

**From:** Bower, Fred  
**Sent:** Tuesday, December 31, 2013 2:27 PM  
**To:** aceactivists@comcast.net  
**Cc:** Coffin, Stephanie; Benner, Eric; Csontos, Aladar; Rahimi, Meraj; Araguas, Christian; Marcano, Damaris; Irani, Guita; Ennis, Rick; Evans, Michele; Rodriguez, Veronica; Bower, Fred; Sampson, Michele; DiPaolo, Eugene; Beasley, Benjamin; Ayala, Juan; Scott, Michael; Thompson, Margaret; Pinkham, Laurie; Jackson, Christopher; Barber, Scott; Screnci, Diane; Sheehan, Neil; Tifft, Doug; McNamara, Nancy  
**Subject:** RE: NRC Response to ACE Concerns Related to High Burnup Fuel at Limerick (EDATS 2013-0370)  
**Attachments:** backgrounder-high-burnup-spent-fuel.pdf; br0215r2\_Public Involvement in the Nuclear Regulatory Process.pdf

Dr. Cuthbert (ACE),

I am writing you for a third and final time on the topic of high burnup nuclear fuel. Specifically, I am writing in response to your email dated December 20, 2013. Your email was a follow up, to my two previous email responses dated December 11 and October 21, regarding questions you asked about high-burn nuclear fuel.

I believe that my responses thus far have been accommodating and responsive in a logical, forthright and comprehensive manner. Additionally, I fail to see anything new or actionable in your December 20, 2013, email. Therefore and firstly, I am providing you with the attached "Backgrounder on High Burnup Spent Fuel." Please note that the document header provides contact information if you have questions regarding its content.

Secondly, I would like to provide you with the attached NRC brochure (NUREG/BR-0215), "Public Involvement in the Nuclear Regulatory Process." This attached brochure describes additional methods for members of the public to be involved in the regulatory process including: 2.206 petitions, reporting safety concerns and freedom of information act (FOIA) requests. Please note that if you choose to exercise the petition and enforcement processes, that additional guidance on the petition process located in "Public Petition Process" (NUREG/BR-0200, Rev. 5) states that: "Unsupported assertions of "safety problems," general opposition to nuclear power, or identification of safety issues without seeking enforcement action are not considered sufficient grounds for consideration as a 2.206 petition."

Thirdly, since your December 20, 2013, email appears to make the following assertions of malfeasance:

- "...NRC grossly mischaracterized and mismanaged oversight of high burnup fuel..."
- "...made unsubstantiated claims and mischaracterized NRC's negligent approval process for high burnup fuel..."
- "It is beyond negligent for NRC to have approved use of high burnup fuel..."

I would like to remind you that you may contact the Office of the Inspector General (OIG) at NRC. The OIG has a 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.

Fourth and finally, although I do not plan to respond to another ACE email regarding the use of high burnup nuclear fuel at Limerick, I am willing to discuss this issue with you on the telephone if you contact me at 610-337-5200.

Respectfully,

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 | 📠: (610) 731-1920

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**From:** aceactivists@comcast.net [mailto:aceactivists@comcast.net]  
**Sent:** Friday, December 20, 2013 10:10 AM  
**To:** Bower, Fred  
**Subject:** ACE Response to NRC e-mail 12-11-13 - High-Burn Fuel Used At Limerick

December 20, 2013

**To:** NRC, Fred Bower  
**From:** The Alliance For A Clean Environment  
Dr. Lewis Cuthbert, President  
**Subject:** HIGH-BURN NUCLEAR FUEL USE AT LIMERICK NUCLEAR PLANT

Mr. Bower,

ACE is a group of citizen volunteers trying to make our region a healthier, safer place to live. Since 2000 we investigated and uncovered numerous significant threats and harms to the health and safety of millions of people in the Greater Philadelphia Region related to Limerick Nuclear Plant. Time after time, instead of taking protective actions for the public, NRC tells us to contact the Office of Inspector General for an investigation.

Once again, instead of answering our questions and concerns, your 12-11-13 e-mail said, *"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."*

**We do feel NRC grossly mischaracterized and mismanaged oversight of high burnup fuel, but citizen volunteers should not have to contact the Office of the Inspector General for an investigation, in order to get NRC to protect public health and safety.**

- 1. NRC NEVER ACTUALLY PROVED HIGH BURNUP FUEL CAN BE SAFELY STORED OR TRANSPORTED, BUT APPROVED ITS USE ANYWAY.**
- 2. NRC IS IGNORING INCREASED RADIOACTIVE THREATS TO PUBLIC HEALTH FROM USE OF HIGH BURNUP NUCLEAR FUEL.**
- 3. BASED ON INDEPENDENT EVIDENCE OF GREATER RISKS FROM RADIOACTIVE RELEASES, STORAGE, AND TRANSPORT, ACE URGES NRC TO STOP EXELON FROM USING HIGH BURNUP FUEL AT LIMERICK NUCLEAR POWER PLANT.**

Yet again, NRC is further jeopardizing long-term public health and safety for nuclear industry profits. The nuclear industry switched to high burnup fuel because it can stay in reactors six years instead of three, allowing the industry to delay or avoid procuring expensive dry cask storage systems.

People in the Greater Philadelphia Region are impacted by unprecedented threats from Limerick Nuclear Plant's high-level radioactive wastes. NRC has allowed those threats to increase for Exelon's profits. The public deserve honest answers, preventive actions, and protection. NRC is failing in its mission to protect our future.

Mr. Bower, your 12-11-13 responses to ACE still failed to answer the following questions we first asked NRC 9-13:

1. When did Limerick Nuclear Plant started using high burnup fuel?
2. When was Limerick's license amended to start using this fuel?
3. Does NRC plan to continue allowing Limerick to use this fuel, despite serious concerns about increased risks of long-term storage and transport?

You stated, *"We still cannot provide specific fuel loading information at the Limerick Nuclear Power station as it is Security-related information."*

**That excuse is evasive and illogical. How can answers to the questions above be security related when U.S. DOE published a copy of the detailed inventory of all spent power reactor fuel in the U.S., including Limerick (3-31-11)?**

**DOE's 3-31-11 Report Shows (Limerick 1 - 2,379) (Limerick 2 - 0)**

- **When did Limerick 1 start using high burnup fuel?**
- **Has Limerick 2 started using high burnup fuel? If so, when?**

You stated, *"it is information that is not normally collected by the NRC"*.

**There is no excuse for NRC to have failed to collect all information on high burnup fuel use. That reveals lax, negligent oversight. There must be accountability to the public for the large volumes of the deadly, dangerous nuclear wastes used at Limerick Nuclear Plant, especially for high-burn fuel.**

ACE submitted information to you 12-11-13 (restated below), showing why high burnup fuel results in unacceptable risks. In your response you ignored this information.

**PLEASE PROVIDE DETAILED RESPONSES To The Following Concerns:**

**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 concerns 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."

Mr. Bower, in your 12-11-13 e-mail response, you made unsubstantiated claims and mischaracterized NRC's negligent approval process for high burnup fuel.

**Below ACE is responding to your 12-11-13 e-mail comments concerning NRC's handling of the use, transportation, and storage of high burnup fuel."**

Your 12-11-13 e-mail stated, *"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"*

ACE Responses:

**In reality, NRC did NOTHING to prevent undue risk to public health and safety from use of high burnup fuel. Our radiation risks from high-burnup fuel could increase.**

### **HIGH BURNUP FUEL CAN CAUSE:**

2 to 3 Times Higher Radioactive Fission Gas Releases - logically more radiation will be released.

Significant Increased Radioactivity and Decay Heat in Limerick's Spent Fuels:

Cancer increases skyrocketed in communities near Limerick after Limerick started operating in 1985. We can't afford more radiation released from Limerick operations for any reason.

### **Citizen Monitoring Recently Detected Radiation Spikes Near Limerick. NRC Provided NO Proof That This Isn't From Limerick's Use of High Burnup Fuel.**

#### **1. NRC Did NO Independent Radiation Monitoring**

#### **2. NRC Failed To Respond To Concerns For Four Days**

- After ACE was alerted to a higher than usual radiation spike taken from a resident's RadAlert 11-22-13, ACE started collecting regular data on radiation spikes above what ACE's RadAlert previously detected during our regular radiation monitoring in 2006.
- Due to the surprising number of radiation spikes detected over several hours, ACE contacted NRC by e-mail 11-22-13.
- Four days later, after our second e-mail alert, NRC finally responded, but claimed no problem, WITHOUT ANY INDEPENDENT NRC RADIATION MONITORING. NRC used ONLY Exelon data, even though Exelon showed it can't be trusted to provide full and accurate disclosure.
- Citizen RadAlert data since November 22, 2013 continued to show radiation spikes for several weeks.
- Bottom line, NRC waited 4 days to respond to the public about concern over radiation spikes, then dismissed citizen findings.
- Even if it can't be proven that high burnup fuel caused radiation spikes detected by citizens, NRC has NO ANSWERS for what did cause them, and we know high burnup fuel releases more radioactive gases.
- **By stopping the use of high burnup fuel, NRC could honestly claim they had prevented some of Limerick's undue risks to public health and safety.**

You used typical language to make the following deceptive claim, *"We (NRC) believe that our oversight of the industry's use of high burnup fuel provides a reasonable assurance of safety"*.

ACE Responses:

**NRC is claiming reasonable assurance of safety WITHOUT SUFFICIENT EVIDENCE to support that claim. NRC CANNOT assure long-term safety.**

NRC's "reasonable assurance of safety" is based on unsubstantiated claims by the nuclear industry.

- NRC jeopardized public safety by allowing the nuclear industry to save money by using this obviously more dangerous "high burnup" fuel, based ONLY on financially self-serving, unsubstantiated claims by the untrustworthy nuclear industry and their lobbyists.
- With NO PROOF of the safety of long-term storage and transport of high burnup fuel, and despite evidence suggesting it isn't safe, NRC approved use of high burnup fuel and continues to allow its use.

**DOE's "Demonstration Project" proves NRC's reasonable assurance of safety is baseless.**

- It will be another 4 years before the U.S. DOE and the Electric Power Energy Institute even start the demonstration project to figure out actual safety implications of "high burnup" spent fuel cask storage and transport. The Electric Power Energy Institute will design and demonstrate dry cask technology for evaluating the condition of "high burnup" spent nuclear fuel during storage.
- If it was safe, DOE would not need to begin a costly five-year "Demonstration" project, with 2017 as a target date to load the fuel into the demonstration cask. This "demonstration project", reported 11-1-13, is costly to the public, who will largely foot the \$15.8 million dollar bill. The nuclear industry, which financially benefits from the use of high burnup fuel, is only required to pay 20%.

You said, *"High burnup fuel has been safely stored for many years"*

ACE Responses:

**Evidence suggests it cannot be stored safely, much less for the time it remains deadly.**

- High burnup fuel has not been stored many years, considering this radioactive waste can stay dangerous for over a million years.
- What does NRC consider many? Math suggests high burnup fuel has NOT been in fuel pools many years.
- NRC approved high burnup fuel use since the 1990s. It can be used in reactors for 6 years.
- In the few years it has been stored, evidence shows significant increased radioactivity and decay heat, with increased corrosion, thinning, and brittleness of fuel cladding.

You said, *"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."*

ACE Responses:

**We cannot understand why NRC approved high burnup fuel use without independent proof that long-term storage or transport is safe.**

- NRC issued negligent approvals, in spite of admitting there is limited data to show cladding of spent fuel with burnups will remain undamaged, even during the licensing periods.

- The evidence suggests NRC could not prove long-term storage and transport were safe when NRC approved long-term storage and transportation packages.

You said, *the Certificates of Compliance for all approved storage and transportation system designs are publically available in NRC's online documents database. in 10 CFR Part 71 or for storage in 10 CFR Part 72.*

ACE Response:

**Certificates of Compliance with unprotective regulations are meaningless.**

You said, *"High burnup fuel, undergoes a rigorous NRC technical review. 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".*

ACE Responses:

**A body of evidence suggests NRC's definition of "rigorous review" falls far short of insuring safety..**

- 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.
- NRC admits there is limited data.
- NRC's reviews are compromised from the start, as evidenced by this very dangerous high burnup fuel fiasco.
- This is "not explicitly defined in [NRC] Regulations, staff guidance or standards."

**It is beyond negligent for NRC to have approved use of high burnup fuel without solid evidence that fuel could actually be stored and transported safely.**

- Unfortunately, NRC bases its technical reviews on financially self-serving information provided to NRC by the nuclear industry and supporting enterprises.
- NRC's leap of faith on behalf of nuclear industry interests must be reversed and NRC should immediately STOP the use of this dangerous process. There could be a serious radiation accident with fuels already stored.

**Despite evidence of increased risk and harm, NRC continues to allow use of this dangerous fuel. NRC never proved high burnup fuel can be safely stored or transported. NRC is ignoring increased radioactive threats to public health from use of high burnup nuclear fuel.**

**On behalf of the health and safety of millions of people in the Greater Philadelphia Region, ACE is urging NRC to stop the use of high burnup fuel at Limerick Nuclear Plant based on serious concerns over:**

- 1. Damage to fuel rods**
- 2. More dangerous storage and transport**
- 3. Higher fission gas releases**

This request is supported by a growing body of evidence:

2 to 3 Times Higher Radioactive Fission Gas Releases  
Significant Increased Radioactivity and Decay Heat in Limerick's Spent Fuels  
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

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**From:** "Fred Bower" <Fred.Bower@nrc.gov>

**To:** aceactivists@comcast.net

**Cc:** "Scott Barber" <Scott.Barber@nrc.gov>, "Eugene DiPaolo" <Eugene.DiPaolo@nrc.gov>, "Michael Scott" <Michael.Scott@nrc.gov>, "Diane Screnci" <Diane.Screnci@nrc.gov>, "Neil Sheehan" <Neil.Sheehan@nrc.gov>, "Nancy McNamara" <Nancy.McNamara@nrc.gov>, "Doug Tiff" <Doug.Tiff@nrc.gov>, "Emily Monteith" <Emily.Monteith@nrc.gov>, "Rick Ennis" <Rick.Ennis@nrc.gov>, "Christopher Jackson" <Christopher.Jackson@nrc.gov>

**Sent:** Wednesday, December 11, 2013 5:12:04 PM

**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 safely 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 then 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](mailto:Fred.Bower@nrc.gov)

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**From:** [aceactivists@comcast.net](mailto:aceactivists@comcast.net) [mailto:[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.**

## High Burnup Spent Fuel

Nuclear fuel is removed from a reactor every few years when it can no longer economically sustain a chain reaction. This “spent” fuel remains radioactive and must be managed. Initially, it goes into a pool onsite for cooling and storage. Some utilities are moving their spent fuel after it has cooled for several years in the pool into NRC-certified dry storage casks. These casks are specially designed to contain the radioactivity and allow hot spent fuel to cool further.

### What is burnup?

“Burnup” is a way to measure the uranium burned in the reactor. It is expressed in gigawatt-days per metric ton of uranium (GWd/MTU). Burnup depends on how long the fuel is in the core and the power level it reaches. The burnup level affects the fuel’s temperature, radioactivity and physical makeup.

In a reactor, uranium fuel fissions—splits apart and releases energy—and the metal cladding that encases the fuel reacts with cooling water. This reaction forms oxide on the outside (similar to rust) and releases hydrogen. These processes begin slowly then start to accelerate as the fuel reaches burnup of 45 GWd/MTU. Anything above this level is considered high burnup.

Over time, burnup has increased, allowing utilities to get more power out of their fuel before replacing it. Average burnup, around 35 GWd/MTU two decades ago, is over 45 GWd/MTU today. How hot and radioactive spent fuel is depends on burnup, the fuel’s initial makeup and conditions in the core. All these factors must be taken into account in designing dry storage and transport systems for spent fuel.

### Is it safe to store and transport high burnup fuel?

To be certified by the NRC, dry cask designs must meet transportation requirements in 10 CFR Part 71 or storage requirements in 10 CFR Part 72. The NRC approves designs only after a full safety review. Based on these reviews, the NRC has certified numerous cask designs for spent fuel storage and transportation. Operating experience since dry storage began in 1986 and short-term tests show both low and high burnup spent fuel can be stored and transported safely.

More casks are available for low than for high burnup spent fuel. Because it has been used longer, there is a great deal more data on low burnup fuel. There is enough data on high burnup fuel that the NRC has been able to certify some high burnup spent fuel storage casks for an initial term of 20 or 40 years. Some systems have also been approved for transporting high burnup spent fuel.

## **Why does burnup matter?**

Burnup is important to the NRC's review of spent fuel cask designs because each system has limits on temperature and radioactivity. When the cask is being dried, pressure increases inside and the fuel heats up. This may cause the cladding to become more brittle when it cools. These changes depend on burnup and the type of cladding, and need to be accounted for in high burnup spent fuel systems. A great deal of work has been done to understand the conditions that make different types of fuel cladding more brittle.

Testing continues on high burnup spent fuel and the set of available data is growing. Cask designers use the results to redesign their casks for higher burnups and additional fuel types. As more data becomes available, the NRC expects to be able to certify more casks. Cask designers also need this data to demonstrate the long-term safety of their systems so they can continue storing spent fuel beyond the initial license term.

## **How does the NRC make sure it remains safe?**

The NRC assures safety by requiring many layers of protection. Casks provide several layers and the fuel cladding itself is an important layer. The regulations are designed to ensure the casks will hold up and the cladding will not break during storage or in a transport accident. The NRC carefully reviews each cask application to see if it meets the requirements. As part of this review, the NRC does its own analysis to confirm information in the application.

The NRC also does inspections before and during loading of dry casks to ensure the correct fuel goes into the right storage systems. Fuel with burnup higher than the NRC certificate allows cannot be loaded. It must remain in pool storage until a cask approved for higher burnup becomes available. The NRC also inspects loaded casks every few years.

## **What confirmatory research is being done?**

Testing has provided a lot of information on how different types of cladding on spent fuel will behave, and this work continues. Planning has begun for an important new study, run jointly by the nuclear industry and the Department of Energy, with regulatory oversight by the NRC. In this study, high burnup spent fuel will be loaded into a cask fitted with instruments to provide temperature readings and allow gas sampling. Those readings, combined with tests on the fuel assemblies and inspection of the cask's interior after years of dry storage, will provide a much better understanding of what happens to high burnup spent fuel in a storage cask as it cools over time.

Work is underway to create better models to determine how much cladding actually may become brittle and the impact of vibration during transport. The NRC is also monitoring work going on internationally.

All this work will help cask designers, users and regulators better understand how to ensure high burnup spent fuel will remain safe in long-term dry storage and during transportation to a centralized storage or disposal facility.

December 2013

# Public Involvement in the Nuclear Regulatory Process





***Table of Contents***

Introduction ..... 2

Rulemakings ..... 3

Licensing ..... 4

Decommissioning and License Renewal ..... 5

High-Level Waste ..... 6

Environmental Impacts ..... 7

Petitions ..... 8

Reporting Safety Concerns ..... 9

Enforcement ..... 9

Public Meetings ..... 10

Freedom of Information Act Requests ..... 12

General Correspondence ..... 12

For Additional Information ..... 12

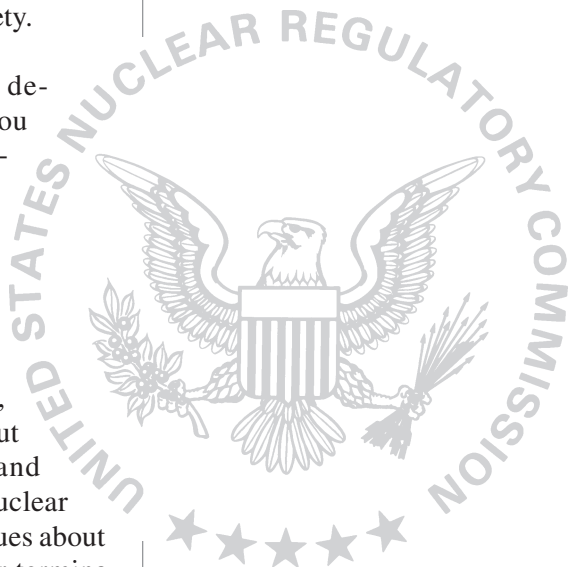
### Introduction

Public involvement in the Nuclear Regulatory Commission's activities is a cornerstone of strong, fair regulation of the nuclear industry. The NRC recognizes the public's interest in the proper regulation of nuclear activities and provides opportunities for citizens to make their opinions known. The NRC seeks to elicit public involvement early in the regulatory process so that safety concerns that may affect a community can be resolved in a timely and practical manner. This process is considered vital to assuring the public that the NRC is making sound, balanced decisions about nuclear safety.

This booklet briefly describes various ways you can learn about and participate in the NRC's regulatory process. Anyone may provide comments or voice concerns at critical junctures in the development of safety rules, including decisions about (1) where to locate and whether to license a nuclear facility, (2) ongoing issues about a facility's operation or termina-

tion, and (3) a facility's impact on the environment.

Notices of opportunities for involvement are published in the *Federal Register*, and sometimes on the Internet. The *Federal Register* is a daily publication announcing rules, policies, and other important actions of the Federal Government. Copies are available at many local libraries, at the NRC's Public Document Room (PDR) in Rockville, Maryland, and on the internet. For major actions, the NRC issues press releases, which reach the public through local newspaper articles, mailings, and the Internet.



### Rulemakings

One of the primary duties of the NRC is to establish regulations on the safe use of nuclear materials. These regulations address such issues as siting, design, construction, operation, and ultimate shutdown of nuclear power plants, uranium mills, fuel facilities, waste repositories, and transportation systems. NRC regulations also address other uses of nuclear materials, such as nuclear medicine programs at hospitals, academic activities, research work, industrial applications such as the use of gauges and testing equipment, and the import and export of nuclear materials and technologies. The process of developing these regulations is called “rulemaking.” A regulation is sometimes referred to as a “rule.”

Rulemaking is initiated mostly by NRC’s technical staff, although any member of the public may petition the NRC to develop, change, or rescind any regulation. Petitions should be addressed to:

The Secretary  
U.S. Nuclear Regulatory  
Commission  
Washington, D.C., 20555-0001.

The rulemaking process is described in detail in the Commission’s regulations in Title 10 of the *Code of Federal Regulations* in Part H, Section 2.802.

All rulemakings provide the public with at least one opportunity for comments. Often, there are several opportunities. In some cases, NRC holds meetings and workshops before a proposed rule is drafted. This way, members of the public can express their concerns early in the process and identify important issues to be covered in the rule. Sometimes, the NRC may publish an Advance Notice of Proposed Rulemaking in the *Federal Register* to obtain public comments and provide clarification of certain issues before developing a proposed rule.

When a proposed rule is developed, it is published in the *Federal Register* for public comment. The notice identifies an NRC contact who can reply to questions and provides an address for sending comments. The agency may hold meetings and workshops to discuss the proposed rule, explain its purpose and background, and receive further comments. These meetings are normally announced

in the *Federal Register*. Comments are factored into the final rule, which, like the proposed rule, is again published in the *Federal Register*. The NRC issues press releases for rules that have strong public interest. In addition, an electronic bulletin board is available which provides the status of all rulemakings in progress. This interactive Ruleworking Forum is located at <http://ruleforum.llnl.gov> on the Internet.

Policy statements, Commission guidance, and generic communications with licensees that have significant public interest are often handled like a rulemaking, offering an opportunity for public comment.



### Licensing

Before a company can propose to site, construct, or operate a nuclear power plant or any other nuclear-related facility or to engage in the use of radioactive materials, it must apply to NRC for a license. The licensing process includes approval of the initial license, amendments, license renewals, and applications for exemptions from NRC regulations.

As part of the prelicensing process, the public is notified through the *Federal Register*, press releases, and local advertisements that an application has been received. Notices regarding opportunities for hearings or public comment on all licensing actions, including amendments to a facility's operating license, or license renewal proceedings, are published in the *Federal Register*. For nuclear power plants, individuals who are directly affected by the proceeding may participate in a formal hearing. However, for materials licenses and fuel cycle facilities, most hearings are informal.

If local interest is strong, the NRC may decide to hold public meetings in the vicinity of a proposed facility. Notices of local meetings may be mailed to citizens' groups and civic and government leaders in the community and may be advertised in local newspapers.

### **Decommissioning and License Renewal**

When a nuclear power plant approaches the end of its initial 40-year operating license period, the utility that operates it may choose to decommission the plant and terminate its license. Other

utilities may decide instead to request an extension of their licenses to continue to produce electricity up to 20 years past the original license under the NRC plant license renewal rule. In either case, the public has an opportunity to participate in NRC's decisionmaking process to either renew a license or decommission a facility.

This process is also used in licensing and decommissioning nuclear materials facilities, such as those handling low-level radioactive waste. When facilities stop operating, the owners must initiate decommissioning to remove or re-



duce radioactive contamination that might have occurred at the site during operation. The NRC has developed a list of sites in the United States that warrant special oversight because of unique decommissioning issues.

The public may become involved in the decommissioning process for these sites during the development of an Environmental Assessment (EA) or an Environmental Impact Statement (EIS). These terms are described in more detail below. The NRC also provides opportunities for public involvement through roundtable meetings. They are convened when the NRC believes that enhanced public involvement will contribute to the success of the decommissioning process. The NRC conducts roundtable meetings in the vicinity of the site to enable the public to collect information, to comment on and question the decommissioning actions at the site, and to discuss decommissioning issues among stakeholders. The roundtable format includes representatives of Federal and State agencies, interest groups, and the community. Meetings are usually announced in local newspapers or on local radio stations.

### High-Level Waste

The projected licensing of a high-level waste (HLW) repository is a first-time endeavor for NRC, and one in which public participation started well before an actual license application. All meetings regarding the HLW program are open to the public and noticed in the *Federal Register*. Up-to-date information on future meetings and other important activities regarding the HLW program can be obtained on the Internet at <http://www.nrc.gov>.

Nuclear power plants can store spent nuclear fuel in independent spent fuel storage installations (ISFSIs) on the premises of the plant under either a specific or a general license from the NRC. Applications for a specific license would be handled the same as other licensing actions—with full notice and participation by the affected community on use of storage containers at the facility. Under the terms of an NRC general license, any nuclear power reactor licensee can use a pre-approved storage cask if the company notifies the NRC in advance, meets the conditions of the cask's NRC certificate of compliance, and complies with the NRC's regulations. Before

approving a cask design for use under a general license, the NRC publishes a notice of proposed rulemaking in the *Federal Register* for public comment and issues a press release.

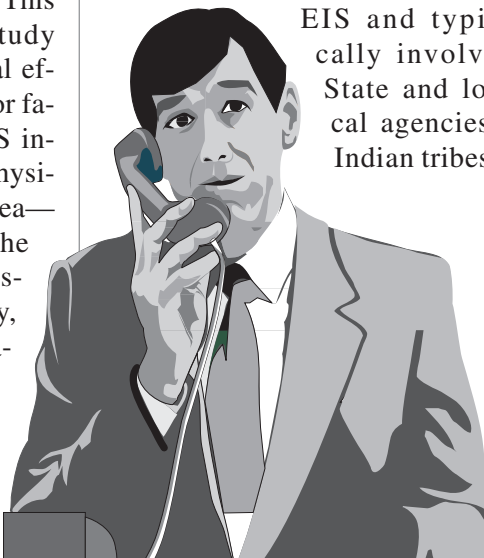
### Environmental Impacts

When the NRC reviews a proposal to build a major new facility or considers any other action that might have a significant impact on the environment, an Environmental Impact Statement (EIS) must be developed by the NRC staff. The concept of an EIS originated in the National Environmental Policy Act (NEPA), which requires Federal evaluation of a proposed facility's impact on the environment. This is a detailed, scientific study describing the environmental effects of the proposed action or facility. For example, the EIS includes information on the physical characteristics of the area—geology, water, and air—the ability of transportation systems to support the facility, and local population information.

An Environmental Assessment (EA) is usually prepared and published in the *Federal Register* as a precursor to an EIS. An EA is a brief discussion of the need for the proposed action, along with a list of the agencies and experts consulted. If the EA indicates the proposed action or facility will not have a significant effect on the environment, no EIS is required.

Scoping meetings provide a forum for members of the public to express their opinion and provide information in preparation for environmental evaluations. These meetings are often held to help NRC identify issues to be

addressed in an EIS and typically involve State and local agencies, Indian tribes,



or other interested people who request participation.

For example, while the NRC was developing its decommissioning rule, the agency conducted four scoping meetings around the country to gather public comments regarding the EIS and the clean-up criteria for the decontamination and decommissioning of NRC-licensed facilities.

### Petitions

Any member of the public may raise potential health and safety issues in a petition to the NRC to take specific enforcement action regarding a licensed, operating facility. This provision is contained in Subpart B, Section 2.206 of the NRC's regulations and is often referred to as a "2.206 petition." In general, the petition is submitted in writing to the Executive Director for Operations and includes specific facts supporting the request for the NRC to take enforcement action. Unsupported assertions of safety problems or general opposition to nuclear power are not considered sufficient grounds for action. If warranted, the NRC could take action to modify, suspend, or revoke a license, or could

take other appropriate enforcement action to resolve a problem identified by a 2.206 petition.

Once a petition is accepted for review, and throughout the petition process, the petitioner is informed of progress, given copies of all relevant correspondence, and may be offered an informal public hearing, if appropriate. An informal public hearing is offered when the petition presents new information that raises a significant safety issue or alleges a violation of NRC requirements involving a significant safety issue for which new information or a new approach is provided. The NRC publishes a notice in the *Federal Register* when it receives a 2.206 petition and again 30 days in advance of an informal public hearing.

Electronic information on petitions is available at <http://www.nrc.gov/what-we-do/regulatory/enforcement/petition.html>. More detailed information on this process is contained in a pamphlet entitled "Public Petition Process," NUREG/BR-0200, which is available from the Government Printing Office and NRC's Office of Public Affairs.



### Reporting Safety Concerns

Often workers at nuclear power plants or members of the public raise concerns that safety rules are not being followed at the facilities where they work or near where they live. The NRC has established a formal process for reviewing and resolving these concerns.

The NRC encourages workers in the nuclear industry to take their concerns directly to their employer because he or she has the primary responsibility for maintaining safe operations. However, should employees not be satisfied by company response or choose to bring safety concerns directly to the NRC, they may do so by calling NRC's toll-free safety hotline,

1-800-695-7403. Any member of the public may voice safety concerns in this same manner. Additional information on reporting safety concerns is found in "Reporting Safety Concerns to the NRC," NUREG/BR-0240, from NRC's Office of Public Affairs.

### Enforcement

The NRC's enforcement program seeks to protect public health and safety by ensuring that licensees comply with regulations and license conditions. Enforcement actions might take the form of notices of violations, civil penalties, or orders to modify, suspend, or revoke licenses. Predecisional enforcement conferences are often held with a licensee, a vendor, or other person before the NRC

makes its final decision on a significant enforcement action. In most cases, these conferences are open to public observation. The NRC issues press releases announcing all open enforcement conferences, as it does with public meetings (see the following section, "Public Meetings"). In addition, summaries of all enforcement conferences, NRC actions, and licensee responses are available in the NRC's Public Document Room.

### Public Meetings

The public can keep abreast of NRC's regulatory activities through a variety of open meetings dealing with significant safety is-

ssues. These include most technical meetings with licensees and meetings with trade organizations and public interest groups. Often, the NRC staff meets with licensees to discuss their safety performance. These meetings are open for public observation.

In some cases, meetings are held in the community near a nuclear power plant or other facility to make it easier for the public to participate. If a community expresses concern over licensing or other actions involving a facility nearby, the NRC may hold public meetings near the site to explain the NRC's role as it relates to the licensee's planned activities and to answer questions posed by local citizens.

Public meetings may also be held when a licensee submits a plan to decommission a facility. Other open meetings may be held at one of the NRC regional offices or at



NRC Headquarters in Rockville, Maryland.

The types of meetings that are not usually open to the public include discussions of classified, proprietary, or safeguards information; ongoing investigations; privacy information; inspector meetings with licensee management and technical staff on site; or meetings that could pose a significant administrative burden and interfere with NRC's primary safety responsibilities.

Schedules of all NRC meetings are available electronically at <http://www.nrc.gov/public-involve/public-meetings/meeting-schedule.html>.

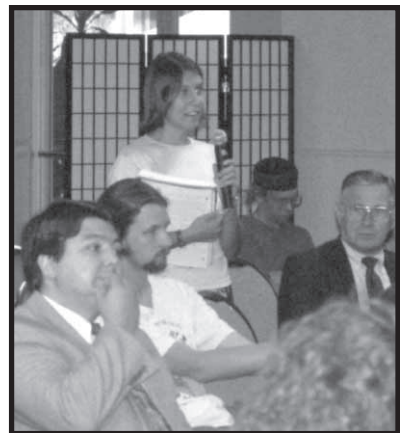
Weekly lists of staff meetings are also posted in the agency's public document room in Rockville, Maryland.

For staff meetings, a listing is available at least 10 calendar days in advance of the date of the meeting. Notices for Commission and Advisory Committee meetings are published in the *Federal Register*.

Persons interested in the activities of a particular committee may call or write the NRC Advisory Committee Management Officer, Office of the Secretary, Washington, D.C. 20555-0001; telephone 301-415-1968.

The agency's policy regarding open meetings is described in more detail in NRC's Management Directive 3.5, "Public Attendance at Certain Meetings Involving the NRC Staff" (available from the Government Printing Office).

In addition to these mechanisms, the NRC announces major meetings in press releases issued to the news media and mailed to more than 1,000 addressees. Notices are posted in the Public Document



Room and sometimes through advertisements placed in local newspapers several days in advance of a meeting.

### **Freedom of Information Acts Requests**

The NRC releases information to the public related to its health and safety mission by placing documents in its Public Document Room. However, under the Freedom of Information Act (FOIA), members of the public may request copies of other NRC documents and, unless these records fall under specific Federal exemptions, the NRC will provide access to them within 20 working days after the request is received. Under certain circumstances, fees are charged to cover the cost of locating and copying the requested material.

Freedom of information inquiries may be addressed to the FOIA/PA officer, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555-0001.

### **General Correspondence**

At any time, of course, a member of the public can request information in writing or identify concerns about nuclear facilities through regular correspondence. Routine correspondence between NRC and its licensees is made available in the Public Document Room. General correspondence should be addressed to the Office of the Secretary, U.S. Nuclear Regulatory Commission, Washington, D.C. 20555-0001.

### **For Additional Information**

For more information on public involvement, contact the NRC Office of Public Affairs by telephone at 301-415-8200, or via Internet electronic mail at <OPA@NRC.GOV>.

For more detailed descriptions of how to obtain information from the NRC, you can order a copy of the latest revision to the "Citizen's Guide to NRC Information," NUREG/BR-0010, by writing to the Superintendent of Documents, Government Printing Office, Mail Stop SSOP, Washington, DC, 20402-0001 or at <http://bookstore.gpo.gov/>.



