From: Bower, Fred
Sent: Wednesday, December 11, 2013 5:12 PM
To: 'aceactivists@comcast.net'
Cc: Barber, Scott; DiPaolo, Eugene; Scott, Michael; Screnci, Diane; Sheehan, Neil; McNamara, Nancy; Tifft, Doug; Monteith, Emily; Ennis, Rick; Jackson, Christopher
Subject: RE: Response to ACE - High-Burn Fuel Used At Limerick (EDATS 2013-0321)

Dr. Cuthbert (ACE),

I am writing in response to your email dated October 30, 2013, which was a follow up to our October 21 response to questions you asked on high burnup fuel. We still cannot provide specific fuel loading information at the Limerick Nuclear Power station as it is Security-related information and it is information that is not normally collected by the NRC. However, we can provide background on high burnup fuel including what NRC has done to ensure it does not pose an undue risk to public health and safety.

The reactor core includes an array of fuel rods that creates heat from a controlled nuclear reaction that occurs when control rods are withdrawn. Burnup refers to the uranium consumed in the nuclear reaction within the fuel rods. It is expressed in gigawatt-days per metric ton of uranium (GWd/MTU) - a measure of how long a fuel rod is in the core and the power level it reaches. "High burnup fuel" is in the reactor core for longer than "low burnup fuel." For the purposes of spent fuel transportation, high burnup commercial spent nuclear fuel is understood to mean fuel burnup in a reactor to greater than 45 GWd/MTU.

As stated in the Applicant's Environmental Report - Operating License Renewal Stage (http://www.nrc.gov/reactors/operating/licensing/renewal/applications/limerick/lgs-er-web.pdf), for the Limerick reactors, fuel enrichment and average peak rod burnup conditions are no more than 5 percent uranium-235 and 62,000 megawatt-days per metric ton of uranium (MWd/MTU), respectively.

New fuel designs, including high burnup fuel, undergo a rigorous NRC technical review, and are generally approved for use via a Topical Report that provides the technical evaluation of the new fuel design and lists any limitations for its use. Once the new fuel design is approved with an associated Topical Report, all NRC reactor licensees are permitted to use that fuel design within their reactor core without requesting specific NRC approval, as long as the core continues to meet all applicable design and safety limits. In an operating nuclear reactor, burnup is one of the many parameters that are considered in designing the fuel and core for each operating cycle. Many parameters are evaluated throughout the operating cycle to verify that design specific limits are met. Data-based, predictive tools are used to evaluate these parameters over the cycle. Throughout the cycle, physics testing is also done to confirm key physics parameters are consistent with predictions. When a new fuel is designed its use is limited by the data available to support the associated predictive tools. As such, burnup is limited for a particular fuel by the supporting predictive tools, the data supporting the predictive tools, and the requirement to not exceed any design limit. The fuel is required to meet all safety limits at all times during the operating cycle.

High burnup fuel has been safety stored for many years. There are many storage system designs that have been approved for the long-term storage of high burnup fuel. A number of transportation packages have also been approved to transport high burnup fuel. The Certificates of Compliance for all approved storage and transportation system designs are publically available in NRC's online documents database. The NRC does not approve a spent fuel transportation package or storage system until it completes a full safety review and verifies the design meets the requirements for transportation in 10 CFR Part 71 or for storage in 10 CFR Part 72. This summarizes some of our activities related to the use, transportation, and storage of high burnup fuel.

We believe that our oversight of the industry's use of high burnup fuel provides a reasonable assurance of safety. If you feel we have grossly mischaracterized or mismanaged our oversight of high burnup fuel than I suggest you contact the Office of the Inspector General as outlined below.

If you feel that NRC has mismanaged elements of our reactor oversight program, you should feel free to contact the Office of the Inspector General (OIG) at NRC. The OIG established the Hotline (**1-800-233-3497**) program to provide the NRC employee, other government employee, licensee/utility employee, contractor employee, and the public with a confidential means of reporting incidences of suspicious activity to the OIG concerning fraud, waste, abuse, and employee or management misconduct. Mismanagement of agency programs or danger to public health and safety may also be reported through the Hotline.

It is not OIG's policy to attempt to identify people contacting the Hotline. People may contact the OIG by telephone, through an online form, or by mail. There is no caller identification feature associated with the Hotline or any other telephone line in the Inspector General's office. No identifying information is captured when you submit an online form. You may provide your name, address, or phone number, if you wish.

Thank you for your email,

Fred Bower
Chief | Projects Branch 4 | Division of Reactor Projects | Region I | U.S. NRC
2100 Renaissance Boulevard, STE 100, King of Prussia, PA 19406 | ☎: (610) 337-5200 | **BB**: (610) 731-1920 |
✉: Fred.Bower@nrc.gov

From: aceactivists@comcast.net [mailto:aceactivists@comcast.net]
Sent: Wednesday, October 30, 2013 3:16 PM
To: Bower, Fred
Cc: Evan Brandt
Subject: ACE Resp to NRC - High-Burn Fuel Used At Limerick

October 30, 2013

To: NRC, Fred Bower

From: ACE, Dr. Lewis Cuthbert

RE: NRC'S Refusal To Disclose Information On Limerick Nuclear Plant's Use Of Extremely Dangerous High-Burn Nuclear Fuel

Mr. Bower,

On 10-21-13 you responded to an email ACE sent Mr. Mel Gray on September 18, 2013, regarding the use of High Burn-up Nuclear Fuel at the Limerick Nuclear Plant.

While you responded, you did NOT answer the three simple questions we asked.

1. What month and year did Exelon start using "high-burn-up fuel" at Limerick Nuclear Plant?
2. What quantity of this fuel has been used by Limerick to date?
3. Does NRC plan to continue to allow the use of "high-burn-up fuel" at Limerick?

Your failure to provide answers is unacceptable, given the facts about "High-Burn Nuclear Fuel. We are extremely concerned with good reason. The entire Greater Philadelphia Region already faces unprecedented risks and harms from Limerick Nuclear Plant's deadly high-level radioactive waste.

Growing evidence confirms devastating consequences from burning "High-Burn Nuclear Fuel". Evidence shows "High-Burn Fuel" at Limerick Can Result In:

- **Significant Increased Radioactivity and Decay Heat in Limerick's Spent Fuels**
- **2 to 3 Times Higher Radioactive Fission Gas Releases**
- **Increased Corrosion, Thinning, and Brittleness of Fuel Cladding**
- **Increased Damage and Rupture of the Fuel Rods in the Reactor Vessels, Leading To Radiation Leaks in Spent Fuel Pools and Casks**

➢ **The more "High-Burn Nuclear Fuel" used at Limerick, the greater our risks. The public has a right to full and accurate disclosure of the long-term consequences of using this fuel, with opportunity for meaningful public discussion and comment.**

By allowing "High-Burn Nuclear Fuel" to be used at Limerick Nuclear Plant, NRC has taken a dangerous leap of faith with respect to the safe operation, storage, and disposal of Limerick Nuclear Plant's spent nuclear fuel. It seems clear that NRC's decision to allow the use of "High-Burn Nuclear Fuel" has been motivated by economics. NRC bowed to the wishes of the nuclear industry, doubling the time nuclear fuel can be irradiated in a reactor. NRC admits, " there is limited data to show that the cladding of spent fuel with burnups ... will remain undamaged during the licensing period." NRC has no proof this is safe.

Your 10-21-13 e-mail said *" NRC will not disclose specific information related to ... special nuclear material in use at nuclear power plants."* This excuse is unacceptable! **We wonder if NRC even has verifiable answers to our questions.**

NRC's own records for Limerick reveal that time after time Exelon does whatever it wants to do, making changes (mostly to reduce their cost of doing business at Limerick), then gets NRC to approve after-the-fact license amendments or other approvals, even when those amendments further jeopardize public safety.

➢ **Did Exelon start using "High-Burn Nuclear Fuel" without a prior NRC license amendment?**

We have yet to see proof this is safe! Growing evidence shows that as a result of higher burn-ups, nuclear fuel cladding cannot be relied upon as a primary barrier to prevent the escape of radioactivity, especially during dry storage. The nuclear industry and NRC staff have known this for several years. Damage in the form of pinhole leaks, and small cracks can lead to breaching of fuel cladding. This is "not explicitly defined in [NRC] Regulations, staff guidance or standards."

Detailed Issues of Concern:

With higher burn up, nuclear fuel rods undergo several risky changes that include:

- Increasing oxidation, corrosion and hydriding of the fuel cladding.
- Oxidation reduces cladding thickness, while hydrogen (H3) absorption of the cladding to form a hydrogen-based rust of the zirconium metal from the gas pressure inside the rod can cause the cladding to become brittle and fail;
- Higher internal rod gas pressure between the pellets and the inner wall of the cladding leading to higher fission gas release. Pressure increases are typically two to three times greater.
- Elongation or thinning of the cladding from increased internal fission gas pressure;
- Structural damage and failure of the cladding caused by hoop (circumferential) stress;
- Increased debris in the reactor vessel, damaging and rupturing fuel rods;
- Cladding wear and failure from prolonged rubbing of fuel rods against grids that hold them in the assembly as the reactor operates (grid to rod fretting).

- A significant increase in radioactivity and decay heat in the spent fuel.
- A potentially larger number of damaged spent fuel assemblies stored in pools
- Upgraded pool storage with respect to heat removal and pool cleaning.
- Requiring as much as 150 years of surface storage before final disposal.

The National Academy of Engineering of the National Academy of Sciences raised concern about the viability of high-burnup fuel by noting,

- "the technical basis for the spent fuel currently being discharged (high utilization, burnup fuels) is not well established..."
- "Spent fuel that may have degraded after extended storage may present new obstacles to safe transport."
- "NRC has not yet granted a license for the transport of the higher burnup fuels discharged from reactors."

A New York Times story mentions:

- Fuel assemblies with enough uranium were approved by NRC to run for 6 years instead of the standard 3 years.
- "Some of the younger fuel shows signs of degrading with age."
- "The "high burn-up fuel" spent longer in the harsh environment of a reactor, and now shows signs of corrosion and cracking."

Your failure to provide answers to our questions is irresponsible, given the facts about "High-Burn Nuclear Fuel". Your excuses for not answering are unacceptable.

You certainly could and should answer the following:

1. **When Limerick started using this fuel**
2. **When Limerick's License was amended to start using it.**
3. **If NRC plans to continue allowing Limerick to use it, despite the increased risks faced by our region.**