April 24, 2002

Dr. William D. Travers
Executive Director for Operations
United States Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT: PETITION PURSUANT TO 10 CFR 2.206 REGARDING SAFETY AT DAVIS-BESSE NUCLEAR POWER PLANT

Dear Dr. Travers:

Request for Enforcement-Related Action

Pursuant to 10 CFR 2.206, the undersigned petitioners request the Nuclear Regulatory Commission to issue an order to FirstEnergy, the owner of the Davis-Besse nuclear power plant, requiring a Verification by an Independent Party (VIP) for issues related to the reactor vessel head problem. As you well know from being the NRC's Director of the Special Projects Office for Millstone, independent programs serve both to verify the adequacy of plant owner performance and to reassure the public that all reasonable safety measures have been taken. Conditions at Davis-Besse warrant that verification and reassurance. The petitioners request that the VIP be tasked with:

1. Verifying the adequacy of problem identification and resolution (PIR) process.

2. Verifying the root cause evaluation prepared by FirstEnergy for the damage to the reactor vessel head.

3. Verifying that the long-term accumulation of boric acid within the reactor containment did not impair the function of safety-related systems, structures, and components.

4. Verifying that FirstEnergy has taken appropriate actions in response to NRC generic communications.

5. Verifying that FirstEnergy has not deferred other plant modifications without appropriate justification.

6. Verifying that all the entities responsible for safety reviews (e.g., Quality Assurance, INPO, the nuclear insurer, the plant operating review committee, the offsite safety review committee, etc.) are properly in the loop and functioning adequately.

7. Documenting its work in a publicly available report.

8. Presenting its conclusions to the NRC in a public meeting conducted near the plant site.

The VIP will consist of a material corrosion expert, an I&C/electrical engineer, a mechanical engineer, a system engineer, and at least one administrative staffer. The petitioners propose the following candidates for the VIP:

Davis-Besse VIP Team Candidates			
Material Corrosion	I&C/Electrical Engineer	Mechanical Engineer	System Engineer
Dr. Rudolf H. Hausler CORRO-CONSULTA 8081 Diane Drive Kaufman, TX 75142 (972) 962-8287 (972) 932-3947 fax	Mr. Paul M. Blanch 135 Hyde Road West Hartford, CT 06117 (860) 236-0326 (415) 532-1730 fax	Mr. Donald C. Prevatte 24430 Mallard Place St. Michaels, MD 21663 (410) 745-0017 (410) 745-0018 fax	Dr. W. R. Corcoran, Ph.D., P.E. Nuclear Safety Review Concepts 21 Broadleaf Circle Windsor, CT 06095-1634 (860) 285-8779

The petitioners contacted all of the proposed candidates and obtained their permission to be proposed for the VIP. The petitioners have no financial arrangements with any of the proposed candidates and will derive no benefits if one or more of the proposed candidates are selected, other than the reassurance from quality independent work by capable individuals.

Facts that Constitute Bases for Requested Action

There is recent and relevant precedent for the action requested by the petitioners. On August 14, 1996, the NRC issued an order to Northeast Nuclear Energy Company (NNECO), the owner of the Millstone nuclear plant in Connecticut. That order required NNECO to bring in an independent team of consultants to verify that the company had adequately fixed a number of problems at Millstone. The NRC stated the following basis for issuing that order:

> The NRC staff noted that NRC inspections and NNECO internal audits since 1991, have identified numerous configuration (design) control failures, failures to implement corrective actions for known problems, failures to implement quality assurance requirements and failures to comply with the terms and conditions of the operating licenses for all three Millstone plants. The NRC staff also noted that there have been indications of weaknesses in the NRC's oversight of the operation of the Millstone plants.[1]
>
> Therefore, the NRC is herewith issuing the enclosed Confirmatory Order Establishing Independent Corrective Action Verification Program (Effective Immediately). This Order states that the selection of the members of the Independent Corrective Action Verification Program (ICAVP) team and the team's plan for conduct of its reviews will be subject to NRC staff approval.[2]

The damage to the reactor vessel head at Davis-Besse occurred over a period of several years that provided numerous opportunities for detection. FirstEnergy freely admitted that it failed to detect the damage in a timely manner:

> In his remarks to the NRC, Howard Bergendahl, a FirstEnergy vice president in charge of Davis-Besse, also said the company did not pick up on such warning signs.
>
> "We could have and we should have found it in previous inspections," Mr. Bergendahl said, referring to the corrosion.[3]

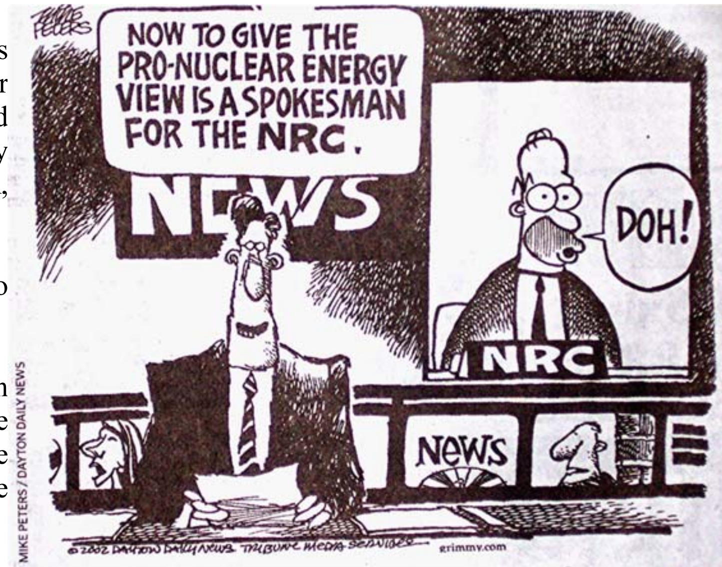
The repeated failures to properly respond to diverse warning signs is analogous to the recurring problems at Millstone.

[1] William T. Russell, Director - Office of Nuclear Reactor Regulation, Nuclear Regulatory Commission, to Ted C. Feigenbaum, Executive Vice President and Chief Nuclear Officer, Northeast Nuclear Energy Company, "Confirmatory Order Establishing Independent Corrective Action Verification Program (Effective Immediately) - Millstone Nuclear Power Station Units 1, 2 and 3," August 14, 1996.

[2] William T. Russell, Director - Office of Nuclear Reactor Regulation, Nuclear Regulatory Commission, to Ted C. Feigenbaum, Executive Vice President and Chief Nuclear Officer, Northeast Nuclear Energy Company, "Confirmatory Order Establishing Independent Corrective Action Verification Program (Effective Immediately) - Millstone Nuclear Power Station Units 1, 2 and 3," August 14, 1996.

[3] Tom Henry, "NRC rips safety flaw at reactor: Corrosion 'worst ever,' no radiation risk likely," *Toledo Blade*, April 6, 2002.

The near-miss at Davis-Besse has also caused the public to question the adequacy of the NRC's oversight role. For example, Rep. Marcy Kaptur of Ohio called for the permanent shut down of the plant based on her lack of trust in the NRC. An editorial in the Akron Beacon Journal stated:



> Where were the NRC inspectors deployed full time at the plant? Their lack of reaction suggests a flawed oversight system or industry unawareness of the potential problem, or both.[4]

A cartoon from the *Dayton Daily News* also questions the competence of the NRC.

The NRC conceded that it lacked a thorough understanding of the conditions at Davis-Besse when it allowed FirstEnergy to postpone the inspections originally requested to be performed by the end of last year:

> "Had we known they had seen these brown deposits that they did [in the air filters], we wouldn't have made the decision we did," according to Brian Sheron, an NRC associate director in Washington who sat in on the high-level negotiations in December.[5]

The VIP will help NRC assure it has more complete knowledge when the agency makes its decision about the restart of Davis-Besse, thus lessening the likelihood that the agency makes another bad decision based on incomplete information.

FirstEnergy itself recognizes the value of independent verification. In its presentation to the NRC staff about the proposed repair to the reactor vessel head, FirstEnergy reported it hired Structural Integrity Associates to conduct a third-party design analysis of the company's proposal.[6] NRC regulations do not require a third-party design analysis, but FirstEnergy obviously deems it prudent. The petitioners agree. The fact that FirstEnergy already arranged for an independent evaluation of the proposed patch to the reactor vessel head is the basis for the petitioners not requesting the NRC to charge the VIP with that task. The petitioners feel that the independent verification measures requested in this petition are equally prudent, but currently overlooked.

As at Millstone, this event at Davis-Besse coupled repeated, long-standing performance problems on the part of the plant owner with questions about the adequacy of NRC oversight. It is therefore entirely appropriate for the NRC to issue an order now as it did then.

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[4] Editorial, "FirstEnergy and federal regulators share the blame at the Davis-Besse. What will their remedy be?" *Akron Beacon Journal*, April 10, 2002.

[5] Tom Henry, "NRC rips safety flaw at reactor: Corrosion 'worst ever,' no radiation risk likely," *Toledo Blade*, April 6, 2002.

[6] FirstEnergy Nuclear Operating Company, Presentation to the NRC, "Davis-Besse Nuclear Power Station Reactor Vessel Head," April 10, 2002, slide 14.

Bases for the specific tasks to be undertaken by the VIP:

Verifying the adequacy of problem identification and resolution (PIR) process

FirstEnergy had many and varied signals of trouble over a period of years. But they consistently failed to get the right message from these signals as evidenced by the following examples:

Example A:

Howard Bergendahl, vice president of nuclear at Davis-Besse, said the utility's prior inspection evaluations concluded that the iron oxide and boric acid deposits clogging the coolant and air filter systems was caused by the leaking pressure valves.

"We have now been proven wrong," Bergendahl said. **"It appears we misdiagnosed the symptoms** because they measure what is going on inside the entire building and the equipment within that building." [7] [emphasis added]

Example B:

In a brief interview with The Blade after the meeting, Bob Saunders said no information was intentionally withheld. He is the president and chief nuclear officer of FirstEnergy Nuclear Operating Company.

As for the frequency with which rust was collected by air filters, he said, "We didn't understand the relevance of it." [8] [emphasis added]

> Problem Identification and Resolution Process
>
> Two to three thousand problems occur each year at the typical nuclear plant. These problems range from very minor (blown-out light bulb) to more severe. The problems can be found during thousands of tests and inspections conducted each year or they can be self-revealing (light goes out). Problems are formally documented and dispatched to maintenance crews to fix.
>
> Problem identification and resolution processes are assessed by examining how effectively workers properly diagnose and correct undesired plant conditions. For example, consider a problem involving a blown fuse in an electrical circuit. The fuse could have blown because it simply wore out or it could have blown because the circuit was overloaded or otherwise faulted. A good problem identification and resolution process establishes why the fuse blew and makes the appropriate repair. A bad problem and identification process requires five or six blown fuses before an electrical circuit problem is found and fixed.

Example C:

In 2000, workers had to use crowbars and hot water to clean the hardened "lava-like," rusty boric acid from the reactor top. Because of the closeness of the insulation and service structure, they did not clean the center of the head - where several sleeves for control rod drive mechanisms were cracked and leaking.

"**Davis-Besse staff assumed the extra boric acid was due to flange leakage** [a harmless leak high above the reactor head] and the color due to the age of the deposits on the air coolers," he [NRC's Jack Grobe] said. "The NRC believes it was a sign of corrosion to the head."[9] [emphasis added]

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[7] Brenda M. Culler, "Feds say D-B missed early damage signs," *Sandusky Register*, April 6, 2002.

[8] Tom Henry, "NRC rips safety flaw at reactor: Corrosion 'worst ever,' no radiation risk likely," *Toledo Blade*, April 6, 2002.

[9] John Funk, "Laxity cited in corrosion of reactor head at Davis-Besse power plant," *Cleveland Plain Dealer*, April 6, 2002.

Example D:
Until 1998, RCS [reactor coolant system] unidentified leakage at Davis-Besse was normally less than 0.1 gallons per minute (gpm). In October 1998, the licensee removed the rupture disks downstream of the pressurizer relief valves and bypassed a drain line that collected leakage from the relief valves in the quench tank (identified leakage). As a result, all leakage past the relief valves was vented directly into the containment atmosphere and collected in the sump, increasing the unidentified leakage to approximately 0.8 gpm. In May 1999, the licensee reinstalled the rupture disks and reconnected the drain line; however, the RCS unidentified leakage was only reduced to approximately 0.2 gpm (or approximately 0.1 gpm higher than normal). **This elevated level of unidentified leakage was attributed by the licensee to control rod drive mechanism (CRDM) flange leakage since the plant had a history of flange leakage.**[10] [emphasis added]

Example E:
Davis-Besse also has REs [radiation elements] that are two identical air sampling systems in containment. The RE filters accumulate particulates and may need to be changed to ensure acceptable system operation. Licensee records correlate RE filter changes with past RCS leakage increases. In March 1999, RE filter clogging from boric acid deposits was identified and attributed to the pressurizer relief valve modification discussed previously. **In November 1999, after identifying yellowish brown deposits in the filters, the licensee obtained a chemical analysis of the filter particulates which identified the presence of ferric oxide in addition to boric acid crystals. Around this time, the licensee began changing the filters every one-to-three weeks. By November 1999, the frequency of filter changes had again increased.**[11] [emphasis added]

An excellent problem identification and resolution process would have allowed any one of these warning signals to cause the cracked CRDM nozzle to be detected and repaired before restart from the 2000 refueling outage. An excellent process fixes problems at the earliest opportunity.

An adequate problem identification and resolution process would have allowed the potpourri of warning signals to cause the cracked CRDM nozzle to be detected and repaired before restart from the 2000 refueling outage. An adequate process fixes problems in a reasonable time frame.

A woefully inadequate problem identification and resolution process allows all warning signals to go unheeded until the problem reveals itself.

FirstEnergy's performance in the reactor vessel head problem was woefully inadequate. The VIP will examine how FirstEnergy handled the warning signals for this problem to understand how and why the company failed to respond properly to the warning signals. Having identified these factors, the VIP will examine how FirstEnergy handled a sampling of other problems unrelated to the reactor vessel head problem. The VIP will determine if FirstEnergy's poor performance was confined to this single problem (i.e., essentially a "blind spot") or was replicated in other areas.

Verifying the root cause evaluation prepared by FirstEnergy for the damage to the reactor vessel head

The reactor vessel head at Davis-Besse is made of carbon steel. Its inner surface is clad with stainless steel for protection against the corrosiveness of the borated water within the reactor vessel. Borated water leaked through CRDM flanges and CRDM nozzles to reach the unprotected carbon steel reactor vessel head. The reactor vessel head was damaged in two separate locations.

[10] Nuclear Regulatory Commission, Information Notice 2002-13, "Possible Indicators of Ongoing Reactor Pressure Vessel Head Degradation," April 4, 2002.
[11] Nuclear Regulatory Commission, Information Notice 2002-13, "Possible Indicators of Ongoing Reactor Pressure Vessel Head Degradation," April 4, 2002.

The petitioners consulted with Dr. Rudolf H. Hausler, an expert in materials corrosion, who raised the questions such as whether molten salt corrosion was occurring:

> The reactor temperature is 600°F, and the head temperature under normal operations is 550°F. "That means that small droplets of boric acid that might drip through flanges - a common occurrence at many nuclear plants - usually evaporate instantly" according to NRC officials. It depends, however, where these boric acid droplets land. Boric acid has a melting point of about 340°F. If the surface, where the droplets land, is hotter than 340°F one has liquid boric acid (not crystals) and so called "molten salt corrosion" will occur. Now, at higher temperatures the following reaction takes place:
>
> $$H_3BO_3 \Rightarrow HBO_2 + H_2O$$
>
> And at still higher temperatures (570°F) pyro-borate is formed through further water loss. However, since the reactor cooling water is hardly ever as clean as it should be other salts form as they do in the steam generator crevices. For this reason I ask: "Have these deposits been analyzed and does one know how they behave at the higher temperatures?"[12]

The answers to these questions are important. FirstEnergy proposes to resume operating with the carbon steel reactor vessel head. Borated water leakage through the CRDM flanges and CRDM nozzles cannot be ruled out in the future. Thus, the VIP will examine the root cause determination prepared by FirstEnergy and determine if the correct failure mechanism was identified.

<u>Verifying that the long-term accumulation of boric acid within the reactor containment did not impair the function of safety-related systems, structures, and components</u>

Borated water leaked into the Davis-Besse containment for a long time:

> Until 1998, RCS [reactor coolant system] unidentified leakage at Davis-Besse was normally less than 0.1 gallons per minute (gpm). In October 1998, the licensee removed the rupture disks downstream of the pressurizer relief valves and bypassed a drain line that collected leakage from the relief valves in the quench tank (identified leakage). As a result, all leakage past the relief valves was vented directly into the containment atmosphere and collected in the sump, increasing the unidentified leakage to approximately 0.8 gpm. In May 1999, the licensee reinstalled the rupture disks and reconnected the drain line; however, the RCS unidentified leakage was only reduced to approximately 0.2 gpm (or approximately 0.1 gpm higher than normal).[13]

Thus, 0.2 gallons/minutes leaking for the 2.75 years between May 1999 and February 2002 (assuming a 90 percent capacity factor) means that roughly 260,350 gallons of borated water entered the containment. Some of this water evaporated leaving boric acid behind. Needless to say, a quarter million gallons of borated water does not leave behind trace amounts of boric acid:

> The Davis-Besse CACs [containment air coolers] control containment temperature and humidity. In November 1998, the licensee identified increased CAC fouling caused by boron deposits. The licensee attributed the increase in CAC fouling to the venting of the pressurizer relief valve leakage directly to containment caused by the October 1998 modification discussed previously. The CACs were cleaned many times between November 1998 and May 1999. In May 1999, the licensee reinstalled the rupture disks and reconnected the drain line. After that modification, the licensee cleaned the CACs again in June and July 1999. At that time, the licensee noticed that the

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[12] Rudolf H. Hausler, CORRO-CONSULTA, to Paul Gunter, Nuclear Information and Resource Service, April 7, 2002.

[13] Nuclear Regulatory Commission, Information Notice 2002-13, "Possible Indicators of Ongoing Reactor Pressure Vessel Head Degradation," April 4, 2002.

boric acid deposits removed from CAC number 1 exhibited a rust-like color. The licensee attributed the discoloration to migration of the surface corrosion on the CACs into the boric acid deposits and to the aging of the boric acid deposits. After the spring 2000 refueling outage, deposits again began to form on the CACs. Between June 2000 and May 2001, the licensee cleaned the CACs eight times. No further CAC cleaning was needed until the current outage **when the licensee reported that fifteen 5-gallon buckets of boric acid were removed from the CAC ductwork and plenum. A flow from the CACs also resulted in boric acid deposits elsewhere within containment including on service water piping, stairwells, and other areas of low ventilation**. [14] [emphasis added]

It is apparent that the borated water leaking from the CRDM flanges and/or CRDM nozzles flashed to steam. Boric acid was transported in this aerosol by the ventilation system throughout the containment. Safety-related equipment within the containment is required to be designed for the environmental conditions it encounters. For example, NRC Bulletin 79-01B required plant owners to ensure that Class 1E electrical equipment could function properly under the temperature, humidity, pressure, and radiation conditions expected inside containment.

Prolonged "dusting" by boric acid was not one of the expected conditions for equipment inside containment. Boric acid can degrade elastomers, gaskets, electrical contactors and connectors, relays, terminal blocks, cable insulation, motor actuators, limit switches, and so on. Boric acid can degrade equipment by corrosion as in the case of the reactor vessel head. Federal safety regulations dictate that electrical equipment important to safety at Davis-Besse be qualified to function in the environmental conditions it must operate. Those environmental conditions explicitly include chemical effects:

Chemical effects. The composition of chemicals used must be at least as severe as that resulting from the **most limiting mode of plant operation** (e.g., containment spray, emergency core cooling, or recirculation from containment sump). If the composition of the chemical spray can be affected by equipment malfunctions, the most severe chemical spray environment that results from a single failure in the spray system must be assumed.[15] [emphasis added]

The VIP will examine the environmental qualification (EQ) program for electrical equipment important to safety within the Davis-Besse containment. The VIP will determine if the boric acid conditions are within the limiting mode of plant operation assumed in the EQ program.

Boric acid is an inorganic acid.[16] The Sandia National Laboratories concluded that inorganic acids have poor compatibility with elastomers made of EPR/EPDM, neoprene, nitrile, and silicone. The Sandia study also concluded that inorganic acids have fair or poor compatibility with thermosets consisting of epoxy resins, polyimide, phenolic resins, and furanic resins.[17] Boric acid has poor compatibility with carbon steel. The VIP will examine how FirstEnergy assessed the condition of elastomers and thermosets inside the Davis-Besse containment to determine if all non-compatibility issues have been resolved.

[14] Nuclear Regulatory Commission, Information Notice 2002-13, "Possible Indicators of Ongoing Reactor Pressure Vessel Head Degradation," April 4, 2002.
[15] Title 10, Energy, of the Code of Federal Regulations, §50.49 "Environmental qualification of electric equipment important to safety for nuclear power plants," paragraph (e)(3).
[16] United States Environmental Protection Agency, "Revised Boric Acid Listing Background Document for the Inorganic Chemical Listing Determination," October 2001.
[17] John Clauss, Project Manager, Sandia National Laboratory, SAND96-0344, "Aging Management Guideline for Commercial Nuclear Power Plants - Electric Cable and Terminations," September 1996, Table 4-9, "Chemical Compatibility of Common Cable and Termination Organic Materials."

Sandia reported numerous actual problems caused at nuclear power plants by corrosion:

- 44 percent of low-voltage connector failures were caused by oxidation/corrosion/dirt [18]
- 17 percent of low-voltage compression and fusion fitting failures were caused by oxidation/corrosion/dirt [19]
- 34 percent of neutron monitor connector failures were caused by oxidation/corrosion/dirt [20]
- Power cable to circulating water pump at an unnamed pressurized water reactor failed when foreign chemical substances (acid) from a nearby sump inadvertently drained in the cable ducting - Neoprene cable insulation for the cable completely dissolved [21]

Sandia characterized the effect of chemicals like boric acid on aging mechanisms as follows:

> Chemical stressors result from the exposure of cable and termination components to moisture, solvents, fuel oils, lubricants, or other substances. Chemical stressors can affect the structure and properties of both organic and inorganic materials, Because electrical cable is present in most every space in a nuclear plant, and a single circuit may be present in many of the spaces, cable and termination components may be exposed to a wide variety of chemical stressors. In general, chemical stressors are highly local and typically affect only very small portions of the plant cable inventory. [22]

The VIP will examine how FirstEnergy assessed boric acid as a chemical stressor with the potential for accelerating aging degradation.

Boric acid can also degrade equipment by physically binding as in the case of the impaired feedwater regulating valves at Indian Point Unit 2 on January 27, 1997.[23] At Indian Point, workers sand-blasted turbine blades in the turbine building. The ventilation system carried sand particles throughout the turbine building. Months after the plant resumed operating, the feedwater system failed to properly respond during a plant transient because sand deposited within the regulating valves mechanically interfered with their movement.

The VIP will examine FirstEnergy's extent-of-condition assessment and the company's inspections for boric acid within containment to verify that the safety functions for equipment are not impaired due to mechanical interference. FirstEnergy missed the accelerated aging of the reactor vessel head. The VIP will determine if this was the only accelerated aging the company missed.

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[18] John Clauss, Project Manager, Sandia National Laboratory, SAND96-0344, "Aging Management Guideline for Commercial Nuclear Power Plants - Electric Cable and Terminations," September 1996, Section 3.7.2.1.3, "Low-Voltage Connectors."

[19] John Clauss, Project Manager, Sandia National Laboratory, SAND96-0344, "Aging Management Guideline for Commercial Nuclear Power Plants - Electric Cable and Terminations," September 1996, Section 3.7.2.1.5, "Low-Voltage Compression and Fusion Fittings."

[20] John Clauss, Project Manager, Sandia National Laboratory, SAND96-0344, "Aging Management Guideline for Commercial Nuclear Power Plants - Electric Cable and Terminations," September 1996, Section 3.7.2.3.2, "Neutron Monitor Connectors."

[21] John Clauss, Project Manager, Sandia National Laboratory, SAND96-0344, "Aging Management Guideline for Commercial Nuclear Power Plants - Electric Cable and Terminations," September 1996, page 3-52.

[22] John Clauss, Project Manager, Sandia National Laboratory, SAND96-0344, "Aging Management Guideline for Commercial Nuclear Power Plants - Electric Cable and Terminations," September 1996, Section 4.1.5, "Chemical / Electrochemical Stressors and Aging Mechanisms."

[23] Hubert J. Miller, Regional Administrator, Nuclear Regulatory Commission, to Stephen E. Quinn, Vice President – Nuclear Power, Consolidated Edison Company of New York, "Notice of Violation and Proposed Imposition of Civil Penalties - $205,000; and Exercise of Enforcement Discretion (NRC Inspection Report Nos. 50-247/96-80; 96-07; 96-08; 97-03)." May 27, 1997.

Verifying that FirstEnergy has taken appropriate actions in response to NRC generic communications

The damage to the reactor vessel head at Davis-Besse is difficult to understand given the following long list of warnings that NRC sent to FirstEnergy over the years:

- April 1987 - NRC informed FirstEnergy that more than 500 pounds of boric acid crystals were discovered on the reactor vessel head at the Turkey Point nuclear plant, resulting in severe corrosion to the head. The NRC informed FirstEnergy "that boric acid will rapidly corrode ferritic (carbon) steel components and it also again demonstrated that if a small leakage occurs near hot surfaces and/or surroundings, then the boric acid solution will boil and concentrate becoming more acidic and thus more corrosive." [24]
- November 1987 - NRC informed FirstEnergy that workers at the Salem nuclear plant discovered "damage to the reactor vessel head caused by borated water that had dripped from the ventilation supports onto the head. The licensee found nine corrosion pits in the ferritic steel vessel head. The pits were 1 to 3 inches in diameter and 0.4 to 0.6 inch deep. [25]
- March 1988 - NRC mandated FirstEnergy to "provide assurances that a program has been implemented consisting of systematic measures to ensure the boric acid corrosion does not lead to degradation of the assurance that the reactor coolant pressure boundary will have an extremely low probability of abnormal leakage, rapidly propagating failure, or gross rupture." [26]
- January 1995 - NRC reminded FirstEnergy that "Boric acid coolant leaking onto hot carbon steel surfaces has significantly damaged reactor pressure boundary components." [27]

Despite a formal mandate and repeated warnings spanning nearly 15 years from the NRC, FirstEnergy permitted boric acid to severely damage the reactor vessel head. The damage was significant:

> "There was an unacceptable reduction in the margin of safety at the Davis-Besse plant," said Jim Dyer, regional administrator for the NRC's Chicago office that oversees Ohio nuclear plants. "The cladding wasn't designed to be pressure containing. But it did. That was fortunate." [28]

The VIP will examine how FirstEnergy handled a sampling of generic communications received from the NRC. The VIP will determine if there are any other unheeded warnings or unmet mandates.

Verifying that FirstEnergy has not deferred other plant modifications without appropriate justification

After the NRC notified FirstEnergy in the late 1980s about potential safety problems caused by boric acid leaking onto the reactor vessel, the company considered modifying the service structure above the reactor vessel head to facilitate inspections. Plans for this modification were developed, but FirstEnergy decided not to modify the service structure. The company concedes that its decision contributed to the severe damage to the reactor vessel head:

> The design of the RPV [reactor pressure vessel] head/service structure makes access to the top of the head difficult for cleaning and inspection. Deferral of the modification to the service structure for improved access when the modification was first considered resulted in the continued limited ability to prevent significant boric acid accumulations and allow for better visual determination of the

[24] Nuclear Regulatory Commission, Information Notice 86-108 Supplement 1, "Degradation of Reactor Coolant System Pressure Boundary Resulting from Boric Acid Corrosion," April 20, 1987.

[25] Nuclear Regulatory Commission, Information Notice 86-108 Supplement 2, "Degradation of Reactor Coolant System Pressure Boundary Resulting from Boric Acid Corrosion," November 19, 1987.

[26] Nuclear Regulator Commission, Generic Letter 88-005, "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants," March 17, 1988.

[27] Nuclear Regulatory Commission, Information Notice 86-108 Supplement 3, "Degradation of Reactor Coolant System Pressure Boundary Resulting from Boric Acid Corrosion," January 5, 1995.

[28] Jim MacKinnon, "FirstEnergy blamed for reactor damage: NRC faults Akron utility for Davis-Besse problems," *Akron Beacon Journal*, April 6, 2002.

> leakage sources. Since the severity of the damage that occurred to the RPV head is judged to have required years to develop after the initiation of a CRDM nozzle leak, the deferral is considered a CONTRIBUTING CAUSE to the incident.[29] [emphasis in original]

The VIP will examine other modifications proposed at Davis-Besse over the past ten years but not implemented to verify that appropriate justification existed for the deferrals/cancellations.

Verifying that all the entities responsible for safety reviews are properly in the loop and functioning adequately

The reactor vessel head damage at Davis-Besse occurred over a period of years with numerous signals of trouble along the way. There are several entities that review safety at Davis-Besse with a responsibility for detecting warning signs and forestalling serious erosions in safety margins. The Quality Assurance department audits work activities performed by the Operations, Maintenance, and Engineering departments. The Institute for Nuclear Power Operations (INPO) is an industry peer group that periodically inspects activities onsite at Davis-Besse against industry standards. Representatives of the nuclear insurance company inspect activities onsite. The plant operating review committee and safety review committee provide safety oversight.

For some reason, all of these layers of safety reviews and checks failed to properly diagnose the numerous signs of reactor vessel head damage. The VIP will evaluate these entities to determine if they are adequately staffed with qualified individuals, they formally receive the information needed to conduct safety reviews, they conduct properly focused reviews, and they make recommendations that are appropriately resolved.

Documenting its work in a publicly available report

By documenting its work in a publicly available report, the VIP will be continuing the very commendable practice of FirstEnergy, industry, and NRC in communicating openly about this matter. The NRC quickly created a page on its website devoted to the Davis-Besse problem and posted materials from FirstEnergy, the Nuclear Energy Institute, and the NRC to this webpage in a very timely fashion.

The VIP will continue this practice. Considering that a primary objective for the VIP is to reassure the public, the report prepared by the VIP should be as jargon-free as possible.

Presenting its conclusions to the NRC in a public meeting conducted near the plant site

The NRC has gone to great lengths to accommodate heightened public interest in the Davis-Besse problem. The NRC arranged for a telephone bridge connection for a public meeting between industry and NRC on March 19, 2002. The NRC conducted another public meeting on March 20, 2002, with its public stakeholders that again featured a telephone bridge connection. The NRC's Augmented Inspection Team exit meeting was held in an auditorium on April 5, 2002, to allow a few hundred interested members of the public to attend. The NRC arranged for a telephone bridge line connection for a public meeting between FirstEnergy and NRC on April 10, 2002.

The VIP will continue the very commendable NRC practice of meeting with the public about Davis-Besse.

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[29] S. A. Loehlein, Root Cause Team Leader, FirstEnergy Nuclear Operating Company, to H. W. Bergendahl, Vice President - Nuclear, FirstEnergy Nuclear Operating Company, "Probable Cause Summary Report for CR2002-0891, *Significant Degradation of the Reactor Vessel Head Pressure Boundary*," March 22, 2002.

Lack of Other NRC Proceeding Available

The NRC issued a Confirmatory Action Letter (CAL) to FirstEnergy outlining six measures the company must take prior to restarting Davis-Besse:[30]

1. Quarantine components or other material from the reactor vessel head and CRDM nozzle penetrations.
2. Determine the root cause of the degradation around the reactor vessel head penetrations.
3. Evaluate and disposition the extent of condition throughout the reactor coolant system relative to the degradation mechanism that occurred on the reactor vessel head.
4. Obtain NRC approval of the repair plans for the reactor vessel head.
5. Meet with NRC prior to restart to discuss the root cause determination, extent of condition evaluation, and corrective actions.
6. Provide a plan and schedule to the NRC for the safety assessment of the safety significance of the reactor vessel head damage.

CAL Item 2 does overlap with a task assigned to the VIP. But the role of the VIP is to provide independent verification of the root cause determination by FirstEnergy. That independent verification should be useful to the NRC as well as to the public.

CAL Item 5 is related to a task assigned to the VIP. The presentation of the written report to the NRC in a public meeting conducted in the vicinity of Davis-Besse could in fact be part of the agenda for the meeting outlined in CAL Item 5.

With these two exceptions, the tasks assigned to the VIP are not part of any other NRC proceeding. For example, the extent of condition specified in CAL Item 3 is limited to the components of the reactor coolant system whereas the task assigned to the VIP is more comprehensive by addressing the extent of condition for all equipment important to safety inside containment. In addition, tasks assigned to the VIP will examine whether there are programmatic faults in the company's problem identification and resolution process and operating experience review program that the NRC is not touching.

This petition was the only process available to the petitioners regarding our safety concerns at Davis-Besse. Factors causing serious damage to the reactor vessel head were overlooked by FirstEnergy and the NRC for many years. This petition provides for an independent check that other potential damage is not overlooked elsewhere. The petitioners therefore expect the NRC to grant this petition and promptly charter the VIP.

Other Matters

The petitioners designate Terry Lodge of the Toledo Coalition for Safe Energy as the primary point of contact for the NRC regarding this petition. David Lochbaum of UCS will be the technical lead for the petitioners.

Sincerely,

<ORIGINAL SIGNED BY>

David Lochbaum
On behalf of the following organizations listed in alphabetical order by organization name:

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[30] J.E. Dyer, Regional Administrator, Nuclear Regulatory Commission, to Howard Bergendahl, Vice President - Nuclear, FirstEnergy Nuclear Operating Company, "Confirmatory Action Letter - Davis-Besse Nuclear Power Station," March 13, 2002.

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