

January 10, 2015

To: **Stephen Burns, Chairman**

U.S. Nuclear Regulatory Commission
Mail Stop O-16G4
Washington, DC 20555-0001
301-415-1750 Chairman@nrc.gov

From: Alliance For A Clean Environment, ACE
Dr. Lewis Cuthbert, ACE President

Re: **Lessons Learned From Fukushima Related To Limerick Nuclear Plant**

NRC Chairman Burns,

The Alliance For A Clean Environment, a public environmental education and advocacy group in the Greater Philadelphia Region, is encouraged to hear that you are willing to devote time and attention to protecting the public from the consequences of Fukushima-like meltdowns in the U.S.

Since Fukushima, we have become extremely concerned about NRC's weakened regulations and lax oversight of Limerick Nuclear Plant.

NRC officials have repeatedly and inexplicably downplayed the very real potential for a Fukushima-like catastrophe at Limerick Nuclear Plant that would impact the millions of people in and beyond the Greater Philadelphia Region.

We encourage you to review the enclosed letters and attachments, in order for you to understand public concerns about Limerick-specific vulnerabilities stemming from original substandard construction, and now increasing risks from earthquakes.

Of equal concern is the fact that Limerick jeopardizes the drinking water supply for almost two million people from Pottstown to Philadelphia. There are many other concerns which we have identified in detail on our website, www.acereport.org.

We look forward to your timely response.

Respectfully,


Dr. Lewis Cuthbert
ACE President

January 10, 2015

To: John Hughey, NRC
Japan Lessons Learned Limerick Nuclear Plant Implementation

From: Alliance for a Clean Environment (ACE)
Dr. Lewis Cuthbert, President aceactivists@comcast.net

RE: AS THE NRC PROJECT MANAGER FOR LIMERICK NUCLEAR PLANT REGARDING JAPAN LESSONS LEARNED, WE URGE YOU TO REVISIT FAULTY NRC ASSUMPTIONS AND DANGEROUSLY DELAYED / AVOIDED ACTIONS AT LIMERICK RELATED TO JAPAN LESSONS LEARNED.

Lessons from Fukushima taught us that Limerick Nuclear Plant, similar to the reactor design of Fukushima, is at severe risk for multiple meltdowns, yet NRC is using unrealistic and unreasonable assumptions about the causes and consequences of a Fukushima-like worst-case scenario at Limerick.

NRC negligently continues to avoid requirements for vital post-Fukushima safety precautions that would protect the public. Why? Because NRC is valuing Exelon's costs for preventive action above the astronomical health and financial costs to the public from potentially catastrophic Limerick meltdowns. In fact, NRC is ignoring the public's costs in its cost-benefit analyses.

Many millions of people in the Greater Philadelphia Region and beyond could be severely impacted by Limerick meltdowns. After Fukushima, NRC deceived U.S. citizens about the devastating consequences to the citizens, communities, and the natural resources in Japan as a result of the Fukushima meltdowns. Now, NRC is making decisions that ignore the very real potential for a worst-case scenario multiple meltdown catastrophe at Limerick.

WE URGE YOU TO REVIEW THE FOLLOWING FLAWED NRC EVALUATIONS AND DECISIONS, THEN RECOMMEND CLOSING LIMERICK TO AVOID A FUKUSHIMA-LIKE CATASTROPHE!

1. **DOCUMENTED UNPRECEDENTED EARTHQUAKE RISKS AT LIMERICK ARE BEING DISMISSED AND MINIMIZED BY NRC** - Limerick's reactors, fuel pools, and other vital buildings are built directly over fault fractures. Massive fracking in PA and surrounding states intensifies the potential for earthquakes in any of the five faults under and within 17 miles of Limerick. NRC is inexplicably allowing Exelon to wait until 2019 to complete a study which cannot and will not prevent a Fukushima-like worst case multiple meltdown scenario.
 - **We urge you to encourage NRC to close Limerick based on evidence in attachments we will be providing about why closing Limerick is the ONLY way to prevent catastrophic Fukushima-like meltdowns resulting from an earthquake. These attachments will show why Limerick's unprecedented earthquake risks can't be fixed and why they are dramatically increasing.**
 - **Attachments:**
 - 1) 3-31-14 ACE 14-page letter to then-NRC Chairman Macfarlane, identifying Limerick's unprecedented earthquake risks.
 - 2) Limerick's Severe Earthquake Vulnerabilities Dismissed and Minimized By NRC, including responses to Chairman Macfarlane's faulty conclusions in response to our 3-31-14 letter.
 - 3) Graphics from NRC records showing earthquake fault fractures directly under Limerick's reactors, fuel pools, and other vital buildings, plus evidence of NRC deception about the severity of Limerick's earthquake vulnerabilities.

2. VITAL RADIATION FILTERS ON VENTS ARE NOT BEING REQUIRED BY NRC

NRC's own staff stated that radiation filters were vital, and that without filters, vents become radioactive hoses into the sky. Yet, NRC failed to require filters for vents which saves Exelon money, but increases our health risks from a highly radioactive Limerick plume. .

- Costs for filters are miniscule compared to the potential health and financial devastation that could become a reality for tens of millions of people in the densely populated Greater Philadelphia Region and beyond.
- Exelon's failure to install vital filters to minimize severe harm from Limerick's radioactive releases is reason enough to close Limerick now, before a severe radiological release occurs.
- **We urge you to recommend closing Limerick to prevent Fukushima-like radioactive releases that would be devastating to the public's health and financial interests.**

3. NOT ENOUGH WATER IS AVAILABLE FROM ALL SOURCES COMBINED TO DEAL WITH A LIMERICK MELTDOWN

Fukushima revealed how much water is required to try to deal with a meltdown. Drinking water sources across six counties could be dangerously depleted by Limerick's insatiable need for water during a meltdown. Radioactive runoff into the Schuylkill River from that process would make drinking water for almost two million people from Pottstown to Philadelphia virtually unusable. Since before Limerick was licensed, NRC knew the Schuylkill River was insufficient to sustain even Limerick's routine water needs.

- **We urge you to recommend closing Limerick, the only way to protect the water supply for many millions of people across six counties in PA. Lessons learned from Fukushima should compel NRC to close Limerick to protect our water.**

4. INDEFINITE BACK-UP POWER IS NOT AVAILABLE AT LIMERICK TO TRY TO PREVENT SIMULTANEOUS MULTIPLE MELTDOWNS IN ITS 2 REACTORS AND 2 FUEL POOLS

Fukushima taught us that there could be simultaneous multiple meltdowns, including its reactors and fuel pools. We learned that back-up power could be needed for months, not just weeks, days, or hours.

- It is inconceivable that almost four years after Fukushima, NRC has failed to require long-term extended back-up power capabilities to prevent multiple Limerick meltdowns, despite being recommended by a former NRC chairman.
- NRC's 12-23-14 correspondence to Exelon revealed Exelon's failure to verify battery capacity to recover from station blackout and failure to evaluate a station blackout timeline for Emergency Diesel Generator (EDG) availability.
- The fact that NRC had to question Exelon's ability to meet the emergency diesel generator design run time of just seven days is very troubling.
- Limerick could lose power for an extended period of time for many reasons, including cyber attacks directed at Limerick systems or the grid, plus natural disasters like earthquakes, or man-made errors.
- **We urge you to recommend that NRC require unlimited back-up power to prevent simultaneous multiple meltdowns at Limerick.**

5. EMERGENCY PREPAREDNESS IS BASED ON ILLUSION, NOT REALITY

NRC and Exelon are ignoring lessons learned from Fukushima. In reality, Fukushima shows that a Limerick radiological accident / meltdown can result in devastating health and financial consequences to Greater Philadelphia region residents. We can lose everything.

- Inexplicably, NRC dangerously weakened emergency preparedness requirements after Fukushima, further jeopardizing public health, safety, and financial interests. Even emergency personnel have spoken out against NRC's weakened requirements.
- NRC also woefully underestimated the timeframe, price tag, and human costs associated with emergency preparedness related to radioactive releases during a nuclear plant accident / meltdown. NRC's post-Fukushima recommendations only deal with communication and staffing. That is insanity.
- After careful review of Exelon's unrealistic, unworkable 12-12 emergency plan for evacuation (ETE), we became more alarmed.
- We repeatedly contacted NRC emergency officials inviting them to meet with us to discuss Exelon's ETE. That never happened.
- NRC's Joseph Anderson finally admitted NRC had no intention of reviewing Exelon's ETE, even though NRC required it. He absurdly claimed it's not NRC's responsibility.
- **We welcome a visit from you to review graphics we prepared that could be helpful in your understanding of the numerous inadequacies in emergency planning for Limerick's evacuation zone.**

Please e-mail your responses to Dr. Lewis Cuthbert at aceactivists@comcast.net

Sincerely,



**Dr. Lewis Cuthbert
ACE President**

CC: U.S. Senator Casey
U.S. Senator Toomey
U.S. Congressman Costello
U.S. Congressman Meehan
U.S. Congressman Dent
PA Senator Rafferty
PA Senator Dinniman
PA Representative Vereb
PA Representative Quigley
PA Representative Hennessey
NRDC
Radiation and Public Health Project
Beyond Nuclear
NIRS
Pottstown Mercury
Philadelphia Inquirer

Attachment

Re: 1-10-15 ACE Correspondence to

John Hughey, NRC

Project Manager for Japan Lessons Learned For Limerick Nuclear Plant Implementation

LIMERICK NUCLEAR PLANT'S UNPRECEDENTED EARTHQUAKE VULNERABILITIES

A SUMMARY OF THE EVIDENCE THAT REFUTES NRC'S SEISMIC RISK EVALUATION AND DECISIONS PERTAINING TO LIMERICK NUCLEAR PLANT

Background:

On March 31, 2014, ACE contacted then-NRC Chairman MacFarlane concerning Limerick's unique and unprecedented earthquake risks. On October 27, 2014, Chairman Macfarlane responded on behalf of the NRC.

We are contacting you because we believe that the NRC has wrongly based Limerick's seismic vulnerability on Exelon's response to generic seismic information. Limerick Nuclear Plant should not be in NRC's lowest seismic tier of concern for all nuclear plants, post-Fukushima. Limerick-specific conditions have been disguised by NRC's current assessment of Limerick and may potentially risk the safety of millions of people for the following reasons:

- **Like Fukushima, Limerick's fuel pools are directly on top of Limerick's reactors. But, worse, Limerick's reactors and fuel pools are built directly on top of earthquake fault zone fractures that break the earth's surface under Limerick's nuclear buildings:**
 - To license Limerick, NRC adopted the flawed Atomic Energy Commission's definition from 1974 that was proven wrong on 8-23-11.
- **Exelon's botched response to the 8-23-11 Virginia Earthquake that jolted Limerick:**

1:51 pm - Units 1 & 2 were operating at full power. That was very lucky, because GE has warned that the newest problem with Limerick's reactors, beyond the fact that containment is not guaranteed, is that if one or both reactors are operating at low power when an earthquake hits, safe shutdown is not guaranteed. Vibrations that shook the control room were felt by operators and activated alarms.

Operators could not confirm an earthquake because Limerick's seismic monitoring system was inoperable "due a previous problem with its power supply". The seismic monitoring system had been inoperable for a year and four months prior to the quake, and problems remained after the quake. Unable to confirm the quake, operators had to call the United States Geological Survey (USGS).

2:11 pm - USGS confirms the earthquake 20 minutes after the earthquake was first felt

2:15 pm - Exelon operators "Declared an Unusual Event" (24 minutes after the earthquake was first felt

2:30 pm - Exelon reports that operators completed notifying all state and local officials within the required 15 minutes of declaring an unusual event, 45 minutes after vibrations were first felt at Limerick

2:56 pm - Exelon notified NRC Operations Center of the "Declaration of Unusual Event".

- NRC noted that Exelon was 9 minutes late in making its declaration because Limerick plant vibrations began at 1:51pm, so operators should have made the Declaration of an Unusual Event by 2:06pm instead of at 2:15 pm.
- The only action the NRC took was to issue a non-cited violation due to the fact that Exelon was 9 minutes late in its declaration of an unusual event.
- Inexplicably, NRC failed to cite Exelon for Limerick's inoperable seismic monitors.
- Note: It is negligent for NRC to have allowed Exelon, a nuclear power company, to operate Limerick with a "seismic monitoring system that had been previously declared inoperable due to problems with its power supply"!
- Exelon's voluntary Special Report omitted any reference to the fact that Limerick's seismic monitors were inoperable and that Limerick had to call the USGS to confirm the earthquake.
- Exelon and NRC performed walkdowns, and claimed no damage was observed.

Note: Licensees who fail to satisfy the declaration and notification requirements are subject to enforcement actions according to NRC's enforcement policy. Because Limerick's seismic monitoring system was inoperable, Exelon failed to meet all the requirements of Limerick's radiological emergency plan regarding an earthquake:

- 1) Within 15 minutes of operators first feeling the vibrations, the declaration must be made.
- 2) Within 15 minutes of the declaration, all appropriate state and local officials must be notified.
- 3) Within 1 hour of the declaration, NRC Operations Center must be notified.

The potential for a Limerick catastrophe cannot be underestimated or remedied.

- **Evidence shows that the NRC and Exelon continue to severely underestimate Limerick's potential problems instead of learning the lessons of Fukushima that could protect the public and the environment..**
- **The earthquake originating in Virginia, that jolted the Limerick Nuclear Plant Control Room, suggests that any of the 5 earthquake faults within 17 miles of Limerick (one of them active), could become capable. Yet NRC failed to acknowledge this reality.**
 - The Virginia earthquake proved NRC's earthquake assumptions to be wrong. That earthquake occurred in a fault that the NRC had identified as incapable, exactly as it had identified Limerick's. Virginia's fault was twice as old as Limerick's, labeled incapable, yet it became capable and was strong enough to jolt Limerick's control room.
 - Despite the fact that the VA. Earthquake proved that the NRC's labeling of fault capability is fatally flawed, the NRC is still defending its decades-old fault definition.
 - The Virginia earthquake also exposed the fact that the NRC does not require the inspection of inaccessible systems, structures, and components (e.g. foundations, buried pipes), even after an earthquake, which could impede control of a Limerick meltdown, should one or more occur.
- **Like Fukushima, Limerick could suffer a worst case scenario leading to multiple meltdowns due to the earthquake fault zone under Limerick's reactors and fuel pools. Meltdowns could also occur due to earthquakes in any of the four other enormous fault zones (one considered active) within 17 miles of Limerick, especially with the enormous increase in Pennsylvania fracking (USGS documented the link between fracking and earthquakes).**
 - Over 4,200 fracking sites are approved in Pennsylvania. There are also numerous other fracking sites in surrounding states. Any of them could initiate earthquakes impacting Limerick.
- **Documentation shows that like Fukushima's reactors, Limerick's reactors are defective. Added to that concern, is Limerick's eye-witness report documenting substandard construction of Limerick's fuel pools, as well as other errors, deviations, and non-conformances that are excluded from NRC's earthquake risk assessment.**
 - We believe that the only way that NRC and Exelon can implement the lessons learned from Fukushima is to see Limerick, not from Exelon's perspective as a money maker, but from the public's perspective, as a threat to public safety and the environment.
 - Fukushima taught us that we should not ignore the catastrophic potential of lax (low cost) safety practices, increasing earthquake risks, and other worse-case scenarios, natural or man-made.
- **There is great cause for concern about beyond-design-basis accident potential at Limerick.**
 - A PECO volume archived in the Pottstown Public Library, titled "Design Assessment Report" has pages missing from Chapter 8 behind the tab, "Mark II T-Quencher Verification Test".
 - Pages are missing behind the tab, "Response to NRC Questions". We worry that Exelon may not be basing Limerick's capabilities on its true design basis.

ACE RESEARCH REVEALS THAT THE NRC'S STANCE ON LIMERICK, AS REPORTED TO US BY CHAIRMAN MACFARLANE, IS UNREALISTIC AND POTENTIALLY DANGEROUS:

1) Ms. Macfarlane stated that "NRC staff continues to conclude that Limerick is designed, built, and operated safely to withstand earthquakes likely to occur in its region, as discussed in more detail in the enclosure to this letter".

- **ACE response:**

Documented evidence in public hearing testimony to NRC suggests otherwise, for example a Limerick engineer at the time of construction testified to NRC in 2011 that he was concerned about the mistakes, errors, and deviations accepted by NRC at the time of construction that now present greater risks in relation to increasing earthquake threats.

2) NRC, as reported to us by Chairman Macfarlane, ignored Limerick Nuclear Plant's design flaws related to seismic hazards. Macfarlane stated that results of seismic hazard reevaluation could potentially identify plant design issues requiring corrective action.

- **ACE response:**

- Since September 2011, ACE repeatedly identified and presented to NRC the Limerick- specific design issues related to seismic risk which can't be corrected, which is why NRC should revoke Limerick's license renewal.
- In 1972, 13 years before NRC issued its first Limerick license, The Atomic Energy Commission (AEC), predecessor of NRC, considered but did not chose, an alternative site for Limerick because it would have cost PE/PECO/Exelon money. The insanity of considering money more important than public safety has increased Limerick's risks over the decades.
- The lesson the NRC should have learned from Fukushima, was that prevention is the key to protecting people and the environment. But it did not. No action has been taken to protect the public, but Limerick operations are protected for Exelon's financial gain.
- To avoid the risk of catastrophic meltdowns at Limerick, NRC should revoke its licenses and close Limerick as soon as possible. Exelon should not be allowed to stall until 2019 to complete what will certainly be a self-serving seismic "study".

3) Ms. Macfarlane stated that "Conditions adverse to quality, identified during Limerick plant construction, including the spent fuel pool concrete issues were evaluated at that time and corrective actions were taken as necessary."

- **ACE response:**

- That is factually inaccurate according to the engineer present at the time of construction.
- NO corrective actions were actually taken. The engineer who testified in 2011 listed many failures, deviations, and non-conformances that he said were accepted then but need to be reviewed in light of what we understand today.
- He said we need to go back and take a look at all of those mistakes and make sure that they're not written off NOW. We are extremely concerned because NRC ignored all of Limerick's construction failures, deviations, and non-conformances in relation to seismic risks when Limerick was relicensed in October of 2014.

4) Ms Macfarlane stated that, "... seismic risk and spent fuel pool evaluation is not warranted for this plant".

- **ACE response:**

- It is negligent beyond belief for NRC to dismiss Limerick-specific fuel pool risks related to earthquake threats.
- NRC dismissed the reality of catastrophic risk from Limerick's packed and vulnerable fuel pools.
- The price of precaution may be high, but the price for fuel pool meltdowns is incalculable.

EXTRAORDINARY LIMERICK RISKS THAT NRC IGNORED:

- **Limerick's fuel pools were constructed on top of its reactors, which sit directly on top of an earthquake fault zone (see attachment).** Limerick's construction diagrams and site preparation photographs clearly show that Limerick's fuel pools were built directly over an earthquake fault zone.

- **Limerick's fuel pools were constructed with substandard cement.** As previously discussed this is confirmed in NRC's public hearing testimony by a former Limerick engineer present at the time of the cement pour, who expressed concerns regarding increasing earthquake risks at Limerick.
- **Limerick's fuel pools have no added containment like reactors, to minimize the escape of radiation in a fuel pool meltdown.** Limerick's spent nuclear fuel pools are contained in ordinary industrial structures designed to merely protect them against the elements, yet they hold some of the most deadly materials on earth.
- **Limerick's spent fuel pools contain more radioactivity than its reactors and would release far more radiation in a meltdown.** Limerick's fuel pools would release far larger concentrations of radiation in a meltdown. Despite that, there is no steel-lined, concrete barrier covering Limerick's fuel pools to limit the escape of radioactivity.
- **Limerick's spent fuel pools are packed beyond design basis.** Limerick's "spent fuel" pools contain some of the largest concentrations of radioactivity on the planet, far more than some older U.S. nuclear plants, like TMI and Oyster Creek.

Compared to Fukushima, Limerick's fuel pools contain far more radioactivity:

- ✓ Limerick: 6,203 assemblies in 2 fuel pools, compared to:
- ✓ Fukushima: 2,400 assemblies in 4 fuel pools

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 26

Source: DOE/EIS-0250, Appendix A, Tables A-7, A-8, A-9, & A-10

- **A spent fuel pool fire could be devastating - all it takes is loss of water: spent fuel rods heat up, self-ignite, and burn in unstoppable fire.** Limerick's fuel pools designs are similar to those at Fukushima. Roof-top fuel pools are highly vulnerable to meltdowns through loss of power and cooling water from earthquakes, other natural disasters, and a variety of attacks by terrorists.
- **Insufficient power and water for multiple meltdowns in reactors and fuel pools triggered by an earthquake are major reasons to re-evaluate seismic risks at Limerick.** NRC does not require Exelon to provide dedicated back-up generators to keep adequate cooling water in Limerick's fuel pools in the event of an earthquake. There is not even enough water to keep cooling fuel pools, even from all Limerick's available sources. We do not have the equivalent of the Sea of Japan available as they do at Fukushima.
- **Studies: Health and economic consequences of spent fuel pool fires and meltdowns clearly show that NRC's seismic evaluation, absent the inclusion of Limerick's fuel pools is meaningless.** According to an NRC study from 2000, a meltdown in a spent fuel pool could cause fatal radiation-induced cancer in thousands of people as far as 500 miles from the site.
- **In his 2004 study, Dr. Edwin Lyman, Senior Scientist at the Union of Concerned Scientists concluded that such a meltdown could result in:**
 - ✓ As many as 44,000 near-term deaths from acute radiation poisoning
 - ✓ 518,000 long term deaths from cancer.
 - ✓ Deaths occurring in people living as far as 60 miles downwind.

EXTRAORDINARY LIMERICK SECURITY RISKS

- **A 2003 study by Dr. Frank Von Hippel, Director of Science and Global Security at Princeton University, concluded:**
 - ✓ A successful terrorist attack on a spent fuel storage pool could have consequences "significantly worse than Chernobyl."
 - ✓ A catastrophic spent fuel fire could release a radiation plume that could contaminate 8 to 70 times more land than Chernobyl. That would be the equivalent of 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", reviewed ways spent fuel pools are vulnerable to attack.**
 - ✓ A nuclear fire in 1 spent fuel pool would release enough radiation to "render about 95,000 square kilometers of land uninhabitable," (would cover about 75% of New York State, and into, segments of NJ and CT.)

**NRC'S PRESENT- DAY GENERIC METHODS AND WEAKENED GUIDANCE
ACTUALLY RAISE LIMERICK'S SEISMIC HAZARD RISKS**

Ms. Macfarlane referred to NRC's March 12, 2012 requirement that nuclear plants be re-evaluated for seismic hazards, based on present-day methods and guidance, which included seismic walkdowns to ensure protections against hazards.

- **ACE response:**
 - Seismic walkdowns are virtually useless as a tool to determine seismic hazards at Limerick. Our greatest concern is disruption in the miles of pipes and cables buried under the Limerick site due to an earthquake, because they are vital to supplying water and power to prevent meltdowns.
 - Inaccessible pipes, cables, structures, systems, components, and foundations are uninspected during NRC walkdowns, yet a walkdown constitutes the only NRC oversight related to seismic hazards, therefore, NRC's weakened guidance absolutely fails to protect the public from unprecedented earthquake risks at Limerick.
 - The fact that the NRC defers to Exelon, the company with a vested interest in the outcome, to evaluate seismic hazards at Limerick, using weakened generic methods and NEI guidance actually allows Exelon to ignore Limerick's extreme seismic vulnerabilities for profit.

**DESPITE THE REALITY OF ENORMOUS SEISMIC RISKS AT LIMERICK,
NRC NEGLIGENTLY ASSIGNED LIMERICK TO THE LOWEST OF THREE PRIORITY GROUPS
FOR A TIMEFRAME OF 2019 (4 MORE YEARS), TO COMPLETE RISK EVALUATION.**

Ms. Macfarlane stated that the NRC placed Limerick in the lowest priority group based on the small amount of exceedance between the re-evaluated seismic hazard and the current licensing basis.

- **ACE response:**
 - Prioritizing Limerick's seismic risks using a flawed generic mathematical model and an irrelevant comparison benefits Exelon while jeopardizing the health, safety, and financial interests of millions of people in the Greater Philadelphia Region.
 - Allowing Exelon to stall for four more years (until 2019) to simply produce a self-serving seismic study for Limerick, reveals just how unprotective NRC policies and regulations are.
 - In essence, NRC has abandoned the lessons learned from Fukushima. Since 2011 NRC has failed to require anything to be done to minimize Limerick's extreme seismic hazard risks.
 - Based on the evidence of seismic risk at Limerick and lessons learned from Fukushima, it is irrational for NRC to allow 8 years for Exelon to even produce a seismic study for Limerick.

**NRC IS USING UNSUBSTANTIATED GENERIC CONCLUSIONS,
INSTEAD OF LIMERICK-SPECIFIC DOCUMENTS TO DETERMINE LIMERICK'S SEISMIC RISKS**

Ms. Macfarlane stated that, "Nuclear power plants have the capacity to withstand earthquakes larger than those assumed in the analyses performed as part of the licensing process. This additional capacity results from nuclear power plants being designed, with safety margins, to withstand the forces of a variety of internal and external events."

- **ACE response:**
 - That is an overly simplified generic statement that is completely irrelevant to Limerick Nuclear Plant.
 - NRC regulations, Unit 1 and Unit 2 licenses, License Renewal Application, and changes post-renewal have excluded and/or disguised Limerick's original defects and age-related deterioration, to say nothing of ignoring Limerick's unprecedented earthquake risks.

NRC'S RELIANCE ON A GENERIC INDUSTRY-BIASED STUDY FOR LIMERICK IS UNACCEPTABLE

Ms. Macfarlane stated that, "...Exelon confirmed that the conclusions of the EPRI study applied to Limerick, as well as the specific information for Limerick and confirmed that fleet-wide seismic risk estimates are consistent with the approach and results used in previously-accepted safety risk assessments."

- **ACE Response:**
 - Exelon's confirmation that EPRI's industry-biased generic fleetwide study applies to Limerick proves nothing.
 - Earthquake prediction is considered unreliable by unbiased mainstream geologists.
 - The Ramapo Fault, just 17 miles from Limerick, is active.

- NRC and Exelon have ignored all the researchers and scientists that agree that earthquakes east of the Rocky Mountains are harder to anticipate because the fault systems are not as well understood as some faults, like the more-studied San Andreas Fault. Limerick's fault zones received almost no study at all.
- Documented historic records of earthquake faults under and near Limerick suggest that NRC should have NO confidence in generic conclusions by Exelon and its industry-biased studies.
- A Penn State geo-expert reviewed Limerick's 1974 geologic survey map showing the Sanatoga fault. She explained 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. If that's true, it might be worth re-assessing"*. Or, better yet, ACE believes that Limerick's license renewal should be revoked and Limerick should be closed down to protect people and the environment.
- The Geo-expert stated that it's not too surprising that the assessment of the Virginia fault was off: *"the study of earthquake dynamics is hard. So while earthquake expertise has value, it is not a sinecure, either in Virginia or, possibly at Limerick. Now, with the equipment that we have, we could certainly get a clearer picture of what's down there, but it wouldn't be free."*
- Clearly, NRC's effort to avoid a Limerick-specific earthquake risk re-evaluation is all about saving Exelon money.

NRC Post-Fukushima Rules Questioned Over Cost, Adequacy **(From 3-10-12 Bloomberg News Article On NRC 3-9-12 Press Release)**

- 1) Exelon does not have to complete implementation of new NRC rules to address safety gap for Limerick Nuclear plant until 2016.
- 2) NRC is allowing Exelon to stall in providing vital safety measures to avoid spending money.
- 3) NRC's safety rules don't go nearly far enough, according to a nuclear analyst for Greenpeace. He said "The industry is trying to do it on the cheap and not have safety-grade equipment but who knows if the commercial-grade will function in the midst of a meltdown."
- 4) A potential requirement for Limerick's reactor containments to have "filtered" vents to prevent radiation leaks is being challenged because of costs.
- 5) NRC IGNORED 2 KEY ISSUES
 1. NRC FAILED TO ADDRESS EXPANDING EVACUATION ZONES
 2. NRC FAILED TO REQUIRE DEADLY WASTE TO BE REMOVED FROM DANGEROUS FUEL POOLS TO DRY CASKS AS SOON AS POSSIBLE.
- 6) NRC Chairman Gregory Jaczko said the agency is still weighing a dozen recommendations from a task force to prevent a disaster similar to Fukushima from occurring at U.S. plants.
- 7) NRC staff proposed allowing reviews of seismic risks to be completed in the latter half of the decade. Jaczko said it's "not acceptable".
- 8) Industry officials have said there aren't enough technical resources to complete the assessments by Jaczko's deadline.
- 9) Rules say Exelon must have a plan to indefinitely survive blackouts. NRC is allowing a "phased-in" approach for installing emergency equipment for black outs, with companies to order the gear or have contracts in place by the end of March.
 - Initially using portable equipment to keep reactors cool during an electric failure, supplemented by gear that can be shipped in "to sustain those functions indefinitely."
 - Reactor owners to have adequate instruments to monitor spent-fuel cooling pools.
 - Older reactors with General Electric Co (GE) design containment structures like Limerick's (similar to those that failed at Fukushima) to have sturdier venting systems to prevent damage to reactor cores.

Senator Barbara Boxer faults the agency for taking too long to develop new safety rule.

"We need the NRC to be an industry watchdog, not an industry lapdog," Representative Edward Markey of Massachusetts

NRC Chairman Allison M. Macfarlane
U.S. Nuclear Regulatory Commission
Mail Stop O-16G4
Washington, DC 20555-0001
301-415-1750 Chairman@nrc.gov

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 reevaluated.

- **"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 be 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 gauges 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 MENTALITY:

- 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 unprotective 1974 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)
1189 Foxview Road
Pottstown, PA 19465
(610) 326-2387
aceactivists@comcast.net**

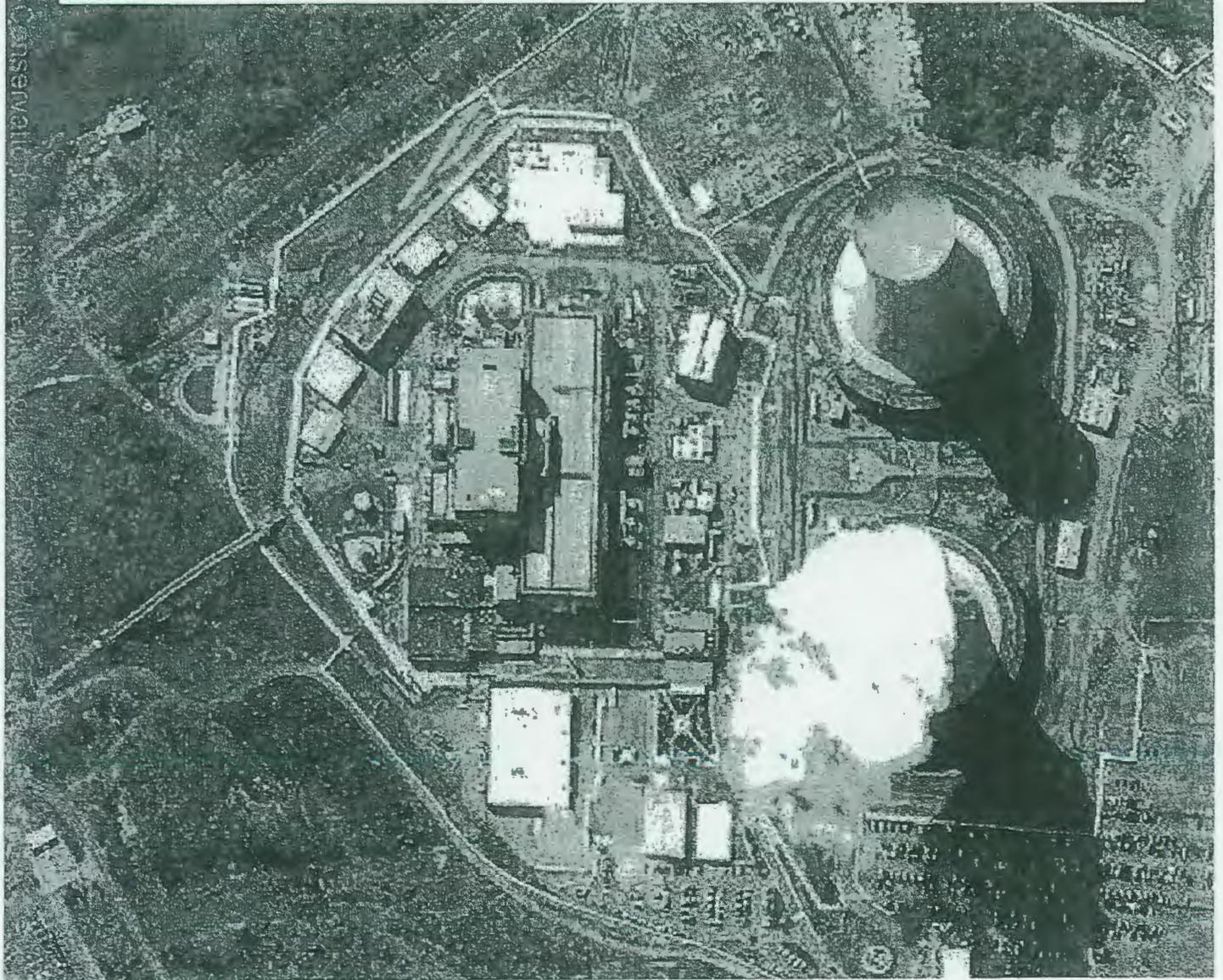
CC U.S. Senator Casey
U.S. Senator Toomey
U.S. Senator Boxer
U.S. Senator Markey
U.S. Senator Sanders
NRDC
NIRS
Beyond Nuclear
Radiation and Public Health Project
Pottstown Mercury
Philadelphia Inquirer

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:

REPORT -

ON



TREATMENT OF FRACTURE ZONES

AT

LIMERICK GENERATING STATION

FOR

PHILADELPHIA ELECTRIC COMPANY

BY

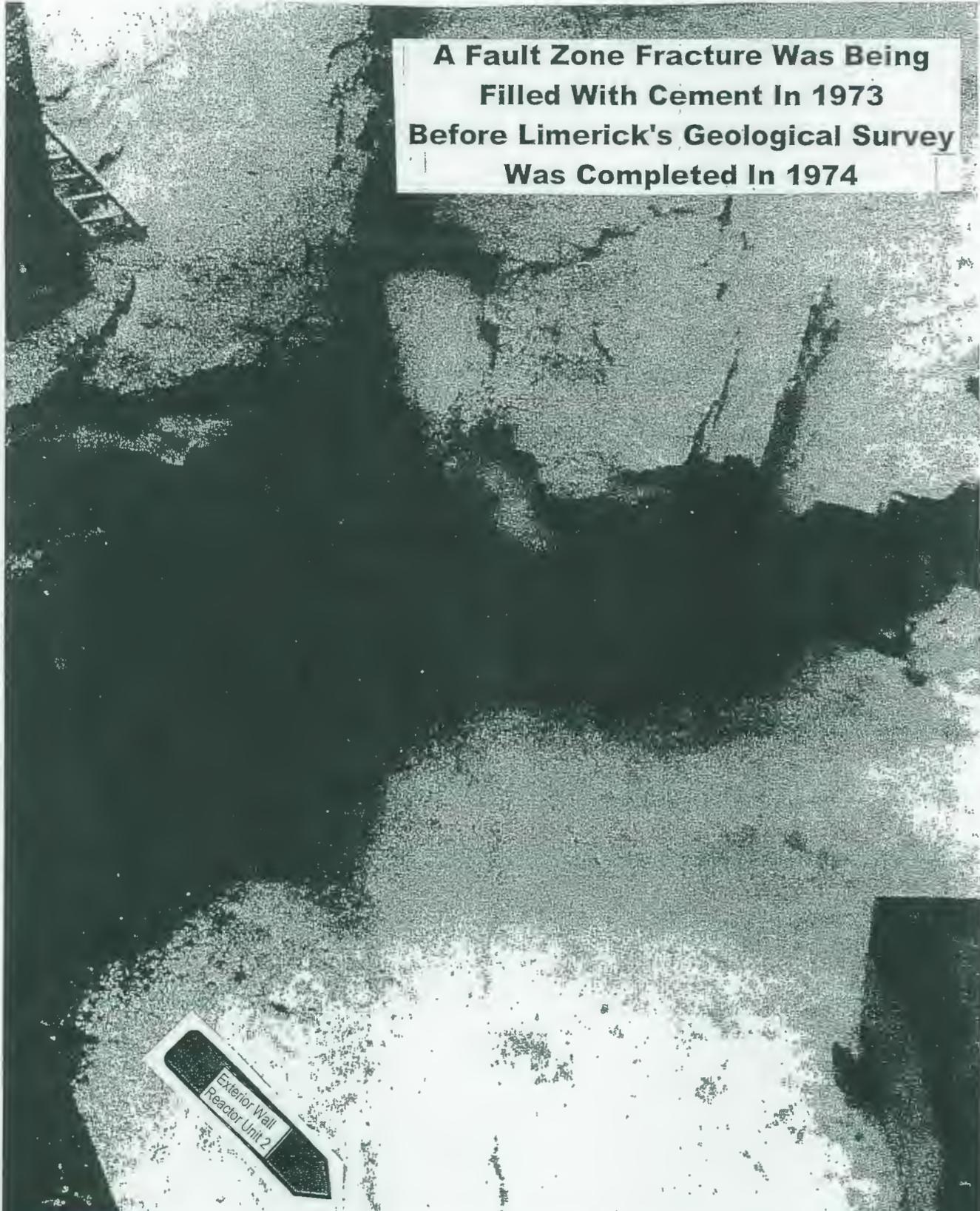
BECHTEL POWER CORPORATION

Reports File

JOB 8031

September 3, 1974

9548



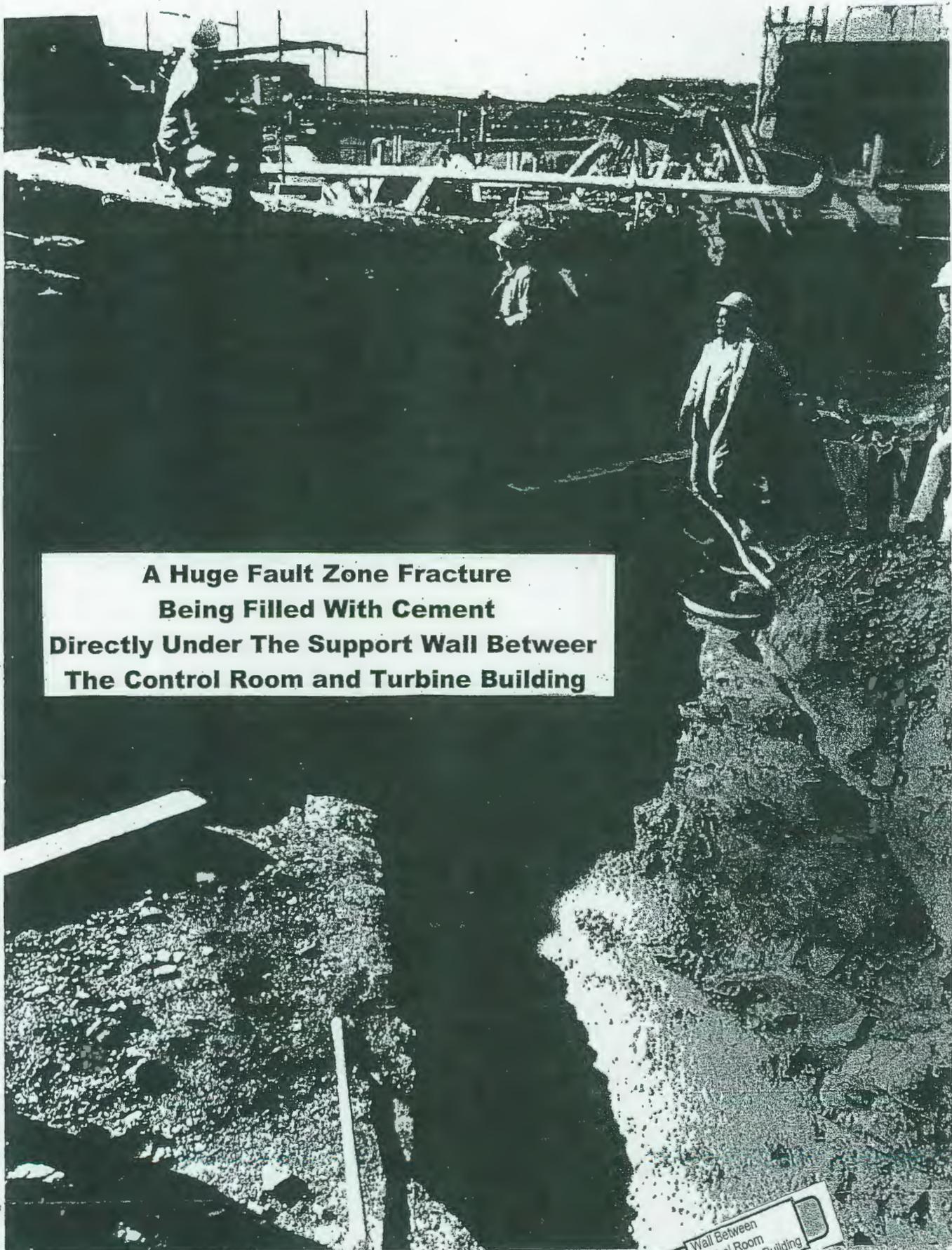
**A Fault Zone Fracture Was Being
Filled With Cement In 1973
Before Limerick's Geological Survey
Was Completed In 1974**

Exterior Wall
Reactor Unit 2

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.



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

Wall Between
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

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

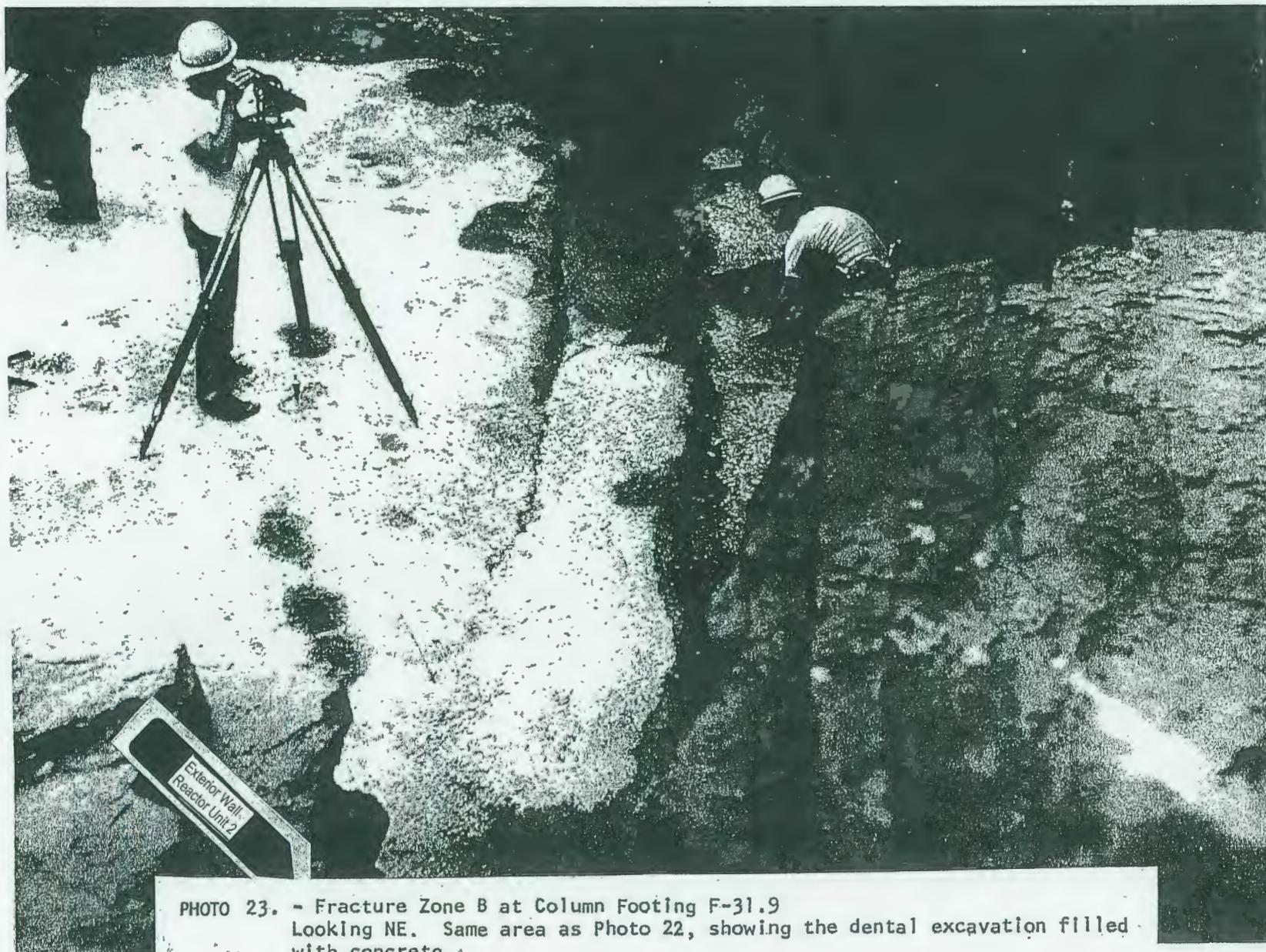


PHOTO 23. - Fracture Zone B at Column Footing F-31.9
Looking NE. Same area as Photo 22, showing the dental excavation filled
with concrete.

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

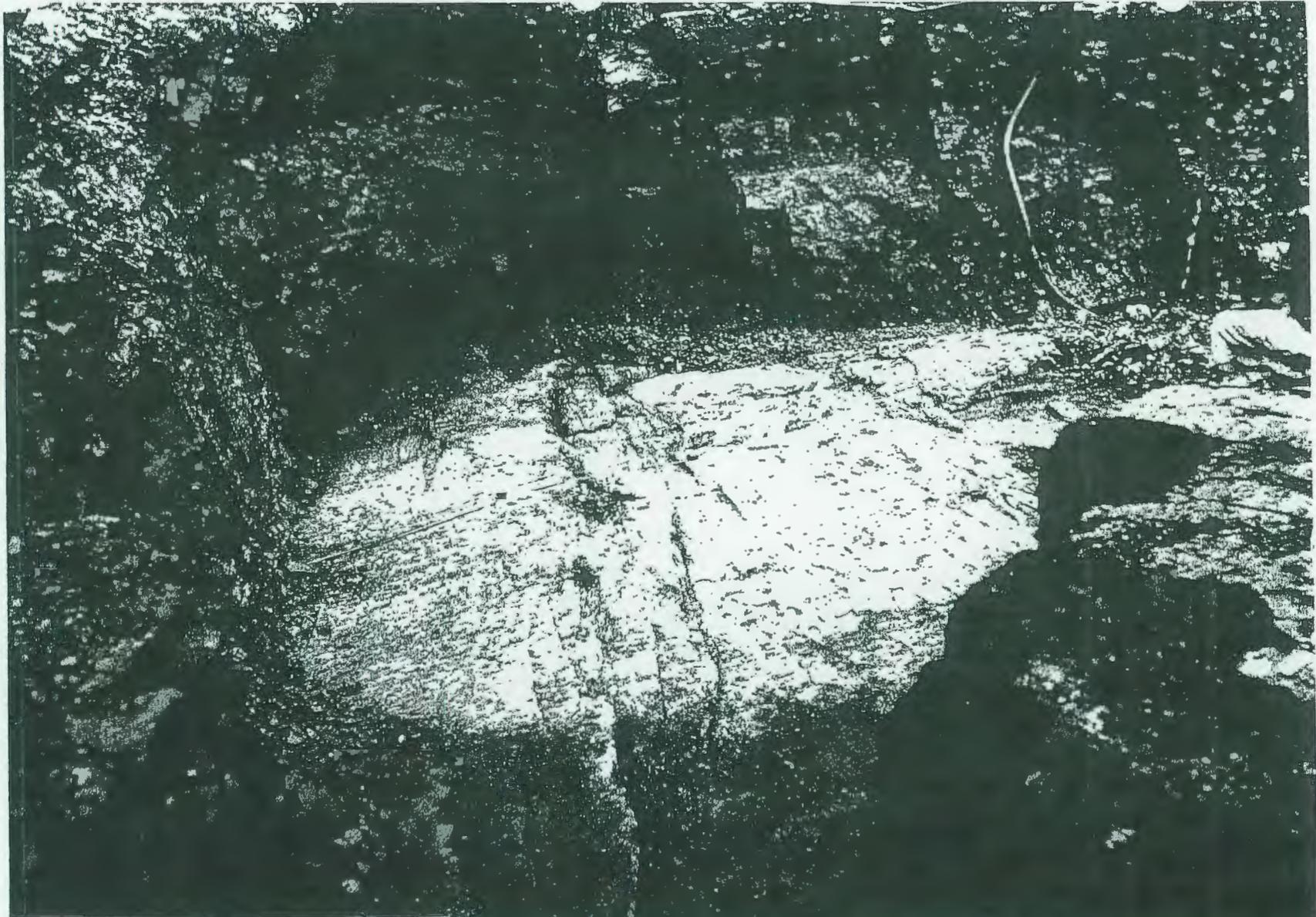
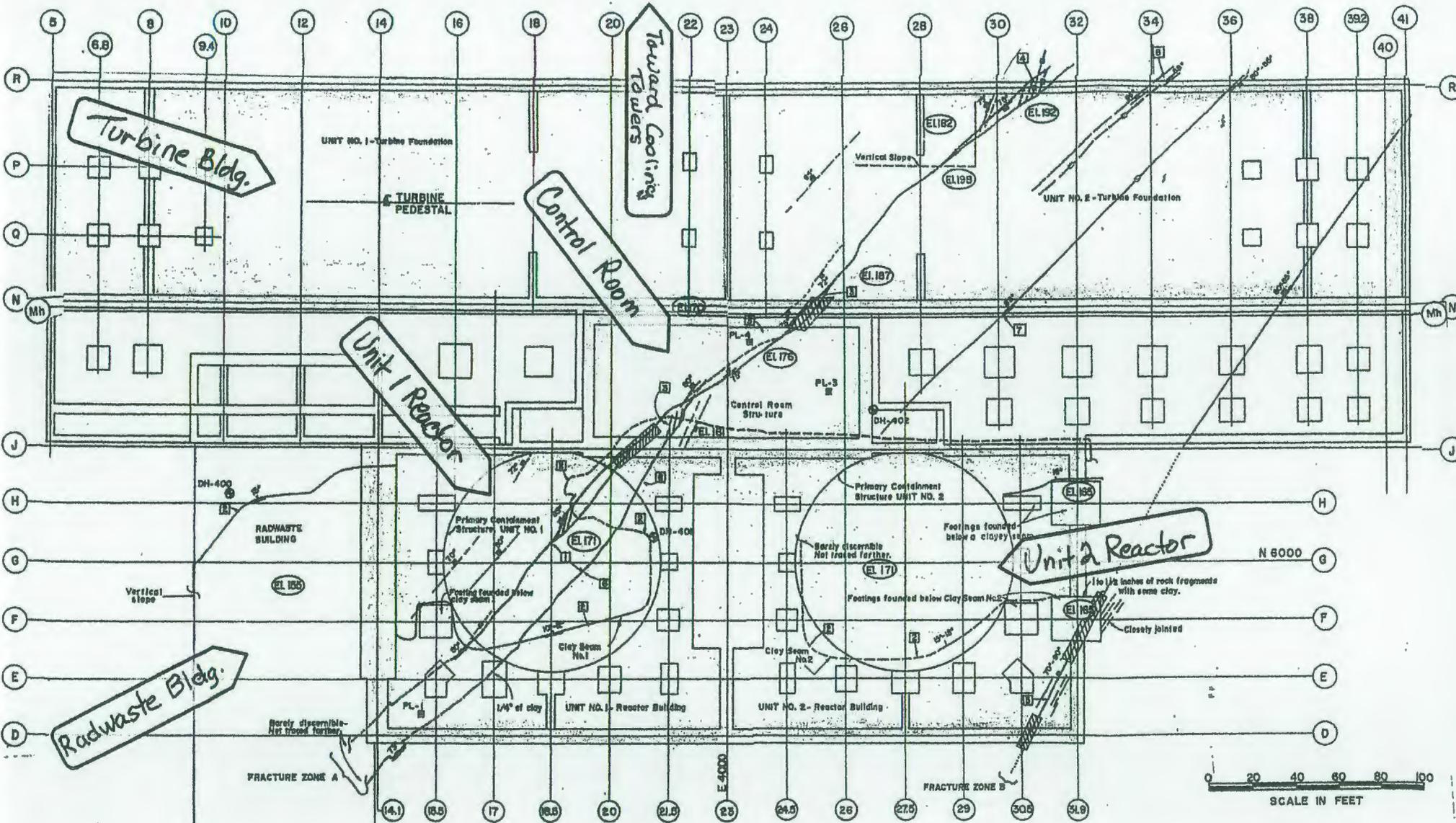


PHOTO 1. - Fracture Zone A at "J" Line.
Looking NE along strike of the zone. "J" line is near the center of the photo. Note that the bedding plane which has been cleaned off (center of the photo) is not displaced across the zone. Clay seam 1 occurs along this bedding plane.

← Wall Between
Control Room
And Unit 1



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 midset. Dotted where fractured.
- Trace of clay seam on excavated rock surface showing dip. Dashed where exposed in excavated slope.
- Area where fracture zones were treated. See report for description and photographs.
- See notes for further descriptions
- Elevation of excavated surface
- Joint showing attitude
- Plate load test showing location and number.

NOTES:

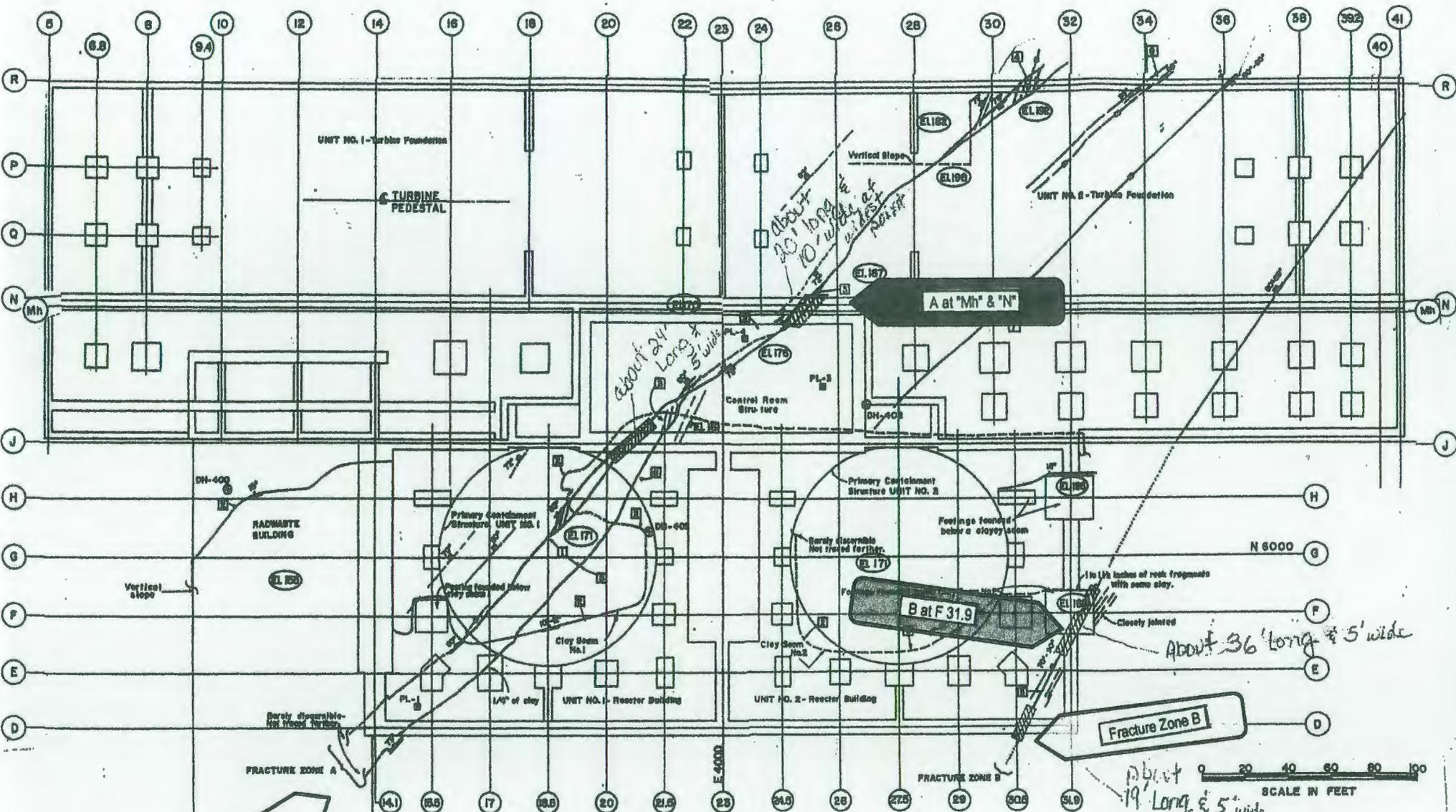
- [1] Fractures generally range from less than 1/4 inch wide to barely discernible from here toward D line. Rock between fractures is unweathered and sound.
- [2] Less than 1/2 inch of clay and rock fragments along clay seam parallel to bedding.
- [3] Fracture zones converge in this area, closely jointed between seams.
- [4] Well defined zone of close jointing with a zone about 8 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 6 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 several inches offset, with westside 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**



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

**GEOLOGIC MAP
 LOCATION OF FRACTURE ZONES**

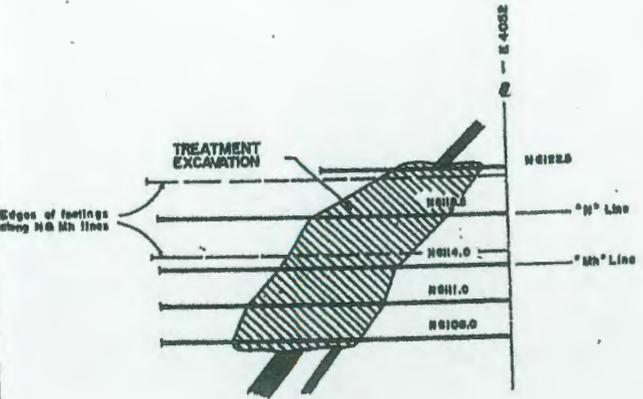
ACE Clarification:
 Arrows Show Fractures
 Documented In Photographs

EXPLANATION

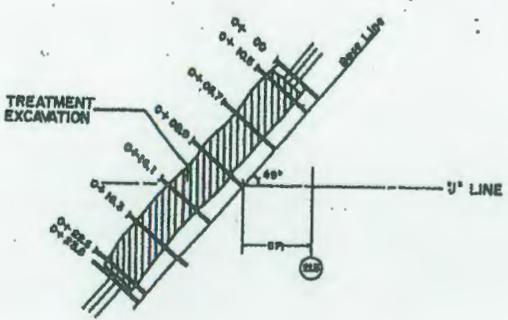
- DH-600 Drill hole to investigate clay seam
- SF Trace of fracture zones on excavated rock surface showing dip. Dashed where fractures are tight and indistinct. Dotted where concealed.
- SF Trace of clay seams on excavated rock surfaces showing dip. Dashed where exposed in excavated slope.
- ▨ Areas where fracture zones were treated. See report for description and photographs.
- See notes for further descriptions
- Ⓜ Elevation of excavated surface
- ↕ Joint showing attitude

NOTES:

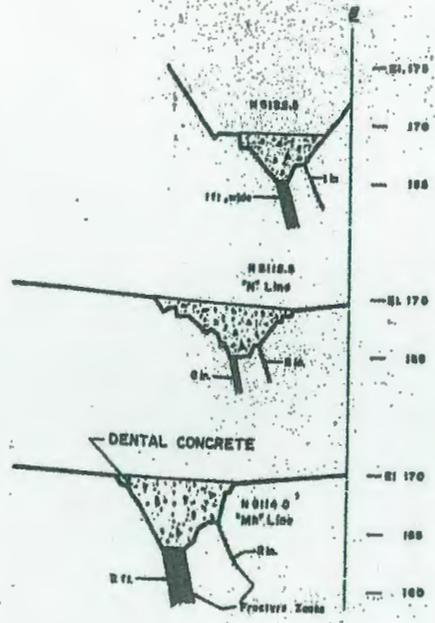
- 1) Fractures generally range from less than 1/4 inch wide to barely discernible from here toward D line. Rock between fractures is unweathered and sound.
- 2) Less than 1/2 inch of clay and rock fragments along clay seam parallel to bedding.
- 3) Fracture zones converge in this area, closely jointed between zones.
- 4) Well defined zone of shear jointing within a zone about 8 to 11' 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 6 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 several inches offset, with west side down. Zone is so narrow, no special treatment is required.
- 8) Dashed lines show areas of fractured rock. Adjacent rock



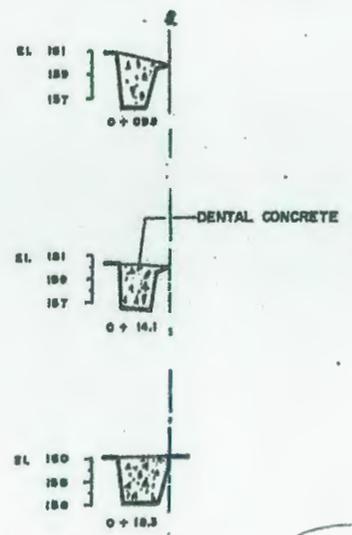
PLAN
TREATMENT OF ZONE A
AT 'N' & 'Mh' LINES



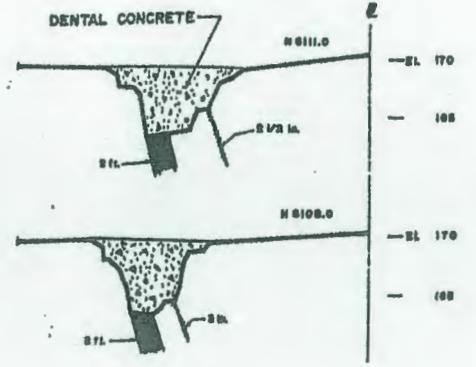
PLAN
TREATMENT OF ZONE A
AT 'J' LINE



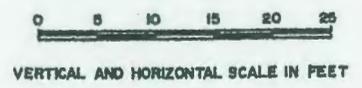
SECTIONS
TREATMENT OF ZONE A
AT 'N' & 'Mh' LINES



SECTIONS
TREATMENT OF ZONE A
AT 'J' LINE



SECTIONS
TREATMENT OF ZONE A
AT 'N' & 'Mh' LINES



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**

**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**

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

 The real reason that an alternative site was not chosen for Limerick Nuclear Plant

DRAFT ENVIRONMENTAL STATEMENT
 Issued: December 1972
 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

A nuclear plant on fault fractures Limerick Nuclear Plant should have never been built!

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.

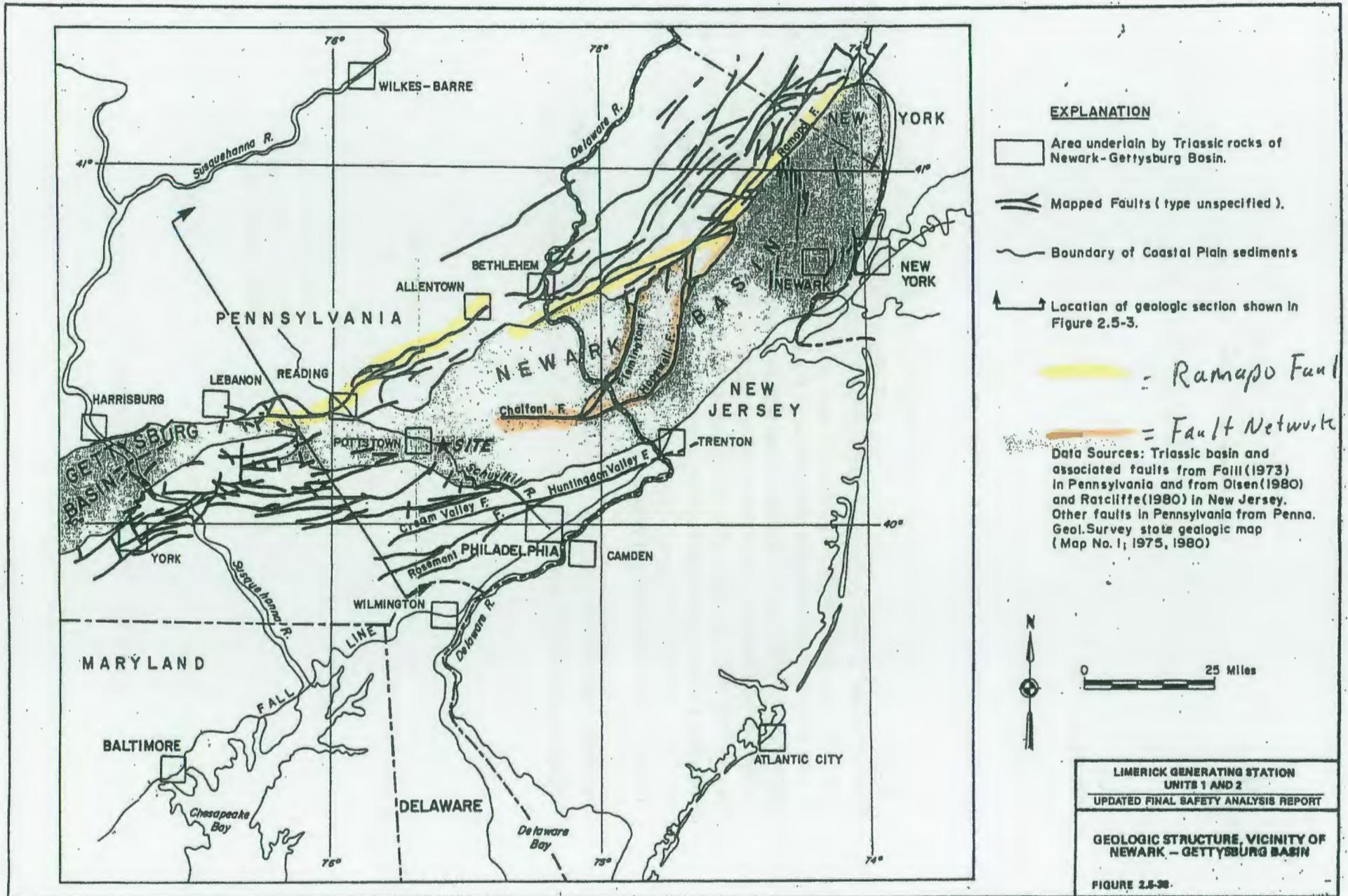
An assessment of the environmental impact of station operation at an alternative site would require a more thorough analysis of the ecological community at a specific site. Operation of the station at the Limerick site is acceptable ecologically.

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

**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**





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,

Andrew A. Rosebrook
Senior Project Engineer
USNRC, Region I

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

NUCLEAR PLANT SITS ON SANATOGA FAULT



LIMERICK NUCLEAR PLANT SITE

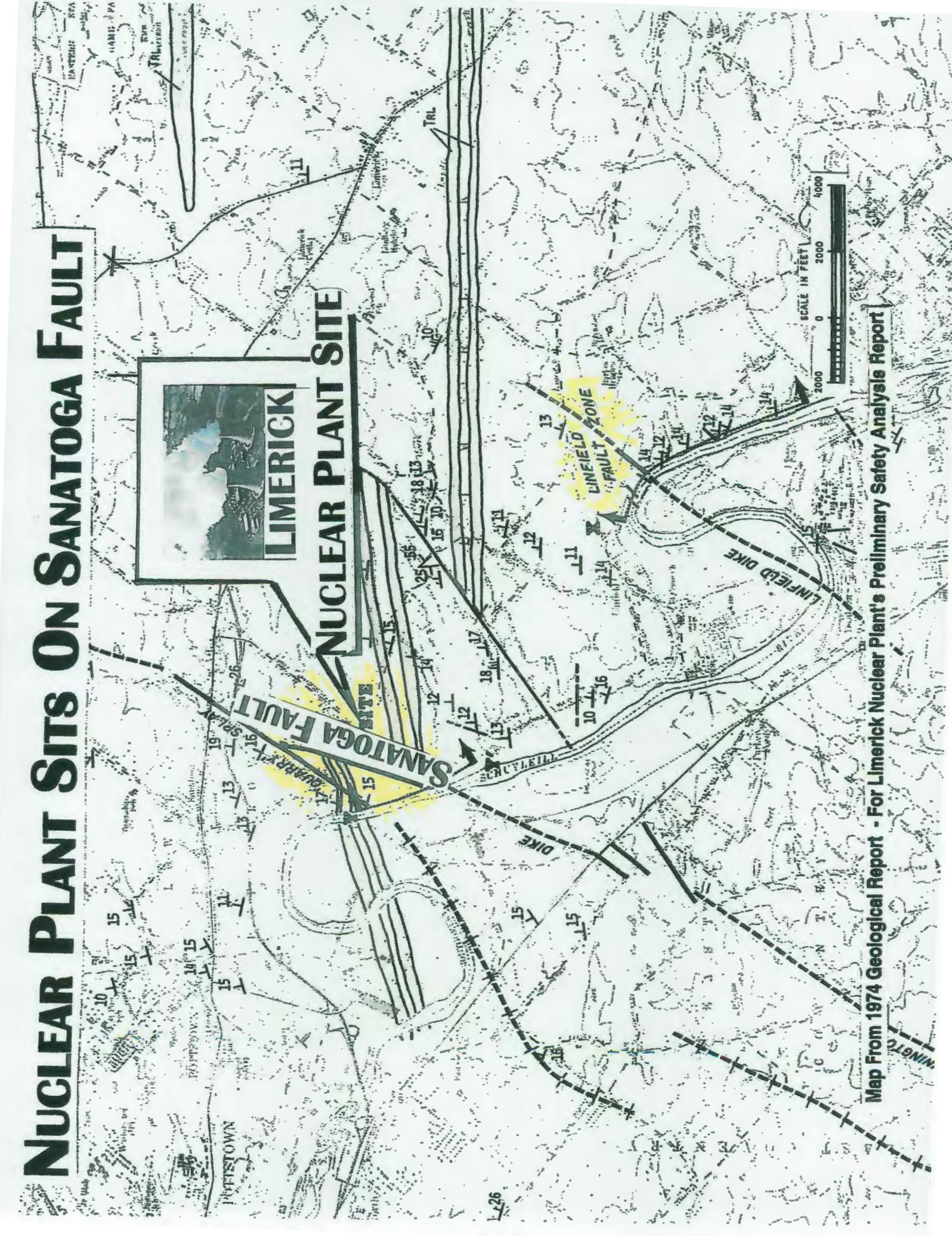
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Map From 1974 Geological Report - For Limerick Nuclear Plant's Preliminary Safety Analysis Report



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 moni-

toring 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



103

1189 Foxview Rd
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Stephen Burns, Chairman
U.S. Nuclear Regulatory Commission
Mail Stop 0-16G4
Washington, DC 20555-001