuel pools were built with substandard cement**, according to a Bechtel quality assurance engineer on site at the time of the fuel pool cement pour (9-22-11 NRC testimony), He said Limerick's fuel pools have a layer of low-strength sand mix where only the highest quality cement should be.
  - Limerick's roof-top fuel pool designs, five stories high, are above and **outside the reinforced containment structure for Limerick's reactors, which could result in extremely high radioactive releases in a meltdown.**

- **Corrosion and Thinning Are Occurring In Limerick's Dangerous Spent Fuel Pools At Rates Up To 10 Times Faster Than Exelon's Calculations Predicted** (Identified by NRC staff)
  - NRC documented corrosion, cracking, pitting, and cavitations.
  - Problems are so severe that on July 20, 2012, NRC staff stated that for Exelon to delay coating the thinning fuel pool liners was unacceptable, yet NRC officials inexplicably caved in and revised NRC

regulations to allow delayed coating for 11 to 16 years and to go without inspection for another 10 years.

- **An Earthquake At Limerick Could Trigger Loss of Cooling Water In Limerick's Spent Fuel Pools Leading To Catastrophic Meltdowns:**
  - Leaks in cement holding Limerick's high-level radioactive wastes can be caused by earthquakes.
  - Loss of water in Limerick's fuel pools can be caused if an earthquake disturbs underground pipes transporting cooling water to the pools.
  - Spent fuel rods could heat up, self-ignite, and burn in an unstoppable fire, leading to meltdowns

- **Fuel Pools At Limerick Are Densely Over-Packed - Far Beyond Design Capacity.**
  - NRC repeatedly failed to explain why Limerick's fuel pools contain so much more spent fuel than other older U.S. nuclear plants, including Exelon's TMI and Oyster Creek.
  - Large volumes (over 6,000 assemblies =1,000 tons), of Limerick's highly radioactive wastes (spent fuel rods) in Limerick's fuel pools could release catastrophic amounts of radiation if an earthquake triggers meltdowns.
  - **Limerick's two fuel pools contain more than twice as much spent fuel as 4 fuel pools at Fukushima**. (Data From The Institute for Policy Studies by Bob Alvarez, *"Spent Nuclear Fuel Pools in the U.S.: Reducing the Deadly Effects of Storage"*, Appendix A: Site Specific Estimates of Radioactivity in U.S. Spent Fuel Page 26Source: DOE/EIS-0250, Appendix A, Tables A-7, A-8, A-9, & A-10)

- **Health and Economic Impacts of Spent Fuel Pool Fires and Meltdowns at Limerick Nuclear Plant**
  - An NRC study in 2000 said, with loss of cooling water in fuel pools, Limerick's fuel rods can heat up, self-ignite, and burn in an unstoppable fire, causing tens of thousands of deaths up to 500 miles away
  - A 2004 Study by Dr. Edwin Lyman, Senior Scientist at the Union of Concerned Scientists, Concluded The Following Health Consequences From Fuel Pool Meltdowns/Fires:
    - ✓ As many as 44,000 near-term deaths from acute radiation poisoning
    - ✓ 518,000 long term deaths from cancer.
    - ✓ Deaths could occur among people living as far as 60 miles downwind.
  - A 2003 study by Dr. Frank Von Hippel, Director of Science and Global Security at Princeton University, concluded that a catastrophic spent fuel fire could release a radiation plume that could contaminate 8 to 70 times more land than Chernobyl. (Would include the entire Philadelphia Metropolitan Region).
  - A January 2003 study by Dr. Gordon Thompson, Director of the Institute for Resource and Security Studies (entitled "Robust Storage of Spent Nuclear Fuel: A Neglected Issue of Homeland Security") said a nuclear fire in 1 spent fuel pool would release radiation to "render about 95,000 square kilometers of land uninhabitable," (would cover about 75% of New York State, and segments of NJ and CT.)

STRONGER AND MORE FREQUENT EARTHQUAKES HAVE SHOWN US THE UNEXPECTED CAN AND DOES OCCUR

- Fukushima, the worst nuclear disaster in history, shows us that there is no reactor containment if an earthquake triggers a meltdown at GE Boiling Water Reactors like Fukushima and like Limerick Nuclear Plant.
- Fukushima also shows us that NRC regulatory controls will not prevent a disaster at Limerick. The Fukushima reactors were supposedly safe and Fukushima had been approved for relicensing shortly before the disaster.

THE VIRGINIA EARTHQUAKE (8-23-11) IMPACTED LIMERICK NUCLEAR PLANT

- Thirty eight years after Virginia's earthquake fault was declared incapable by AEC standards, it was at the epicenter of the earthquake in 2011 that impacted Limerick.
- The fact that the earthquake fault under Limerick was defined exactly the same way is no comfort to our residents. AEC/NRC concluded an earthquake would not happen in the fault under North Anna, Virginia, but it did.

LIMERICK'S UNDERGROUND INFRASTRUCTURE WAS NOT INSPECTED AFTER THE 8-23-11 QUAKE

- Earthquakes can trigger meltdowns through loss of water and power as a result of damage and/or leaks in the miles of vital pipes and cables buried under Limerick Nuclear Plant.

- After the 8-23-11 Virginia quake shook the Limerick site, it became clear that there is no real way to inspect the miles of buried pipes and cables under Limerick for damage or leaks from earthquakes. An Associated Press article revealed that leaks can go undetected for many years at nuclear plants.
- Undetected damage and leaks, combined with inoperable monitors and guages increase the chance of meltdowns from earthquakes at Limerick.

LIMERICK NUCLEAR PLANT WAS NOT PREPARED FOR THE 8-23-11 VIRGINIA EARTHQUAKE

Despite public assurances from Exelon and the NRC following that earthquake, an NRC email response to us revealed that when the Virginia earthquake hit Limerick, Exelon was not prepared:

- **Limerick's Unit 1 & 2 seismic monitoring system was inoperable.**
- **Seismic monitors could not confirm that an earthquake caused shaking in Limerick's control room.**
- **Exelon had to call USGS for confirmation.**
- **NRC issued a non-cited violation to Exelon for a delay caused by its call to the USGS, referred to in NRC's chart entitled "NRC Findings for VY 2011 at Limerick Generating Station" as an "Untimely Declaration of Notification of Unusual Event Following an Earthquake".**

However, Exelon's deceptive Special Report did not reflect problems with Limerick's seismic monitors or the NRC-issued violation. In fact, if one relied on Exelon's report, which also stated that the post-quake seismic walkdowns revealed no damages, it would seem as if Limerick had functioned very well.

Exelon's deceptive report titled, "Voluntary Special Report-Seismic Monitoring Instrumentation Actuation" failed to mention:

- **Limerick's inoperable seismic monitors, or their inability to confirm the earthquake.**
- **Exelon called USGS to confirm the earthquake.**
- **NRC's violation for the time delay was caused by Exelon's call to the USGS.**

Limerick's Seismic Monitors Had Been Inoperable For 1 Year and 4 Months Before The Virginia Earthquake

- **At Least One Monitor Remained Degraded and Inoperable For 4 Months After The Quake,** not the one identified in Exelon's Special Report, remained degraded and inoperable for 4 months after the quake.
  - NRC's February 27, 2013 Letter Introducing NRC's Audit of Licensee's Management of Regulatory Commitments reveals that Exelon submitted its commitment to fix Limerick's inoperable seismic monitors in 2010, then resubmitted the same commitment 2 more times but never followed through.
- **The audit letter from NRC informs Exelon that its commitment performance "reveals serious, long-standing mismanagement at Limerick Nuclear Plant."** (The audit was conducted at NRC headquarters in Rockville, Maryland from June 6, 2012 to January 29, 2013 and covered a three year period. It was based on a sampling of documents supplied by Exelon.)

THERE ARE AT LEAST 5 EARTHQUAKE FAULTS WITHIN 17 MILES OF LIMERICK. ONE, THE RAMAPO FAULT ZONE, IS DECLARED ACTIVE.

- **LIMERICK WAS IMPACTED BY THE EARTHQUAKE ORIGINATING IN VIRGINIA.**
- **NRC'S 1983 EARTHQUAKE ANALYSIS FOR LIMERICK NUCLEAR PLANT IS NOT ACCURATE AND IS NOT RELEVANT CONSIDERING THE RISKS WE NOW KNOW WE FACE FROM AN EARTHQUAKE AT LIMERICK.**

Full and accurate disclosure of an earthquake fault under Limerick Nuclear Plant's generators and fuel pools has remained hidden from the public until now, AFTER the evidence was located and disclosed by members of the public, not NRC.

Millions of people live in the Greater Philadelphia Region. Most of us never realized we faced such enormous risks from earthquakes related to Limerick Nuclear Plant because the fact that building the nuclear plant over an earthquake fault zone was never disclosed to the public.

In fact, the public appears to have actually been deceived from the beginning. Originally, the public was told that Limerick's earthquake risks were low. In one of Limerick's earliest Safety Analysis Reports, it states under "Seismology" that "the site lies in a region that has experienced a moderate amount of earthquake activity."

In 2008, the USGS updated its assessment of seismic threats for Limerick, concluding that because Limerick's earthquake risk was considered low when its construction began, it now needs to be updated in light of new understanding of increasing earthquake risks.

Clearly, there is NO way to fix the horrific risks that millions of people face from an earthquake impact at Limerick Nuclear Plant.

THE AGENCY DEFINITION OF THE SANATOGA FAULT UNDER LIMERICK IS NOT VALID:

- **Thirty eight years after the AEC (now NRC) defined North Anna's 1 million year old fault as not capable, it was at the epicenter of a 5.86 magnitude earthquake that impacted Limerick Nuclear Plant on August 23, 2011.**
- **It is indefensible to continue to claim the fault under Limerick is not capable:** AEC defined the Virginia fault under the North Anna Nuclear Plant in the same way they described the Limerick Nuclear Plant fault under Limerick except:
  - The fault under North Anna was described as having shown no displacement in 1 million years.
  - The fault under Limerick was described as having shown no displacement in 500,000 years.

  It seems clear that the Atomic Energy Commission was determined to allow nuclear plants to be built on top of fault zones in populated areas. But a *nuclear* plant built over an *earthquake fault* doesn't make sense, so the AEC simply defined the faults under nuclear plants as not capable.
  - In 1974, a Geologic Survey was submitted to the Philadelphia Electric Company (PECO). It stated that the [Sanatoga Fault] shears had shown no displacement in 500,000 and therefore was not capable according to AEC (Atomic Energy Commission) standards.
  - In 1983, the NRC adopted the AEC's definition of Limerick's fault shears, noting that "there were no capable faults in the site area".
  - We believe this sequence of events shows that the public statement that "the fault was factored into NRC's 1983 earthquake analysis, is industry-speak for " We get away with constructing nuclear plants on earthquake faults by defining them as not capable."

THE AEC/NRC ASSESSMENT THAT A FAULT IS NOT CAPABLE HAS BEEN PROVEN WRONG:

- **In 2012, Eliza Richardson, a Penn State Geo-expert, said that it's not too surprising that the assessment of the Virginia fault was off: "...while earthquake expertise has value, it is not a sinecure, either in Virginia or, possibly at Limerick".**
- Richardson had reviewed PECO's 1974 Geologic Survey map for Limerick and her assessment was that, if all the features inferred on the map are part of the same fault, "then it would be a pretty big fault going through there".
- Richardson further explained, referring to Limerick's 1974 map, that "the faults on this map are roughly similar to the one that caused the northern Virginia earthquake. One earthquake of that size does not happen every day. There are 100 places more likely that you would expect to see, but that one happened where no one expected it."
  - In 2011, North Anna's fault was at the epicenter of the largest earthquake east of the Rockies since 1897. It was felt all the way to New England.
  - Twelve miles from the 5.86 epicenter, 25 of North Anna's 115-ton spent fuel casks were shifted by the quake.
  - The quake caused cracks in the reactor containment building.
  - The Washington Monument, 90 miles from the epicenter, was cracked by the Virginia quake and closed to the public for assessment.
  - Concerns have risen about leaks in the miles of undetectable underground pipes and cables at North Anna and Limerick.

NRC HAS INACCURATELY CLAIMED THAT LIMERICK'S EARTHQUAKE RISKS WERE ORIGINALLY FACTORED INTO LIMERICK'S LICENSE.

- **NRC's adoption of the 1974 AEC definition of earthquake faults not being capable benefits only the nuclear industry, not the over 8 million people living within 50 miles of Limerick Nuclear Plant.**

➢ **THE PROOF THAT LIMERICK'S EARTHQUAKE RISKS WERE NOT FACTORED IN, IS THAT LIMERICK'S REACTOR COMPONENTS ARRIVED AT THE LIMERICK SITE IN 1972, TWO YEARS BEFORE LIMERICK'S GEOLOGIC SURVEY WAS SUBMITTED IN 1974.**

- in 1972, the Atomic Energy Commission (AEC) issued Limerick's construction permit, a 90-wheel truck carried the first component of PECO's defectively designed GE Mark II Boiling Water Reactor onto PECO's Limerick Nuclear Plant site, accompanied by a police escort.
- In 1972 when Limerick's Draft EIS was released by AEC, the AEC stated that it did not abandon the location for Limerick Nuclear Plant in favor of an alternative site because it would cost too much money.
- (See Attachment)
- The 1972 Draft EIS for Limerick - Page 2-16, Section 2.4.2 , "Regional Geology and Assessment of Possible Earthquake Hazard", exposes faults near and far away from Limerick, but it fails to disclose the Sanatoga Fault and Zone under Limerick or the Ramapo Fault Zone, 17 miles away.

AEC's 1972 Draft EIS for Limerick Nuclear Plant seemed to deliberately downplay earthquake risks at the Limerick site, by eliminating any mention of the Sanatoga Fault.

By matching the 1972 Bechtel Report photographs with its diagrams, the report shows that as early as 1973 Bechtel was filling in Sanatoga Fault fractures with cement to prepare the site for the construction of the plant.

➢ PICTURES SHOW FAULT FRACTURES UNDER LIMERICK BEING FILLED IN WITH CEMENT IN 1973, ONE YEAR BEFORE LIMERICK'S GEOLOGIC SURVEY WAS SUBMITTED IN 1974

CONSEQUENCES: LIMERICK'S TWO INHERENTLY DEFECTIVE, SEISMICALLY CHALLENGED NUCLEAR REACTORS ARE LOCATED ON A FAULT WHERE EARTHQUAKE RISKS WERE SERIOUSLY UNDERESTIMATED

THE FOLLOWING TIMELINE TELLS THE STORY OF A "CART BEFORE THE HORSE" CHECKLIST MENTAILTY:

- **On November 15, 1972, the first reactor component arrived at the Limerick site aboard a 90-wheel truck, two years before Limerick's seismic study was submitted.**
- **In 1973, before it had a construction permit from the AEC/NRC, Bechtel was filling in Sanatoga fault fractures with "dental concrete".**
- **On June 19, 1974: The Atomic Energy Commission (AEC - now NRC) issued a construction permit for Limerick Nuclear Plant**
- **On July 30, 1974: The Geologic Survey was submitted to PECO.**
- **On September 3, 1974: Bechtel Power Corporation submitted its report on its treatment of Sanatoga Fault zone fractures.**

WE FACE UNACCEPTABLE, UNFIXABLE RISKS FROM THE ORIGINAL NEGLIGENT DECISION TO ALLOW LIMERICK NUCLEAR PLANT'S REACTORS, FUEL POOLS, AND OTHER BUILDINGS TO BE BUILT ON TOP OF AN EARTHQUAKE FAULT.

This clearly unfixable threat to the health, safety, and financial interests of millions of people in the entire Greater Philadelphia Region is the result of a

predictable decades old AEC/NRC mentality and pattern of putting the "cart before the horse".

NRC ATTEMPTED TO HIDE THE TRUTH FROM THE PUBLIC ABOUT THE SANATOGA FAULT

- **NRC FAILED TO PROVIDE FULL AND ACCURATE DISCLOSURE ABOUT THE EARTHQUAKE FAULT UNDER LIMERICK, BY LYING TO THE PUBLIC BY OMISSION**

NRC first refused to respond to a local concerned mother for four months about the closest earthquake fault to Limerick. When NRC finally responded 4 months later, they lied by omission.

- May, 2011, after Fukushima, she asked about the nearest earthquake fault to Limerick.
- NRC failed to respond for four months
- At NRC's September, 2011 EIS hearing, the resident repeated her request.
- October 2011, the resident finally received a response letter dated September 26, 2011 from Andrew Rosebrook, Senior Projects Engineer for Limerick.
  - His response to the question about the closest fault to Limerick Nuclear Plant included a fault map of the PA-NJ area.
  - His explanatory letter focused on the Ramapo and Chalfont faults, 9 and 17 miles away, which, he stated included the Hopewell and Flemington faults, highlighted on the PA/NJ map the fault zones in yellow and orange.

- **NRC Lied by Omission About The Closest Earthquake Fault To Limerick Nuclear Plant** by not identifying the Sanatoga Fault directly under the Limerick site

- Later, we discovered PE's 1974 Geologic Survey map at the local library showing the Sanatoga Fault under the Limerick site. At NRC's 4-18-12 Annual Limerick Assessment Meeting, we showed NRC officials the map showing the Sanatoga Fault under the Limerick site.

  - **NRC Officials Denied Knowledge About the Earthquake Fault Under Limerick**
    - Andrew Rosebrook, Senior Projects Engineer for Limerick (the NRC official who sent the letter and map to the resident), Paul Krohn, Chief Branch 4 Reactor Projects, Region 1, and both site inspectors acted surprised that there was an earthquake fault under the Limerick site.
    - First, Paul Krohn acted like he had never seen the fault before and denied knowledge of the Sanatoga Fault, referring us to Mr. Rosebrook.
    - Mr. Rosebrook also denied knowledge of the Sanatoga Fault or PE's 1974 Geologic Survey

  NRC claimed that the Sanatoga Fault under the Limerick site was factored into Limerick's earthquake risk.
    - Despite these officials' denials to residents, the NRC's public printed statement in Evan Brandt's 5-20-12 massive article on the Sanatoga Fault under Limerick, was that the fault had been factored into its original 1983 earthquake analysis prior to Limerick licensing.

- On February 18, 2014, we, as ACE researchers, returned to the library for further investigation and discovered a report showing the position of Earthquake Fault Zone Fractures Directly Under Limerick's Reactors, Fuel Pools, Control Room, Turbine Building, and Rad-Waste Building (Spent fuel pools on top of reactors are not shown)

  - **NRC Failed to Publicly Disclose This Alarming Information, in even three years after Fukushima and the 2011 earthquake in Virginia.**

Background:

- Having lived in the area when controversy over Limerick nuclear plant's construction began, we had heard rumors of an earthquake fault where the Limerick site was to be built.

- After seeing the resident's map, we went to the Pottstown Library to look for more precise information. Our search led us to the Dames and Moore Geologic Survey submitted to PECO in 1974, which contained a map showing the Sanatoga Fault running through the Limerick site.
- The following spring, we took a copy of the map to a 2012 NRC public meeting.
- We showed it to NRC's Limerick Branch Chief at the time, Paul Krohn, who acted as though he knew nothing about the fault under the Limerick site.
- February, 2014 we returned to the library and we were shocked to discover a report that shows that both of Limerick Nuclear Plant's GE Mark II Boiling Water Reactors are built on top of fault fractures, portions of which were filled in with cement, as early as 1973. ("Report on Treatment of Fracture Zones for PECO by Bechtel Power Company, 1974" including photographs and diagrams).

It is alarming to know that Limerick's spent fuel pools, built on top of Limerick's reactors, are also on top of earthquake fault fractures that could trigger multiple meltdowns.

- **It is worrisome to know that other Limerick buildings are over fault fractures, including the control room, turbine building and radwaste storage building.**
- **Perpendicular to the exposed horizontal fault zone fractures, are fracture fingers extending down into the earth, ranging in width from an inch to two feet wide, no one knows how far.**

After two years of public concern, questions, and research, residents' confirmed that there is an earthquake fault directly under the Limerick site, filled in, in places, with cement, and that right on top of that is built the Limerick Nuclear plant, and at least 4 other earthquake faults within 17 miles of the Limerick site.

NRC HAD TO HAVE KNOWN ABOUT THE EARTHQUAKE FAULT UNDER LIMERICK NUCLEAR PLANT, YET NRC OFFICIALS FAILED TO ACT WITH TRANSPARENCY

- In response to PECO/Exelon's application for an operating license, in August 1983 NRC issued its Safety Evaluation Report (SER). On page "2-44" NRC mentions its earthquake risk analysis performed accordance with NUREG-0991.
- NRC notes that 3 faults have been mapped and investigated within 2 miles of the Limerick site, and yet downplays Limerick's earthquake risks.

NRC IS AWARE OF INCREASED EARTHQUAKE PROBLEMS AND LACK OF SAFEGUARDS, YET, NRC ILLOGICALLY WEAKENED EARTHQUAKE RECOMMENDATIONS OF THE FUKUSHIMA TASK FORCE.

- The Associated Press released a report on its 11,000-page records-request, that reveals the NRC's concern, yet to date the NRC has taken no meaningful action to reduce earthquake risks at U.S. nuclear plants.

NRC ISSUED ITS ILLOGICAL DETERMINATION NOT TO HARDEN LIMERICK NUCLEAR PLANT OR ANY OTHERS AGAINST EARTHQUAKES, EVEN DISMISSING THE USGS FINDINGS THAT "FRACKING" CAN TRIGGER EARTHQUAKES.

- The AP records request exposed NRC concerns about the risk at nuclear plants from fracking triggering earthquakes, yet NRC used the flawed rationale that "U.S. Plants can stand multiple earthquakes weaker than they were designed for" (5/ 20/12), Mercury, Evan Brandt: " 'Fracking' Quakes Not a Factor for NRC in Nuke Plant Licensing").
- **Evidence shows that "Fracking" can cause earthquakes, yet NRC has declared that it won't be considering "Fracking" in relicensing Limerick.**
  - By 2007, PA approved over 4,200 natural gas wells for fracking. Since then, many others were approved.
  - Nearby states like Ohio and New York are also fracking, USGS confirmed that many Ohio earthquakes were due to fracking.
  - USGS has also determined that Limerick is in an active earthquake fault zone.
  - There is an earthquake fault under Limerick. At least 4 other earthquake faults are within 17 miles of Limerick. The one just 9 miles away is considered active.

IT IS ILLOGICAL AND UNACCEPTABLE FOR NRC TO CLAIM THAT LIMERICK MEETS ALL SEISMIC REQUIREMENTS IMPOSED BY NRC WHEN NRC REQUIREMENTS HAVE BEEN WEAKENED TO THE POINT OF BEING UNPROTECTIVE OF PUBLIC SAFETY.

Limerick sits on the brink of disaster while NRC, the agency that has the power to intervene, has denied and dismissed extraordinary risks to benefit industry.

- **Despite stronger and more frequent unpredictable earthquakes, and the fact that the 8-23-11 earthquake actually jolted Limerick Nuclear Plant, NRC is failing to acknowledge the reality of the potential for multiple meltdowns from Limerick's extraordinary earthquake risks. Even after the catastrophic multiple meltdowns at Fukushima, the NRC still failed to fully disclose, much less address, the fact that Limerick Nuclear Plant was built on fault zone fractures.**

- Instead of working to effect precaution and prevention, NRC officials tried to deceive residents about Limerick's increased earthquake risks. NRC officials for Limerick have tarnished the mission statement of the NRC by being deceptive and dismissive of our concerns about Limerick's increased earthquake risks.

- Limerick's escalated earthquake risk cannot be evaluated in the neat and tidy illustration of risk assessment in NRC's "parachutist scenario" of NUREG 2122, which asserts "no special risk knowledge is presumed...a basic understanding of nuclear safety is assumed," to illustrate risk methodology.
- NRC operations began the year after the notorious Atomic Energy Commission issued Limerick's construction permit in 1974. The AEC was disbanded that same year due to protests over its controversial decisions, as both regulator and promoter of nuclear energy plants. The NRC, created from its ashes, was supposed to regulate on behalf of public safety and the environment.
- The AEC's original regulations would not have allowed the use of GE's Mark II Boiling Water Reactors, because containment is not guaranteed. NRC's regulations, as they were written originally, would not have allowed the construction of a nuclear power plant on the Limerick site due to an evacuation zone that was double the population density for safe evacuation.

- **Fred Bower, NRC Chief Branch 4, has informed us by e-mail 10-23-13 that seismic reports by Exelon for Limerick Nuclear Plant have satisfied the NRC and so no further audit is necessary in terms of seismic walkdowns.**

- Mr. Bower said Limerick was not selected to be audited by the Japan's Lessons Learned seismic walkdown, because Exelon's seismic report satisfied NRC's criteria..
  - ✓ PROBLEM: NRC Is Still Using Inaccurate Prediction Models For Limerick's Earthquake Risks, Based On Decades Old Flawed Assumptions Of Risk
  - ✓ PROBLEM: Exelon's biased, self-serving seismic report for Limerick Nuclear Plant should not have been used to dismiss actual enormous seismic risk. The original intent of the post-Fukushima earthquake assessment has been diluted and, because it contains no requirement of proof that what is reported by Exelon is true, it is as good as no assessment at all. Exelon controls Limerick's maintenance, testing, reporting, and data. NRC doesn't see anything that Exelon doesn't want it to see.

PROBLEM: NRC's compliance standards are obviously far too low when they can exclude a nuclear plant with the extraordinary seismic risks at Limerick Nuclear Plant.

- **Fred Bower absurdly claimed that Limerick was not a nuclear plant that represented a higher than average seismic risk**

NRC's WILLFUL BLINDNESS TO EXTRAORDINARY EARTHQUAKE RISKS AT LIMERICK NUCLEAR PLANT HAS BEEN, AND CONTINUES TO BE, UNACCEPTABLE AND UNPROTECTIVE.

- **NRC originally wrote off actual risks from building Limerick Nuclear Plant's vital infrastructure over an earthquake fault by declaring that fault (Sanatoga Fault) incapable.**
- **Bechtel, the company that built Limerick, was actually filling in portions of the fault zone fractures at Limerick with cement, a year before Limerick's geologic survey was submitted.**

- **Errors made during Limerick construction were overlooked, intensifying the risks from today's stronger and more frequent earthquakes.**

- **Unfortunately, It Appears NRC Has Learned NO Lessons from the Fukushima Disaster.**
  - Even as the crisis of Fukushima continues uncontrolled, the NRC's response is to double down, making access harder to acquire or to dismiss the evidence, by saying "we factored it in", or "we have redundant safety systems", or the design basis "has an adequate margin" with no proof that such terminology is anything more than a cloaking device for, "We're dismissing that because meaningful requirements would oblige licensees to spend money.
  - There are many similarities between what caused the Fukushima meltdowns and the potential for disaster at Limerick. TEPCO had too cozy a relationship with Japan's Nuclear Regulation Authority (NRA). The same can be said of Exelon and the NRC.
  - TEPCO and Japan's NRA ignored expert advice against building a nuclear reactor on an unsuitable site. Japan had a history of cyclical, predictable tsunamis and earthquakes on Fukushima's coast. But common sense was no match for the promise of the money to be made.
  - The same potential for disaster exists at Limerick. Like TEPCO and the NRA, PECO and the NRC were warned repeatedly before Limerick was licensed, that Limerick was an unsuitable site for a nuclear plant.

- **Public Safety Has Been, And Continues To Be, Ignored By NRC, Even When Challenged.**
  - A nine year legal action against Limerick over safety was fought and won in the 3rd circuit court of appeals in 1989, but it was too late to protect the public. Both Limerick units were already operating by 1989.
  - The National Resources Defense Council's request to have Limerick's Severe Accident Mitigation Alternatives updated was approved, but challenged by Exelon. NRC joined Exelon in the challenge, instead of protecting public interests.
  - Requests to update Limerick's unprotective1974 Atomic Energy Commission definition of earthquake fault capability based on Appalachian experts and staff have been ignored.

- **Limerick Fails The Most Rudimentary Tests For Safety. Public Interests Have Been Abandoned From The Start. If AEC/NRC Had Adhered To Its Regulations In The Beginning, Millions Of People In The Greater Philadelphia Region Wouldn't Face Such Risk From Limerick Nuclear Plant Today:**
  - The Sanatoga Fault runs under the Limerick Nuclear Plant site
  - A blasting quarry shares Limerick nuclear plant's border
  - Both GE Mark II Boiling Water Reactors could breach in an accident due to substandard design.
  - The population density in 1980, was double the size that could be safely be evacuated in case of an accident
  - Limerick's extraordinary threats to public drinking water were well known in 1980. There was not enough water in the Schuylkill River to sustain Limerick Nuclear Plant operations. The health threats from decades of routine radioactive releases into a vital drinking water source for vast numbers of people were overlooked.

- **A Major Concern Defined by Former NRC Secretary Jaczko on "Frontline" Shows Why Limerick's Risks Need To Be Re-Evaluated.**
  - Former NRC chairman Gregory Jaczko told FRONTLINE in January 2012: "Invariably, I think right now the kinds of situations in which you [have] accidents are going to be those in which has happened that you haven't necessarily thought about or you misunderstood, or you misanalyzed, or you just missed."
  - That is exactly the problem and concern related to Limerick's earthquake risks.

- **The Consequences Of Limerick Meltdowns Triggered By An Earthquake Would Be Catastrophic To Public Health, Safety, and Financial Interests.**
  - Unfortunately, the public will suffer from a Limerick disaster, not Exelon or its stockholders.
  - In 2013, Naoto Kan, Japan's former prime minister when the Fukushima disaster started, said, "...no other accident or disaster" other than a nuclear plant disaster can "affect 50 million people...no other disaster "could cause such a tragedy" He further said, that "without nuclear power plants we can absolutely provide the energy to meet our demands...we could generate all our energy through renewable energy." ("Counterpunch", March 3, 2014)

WHY LIMERICK SHOULD BE CLOSED DUE TO NEWLY- FOUND EVIDENCE OF EARTHQUAKE FAULT FRACTURES UNDER LIMERICK'S VITAL INFRASTRUCTURE:

- **LIMERICK'S RISKS FROM EARTHQUAKES ARE EXTRAORDINARY**
  - Structural deficiencies that can be destabilized by an earthquake, were created by errors, failures, and non-compliances during Limerick construction. These cannot be fixed now.
  - USGS said Limerick is in an active earthquake zone.
  - In addition to the earthquake fault under Limerick, there are at least four other faults within 17 miles of Limerick, one declared active.
  - Limerick Nuclear Plant was impacted by the 8/23/11 Virginia earthquake. That is a fact that is now part of Limerick's historical record. And Exelon was not prepared. That too, is a fact in the historical record.
  - Massive fracking in PA and nearby states has increased the risk of triggering earthquakes.
  - Earthquakes can undermine plant stability by disturbing the impossible to inspect miles of buried pipes and cables under Limerick vital to supplying power and water needed to prevent multiple meltdowns at Limerick.

- **SAFE EVACUATION IS IMPOSSIBLE!**
  - It is impossible to safely evacuate this densely populated Greater Philadelphia Region. In 1980 NRC knew there was double the population density than could safely evacuate a 30-mile radius. Now there are at least four times that number.
  - Over 8 million people now live within 50 miles of Limerick Nuclear Plant.
  - Everything these people need to survive may hang in the balance of what the NRC does or does not do regarding Limerick's increased earthquake risks.
  - Millions of people could lose everything - Health, homes, farms, businesses, schools, and historical sites
  - Air and water (possibly within 100 miles) would become too radioactive for exposure from Limerick's meltdown releases. Drinking water supplies and a safe food supply hang in the balance of NRC's decision about what to do about Limerick's increased earthquake risks.

CONCLUSION:

Limerick Nuclear Plant's Reactors and Spent Fuel Pools Were Built Directly On Top of Earthquake Fault Fractures.

➢ No NRC study or regulation can remove the extraordinary earthquake risks at Limerick Nuclear Plant.

Seismic walkdown audits performed by Exelon, the company with a vested interest in the outcome, mean nothing at Limerick. It is clear that Limerick's inherent design flaws, plus construction errors, failures, and non-conformances increase Limerick's vulnerability to seismic events, large or small.

You could prevent unnecessary catastrophic health and economic consequences that would follow meltdowns triggered by an earthquake at Limerick Nuclear Plant. Right now, over 8 million people within 50 miles of Limerick are counting on NRC to protect them. NRC's mission statement creates the impression that people are protected by NRC regulations, but to date, that is not happening.

➢ **To protect the millions of people in the Greater Philadelphia Region, we urge you to use the full power of your position to take these unprecedented and imperative actions to prevent catastrophic and unnecessary disaster at Limerick Nuclear Plant:**

1. **Revoke Limerick Nuclear Plant's Operating License Immediately.**
2. **Require Exelon To Remove Limerick's Deadly Radioactive Wastes From Limerick's Spent Fuel Pools As Soon As Safely Possible.**
3. **Require Exelon To Harden On-Site Above-Ground Cask Storage For Wastes Removed From Limerick's Fuel Pools.**

We request that this communication, including all attachments, be placed in NRC's record and posted on NRC's website. Please inform us of the ADAMS location when it is posted.

Thank you in advance,

Betty and Charlie Shank, ACE Research Assistants
Alliance For A Clean Environment (ACE)
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Pottstown, PA 19465
(610) 326-2387
aceactivists@comcast.net

CC U.S. Senator Casey
U.S. Senator Toomey
U.S. Senator Boxer
U.S. Senator Markey
U.S. Senator Sanders
NRDC
NIRS
Beyond Nuclear
Radiation and Public Health Project
Pottstown Mercury
Philadelphia Inquirer

LIMERICK'S EARTHQUAKE RISKS CAN'T BE ELIMINATED

PottsMerc.com
FACEBOOK: Pottstown Mercury
TWITTER: @MercuryX
OPINION
Awarded the Pulitzer Prize for spot news photography in 1979 and editorial writing in 1990

ANOTHER VIEW

Limerick nuke plant should be shut down

Exelon is considering closing some of its nuclear plants early. Limerick should be near the top of the list for nuclear plants to be closed.

Last month, we found Bechtel's 1974 report on the "Treatment of Fracture Zones" at Limerick. A diagram shows Sanatoga Fault zone fractures running directly under a Limerick reactor. Photos show portions of the fault being filled with cement to level the surface so the plant could be built on top.

Limerick's risks aren't just limited to the fact that Limerick is third on the nation's earthquake risk list and has the second-most populated evacuation zone in the nation. Yet, NRC has refused requests to update Limerick's outdated earthquake analysis, clinging to its 1983 stance based on 40-year-old information from a time when earthquake risks were less understood, less frequent and less severe.

Guest Columnist

In 2011, NRC lied by omission when it provided a resident with a map which showed only off-site faults and that failed to include the fault under Limerick.

It wasn't until 2012, after residents showed NRC officials Limerick's 1974 Geologic Survey map illustrating the Sanatoga Fault running under the Limerick site, that NRC officials finally acknowledged its existence. Then NRC claimed the fault had been factored into its 1983 earthquake analysis. If so, why did NRC omit the fault under Limerick from the map it sent to the resident?

A Penn State Geo-expert who reviewed the 1974 Geologic Survey map saw indications that the fault under Limerick could be pretty big. She suggested that a more accurate picture of what's going on down there is possible using new equipment, but it wouldn't be free (Mercury May 20, 2012). To date, it hasn't been done.

Limerick's overloaded fuel pools, storing high-level radioactive wastes, sitting on top of Limerick's reactors, which sit on top of fault fractures, present an enormous potential for catastrophe.

Of major concern, Limerick's seismic monitors were inoperable when the Aug. 23, 2011 Virginia earthquake shook Limerick Nuclear Plant. For a year and four months before the quake, Exelon had been promising to fix the seismic monitoring system, but never did. Inoperable on Aug. 23, 2011, Limerick's seismic monitors could not confirm the quake. Exelon had to call the USGS to confirm the quake. NRC cited Exelon with a violation.

Incredibly, Exelon created a contradictory report claiming that Limerick's seismic monitors worked as soon as vibrations were felt in the control room.

Additionally, GE Hitachi repeatedly warned Limerick to test its GE Mark II Boiling Water Reactors because they may fail to shut down safely if running at low power when a quake hits. Fortunately, Limerick Units 1 and 2 were operating at 100 percent power when the Virginia quake hit Limerick.

Our risks are multiplied by NRC's refusal to inspect any Limerick underground infrastructure. NRC is relying on Limerick's gauges and monitors to reveal problems in the miles of nearly 30-year-old inaccessible buried pipes and cables under the Limerick site.

An AP report reveals that underground leaks can go undetected at nuclear plants for years before discovery. Worse, NRC Safety Reports show that, in addition to Limerick's inoperable seismic monitors, many violations at Limerick have stemmed from other monitors and systems also inoperable for years before they were discovered.

In short, hollow assurances from Exelon and NRC have not, and cannot, fix Limerick's increasing threats to public safety. Even fracking in Pennsylvania and its adjoining states adds to Limerick's earthquake risk.

One reason Exelon cites for early nuclear plant closure is political support. (Cooper report July 17, 2013 and Mercury July 19, 2013.) Our politicians should speak up now to close Limerick Nuclear Plant early to protect the safety and economic future of the Greater Philadelphia Region.

For more information see www.acereport.org: Section 11 "Earthquake Risks." For political contact information, see "Recent Posts" - Video Blog, "Elected Officials Must Take Action." Contact elected officials today.

BETTY and CHARLIE SHANK
Pottstown

ATTACHMENT

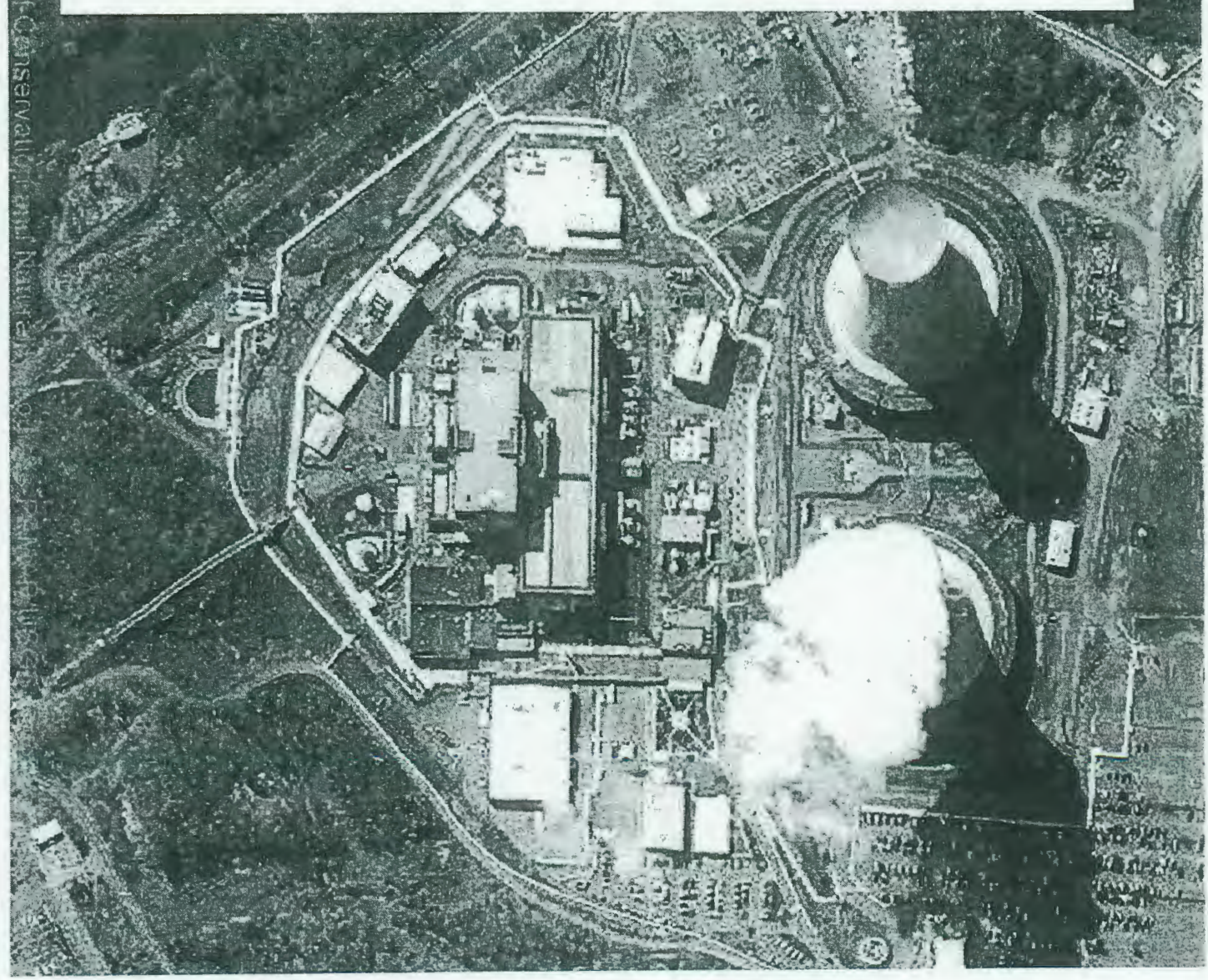
FOR ACE 3-31-14 LETTER TO NRC CHAIRMAN ALLISON MACFARLANE

LIMERICK NUCLEAR PLANT MUST CLOSE!

IT CAN'T BE MADE SAFE!

LIMERICK'S REACTORS AND FUEL POOLS ARE BUILT ON TOP OF AN EARTHQUAKE FAULT ZONE

THERE IS NO WAY TO FIX THIS!



CONTENTS

OF THIS PACKET

Evidence That Shows That Limerick Nuclear Plant's Reactors and Spent Fuel Pools Were Built Directly On Top of Earthquake Fault Fractures.

ATTACHED PHOTOGRAPHS AND DIAGRAMS ARE FROM:

The 1974 report for Limerick Nuclear Plant titled: "Report on Treatment of Fracture Zones for PECO by Bechtel Power Company", Showing That Fault Fractures Under Limerick Were So Big They Decided To Fill Them In With Cement In Order To Construct Limerick Buildings On Top Of The Fractures

Bechtel's September 3, 1974 Report Reveals That Limerick Nuclear Plant's Buildings Were Built Directly ON TOP Of Earthquake Fault Fractures:

(1) Reactors [Plus Spent Fuel Pools]
(2) Control Room
(3) Turbine Building
(4) Rad-Waste Building

Photographs And Diagrams From The 1974 Report:

1. Copy of Bechtel's 1974 Report Cover
2. Photograph - A fault zone fracture filled with cement that supports a column for Limerick Unit 2 reactor
3. Photograph - A fault zone fracture after it was filled in with cement (called dental concrete) in 1973, BEFORE Limerick's Geological Survey was completed in 1974
4. Photograph - A fault zone fracture being filled with cement directly under the support wall between the control room and turbine building
5. Photograph - A fault zone fracture directly under Limerick Unit 1 reactor
6. Diagram - The location of Limerick Nuclear Plant buildings and their position over the fault zone fractures
7. Diagram - The location of fault fractures and their position under Limerick Nuclear Plant buildings
8. Diagram - Showing fracture fingers extending from the horizontal surface fractures into the earth: no one knows how far down they go

NOTE: Spent fuel pools are not shown in the diagram, since Limerick is a GE Mark II BWR design, with its fuel pools built on top of its reactors.

REPORT

ON

TREATMENT OF FRACTURE ZONES

AT

LIMERICK GENERATING STATION

FOR

PHILADELPHIA ELECTRIC COMPANY

BY

BECHTEL POWER CORPORATION

JOB 8031

September 3, 1974

RECEIVED
SEP 16 1974
U.S. ATOMIC ENERGY COMMISSION
Regulatory
Mail Section

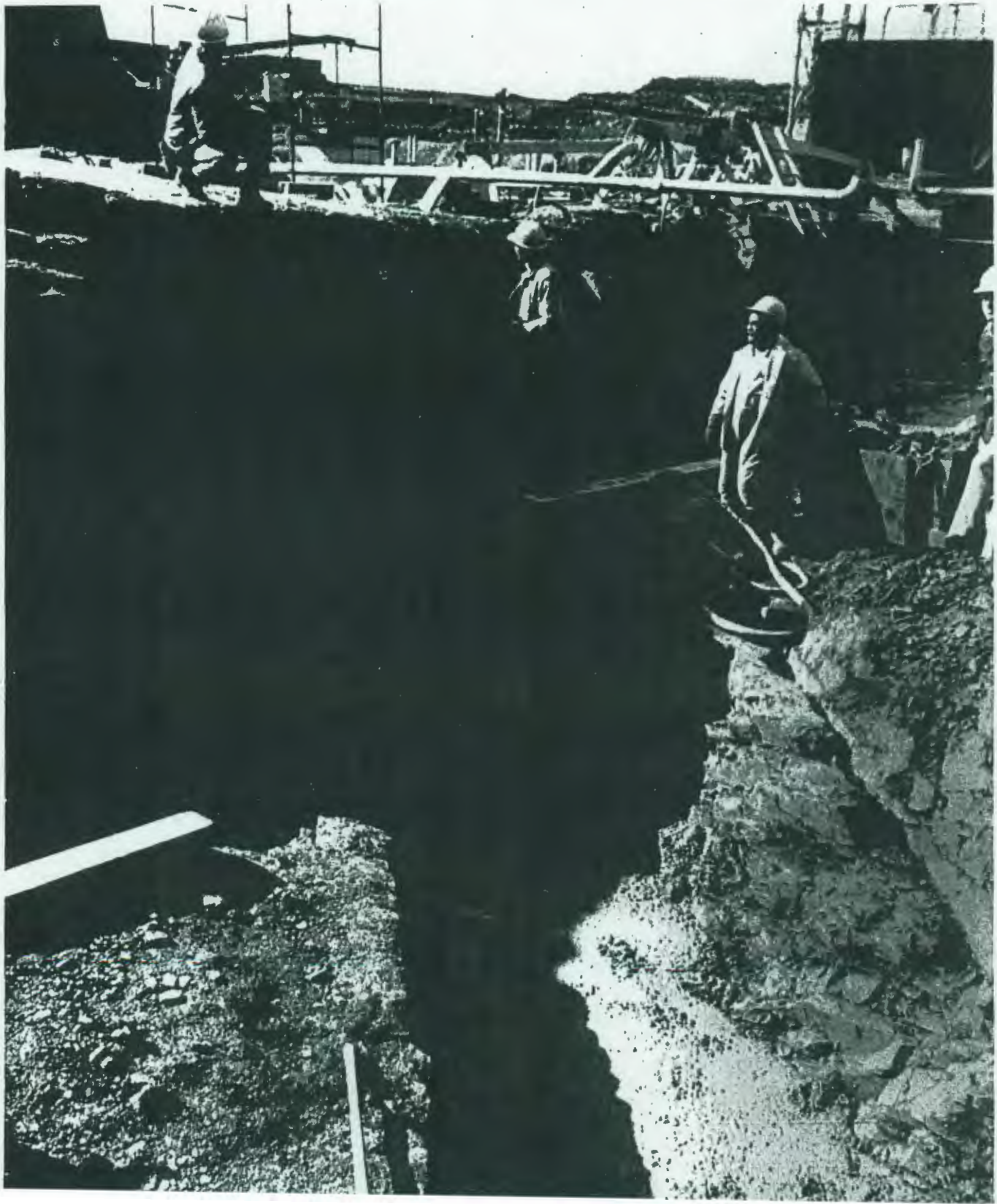
Reports File

9548

This Is A Fault Zone Fracture Filled With Cement That Supports A Column For Limerick Unit 2 Reactor

PHOTO 23. - Fracture Zone B at Column Footing F-31.9
Looking NE. Same area as Photo 22, showing the dental excavation filled with concrete.

A Huge Fault Zone Fracture Being Filled With Cement Directly Under The Support Wall Between The Control Room and Turbine Building



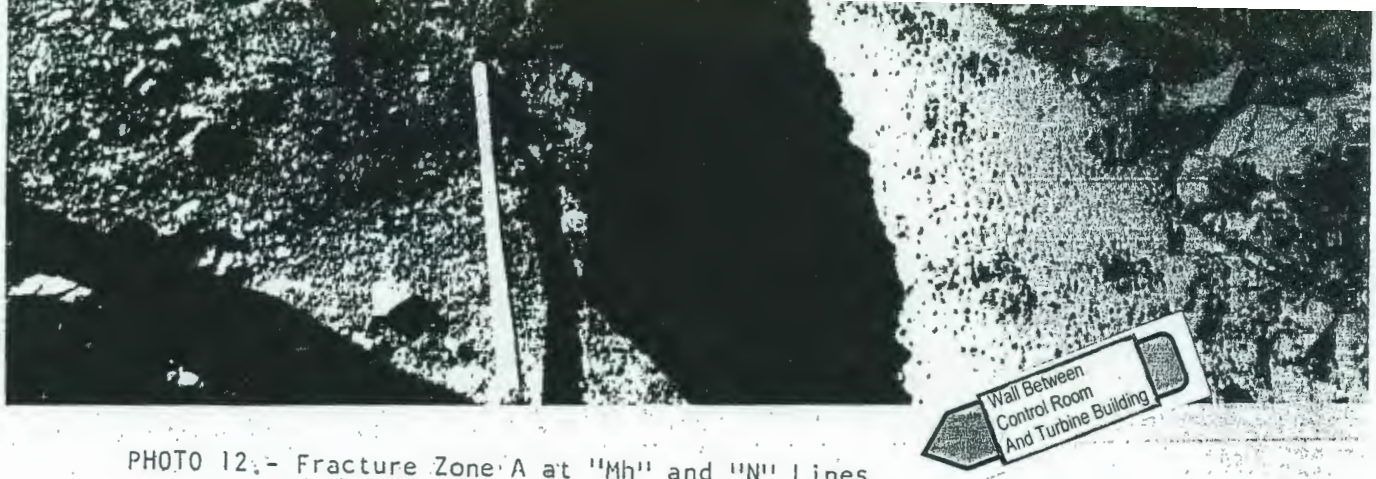


PHOTO 12 - Fracture Zone A at "Mh" and "N" Lines
Looking SW along strike as dental concrete is being placed in the zone

A Fault Zone Fracture Was Being Filled With Cement In 1973 Before Limerick's Geological Survey Was Completed In 1974

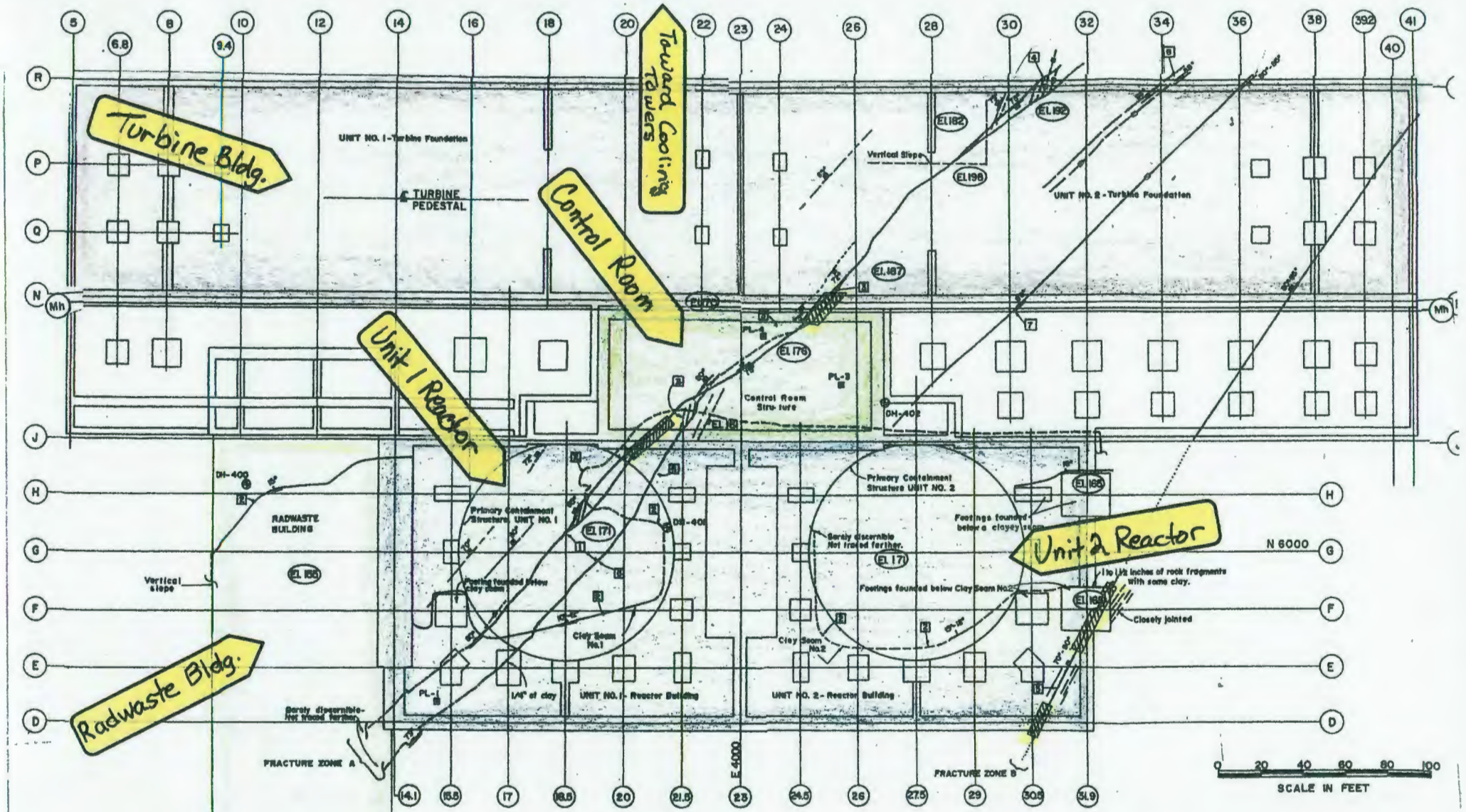
PHOTO 24. - Fracture Zone B at Column Line 31.9 and Column Footing F-31.9 Looking SW along strike of Zone B. Column footing is in foreground. Paint marks column line 31.9'. Shows the zone after being filled with dental concrete.

Dental concrete was placed in the treated zone on August 10, 1973.

Photo 24 shows the zone after being filled with concrete.

This Is Part Of The Fault Zone Fracture Under Limerick Unit 1 Reactor

PHOTO 1. - Fracture Zone A at "J" Line.
Looking NE along strike of the zone. "J" line is near the center of the photo. Note that the bedding plane which has been cleaned off (center of the photo) is not displaced across the zone. Clay seam I occurs along this bedding plane.



EXPLANATION

DH-400 — Drill hole to investigate clay seam

Trace of fracture zones on excavated rock surface showing dip. Dashed where fractures are tight and indistinct. Dotted where concealed.

Trace of clay seam on excavated rock surface showing dip. Dashed where exposed in excavated slope

Areas where fracture zones were treated. See report for description and photographs.

[7] — See notes for further descriptions

(El. 171) — Elevation of excavated surface

Joint showing attitude

PL-3 — Plate load test showing location and number.

NOTES:

[1] Fractures generally range from less than 1/4 inch wide to barely discernible from here toward O line. Rock between fractures is unweathered and sound

[2] Less than 1/2 inch of clay and rock fragments along clay seam parallel to bedding.

[3] Fracture zones converge in this area, closely jointed between zones.

[4] Well defined zone of close jointing within a zone about 6 to 8 ft. wide. Clay along some joints.

[5] Fracture Zone B contains 2 to 10 inches of clay and decomposed rock, with adjacent closely spaced joints in hard unweathered rock. Shows 8 to 10 inches of apparent vertical offset with east side down.

[6] Strong, clean joint. No clay or crushed rock.

[7] Fracture zone 1/4 to 2 inches wide containing soft, decomposed rock. Show seven inches offset, with west side down. Zone is so narrow, no special treatment is required.

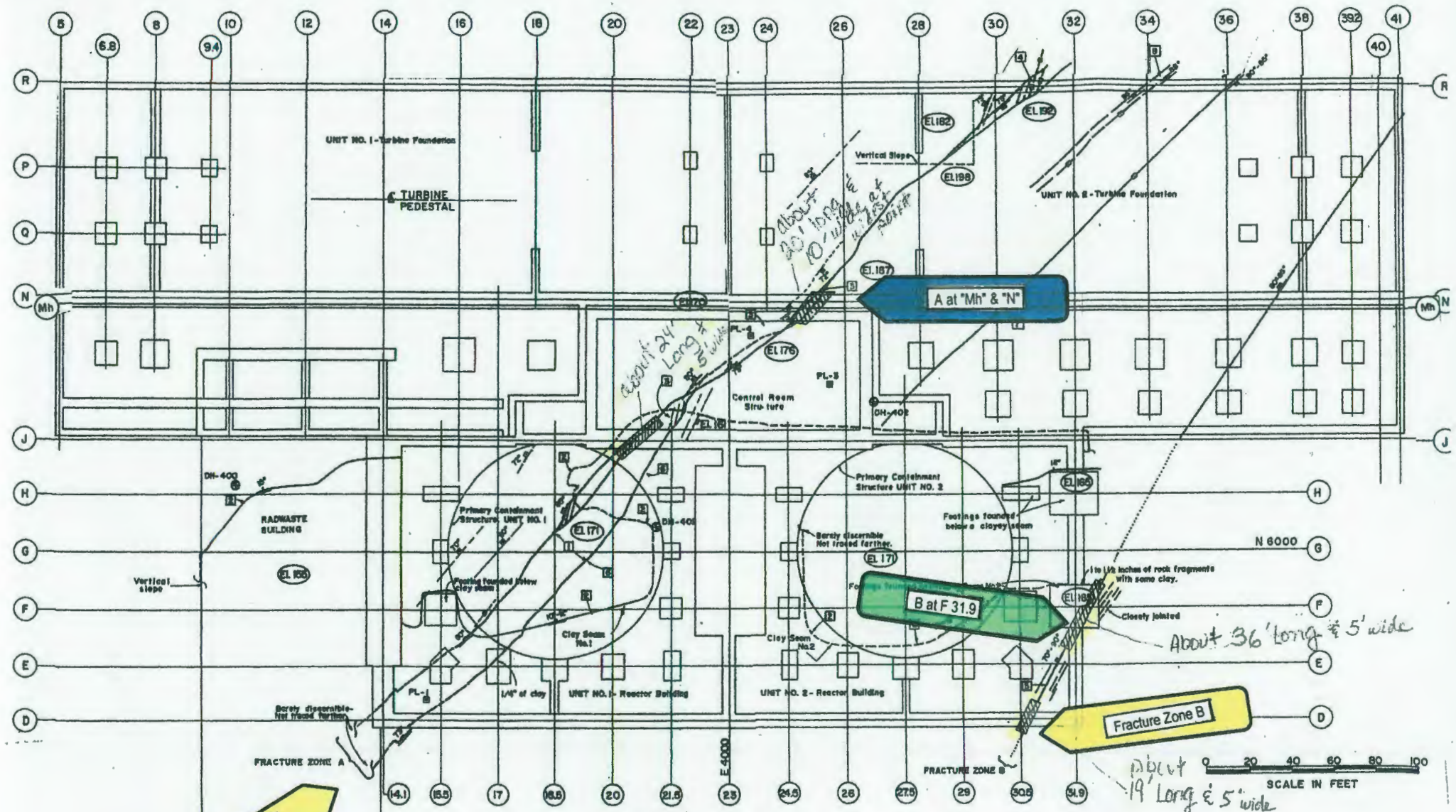
[8] Fracture zone up to 4 inches wide containing highly fractured rock. Adjacent rock closely jointed. Shows 3 to 4 inches of offset with east side down. Zone is so narrow, no special treatment is required.

PHILADELPHIA ELECTRIC COMPANY
LIMERICK GENERATING STATION
UNITS 1 AND 2
PRELIMINARY SAFETY ANALYSIS REPORTS

GEOLOGIC MAP
LOCATION OF FRACTURE ZONES

FIGURE 1

ACE Clarification:
Positions of Limerick Buildings Over Fault Fractures



EXPLANATION

- DH-400 — Drill hole to investigate clay seam
- Trace of fracture zones on excavated rock surface showing dip. Dashed where fractures are tight and indistinct. Dotted where concealed.
- Trace of clay seam on excavated rock surface showing dip. Dashed where exposed in excavated slope
- Areas where fracture zones were traced. See report for description and photographs.
- 7 — See notes for further descriptions
- El. 171 — Elevation of excavated surface
- Joint showing attitude

NOTES:

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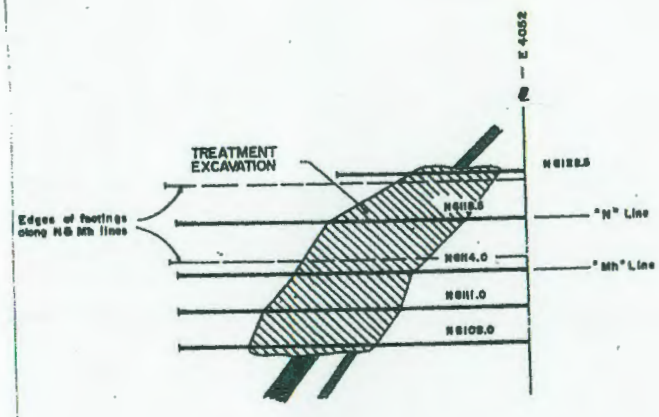
PHILADELPHIA ELECTRIC COMPANY
LIMERICK GENERATING STATION
UNITS 1 AND 2
PRELIMINARY SAFETY ANALYSIS REPORTS

GEOLOGIC MAP
LOCATION OF FRACTURE ZONES

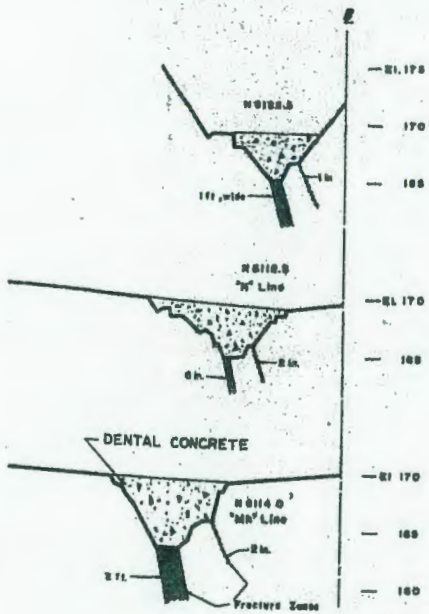
FIGURE 1

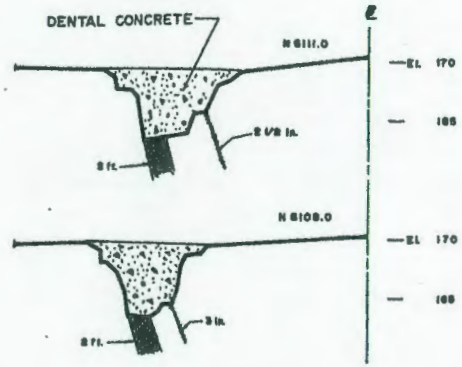
ACE Clarification:
Arrows Show Fractures Documented In Photographs



PLAN

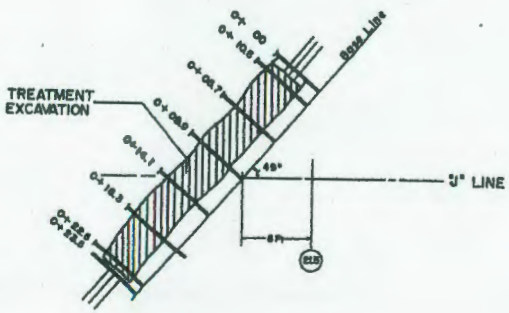
TREATMENT OF ZONE A AT "N" & "Mh" LINES





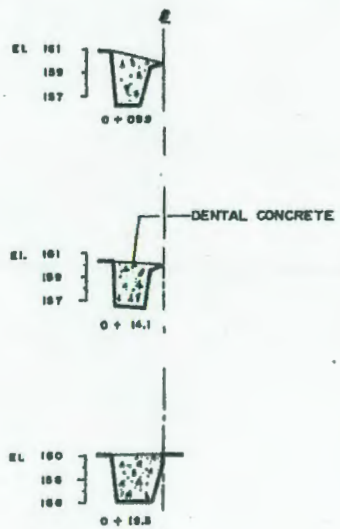
SECTIONS

TREATMENT OF ZONE A AT "N" & "Mh" LINES



PLAN

TREATMENT OF ZONE A AT "J" LINE



SECTIONS

TREATMENT OF ZONE A AT "J" LINE

VERTICAL AND HORIZONTAL SCALE IN FEET

ACE Clarification:
Fracture Fingers Extend Down From Horizontal Fractures

PHILADELPHIA ELECTRIC COMPANY
LIMERICK GENERATING STATION
UNITS 1 AND 2
PRELIMINARY SAFETY ANALYSIS REPORTS

TREATMENT OF FRACTURE ZONE A

FIGURE 2

ATTACHMENT

FOR ACE 3-31-14 LETTER TO NRC CHAIRMAN ALLISON MACFARLANE

Attached Documents Show That NRC Lied by Omission About The Closest Earthquake Fault To Limerick Nuclear Plant

NRC did not respond to a local concerned mother for four months about the closest earthquake fault to Limerick. When NRC finally responded, NRC lied by omission:

- In May, 2011, after Fukushima, Lorraine Ruppe, a resident asked about the nearest earthquake fault to Limerick.
- On September 22, 2011, at NRC's EIS hearing, the resident repeated her request.
- In October, 2011, the resident finally received a letter dated September 26, 2011, from Andrew Rosebrook, Senior Projects Engineer for Limerick.
  - His response to the question about the closest fault to Limerick Nuclear Plant, included a fault map of the PA-NJ area.
  - His explanation focused on the Ramapo and Chalfont faults, 9 and 17 miles away, which, he stated included the Hopewell and Flemington faults. Highlighted on the PA/NJ map the fault zones in yellow and orange were the faults 9 and 17 miles from Limerick. He failed to mention the Sanatoga Fault under the Limerick site.

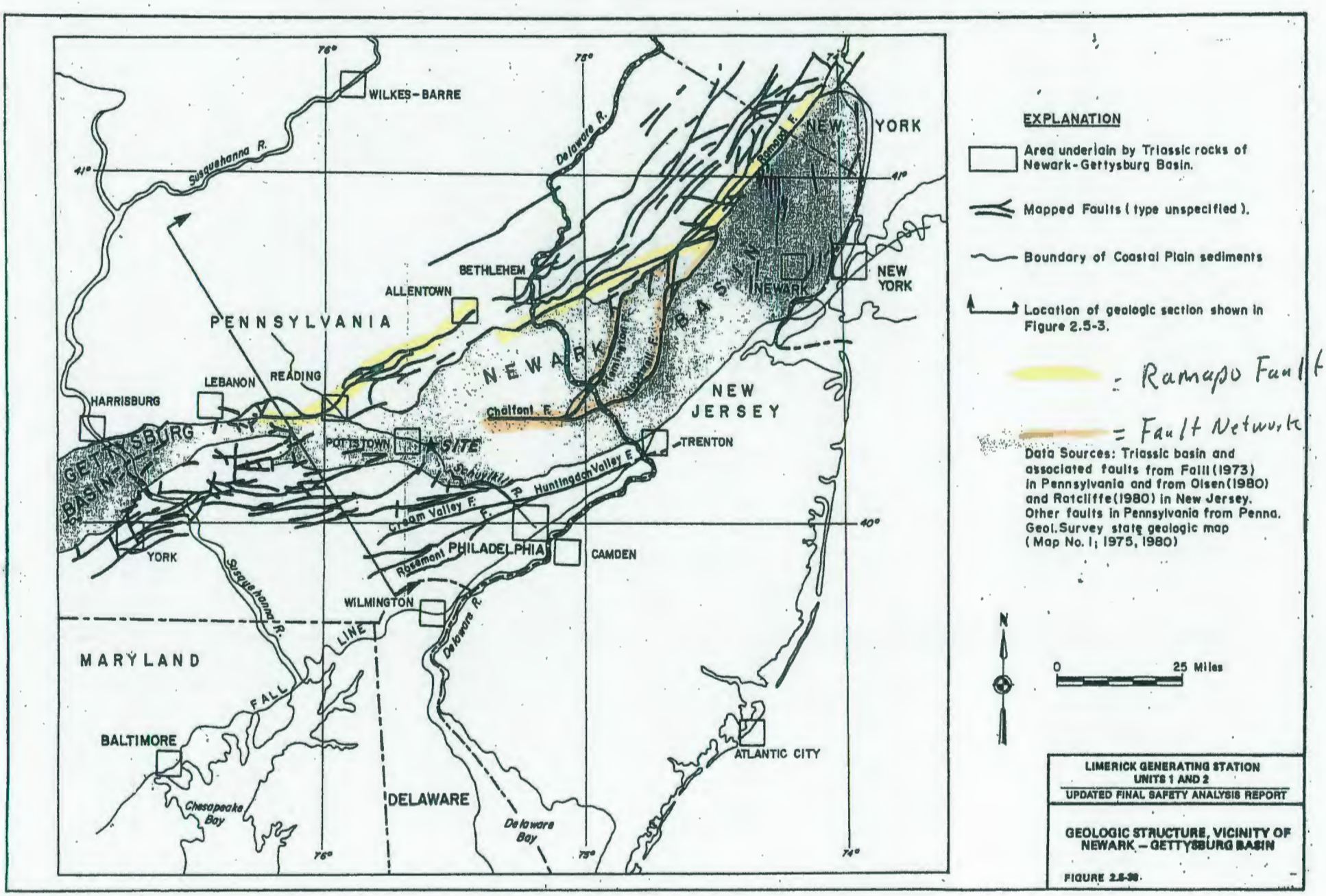
CONTENTS:

1. Deceptive NRC map omitting the Sanatoga Fault under the Limerick site
2. Deceptive NRC letter omitting the Sanatoga Fault from the description of the closest faults to Limerick
3. 1974 map showing Limerick Nuclear Plant sits on the Santoga Fault
4. 1974 map as it originally appeared in the Dames & Moore Geologic Survey
5. Copy of cover of Geologic Report submitted to Philadelphia Electric Company in 1974, discovered by local residents in the local library
6. Copy of Lorraine Ruppe's letter to the editor expressing concern over Limerick's drastically higher earthquake risks
7. Copy of Lorraine Ruppe's letter to the editor expressing concern over NRC's failure to require immediate expansion of Limerick's evacuation zone relative to increased earthquake risks.
8. Copy of Charlie and Betty Shank's letter to the editor expressing concerns over NRC's stance minimizing Limerick's earthquake risks.
9. Copy of satellite map showing the Limerick site on the Schuylkill River and the adjacent active quarry

- **NRC HAS KNOWN ABOUT THE EARTHQUAKE FAULT UNDER LIMERICK NUCLEAR PLANT, YET NRC OFFICIALS FAILED TO ACT WITH TRANSPARENCY**

- **NRC IS AWARE OF INCREASED EARTHQUAKE PROBLEMS AND LACK OF SAFEGUARDS, YET, NRC ILLOGICALLY WEAKENED EARTHQUAKE RECOMMENDATIONS OF THE FUKUSHIMA TASK FORCE.**

This Is The Deceptive Map, Sent By Mr. Rosebrook, NRC,
To A Resident Who Wanted To Know The Closest Fault To Limerick,
OMITTING THE SANATOGA FAULT UNDER LIMERICK



LIMERICK GENERATING STATION
UNITS 1 AND 2
UPDATED FINAL SAFETY ANALYSIS REPORT

GEOLOGIC STRUCTURE, VICINITY OF NEWARK – GETTYSBURG BASIN

FIGURE 2.5-3B

UNITED STATES
NUCLEAR REGULATORY COMMISSION
REGION I
475 ALLENDALE ROAD
KING OF PRUSSIA, PENNSYLVANIA 19406-1415

September 26, 2011

Lorraine Ruppe
2120 Buchert Road
Apartment # 20
Pottstown, PA 19464

Mrs. Ruppe:

This letter is response to a question you brought up to Nicole Sieller, the NRC Resident Inspector at the Limerick Generating Station during the September 22nd Limerick Licensee Renewal Meeting concerning the location of the Ramapo fault and how close it comes to the Limerick Generating Station. I spoke with you on Friday September 23rd on the phone and am sending you a copy a Geologic Structure Map from the Limerick Updated Final Safety Analysis Report which illustrates the Ramapo Fault and other known fault lines in the PA-NJ area. I highlighted the Ramapo Fault itself in Yellow (Note the fault is non contiguous on the western side) and the Ramapo fault network in Orange, which includes the Chalfont, Hopewell, and Flemington Faults which branch off the Ramapo Fault. The Chalfont Fault is approximately 9 miles from Limerick to the east. The Ramapo Fault itself is approximately 17 miles from Limerick to the northwest near Reading.

I hope this answers your question. Feel free to contact me at 610-337-5199 or Andrew.Rosebrook@NRC.gov if you have any additional questions or concerns.

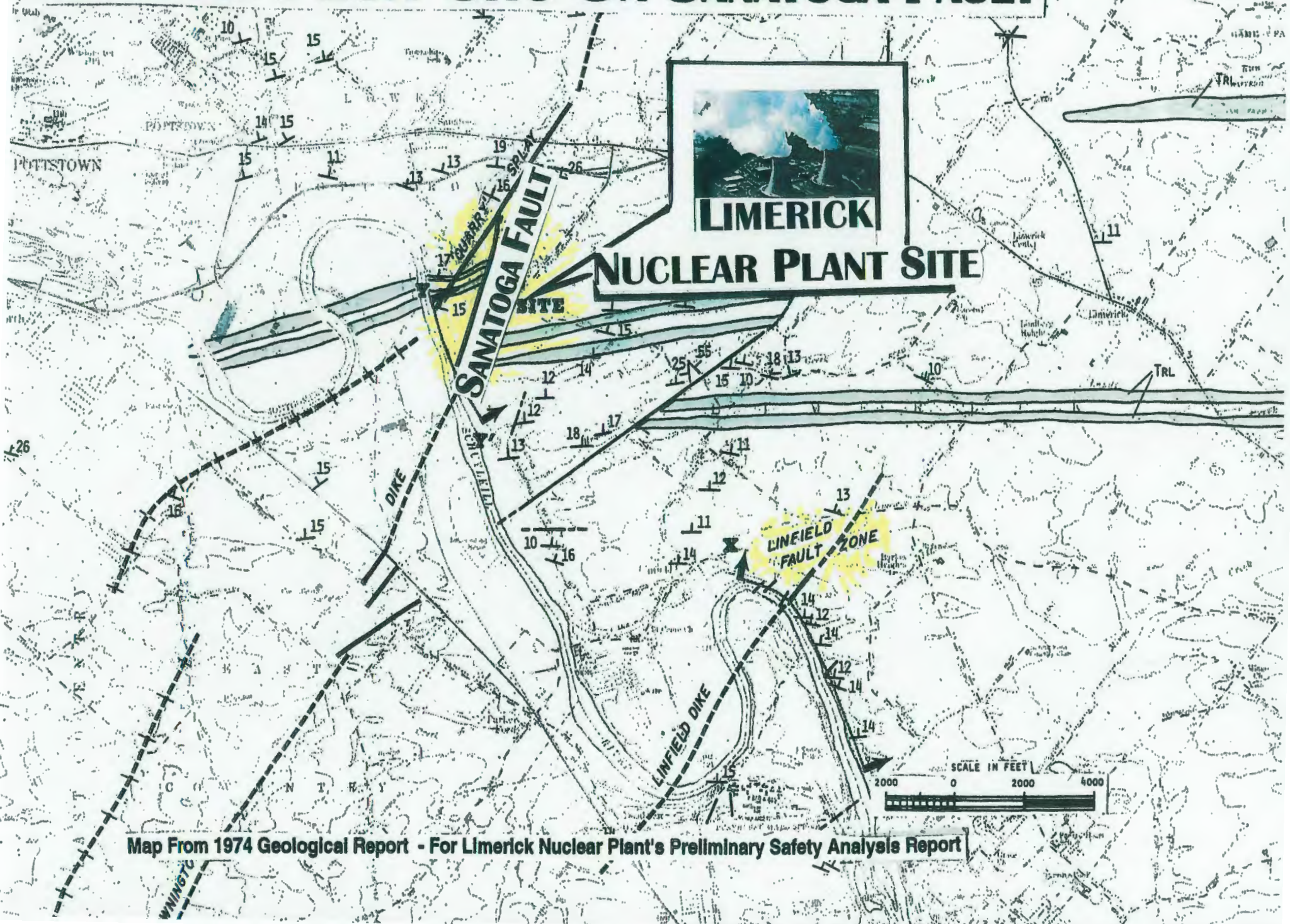
Respectfully,

A Rosebrook

Andrew A. Rosebrook
Senior Project Engineer
USNRC, Region I

Enclosure: Geologic Structure, Vicinity of Newark-Gettysburg Basin.

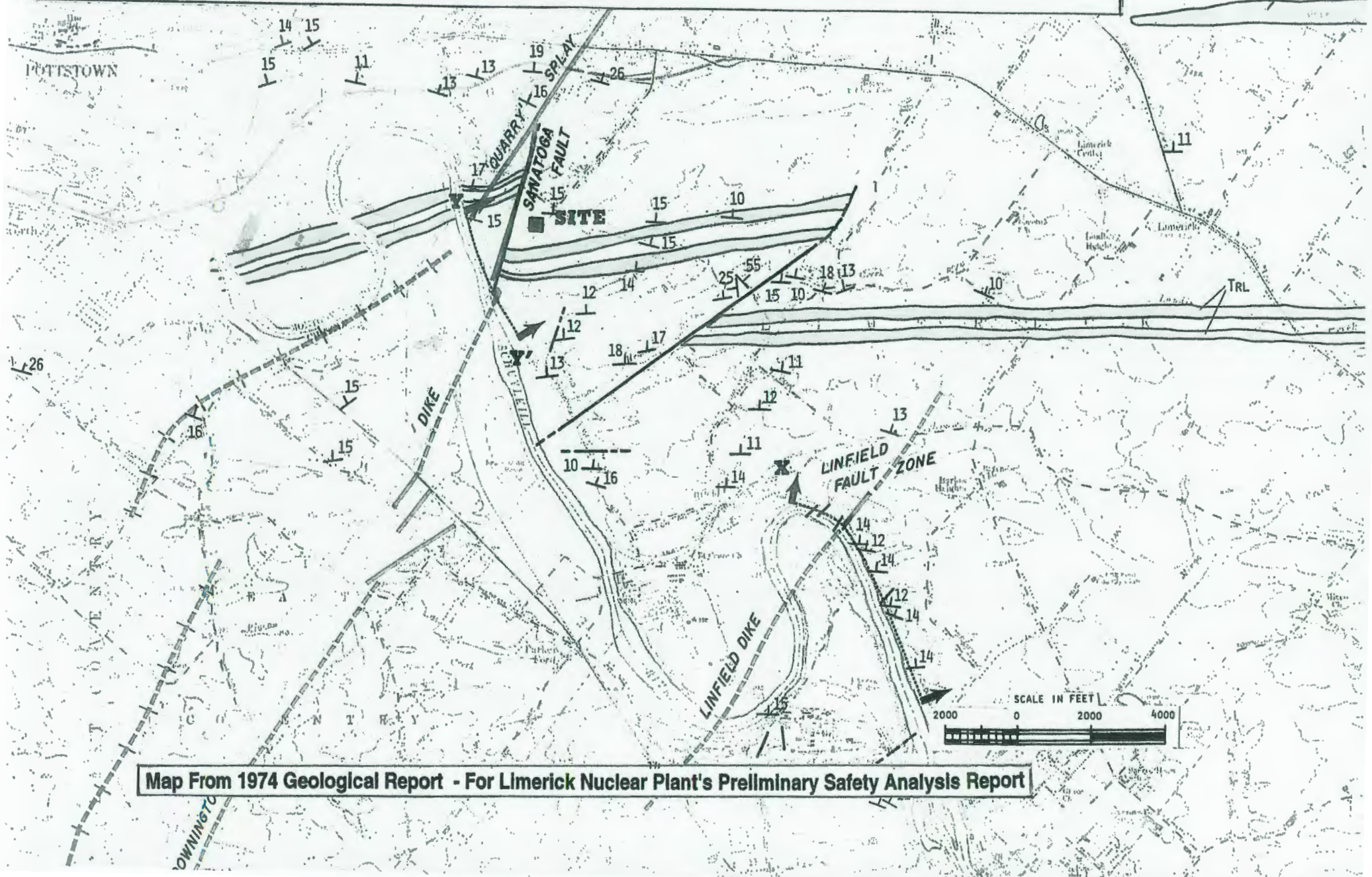
NUCLEAR PLANT SITS ON SANATOGA FAULT



Map From 1974 Geological Report - For Limerick Nuclear Plant's Preliminary Safety Analysis Report

NUCLEAR PLANT SITS ON SANATOGA FAULT

This Is The Original Map, As It Appeared In Dames & Moore's Geologic Survey Submitted To PECO In 1974. (Heading and Reference at Bottom Added By ACE)



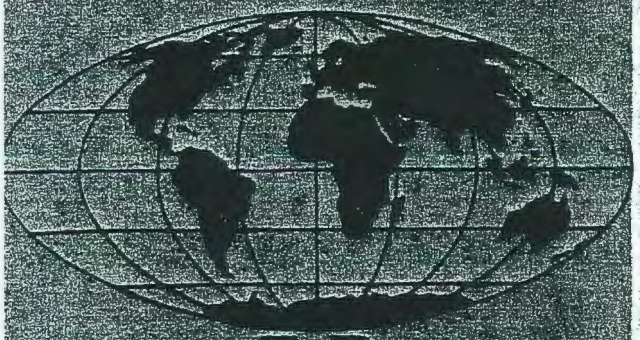
Map From 1974 Geological Report - For Limerick Nuclear Plant's Preliminary Safety Analysis Report

GEOLOGIC REPORT

LIMERICK GENERATING STATION

LIMERICK, PENNSYLVANIA

PHILADELPHIA ELECTRIC COMPANY



DAMES & MOORE

ANOTHER VIEW 2/23/12

Earthquake risks at Limerick are too high

On Nov. 9, 2011, Vaughn Shirey responded to my concerns over drastically higher earthquake risks than first thought at Limerick Nuclear Power Plant. He rejected information from the most recent study on earthquake risk reported in the Mercury and information from a Nuclear Regulatory Commission meeting I attended in May 2011. He denies a logical link between Limerick's radiation releases since Limerick started operating and skyrocketing cancer rates.

Guest Columnist

On Jan. 1 Shirey responded to my response. Instead of further addressing recent issues on earthquake risks, he attacked my credibility. It seems I hit a nerve observing that he was uninformed on the latest government and independent earthquake news and reports.

Unfortunately, Vaughn Shirey's agenda appears critical rather than inquisitive. He also attacked ACE because their new website was under construction. While claiming to seek the facts, he never visited the ACE office to review permits, other documentation, or discuss the issues. Call ACE for an appointment 610-326-2387 to review their documentation. It's quite credible. For information on nuclear power issues go to www.nirs.org, www.beyondnuclear.org, and radiation.org.

Shirey says he's a high school student. While I applaud seeking environmental truths, you rarely get that from those with a vested interest. I worry that Mr. Shirey's attitude could be an unfortunate consequence of programs like Exelon's "Nuclear 101" program in our schools. On Jan. 11, I expressed deep concerns about one-sided indoctrination of our students by polluters like Exelon.

The more we learn about earthquake risk at Limerick Nuclear Plant, the more worried I become. As we saw in Japan, earthquakes can lead to a loss of water and meltdowns in fuel pools and generators.

1. Limerick is third on the earthquake risk list.

2. Two fault lines are far too close to Limerick – Just nine and 17 miles away.

3. The Aug. 23, 2011 earthquake in Virginia jolted our region. Limerick was forced to check for damage.

4. A key Limerick "safety mechanism" might not be able to shut down after an earthquake.

5. A quality assurance engineer testified Sept. 22, 2011 that he was concerned about earthquakes because he saw substandard cement used in construction of Limerick's fuel pools that hold deadly radioactive wastes at Limerick.

6. A U.S.G.S. study released January 2012 shows earthquake risks are drastically increasing from fracking in Pennsylvania. Over 4,200 wells were drilled in Pennsylvania since 2007.

7. Fires can lead to a meltdown and could result from earthquake damage. Limerick does not follow the safest fire safety regulations.

These are facts. Earthquake risks at Limerick are too high. Some are not fixable. I and many other people looking at the growing body of evidence are convinced that the best way to avoid a meltdown is to close Limerick Nuclear Plant.

LORRAINE RUPPE
Pottstown

OPINION

Saturday, April 14, 2012

PottsMerc.com

ANOTHER VIEW

NRC has failed to protect area residents

After waiting an entire year after Fukushima, we learned from The Mercury on March 11 that the Nuclear Regulatory Commission failed to require an immediate expanded evacuation zone and improved planning for a Limerick Nuclear Plant meltdown.

NRC is shamelessly allowing Exelon to use yet another stall tactic study, jeopardizing public health and safety to protect Exelon's profits once again.

Guest Columnist

We need common sense and a more protective evacuation plan immediately, not another study. The potential for evacuation of our region because of a Limerick Nuclear Plant disaster is all too real, but the evacuation plan is not. Limerick must be closed as soon as possible to prevent a meltdown.

- NRC recommended a 50 mile evacuation zone in Japan, but for Limerick it's still 10 miles. Why? Under the 10 mile rule, Exelon can get away with the idea that evacuation is possible; but not if the zone is expanded to 50. Limerick should have to close.
- Over eight million people are within 50 miles of Limerick. There are 1,914 schools and 176 hospitals. Evacuation chaos would be indescribable as people are subjected to radioactive plumes during evacuation, with literally not enough road space to evacuate safely.
- Philadelphia is 21 miles downwind, downstream from Limerick, but not in its evacuation plan.
- Limerick's emergency plan still irresponsibly doesn't account for wind patterns and population. An estimated one million people now live downwind from Limerick.
- NRC is choosing to ignore the 183 percent population increase since 1980 under Limerick's original permitting.

Meltdown threats at Limerick are increasing from natural disasters like earthquakes, aging, and terrorists attacks.

- Fukushima meltdowns prove "so called" redundant safety systems fail.
- August 23, 2011 a Virginia earthquake caused Limerick to check for damage. Two faults are just nine and 17 miles from Limerick.
- A January 2012 USGS study showed fracking causes earthquakes. Fracking is drastically increasing in Pennsylvania as 4,200 natural gas wells were approved in Pennsylvania since 2007.
- Limerick still isn't protected against terrorist planes or missiles, nor completely protected against cyber attacks.
- In 2011, five nuclear plants in U.S. lost primary power due to earthquakes or extreme weather events such as tornadoes, hurricanes and flooding.

NRC's grotesque dereliction of responsibility related to Limerick relicensing was challenged November 2011 by the National Resources Defense Council. NRDC filed a petition to intervene for circumventing safety analysis requirements, citing Limerick's obsolete accident mitigation study.

While radiation would travel a long distance, we who are closest would get the brunt of radiation exposure. Better emergency planning could minimize radiation exposures during evacuation, but only closing Limerick would eliminate risk of meltdown.

LORRAINE RUPPE
Pottstown

OPINION

ANOTHER VIEW

Nuclear plant safety should be top concern

Staff writer Evan Brandt did a great job of presenting new issues in "On the Fault Line" in The Mercury on May 20. The Mercury laid the groundwork for what should be the starting point for a comprehensive, updated safety analysis of the Limerick nuclear plant. Although the Nuclear Regulatory Commission should be our watchdog, it stands squarely in the way of crucial new scrutiny.

Guest Columnist

NRC's stance is not surprising. In 1981, before Unit 1 was completed, LEA (the predecessors of ACE) filed a suit on behalf of the public against the Atomic Energy Commission, predecessor of NRC. Even back then, it had too cozy a relationship with PECO (now Exelon). The Mercury aptly titled the report of that story, "David Against Federal Goliath" (Sept. 28, 1997). In it, LEA charged Limerick with: 1) violating the National Environmental Policy Act and 2) not considering safety-enhancing nuclear design alternatives for Limerick. The suit dragged on for nine years, but LEA won its fact-based case in federal court. The judge's ruling was a major embarrassment for the AEC, but it was too late for real safety. Limerick was already constructed.

We are very concerned about the design flaws of Limerick's aging GE Mark II Boiling Water Reactors. Ordinary reactor operations can produce an internal seismic reaction similar to a major earthquake, causing possible catastrophic containment failure. An accident in 1972 at a West German plant was the first sign of that trouble: the forces ruptured the wall of the wet well.

GE notified PECO of the reactor problems in 1974. Other nuclear plants sued GE, or were scrapped, but not Limerick. PECO braced the reactors with expensive engineering and construction work, passing the new costs onto their ratepayers. So, after being promised that Limerick's energy would be too cheap to meter, ratepayers were burdened with monumental increased costs while PECO raked in huge profits (Phila. Inquirer August 13, 1984). We worry about why a safety test for Limerick's GE Mark II reactor and NRC's response to it are both missing from one of PECO's Final Analysis Safety Report volumes in the library.

We know that an earthquake triggered Fukushima's multiple meltdowns by causing loss of power and loss of cooling water. The Aug. 23, 2011 Virginia earthquake caused tremors at Limerick. Limerick is ranked third on our nation's earthquake risk list. Despite all these facts coupled with quarry blasting on the border of Limerick's property and possible earthquake risks from fracking in Pennsylvania, the NRC still resists updating its safety analysis for the Limerick Nuclear plant.

When a concerned mother requested information about the nearest faults to the nuclear plant, NRC sent her one of the maps shown on The Mercury's front page on May 20, highlighting the Ramapo and Chalfont Faults. Following that, our own research at the Pottstown Library, led us to PECO's 1974 Geological Survey map. It highlighted the Sanatoga Fault right under the plant site. That map was also featured on the Mercury's front page.

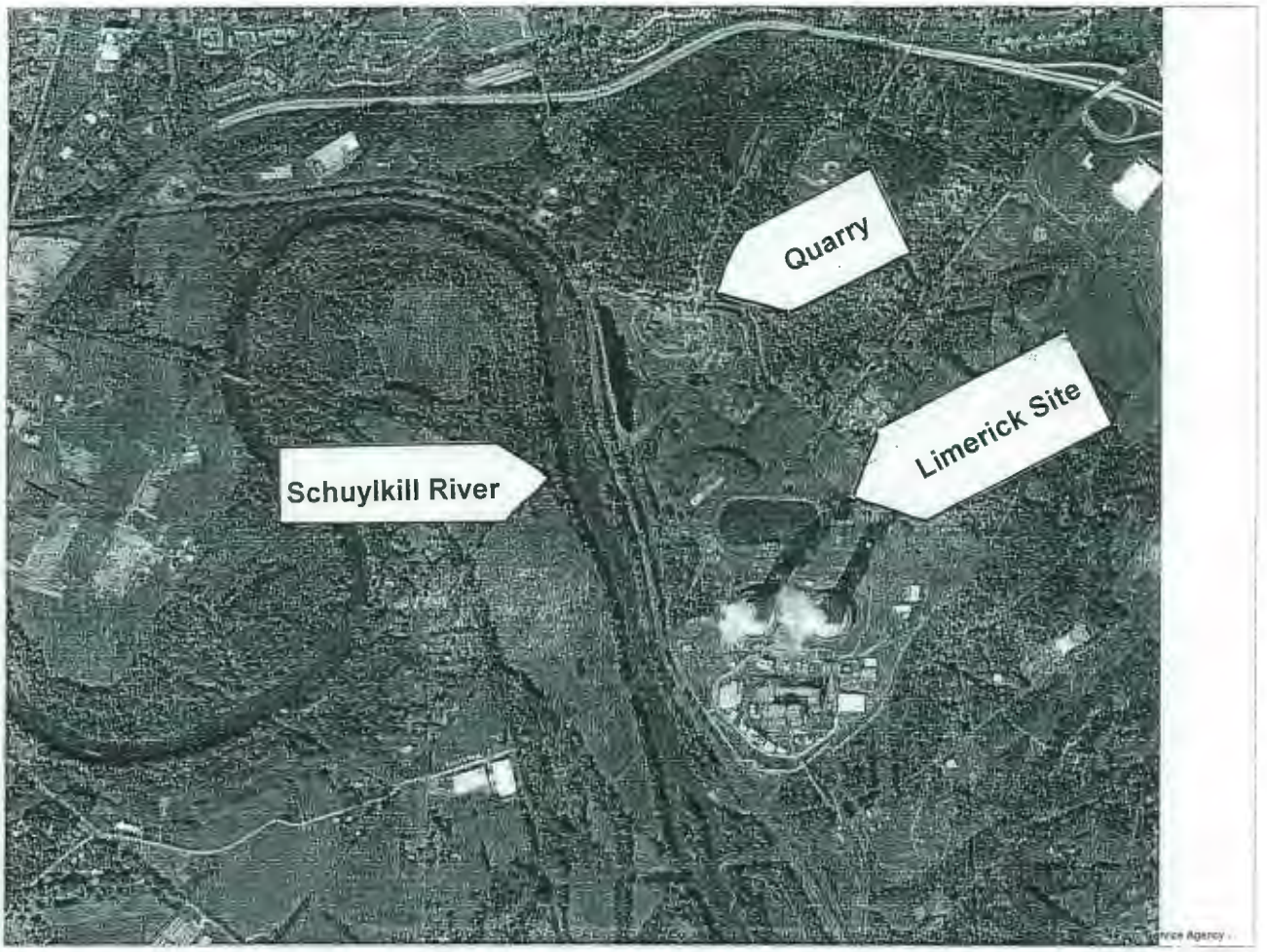
We showed the 1974 map to NRC officials at their public meeting on April 18. Each of them denied ever having seen it before. NRC says that earthquake risks were assessed before Limerick construction began. However, Limerick's first reactor was rolled onto the site in 1972, but the seismic study was not completed until 1974.

We feel that, because of Limerick's troubled history, plus evolving understanding of earthquake risks and their relationship to catastrophic events, the plant should shut down before it melts down.

CHARLIE and BETTY SHANK
Pottstown

To see all the details that are visible on the screen, use the "Print" link next to the map.

Google



ACE Clarification:

Limerick Nuclear Plant Is Located On The Schuylkill River, Bordered By An Active Blasting Quarry.

ATTACHMENT

FOR ACE 3-31-14 LETTER TO NRC CHAIRMAN ALLISON MACFARLANE

AEC SHOULD HAVE CHOSEN AN ALTERNATIVE SITE FOR LIMERICK NUCLEAR PLANT

HOWEVER AEC'S DRAFT ENVIRONMENTAL STATEMENT SHOWS THAT COST CONSIDERATIONS PRE-EMPTED PUBLIC SAFETY CONCERNS

- The Atomic Energy Commission's 1972 DRAFT ENVIRONMENTAL STATEMENT shows that AEC knew in 1972 that the site chosen for Limerick Nuclear Plant was in an area that had experienced earthquakes.

- AEC considered alternative sites, however chose the Limerick site due to economic considerations, downplaying the earthquake risks,.

  - **AEC did not choose an alternative site, due to what Philadelphia Electric considered:**
    - ✓ **Irrecoverable Costs**
    - ✓ **New Site Capitol Costs**
    - ✓ **Purchase Power Costs Due To Construction Delay**

  - **Costs Were Based On Philadelphia Electric (PE) Estimates See Attached Table 12.4**
    - ✓ **PE Saved An Estimated $201 to $236 Million In Projected Losses**
    - ✓ **That decision costs PE/PECO ratepayers the lions' share of $6.8 Billion Reported In 1997**

<u>AEC's 1972 Environmental Statement Downplays Possible Earthquake Hazard By Failing to Mention the Sanatoga Fault Under the Limerick site.</u>

DRAFT ENVIRONMENTAL STATEMENT

by the

DIRECTORATE OF LICENSING

UNITED STATES ATOMIC ENERGY COMMISSION

related to the

LIMERICK GENERATING STATION
UNITS 1 AND 2

PHILADELPHIA ELECTRIC COMPANY

Docket Nos. 50-352 and 50-353

Issued: December 1972

12.3.3 Alternative Site

Abandonment of the Limerick site in favor of one of the alternative sites would entail a two year (minimum) delay and numerous additional monetary and environmental costs. The monetary penalty of an alternate site would be composed mainly of three factors: a) irrecoverable costs of site preparation activities at the Limerick site, b) new site capital costs greater than original Limerick site capital costs, and c) purchase of power during the delay period necessitated by starting with another site. The applicant's estimate of these economic penalties are given in Table 12.4.

The environmental impact of station construction at an alternative site selected now would be greater than at the Limerick site since it would be in addition to site preparation activities which have already occurred at the Limerick site.

An assessment of the environmental impact of station operation at an alternative site would require a more thorough analysis of the ecological community at a specific site. Operation of the station at the Limerick site is acceptable ecologically.

The staff concludes that on balance the additional monetary and ecological costs associated with relocating the station at an alternative site are greater than any benefits to be gained by this action.

Table 12.4 **Economic penalty for alternative site**

	Penalty compared with Limerick (millions of dollars)
Irrecoverable costs	60
Additional capital costs	45–80
1976 and 1977 energy	96
Total penalty	201–236

2.4.2 Regional geology and assessment of possible earthquake hazard

The site is in an area where earthquake frequency is moderate; however, no earthquake to our knowledge has ever been severe enough to cause more than trivial damage. Nevertheless, to assess the possible hazard from earthquakes, an examination of the geology of more than just the Triassic Basin, which in the plant area is only about 12 miles wide, will be necessary.[11-18]

The Triassic Basin forms part of the Piedmont Physiographic Province, which is divided into upland and lowland sections. The upland section is underlain by metamorphosed sedimentary and crystalline rocks of Paleozoic and Precambrian age. The rocks are relatively resistant to erosion and support an uneven hilly surface. The higher hills are capped by Cambrian quartzites and by Precambrian crystalline rocks; broad valleys characterize the areas underlain by limestone and calcareous shale. The less rugged lowland section to the north and west of the Piedmont uplands is formed largely on relatively soft shales and sandstones of Triassic age. Ridges in the Triassic lowland trend northeast-southwest along the strike of the more resistant bedrock formations. Higher and more rugged terrain exists where these formations have been intruded by diabase dikes and sills.

The peneplain surface cut on the Precambrian and metamorphosed early Paleozoic rocks of the Piedmont slopes south and east where it is overlain by the sand, silt, and clay of the Coastal Plain Province. To the north, the Piedmont Province is bordered by the Valley and Ridge Province, which is underlain by moderately metamorphosed Paleozoic sediments, and by the Reading Prong of the New England upland, which is underlain by Precambrian crystalline rocks.

The Precambrian rocks are much altered by igneous intrusion and by deformation. However, these deformations occurred long ago, and there is no remnant of the forces which caused them. The early Paleozoic rocks of the Piedmont are also much deformed by orogenies which date from the early and middle Paleozoic. Like the later Paleozoic rocks of the Valley and Ridge Province, they were again deformed at the close of the Paleozoic in the Appalachian Revolution, some 200 million years ago, but these forces likewise appear to have been dissipated at that time, and there is no longer any movement on the large faults then formed.

During the late Paleozoic and perhaps during the early part of the Triassic, the mountains formed during the Appalachian Revolution were worn down to base level. Indeed, the Triassic red beds may be regarded as part of the later phases of this peneplanation.

During the Triassic, this partial peneplain was warped and faulted to form the basins in which the red beds were deposited and to produce the higher land from which these sediments were derived. There was some igneous activity during this period of deposition, and basalt lavas were poured out on the surface. After the deposition of the red beds, faulting continued as did the emplacement of diabase dikes and sill, which cut the red beds. The dikes in particular continued to be intruded after the faulting had ceased. Evidence for this is the observation that some of the faults were intruded by the dikes, which must have come after the faulting, since they are not displaced by it. The Chalfont fault, the closest of these major faults, passes 9 miles to the northeast of the site. The maximum throw on this fault in the general area of the site is 6500 ft in Bucks County, Pennsylvania, but the throw decreases to 3000 ft or less nearer the site. This fault extends to the northeast through New Jersey, where the maximum vertical displacement is some 10,000 ft. This is a major structural element, but there has been no movement along this fault, as shown by the unfractured dikes, since the close of the Triassic some 140 million years ago. There are also several smaller faults closer to the site. The nearest approach of a fault trace to the site is 1300 ft west; its vertical displacement is 350 ft. The fault plane is occupied by a Triassic diabase intrusive which is part of the Downingtown dike and which has not been affected by the movement on the fault. Another fault with an apparent vertical movement of 350 ft passes 2800 ft south of the plant area. A third fault, about 2 miles southeast of the site, shows vertical movement of 130 ft. There are also numerous small faults in the area with displacements of less than 2 ft, but these are of no importance.

Where any of these Triassic faults, or any of the faults in the older rocks of the Piedmont, pass under the unconsolidated deposits of the coastal plain, the coastal plain deposits are not displaced. Clearly, these faults have been inactive for a very long time. There are, however, small earthquakes in the general region, most of them in the Piedmont Province. Some minor shocks have occurred in a northeast-southwest trend along the fall zone, which is the dividing line between the Piedmont Province and the Coastal Plain. The nearest destructive earthquakes were in Charleston, South Carolina, over 500 miles away, and in the St. Lawrence River Valley, 350 miles away, so that their intensity at the site was negligible. There have, however, been numerous minor earthquakes much nearer to the site.

The most important of these relatively minor earthquakes took place near Wilmington, Delaware, in 1871, some 30 to 40 miles from the site. The intensity at the epicenter was VII on the Modified Mercalli scale. An earthquake intensity of VII can slightly damage,

but will not destroy, buildings of ordinary construction but presents no threat to well-constructed buildings like a nuclear power plant. This shock may have been felt as far away as the site but would present no hazard at this distance. The quake is believed to have been associated with rock structures in the Piedmont, possibly with earth adjustments along the fall line.

A second earthquake occurred at Wilkes-Barre in 1954; this is a coal-mining area, about 65 miles north of the site. At the epicenter the intensity was VII, and hundreds of homes were damaged in a five-block area. Sidewalks were pushed upward with a heaving motion and then collapsed. Two days later there was a second shock much like the first, and more damage resulted. The origin of the shocks was at shallow depth, as the intensity died out rapidly away from the epicenter. There is a possibility that the shock was due to a cave-in in one of the mines. The shock would not have been felt at the site.

A third earthquake in the general area of the site was at or near York, 60 miles southwest of the site, in 1889. The maximum intensity at the epicenter was VI. No serious damage was reported. The shock was felt throughout northeastern Maryland, northern Delaware, and southeastern Pennsylvania, from Trenton on the north to Hagerstown, Maryland. Although it would have been felt at the site, the intensity would have been too low to cause any damage.

In view of the foregoing, and after a study of all the evidence, the design basis earthquake (the strongest shock which would not damage the station) was put at a ground acceleration of 0.15 g, and the operating basis earthquake (the strongest shock which would not require the station to shut down) was put at 0.075 g.[19] The design basis earthquake is roughly equivalent to the intensity of VII at the epicenter of the 1871 Wilmington, Delaware earthquake. This design appears conservative and is equivalent to the anti-seismic design of most nuclear power reactors in the northeastern United States.

2.5 HYDROLOGY

2.5.1 Groundwater

Groundwater is a minor resource in the area around the station and, in general, in the lowlands underlain by the Triassic rocks.[20-25] These red beds hold water only in joints and fractures. Except very locally where the rock is much shattered, wells yield less than 100 gpm. Groundwater accounts for only about 3% of the total

industrial and commercial use in the region. Numerous domestic wells, however, extract small quantities of water from the Triassic strata, and there are about 75 small domestic wells within a 1-mile radius of the Station site.

Groundwater occurs largely under water table conditions, although its movement along joints and fractures is complex and locally the deeper groundwater may be confined under artesian conditions. The complexity of the groundwater movement makes mapping the water table difficult, but in general such a map is a subdued replica of the topography. Groundwater in the station area moves very slowly in the direction of the Schuylkill River. There is no danger of contaminating the groundwater resources of the area by even a major accident at the Station.

2.5.2 Surface water

2.5.2.1 Schuylkill River

The watershed of the Schuylkill River lies entirely in southeastern Pennsylvania.[26] The basin is about 80 miles long and 25 miles wide and has an area of 1909 square miles above its junction with the Delaware at Philadelphia. The station site is on the northeast side of the river, about 49 river miles upstream from the Delaware and 4 miles downstream from Pottstown (see Fig. 2.8). Most of the rocks underlying the watershed of the Schuylkill are of low permeability and store little groundwater. The Pleistocene ice sheets did not come as far south as the headwaters of the Schuylkill; therefore, its valley lacks the highly permeable deposits of sand and gravel which underlie the northern parts of the watershed of the Delaware River and much of the Hudson River. For this reason the river shows marked variations in flow. For example, the instantaneous low flows for the Schuylkill River at Pottstown were only 87, 97, 117, and 107 cfs for 1930, 1931, 1932, and 1933, respectively. In 1951 the instantaneous low flow was 461 cfs. All of these low flow readings were in September or October and represent the extremes of the period of record from 1927 to 1969. Flow frequency curves are shown in Figs. 2.9 and 2.10. Upon the completion of the Blue Marsh Dam, the low flows will be augmented by 65 cfs, but the general pattern of flow will not be greatly changed. The average consumptive water requirements of the station are 54 cfs, and in view of the quantities already allotted to other users both upstream (52.6 cfs) at Pottstown and downstream (471 cfs), principally in Philadelphia, the Schuylkill is already overallocated at times of low flow. The applicant plans to make up the deficiency with water imported from the Delaware River. The proposed route for this water is shown in Fig. 2.11.

ATTACHMENT

FOR ACE 3-31-14 LETTER TO NRC CHAIRMAN ALLISON MACFARLANE

ACE CHALLENGES TO INFORMATION PROVIDED BY NRC OFFICIALS RELATED TO INCREASED EARTHQUAKE RISKS THAT COULD TRIGGER MELTDOWNS AT LIMERICK NUCLEAR PLANT

NRC Responses to ACE Questions and Concerns:

- **Reveal How One NRC Official After The Other Down-Played and/or Covered Up Absolutely Unacceptable Earthquake Risks at Limerick Nuclear Plant.**
- **Demonstrate That NRC Has No Intention of Acknowledging or Reducing Documented and Increasing Earthquake Risks at Limerick Nuclear Plant.**

NRC Comments Were Taken From E-Mail Responses To ACE From The Following NRC Officials:

October 2, 2012

Paul Krohn, PE, Chief, Projects Branch 4 Division of Reactor Projects
E-mail Response to ACE Questions Raised 9-16-12

May16, 2013

Mel Gray, Chief, Branch 4, Division of Reactor Projects, NRC Region 1 Office,
E-mail Responses to ACE Concerns Submitted March, 2013.

December 9, 2013

Fred Bower, NRC Chief Projects Branch 4, Region 1
E-mail Responses to Shanks' 11-4-13 Questions and Concerns

October 2, 2012

Paul Krohn, PE, Chief, Projects Branch 4 Division of Reactor Projects

E-mail Response to ACE Questions Raised 9-16-12

ACE's 9-16-12 e-mail requested information concerning a "new seismic study" for Limerick Generating Station, Units 1 and 2.

Mr. Krohn's Response:
I assume you are referring to the seismic reevaluation that will be performed in response to NRC staff recommendations from the Near-Term Task Force (NTTF) review of the accident at the Fukushima Dai-ichi nuclear facility. By letter dated March 12, 2012 (ADAMS Accession No. ML12053A340), the NRC issued a Request for Information (RFI) to nuclear power plant licensees, pursuant to 10 CFR 50.54(f), regarding Recommendations 2.1 (seismic and flooding evaluations), 2.3 (seismic and flooding walkdowns), and 9.3 (emergency preparedness communication and staffing) of the NTTF review of insights from the Fukushima Dai-ichi accident. With respect to the seismic portion of Recommendation 2.1, the RFI requested licensees to perform a reevaluation of the seismic hazards at the site using present-day NRC requirements and guidance. Specific details regarding the reevaluation of seismic hazards are contained in Enclosure 1 to the letter dated March 12, 2012.

Our Responses:

- **This process if flawed. NRC's industry-driven, self-serving checklist mentality is jeopardizing safety of the entire Greater Philadelphia Region.**
- **NRC has amended the original NTTF, so that NRC regulations give the appearance of attention to the new seismic risks since Fukushima, yet is allows loopholes for Limerick's extraordinary seismic risks to be ignored.**
- **Now, in 2014, three years after Fukushima, still nothing has been done to minimize seismic risks at Limerick Nuclear Plant.**
- **In 2008, the USGS updated its assessment of seismic threats for Limerick, concluding that because Limerick's earthquake risk was considered low when its construction began, it now needs to be updated in light of new understanding of earthquake risks on the East Coast, yet NRC is dismissing newly understood earthquake risks for the entire East Coast.**
- **Within 1 year of Paul Krohn's response, on 10-23-13, Fred Bower, NRC Chief Branch 4 informed us that no further audit is necessary in terms of seismic walkdowns for Limerick Nuclear Plant.**

Paul Krohn's Response:
In response to your question regarding who will do the study, for Limerick, the study will be done by Exelon (and/or its consultants).

Our Response

NRC's seismic requirements have been weakened to such a degree that Exelon's biased, self-serving seismic report for Limerick Nuclear Plant satisfies NRC's criteria. NRC's compliance standards are obviously so low that they allow NRC to ignore the extraordinary seismic risks at Limerick Nuclear Plant.

Paul Krohn's Response:
Regarding the interface between Limerick seismic studies and NTTF activities, Mr. Chris Gratton, Senior Project Engineer, Nuclear Reactor Regulation, is an appropriate contact (301 415-1055).

Our Response:

Suggesting that we speak on the phone, off the record, not in writing, fails to result in documentation that we are seeking. Phone conversations allow for misinterpretations. We object to NRC's repeated use of the phone conversation tactic. We believe it is meant to avoid accountability.

Paul Krohn Response:
Your email also mentioned that earthquake faults in the vicinity of the Limerick site must be included in the seismic evaluation.

Our Response:

NRC completely ignored our request by failing to do an honest updated seismic evaluation for Limerick Nuclear Plant. Instead, one NRC official after the other, including Mr. Krohn, has down-played and/or covered-up the absolutely unacceptable earthquake risks at Limerick Nuclear Plant.

Paul Krohn Response:
The licensing bases for existing nuclear power plants considered historical data at each site (e.g., faults, seismic activity).

Our Response:

AEC/NRC never honestly considered the actual earthquake risk, historically or currently, as evidenced in AEC's December 1972 Draft EIS for Limerick. Limerick's fault is just as vulnerable and unpredictable as North Anna's fault. AEC declared both not capable.

Paul Krohn Response:
Notwithstanding, as discussed in Enclosure 1 to the NRC's letter dated March 12, 2012, licensees will be using present-day NRC requirements (i.e., U.S. Code of Federal Regulations, Title 10, Energy, Part 100, "Reactor Site Criteria") and guidance with respect to characterizing seismic hazards for their reevaluations.

Our Response:

NRC's regulations are meaningless because they allow such enormous seismic risks at Limerick Nuclear Plant. NRC characterizations have repeatedly been proven erroneous.

Paul Krohn Response:
As such, all licensees in the central and eastern United States will be using a new seismic source model (NUREG 2115) developed jointly by industry and the NRC. This new seismic source model was developed with input from many geologic experts and considered all relevant geologic studies in the central and eastern United States.

Our Response:

When industry is at the table to develop regulations, the public's safety is abandoned. Geologists and scientists outside the nuclear industry disagree with those models used by the nuclear industry. NRC's new seismic source model fails to take seriously the seismic hazardous we really have in the Greater Philadelphia Region.

Paul Krohn Response:
Your email also raised concerns regarding the risks of earthquakes being triggered by certain activities (quarry blasting, drilling of gas wells). The focus of the seismic reevaluation is on the expected seismic ground motion levels for the site from potential earthquakes that are large enough to impact a nuclear power plant. Smaller earthquakes generated from blasting and drilling of gas wells are not expected to have a significant impact on well-engineered facilities such as nuclear power plants.

Our Response:

- **Evidence presented at NRC's 9-22-11 public hearing proves that Limerick Nuclear Plant is not well engineered.**
- **Prediction models do not allow for a worst case scenario.**
- **Common sense suggests that it wouldn't take a large earthquake to disrupt the miles of buried deteriorating pipes and cables under Limerick Nuclear Plant that are vital to ensuring the constant supply of power and water to avoid meltdowns.**
- **USGS documented that fracking triggers earthquakes. NRC can't predict how many or know how significant the earthquakes might be from any of the 4,200 gas wells approved in PA by 2007, or from massive fracking in surrounding states.**
- **After Fukushima, NRC should have learned that predictability models don't work to protect the public.**

Paul Krohn Response:
Your email also raised concerns that "specific deficiencies and structural flaws" must be included in the seismic evaluation. If the reevaluated ground motion levels are higher than the original plant's design ground motion levels, then licensees will evaluate the impact of the reevaluated ground motion levels on their plant systems, structures and components through a risk evaluation.

Our Response:

- **Evidence proves that Limerick has "specific design deficiencies and structural flaws" that obviously have not been included in Exelon's self-serving seismic evaluation.**
- **NRC has not addressed our concerns about substandard cement in Limerick's reactors and spent fuel pools, built directly on top of fault fractures.**
- **Errors were documented 9-22-11. NRC was made aware that there were failures, deviations, and non-conformances in the construction of Limerick that now need to be re-evaluated. These can't be fixed after the fact. There is no way to make Limerick safe.**

May 16, 2013

Mel Gray, Chief, Branch 4, Division of Reactor Projects, NRC Region 1 Office, E-mail Responses to Questions and Concerns Submitted by ACE March, 2013.

Mel Gray, Chief, Branch 4, Division of Reactor Projects, NRC Region 1 Office, finally e-mailed responses 5-16-13 to concerns ACE submitted to NRC in March, 2013.

Mel Gray Response:
Limerick units currently meet all seismic requirements imposed by NRC.
Our Response: Considering the magnitude of Limerick's earthquake risks, NRC's seismic requirements are grossly insufficient.

Mel Gray Response:
NRC estimates of the potential for earthquake hazards for some nuclear power plants may be larger than previous estimates. However, NRC has determined that currently operating plants remain safe.
Our Response:
NRC has provided no actual proof that Limerick Nuclear Plant is safe from earthquake hazards. Worse, NRC requires no actual proof. Based on the evidence we have collected, Limerick Nuclear Plant's earthquake hazard risk is enormous. The USGS study actually proves that Limerick's earthquake risks are dramatically greater than originally estimated.

Mel Gray Response:
Recent data warrants further study and analysis under NRC's Generic Issue Program.
Our Response:
The problem is that the Generic Issue Program does not begin to address the degree of Limerick's enormous earthquake hazard risks.

Mel Gray Response:
The objective of the Generic Issue (GI) 199, "Implications of Updated Probabilistic Seismic Hazard Estimates in Central and Eastern U.S. on Exiting Plants," was to perform a conservative, screening-level assessment to evaluate if further investigations of seismic safety for operating reactors in the central and eastern US are warranted, consistent with NRC directives.
Our Response:
NRC acknowledges probabilistic seismic hazard problems exist for Eastern U.S., yet NRC to this day, has never truly addressed worst-case scenario assessments at Limerick Nuclear Plant. Limerick's earthquake risks cannot be considered generically, when the USGS says Limerick is in an ACTIVE earthquake region, and its reactors and fuel pools are directly on top of fault fractures. Limerick doesn't need further investigation of seismic safety. Risks are gigantic and obvious. Limerick needs to be closed now to prevent meltdowns triggered by an earthquake.

Mel Gray Response:
Results of the GI-199 safety/risk assessment should not be interpreted as definitive estimates of plant-specific seismic risk because some analyses were conservative making the calculated risk higher than in reality.
Our Response:
This absurd dangerous loophole ignores actual risks at Limerick.

Mel Gray Response:
The nature of the information used (both seismic hazard data and plant-level fragility information) make these estimates useful only as a screening tool.
Our Response:
Both seismic hazard data and plant-level fragility information should have closed Limerick down. Instead, NRC is dismissing Limerick's risks, jeopardizing millions of people unnecessarily, based on subjective and biased conclusions. Data and fragility information imply that objective markers exist that NRC is choosing to ignore.

Mel Gray Response:

Further actions to address the GI-199 issues are being taken as part of the regulatory actions by the NRC's Japan Lessons-Learned Project Directorate.

Our Response:

The Fukushima disaster happened on March 11, 2011. Yet, 3 years later, to date, NRC has taken NO ACTION. It is beyond negligent for NRC to have given nuclear facilities 6 years to complete just a "study" at a high-risk nuclear plant like Limerick. It's even worse, for NRC to be looking for ways to ignore risks and avoid action.

Mel Gray Response:

Licensees have been requested, pursuant to 10 CFR 50.54(f), to perform a re-evaluation of the seismic hazards at the site using present-day NRC requirements and guidance.

Our Response:

It defies logic to ask Exelon to re-evaluate Limerick's seismic hazards, when Exelon has a vested interest in minimizing Limerick's earthquake risks.

Mel Gray Response:

Small magnitude earthquakes have had little effect on well-engineered structures such as nuclear power plants.

Our Response:

The evidence shows that Limerick does NOT have well-engineered reactors or fuel pools. There is no proof that even small earthquakes won't disturb the miles of vital inaccessibly aging and deteriorating underground pipes and cables buried under Limerick, which are necessary to prevent meltdowns.

Mel Gray Response:

All currently operating nuclear power reactors, including the Limerick Generating Station, are designed to withstand the effects of natural phenomena, such as earthquakes.

Our Response:

A body of evidence related to Limerick shows that statement is NOT true.

Mel Gray Response:

NRC requires safety-significant structures, systems, and components be designed to take into account:

a. The most severe natural phenomena (earthquakes) historically reported for the site and surrounding area. The NRC's regulations require additional design margin be added to account for uncertainties due to a limited historical data record;
b. Appropriate combinations of the effects of normal and accident conditions with the effects of the natural phenomena; and
c. The importance of the safety functions to be performed.

Our Response:

- ✓ **During Limerick construction there were errors, failures, deviations, and non-conformances which NRC requirements fail to take into account.**
- ✓ **Historically reported earthquake data to determine Limerick's risk is moot after the 8-23-11 Virginia earthquake jolted Limerick.**
- ✓ **We learned that NRC had no intention of attempting to inspect underground infrastructure at Limerick after the Virginia quake jolted Limerick. Miles of pipes and cables buried under Limerick are difficult, if not impossible, to actually inspect. There is no proof that other damages did not occur in other areas of the site.**
- ✓ **NRC can't guarantee that any structure systems or components will work as intended. On 8-23-11, Limerick's seismic monitors were inoperable when the quake hit Limerick. Exelon had to rely on the USGS for conformation. What else wasn't working?**

Mel Gray Response:

NRC continues to monitor the safety of all nuclear power reactors. This effort includes a request for reactor licensees to re-evaluate seismic hazards as part of the NRC-required actions following the March 2011 Fukushima accident.

Our Response:

To date, 3 years later, NO meaningful changes have made Limerick Nuclear plant safer. NRC's monitoring of Exelon's data to assess Limerick's safety from earthquake risks defies all logic and reason. In fact, no monitoring, no study, no evaluation or assessment can reduce the possibility of a catastrophic meltdown at Limerick Nuclear Plant.

December 9, 2013

Fred Bower, NRC Chief Projects Branch 4, Region 1

E-mail Responses to Shanks' Questions 11-4-13 Questions and Concerns

- 11-4-13 - We e-mailed Fred Bower, NRC Chief Projects Branch 4, Region 1, to ask if Limerick had been included in the seismic hazard walkdown audit associated with the Near-Term Task Force Recommendation 2.3 that NRC requested March 12. 2012. We asked if not, why not.

Fred Bower Response:
Limerick was NOT one of the sites audited.

Our Response:

The reasons Bower cited for Limerick not being audited are exactly the reasons that LIMERICK SHOULD HAVE BEEN AUDITED.

Fred Bower Response:
Limerick was not chosen because Exelon's report for Limerick was consistent with walkdown guidance.

Our Response:

NRC's guidance is clearly flawed Clarity of walkdown guidance is not an acceptable measure of earthquake risk.

Fred Bower Response:
Limerick was not chosen because it was not among sites with higher than average seismic risk.

Our Response: Limerick certainly qualifies as having higher than average seismic risk, a documented fact that NRC officials have repeatedly dismissed.

- **3-17-11 - Our local newspaper reported that Limerick Nuclear Plant was identified as 3rd on the nation's earthquake risk list, according to a USGS report. It is impossible to understand that when NRC selected six plants of 66 U.S. plants, Limerick was not one of the six selected, when USGS assessed Limerick to be 3rd highest at risk.**
- **8-24-11 - The article in our local paper, "Earthquake Jolts Region" reported that Limerick was impacted by the 9-23-11 Virginia earthquake.**
- **Spring 2012, we showed NRC a map of the Sanatoga Fault under the Limerick site from its 1974 Geologic Survey.**

Fred Bower Response:
Limerick was not chosen because of the apparent level of effort or experience of licensee staff performing the walkdowns was questioned;

Our Response:

This is clearly irrelevant. No walkdown, regardless of effort, can expose the magnitude of Limerick's earthquake risks.

Fred Bower Response:
Limerick was not chosen because it was not representative of the larger population of US nuclear plants.

Our Response:

Limerick should have been chosen precisely because its risks are far higher than many other US nuclear power plants. Not only is Limerick at higher earthquake risk, it has the 2nd most densely populated evacuation zone in the U.S.

Fred Bower Response:
Although Limerick was considered, six other plants were selected because they met more of the selection criteria and the plants were expected to give the staff insights into how licensees, in general, implemented the seismic walkdowns.

Our Response:

The immense earthquake risks that actually exist at Limerick show that if NRC actually did consider Limerick and dismissed it, that <u>NRC's Seismic Walkdown Audit appears designed to eliminate the perception of earthquake risks at nuclear plants.</u>

Fred Bower Response:
Each plant's walkdown report, including Limerick's will be reviewed individually and a staff assessment of adequacy will be issued.

<u>Our Response:</u>
NRC's review of Exelon's responses is meaningless. The adequacy of Exelon's responses have nothing to do with the reality of Limerick's extraordinary risks. This NRC process will not, and cannot, lead to earthquake risk reduction at Limerick.

<u>Fred Bower Response:</u>
stated that during original Limerick licensing, NRC reviewed earthquake risk in NUREG-0991, dated August 1983, which was NRC's Safety Evaluation Report (SER) concerning the application for an operating license for Limerick:

- ✓ NRC noted that three faults have been mapped and investigated within 2 miles of the site. The closest one is the Sanatoga fault. (Page 2-44 of the SER)
- ✓ A panel of experts in Appalachian geology and the NRC staff concluded that that these faults have experienced their last displacements more than 500,000 years ago.
- ✓ This section of the SER concluded that there were no capable faults in the site area.

<u>Our Response</u>:
Why would NRC dismiss the earthquake fault risk at Limerick? Clearly, it was not because there was no earthquake risk. This was a very controversial decision made clearly to enable Limerick to be licensed, despite being built directly on top of earthquake fault fractures. It seems clear that NRC chose to dismiss the earthquake fault risk at Limerick in order to license Limerick. Clearly, earthquake faults directly under Limerick's nuclear reactors and spent fuel pools, as well as the control room, turbine building, and rad-waste building present unacceptable earthquake risks.

- ➢ **The risk was too great even before Limerick was licensed. NRC's regulations, had they been followed at the time of licensing, would have prohibited Limerick licensing. NRC's regulations were weakened to permit Limerick licensing, and they have continued to be weakened even further ever since.**

ATTACHMENT:

LOCAL NEWS ARTICLES SHOW:

1. Since Fukushima, Information About Increased Earthquake Risks at Limerick Nuclear Plant, Originally Acknowledged by NRC, Have Been Dismissed by NRC.

2. As More Is Understood About Limerick's Increasing Earthquake Risks, Residents' Concerns also Increase.

3. Advances in Seismic Science are dismissed by the NRC by stating that Nuclear Plants are Designed Well Enough to Withstand any Earthquakes That May Come.

- **In The Case of Limerick Nuclear Plant, that is not True - Limerick's Errors, Deviations, and Non-conformances During Construction Cannot Be Fixed.**

- **Limerick's Construction is Documented to be Substandard.**

Only the first page of each article is included.
The articles are available at the Pottstown Mercury website, PottsMerc.com

Limerick plant ranked 3rd on U.S. quake-risk list

Published: Thursday, March 17, 2011; Last Updated: Thu. Mar 17, 2011, 7:21am

By Evan Brandt
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LIMERICK -- Data in a Nuclear Regulatory Commission study released less than a year ago has led an MSNBC investigation to conclude that Exelon Nuclear's Limerick Generating Station is the third most at risk of damage from earthquake of all 104 nuclear plants in the nation.

The ranking takes on particular significance as the world watches Japan grapple with a cascading nuclear disaster caused by a Pacific Ocean earthquake and subsequent tsunami on March 11.

The NRC study came about as a result of the U.S. Geologic Survey's 2008 updating of earthquake risks around the country, which used better data and more sophisticated measurements and modeling than were used in the 1996 and 2002 efforts.

As a result of the new seismic data, the NRC study looked at all 104 nuclear plants in the country and increased the risk probability of an earthquake damaging many of them. In fact, only eight had their risk of earthquake damage lowered, MSNBC reported.

The risk of an earthquake damaging either or both reactors at Limerick was increased by 141 percent, now making it the third most at risk, after the Pilgrim Nuclear Plant in Plymouth Mass. and the Indian Point Atomic Generating Station in Buchanan, N.Y., according to the analysis by MSNBC.

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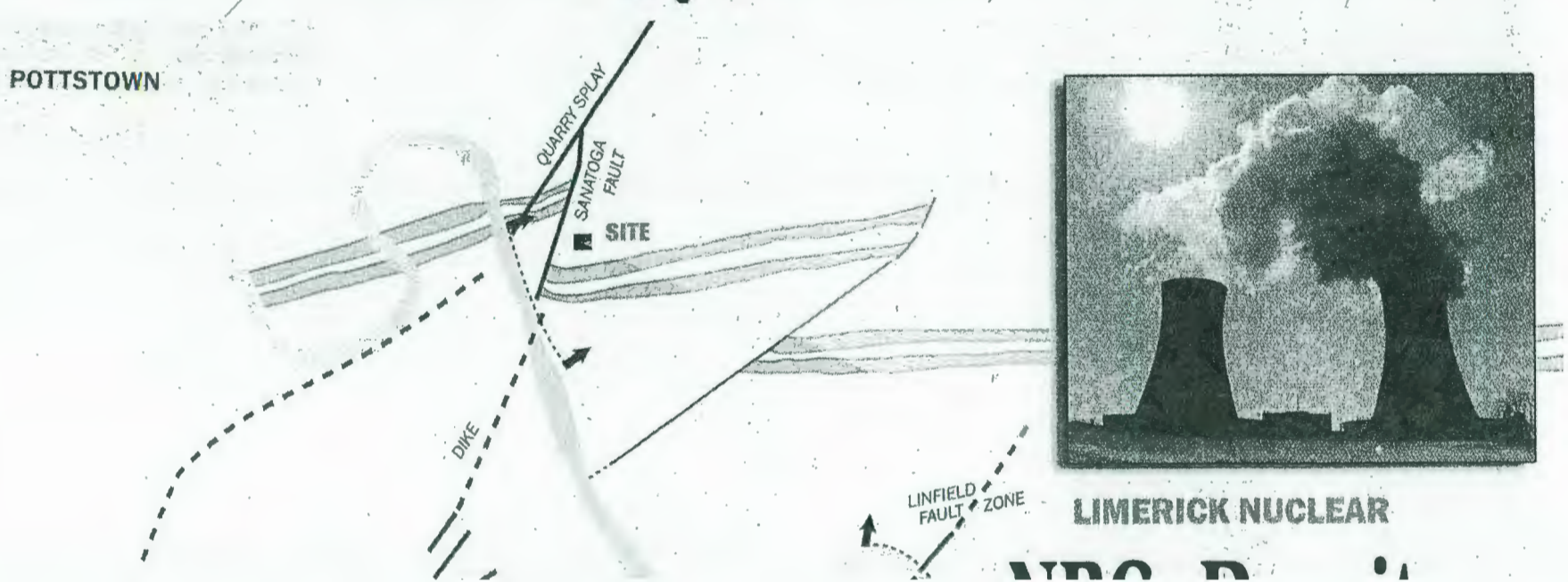
On the fault line



local fault, quake risk not a factor in relicensing

By Evan Brandt
ebrandt@pottsmerc.com

LIMERICK – Deep in the ground, beneath the poured concrete and reinforced steel of the Limerick nuclear plant's evaporation towers, lie several sleeping subterranean threats.

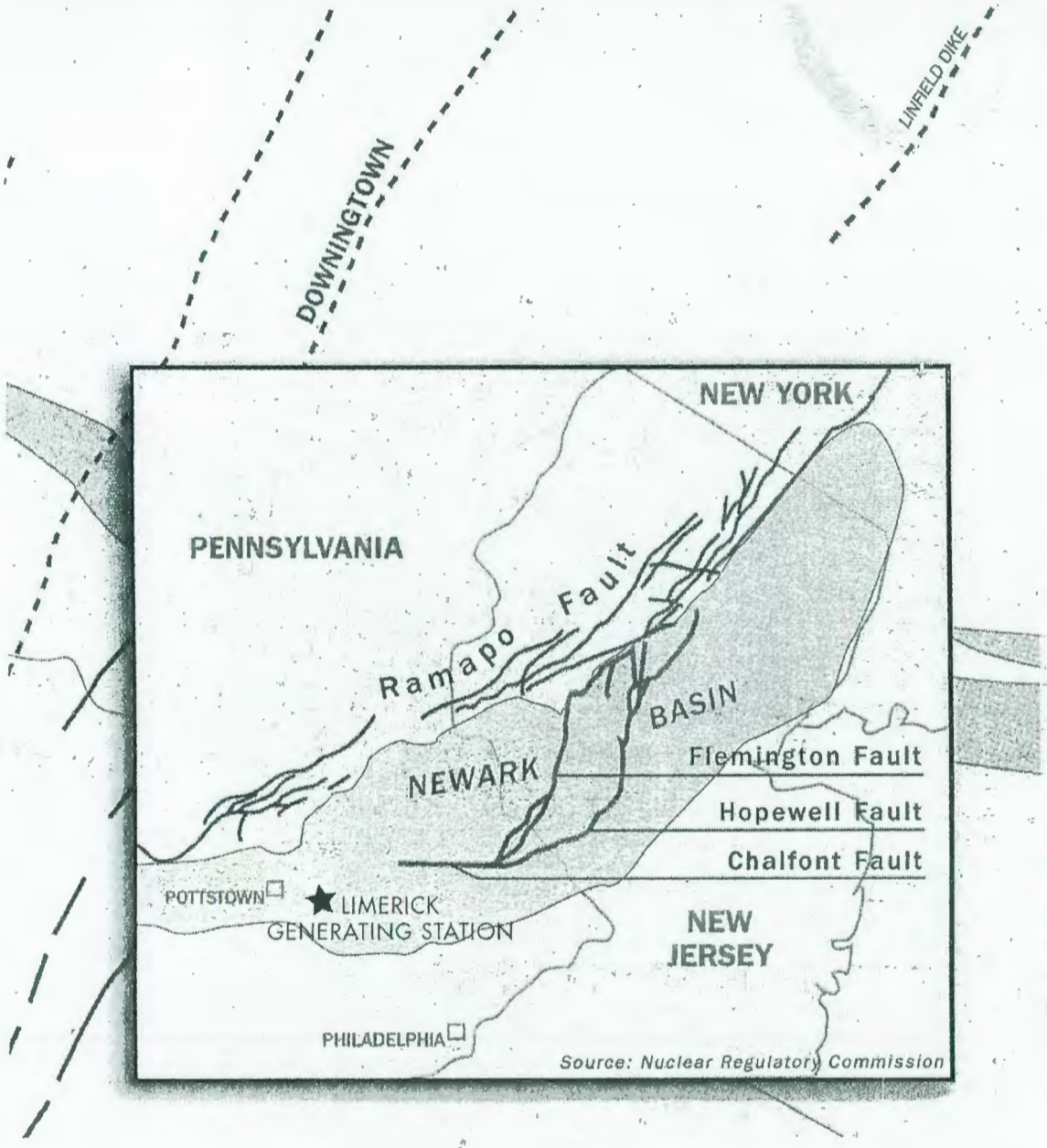
As far as the plant's operators are concerned – as well as the regulators of the federal agency that oversees nuclear plants – they are threats that are likely to stay asleep.

And even if the Sanatoga fault, or the Chalfont fault, or the Ramapo fault, awoke and shook those landmark towers in an earthquake, it's unlikely that quake would be severe enough to cause enough damage to the plant to create disaster.

At least that was the conclusion reached by the geologists who mapped the local faults in 1974 for the Philadelphia Electric Company.

Despite improvements in geologists' understanding of the East Coast earthquake picture – clearly punctuated by last August's unexpected Virginia tremor felt in several states – that conclusion remains unshaken for both the plant's current owner, Exelon Nuclear, and the agency which oversees their plant,

Please see **FAULT** on **A3**



Source: Dawes & Moore Geologic Report 1974

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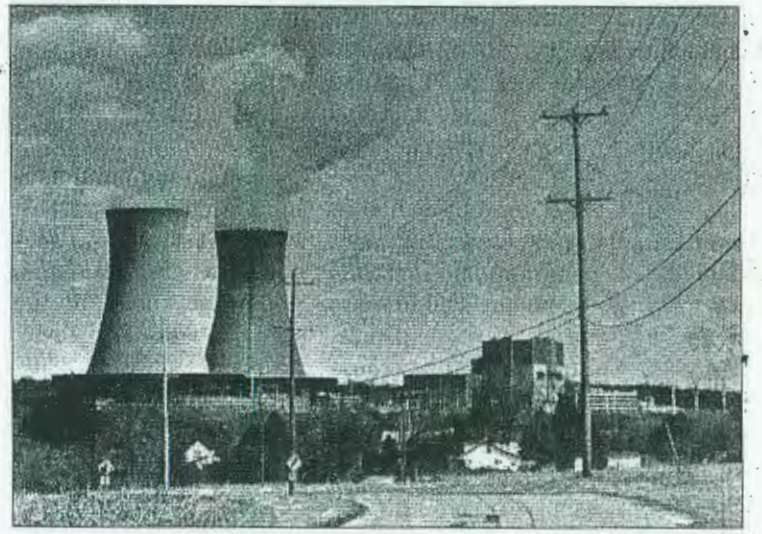

Mercury File Photo
Experts at the Limerick Nuclear Generating Station will have to reassess the plant's earthquake preparedness.

LIMERICK

NRC: Nuke plants must reassess earthquake risk

By Evan Brandt
ebrandt@pottsmerc.com

LIMERICK – Experts at Exelon Nuclear's Limerick Generating Station will have to reassess how vulnerable the plant and its equipment are to earthquake damage as the result of a new model developed for just that purpose.

The model was developed using new and more accurate assessments of earthquake risk east of the Mississippi River, an area of the country once believed to be largely free of the risk of such phenomena.

That belief evaporated Aug. 23 when a 5.8-magnitude earthquake centered in Louisa County, Va., spawned tremors that

Please see **EARTHQUAKE** on **A3**

9/21/11

Quakes may be factor in nuke plant relicensing

By Evan Brandt
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LOWER POTTSGROVE – As the Nuclear Regulatory Commission prepares to receive comment from the public tomorrow about what environmental issues should be considered when deciding on Exelon's request to re-license the Limerick Nuclear Generating Station, they are likely preparing to answer a few questions about earthquakes.

Limerick on AP's quake risk list — A4

Earthquakes are much on the mind of the agency these days as it announced last week it is looking for public input on a draft instruction requiring "U.S. nuclear power plants to re-examine their sites' seismic risk and provide that information to the NRC."

This request for public comments – which will be accepted until Nov. 15 and which will also be the subject of a public meeting in October – comes in the heels of the earthquake-related Fukushima Dai-ichi nuclear plant disaster in Japan and the Aug. 23 earthquake that rocked a Virginia nuclear plant and was felt in Pennsylvania near the Limerick plant.

(See NRC on A4)

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QUAKE JOLTS REGION

LIMERICK

Tremor felt at nuke plant but operation continues

By Evan Brandt
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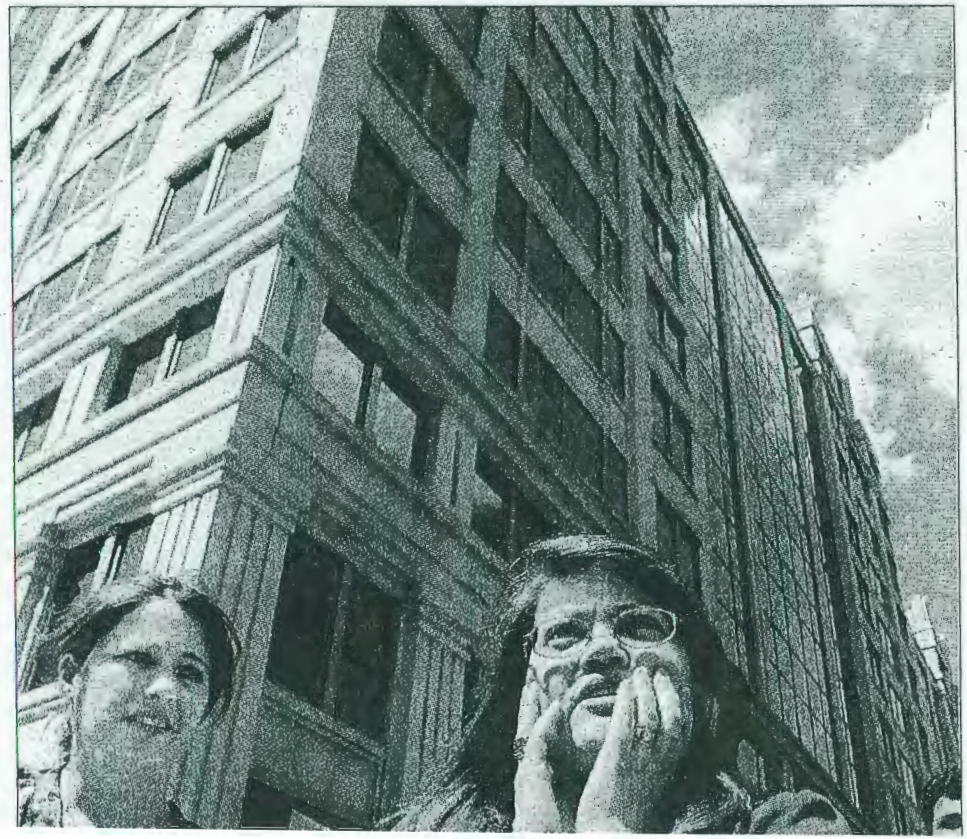
LIMERICK – The earthquake that struck the East Coast Tuesday afternoon did not shut down Exelon Nuclear's Limerick Generating Station.

Spokesman Joseph Szafran said following the seismic event, which did register at the nuclear facility, the plant was operating at full capacity.



Va. earthquake measuring 5.8 sends tremors as far as Maine

By Brandie Kessler
bkessler@pottsmerc.com

POTTSTOWN – A 5.8 magnitude earthquake struck near Richmond, Va., shortly before 2 p.m. Tuesday, sending tremors through Pottstown and along most of the East Coast.

The earthquake was among the strongest ever recorded on the East Coast, according to the U.S. Geological Survey.

Officials said there were no immediate reports of deaths, but the trembling of the quake, the epicenter of which was about 40 miles northwest of Richmond, Va., caused panic in Washington, D.C., just

Both units are 100 percent and are online," Szafran said in a phone interview just before 3 p.m. Tuesday.

"For this type of event, we have procedures in place, including a walk-down of all structures." No evacuation was necessary, he said.

"We're doing like we always do, making sure the plant is operating safely," Szafran said. "Our team went right into making sure everything is fine. We have pro-

(See NUCLEAR on A5)

AP Photos

Susy Ward, center, and other office workers gather on the sidewalk in downtown Washington moments after an earthquake shook the nation's capitol Tuesday.

Earthquake centered in Va. rolls across Pa.

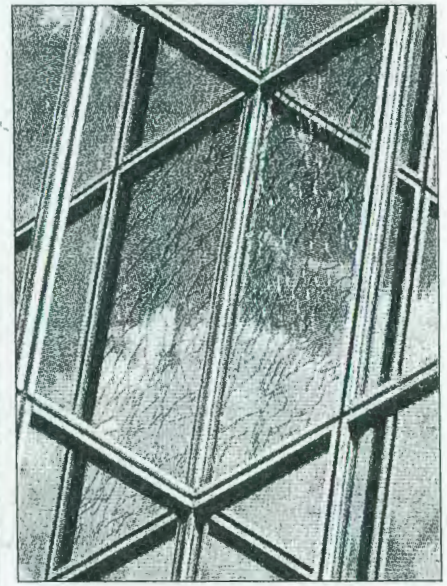
By Joe Mandak and Maryclaire Dale
Associated Press

PHILADELPHIA – Buildings shook from Philadelphia to Pittsburgh and points north Tuesday as a 5.8 magnitude earthquake centered in Virginia rolled across Pennsylvania, causing little damage but giving many their first real taste of a tremor.

The state's nuclear power plants reported no impact.

The Department of Transportation sent its inspectors to do precautionary checks of bridges across the state, with priority to

(See PA QUAKE on A6)



Cracks appear on the facade of a building on Market Street in downtown Philadelphia following an earthquake along the East Coast Tuesday.

At left, people who came out on the street after an earthquake look up at a window that cracked during the quake on Market Street in Philadelphia.

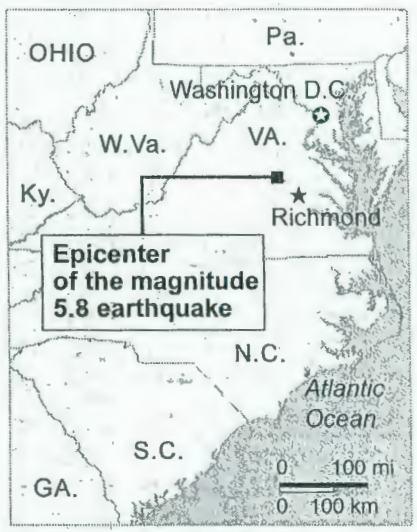
of 9/11, forcing the evacuation of parts of the Capitol, White House and Pentagon.

At the Pentagon, a low rumbling increased until the building itself was shaking, and people ran into the corridors of the complex. The shaking continued there, to shouts of "Evacuate! Evacuate!"

The Park Service closed all monuments and memorials on the National Mall, and ceiling tiles fell at Reagan National Airport outside Washington. All flights there were put on hold.

In lower Manhattan, the 26-story federal courthouse in lower Manhattan, blocks from ground zero of the Sept. 11

(See QUAKE on A3)



SOURCES: ESRI; USGS AP

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LIMERICK POWER PLANT

Underground infrastructure uninspected after quake

By Evan Brandt
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LIMERICK – When an earthquake hit Virginia Tuesday afternoon, nuclear power plants up and down the East Coast – including Exelon Nuclear's Limerick Generating Station – began assessing if damage had occurred.

Part of the problem, however, may be that the place an earthquake is most likely to cause damage is also the place the hardest to inspect – underground.

Making that scenario more worrisome is a June investigative report by the Associated Press that found that as the nation's nuclear fleet ages, much of its underground infrastructure, exposed constantly to moist conditions, may be deteriorating even faster.

Assessing earthquake damage is not a simple operation given that "each plant has unique design specifications for seismic resistance," according to Nuclear Regulatory Commission spokesman Neil Sheehan.

Called it's "design basis," each plant is "built to withstand the largest historical earthquake in the area, with additional

(See NUCLEAR on A3)

The Mercury (http://www.pottsmerc.com),Serving Pottstown, PA and The Tri County area, PA.

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'Fracking' Quakes Not A Factor For NRC In Nuke Plant Licensing

By Evan Brandt
ebrandt@pottsmerc.com

Sunday, May 20,2012

The last thing the people of Youngstown, Ohio expected last New Year's Eve was another earthquake.

But not only did a magnitude 4.0 earthquake hit, it was just the latest and the largest in a series of a dozen quakes that had been going on for a year in an area of the country not known for earthquakes.

The culprit, according to a preliminary report by the Ohio Department of Natural Resources issued March 12, was "fracking" wastewater injected deep into the earth and, apparently, unsettling things down there.

The conclusion -- soon to be bolstered by a U.S. Geological Survey report that says injecting fracking wastewater deep into the ground "almost certainly" caused a wave of earthquakes from Alabama to Colorado – is bound to add fuel to the already fiery discussion about the environmental impacts of fracking.

But the science is too fresh to affect the Nuclear Regulatory Commission's view of whether an increased risk of earthquakes from fracking poses an increased risk of damage to nuclear plants.

"The NRC continues to conclude, based on the evidence available today, that U.S. nuclear plants can safely withstand multiple earthquakes weaker than the plants are designed for," Scott Burnell, a public affairs officer for the NRC wrote in a May 18 e-mail to The Mercury.

To be sure, the evidence of a connection between fracking practices and earthquakes is new science.

The soon-to-be released USGS report makes note of a six-fold increase in earthquakes of magnitude 3 or greater since 2001, according to reporting by National Public Radio's StateImpact Pennsylvania news service.

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U.S. Nuclear Regulatory Commission
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NRC FORM 253 (9-96)

U.S. NUCLEAR REGULATORY COMMISSION

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