Union of Concerned Scientists
Citizens and Scientists for Environmental Solutions

April 5, 2010

R. Willam Borchardt, Executive Director for Operations
U.S. Nuclear Regulatory Commission
Washington, DC 20555-0001

SUBJECT **Request for Restoration and Maintenance of Adequate Protection of Public Health and Safety at the Davis-Besse Nuclear Plant**

Dear Mr. Borchardt:

Pursuant to §2.206 of Title 10 in the Code of Federal Regulations, the Union of Concerned Scientists (UCS) requests that the Nuclear Regulatory Commission (NRC) initiate a proceeding pursuant to §2.202 of Title 10 in the Code of Federal Regulations culminating in the issuance of a Show Cause Order, or comparable enforcement action, to the licensee for the Davis-Besse nuclear plant in Ohio preventing the reactor from restarting until such that time the NRC determines that applicable adequate protection standards have been met and reasonable assurance exists that these standards will continue to be met after operation is resumed.

The NRC's regulations in general and the operating license the agency issued for Davis-Besse define adequate protection standards that include zero reactor coolant pressure boundary leakage during operation with the requirement to shut down the reactor within six hours if such leakage occurs. These regulations and requirements are vital elements of the leak-before-break safety principle; namely, that pressure boundary leakage triggers a prompt reactor shutdown before the damage propagates to catastrophic failure. The Davis-Besse licensee has repeatedly violated federal regulations and the explicit conditions of its operating license by operating the reactor with pressure boundary leakage longer than six hours. In doing so, the public was exposed to elevated and undue risk.

Two weeks prior to the partial meltdown of the Unit 2 reactor at Three Mile Island, the NRC issued a Show Cause Order to the licensee of the Surry nuclear plant requiring both reactors to be shut down and remain shut down until a potential safety problem was remedied. In the Surry case, non-conservative mistakes in computer studies prevented a determination that the adequate protection standard was met and the NRC did not allow the reactors to operate until this shortcoming was rectified. In the Davis-Besse case, ample evidence clearly demonstrates that the adequate protection standard was not met on multiple occasions. Thus, it is imperative that the NRC act now to protect the public from an actual hazard as the NRC acted then to protect the public from a potential one.

While UCS has no obligation to resolve the inadequate protection situation at Davis-Besse, we did undertake an effort to ascertain if there was a credible solution available.[1] As detailed in Enclosure 1, we

[1] To be honest, the purpose of this effort was to determine if Davis-Besse's problem was solvable. If no credible solution was found, our request today would have sought the suspension or revocation of the operating license.

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found three options for resolving the problem. We assume there may be other options. We conclude it is unreasonable and unacceptable for Davis-Besse to routinely violate the NRC's adequate protection standards and expose the public to unnecessarily elevated risk. We request that the NRC end this behavior pattern by taking steps to ensure that the Davis-Besse reactor does not operate unless adequate protection standards are met.

We understand that NRC's procedures provide us an opportunity to appear before the agency's Petition Review Board (PRB) before it reaches a decision regarding our request. We believe that our request and its basis are thoroughly described herein. Therefore, we do not request the public meeting. However, we stand ready to provide clarifying information to and/or answer any questions from the PRB if needed.

We look forward to the NRC's resolution of the recurring safety problems at Davis-Besse.

Sincerely,

David Lochbaum
Director, Nuclear Safety Project
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Enclosures:

1. Request to Restore and Maintain Adequate Protection of Public Health and Safety at the Davis-Besse Nuclear Plant

2. Reactor Coolant System Leakage

Request to Restore and Maintain Adequate Protection of Public Health and Safety at the Davis-Besse Nuclear Plant

SUMMARY OF THE FACTS AND CONCLUSIONS

This section summarizes the facts and conclusions associated with our request that NRC take measures to restore and then maintain its adequate protection standards at Davis-Besse.

Conclusions

UCS's evaluation of the underlying facts in this matter concluded:

1. The NRC's adequate protection standards include requirements that (a) the Davis-Besse reactor operate with no reactor coolant pressure boundary leakage and (b) that the reactor be shut down within six hours of pressure boundary leakage occurring.

2. Davis-Besse has operated repeatedly operated for longer than six hours after the onset of pressure boundary leakage.

3. The public has been repeatedly exposed to higher risk than necessary because Davis-Besse has violated the NRC's adequate protection standards.

4. NRC action is needed to prevent undue risk to public health and safety in the future.

Facts

The relevant facts in this matter supporting the conclusions above are:

1. Adequate protection standards for public health and safety are established by the NRC's regulations.

2. Compliance with the NRC's regulations demonstrates that the adequate protection standards are met.

3. NRC's regulations require that the operating license for Davis-Besse include technical specifications.

4. NRC's regulations require that technical specifications include limiting conditions for operation.

5. NRC's regulations require that remedial actions be taken when a limiting condition for operation is not met.

6. The NRC issued an operating license for Davis-Besse.

7. The NRC approved technical specifications associated with the Davis-Besse operating license.

8. The Davis-Besse technical specifications contain a limiting condition for operation (LCO) for leakage from the reactor coolant system (RCS).

9. The RCS leakage LCO in the Davis-Besse technical specifications defines actions to be taken when leakage limits are exceeded with associated completion times.

10. The RCS leakage LCO in the Davis-Besse technical specifications permits no pressure boundary leakage when the reactor is operating.

11. The remedial action to be taken per the Davis-Besse technical specifications if pressure boundary leakage exists is for the reactor to be shut down within six hours.

12. For a prolonged period prior to February 2002, the Davis-Besse reactor operated with pressure boundary leakage.

13. The NRC proposed a record $5.45 million civil penalty to the Davis-Besse licensee in April 2005, of which $5 million was for operating the reactor for prolonged periods with pressure boundary leakage.

14. For an unspecified period but certainly longer than six hours prior to February 2010, the Davis-Besse reactor operated with pressure boundary leakage.

15. The Davis-Besse licensee violated 10 CFR Part 50, Appendix B by its failure to take corrective actions following the CRDM nozzle leakage identified in 2002 that precluded the CRDM nozzle leakage identified in 2010.

16. The NRC issued a Show Cause Order to the licensee for the Surry reactors requiring both reactors to shut down and remain shut down until steps were completed to provide adequate protection of public health and safety.

These facts are now presented in detail along with applicable references.

The NRC's stated mission[2] is:

> *To regulate the nation's civilian use of byproduct, source, and special nuclear materials to ensure adequate protection of public health and safety, to promote the common defense and security, and to protect the environment.*

The NRC's general counsel provided the Commissioners a lengthy paper on the legal meaning of "adequate protection."[3] In it, the NRC's general counsel described adequate protection as being:

> *The underlying nature of the adequate protection standard has been addressed in only a few adjudicatory decisions. The most definitive is Maine Yankee Atomic Power Company (Maine Yankee Atomic Power Station). In Maine Yankee, the Appeal Board, speaking for the Commission, stated the matter at issue and the conclusion thereon as follows:*
>
> > *… the Commission's regulations reflect what it regards as adequate to protect the public health and safety …*
> >
> > …

[2] See http://www.nrc.gov/about-nrc.html

[3] Memo from Leonard Bickwit, Jr., General Counsel, to Nuclear Regulatory Commission Chairman and Commissioners, "Adequate Protection of the Health and Safety of the Public," October 18, 1979.

This decision, unless overturned by the Commission, holds that adequate protection under the Act is measured solely by the nature and extent of the risk, and that the amount of the benefits associated with plant operation can play no role in safety decisions under the Act. While the decision does not address the role of economic costs, a reasonable inference from the decision is that this factor would also be irrelevant in determining adequate protection.

Later in the same memo, the NRC's general counsel summarized the legal basis behind "adequate protection":

To be sure the regulations do in a collective sense embody what is necessary to provide adequate protection.

It is quite clear from these decisions that once compliance with the regulations is demonstrated, it necessarily follows, absent some special showing, that the adequate protection standard is met.

Thus, the NRC's regulations establish the attributes, characteristics, and parameters that constitute adequate protection and compliance with these regulations demonstrate the adequate protection standard is met.

The NRC's regulations,[4] specifically §50.36 paragraphs (a)(1) and (b) of Title 10 in the Code of Federal Regulations require that each application for a reactor operating license to include proposed technical specifications with the application and that each operating license issued by the NRC include technical specifications.

The operating license[5] issued by the NRC for Davis-Besse included technical specifications in Appendix A (highlighted added):

[4] See http://www.nrc.gov/reading-rm/doc-collections/cfr/part050/part050-0036.html

[5] See ML053110490 in NRC's online electronic library (ADAMS) at http://adamswebsearch.nrc.gov/scripts/securelogin.pl

FIRSTENERGY NUCLEAR OPERATING COMPANY

AND

FIRSTENERGY NUCLEAR GENERATION CORP.

DOCKET NO. 50-346

DAVIS-BESSE NUCLEAR POWER STATION, UNIT NO. 1

FACILITY OPERATING LICENSE

License No. NPF-3

1. The Nuclear Regulatory Commission (the Commission) having found that:

A. The application for license filed by FirstEnergy Nuclear Operating Company (FENOC)[1], acting on its own behalf and as agent for FirstEnergy Nuclear Generation Corp. (licensees) complies with the standards and requirements of the Atomic Energy Act of 1954, as amended (the Act), and the Commission's rules and regulations set forth in 10 CFR Chapter I and all required notifications to other agencies or bodies have been duly made;

B. Construction of the Davis-Besse Nuclear Power Station, Unit No. 1 (the facility) has been substantially completed in conformity with Construction Permit No. CPPR-80 and the application, as amended, the provisions of the Act and the rules and regulations of the Commission;

C. The facility will operate in conformity with the application, as amended, the provisions of the Act, and the rules and regulations of the Commission;

1.D. There is reasonable assurance: (i) that the activities authorized by this operating license can be conducted without endangering the health and safety of the public, and (ii) that such activities will be conducted in compliance with the rules and regulations of the Commission;

2.C. This license shall be deemed to contain and is subject to the conditions specified in the following Commission regulations in 10 CFR Chapter I: Part 20, Section 30.34 of Part 30, Section 40.41 of Part 40, Sections 50.54 and 50.59 of Part 50, and Section 70.32 of Part 70; and is subject to all applicable provisions of the Act and to the rules, regulations, and orders of the Commission now or hereafter in effect; and is subject to the additional conditions specified or incorporated below:

(1) Maximum Power Level

FENOC is authorized to operate the facility at steady state reactor core power levels not in excess of 2817 megawatts (thermal). Prior to attaining the power level, Toledo Edison Company shall comply with the conditions identified in Paragraph (3) (o) below and complete the preoperational tests, startup tests and other items identified in Attachment 2 to this license in the sequence specified. Attachment 2 is an integral part of this license.

(2) Technical Specifications

The Technical Specifications contained in Appendix A, as revised through Amendment No. 280 , are hereby incorporated in the license. FENOC shall operate the facility in accordance with the Technical Specifications.

The NRC's regulations[6] in §50.36 paragraph (c)(2) require that the technical specifications contain "limiting conditions for operation." The regulations define limiting conditions for operation as:

[6] See http://www.nrc.gov/reading-rm/doc-collections/cfr/part050/part050-0036.html

Limiting conditions for operation are the lowest functional capability or performance levels of equipment required for safe operation of the facility. When a limiting condition for operation of a nuclear reactor is not met, the licensee shall shut down the reactor or follow any remedial action permitted by the technical specifications until the condition can be met.

The Davis-Besse technical specifications[7] contain Limiting Condition for Operation (LCO) 3.4.13 on operational leakage from the reactor coolant system (highlighting added):

3.4 REACTOR COOLANT SYSTEM (RCS)

3.4.13 RCS Operational LEAKAGE

LCO 3.4.13 RCS operational LEAKAGE shall be limited to:

a. No pressure boundary LEAKAGE;

b. 1 gpm unidentified LEAKAGE;

c. 10 gpm identified LEAKAGE; and

d. 150 gallons per day primary to secondary LEAKAGE through any one steam generator (SG).

APPLICABILITY: MODES 1, 2, 3, and 4.

ACTIONS

CONDITION	REQUIRED ACTION	COMPLETION TIME
A. RCS operational LEAKAGE not within limits for reasons other than pressure boundary LEAKAGE or primary to secondary LEAKAGE.	A.1 Reduce LEAKAGE to within limits.	4 hours
B. Required Action and associated Completion Time of Condition A not met. OR Pressure boundary LEAKAGE exists. OR Primary to secondary LEAKAGE not within limit.	B.1 Be in MODE 3. AND B.2 Be in MODE 5.	6 hours 36 hours

Davis-Besse 3.4.13-1 Amendment 279

LCO 3.4.13 describes four leakage limits for what appears to be only two conditions; something either leaks or it doesn't. But where a leak is coming from and where it is going to form the basis for the four leakage limits. See Enclosure 2, Reactor Coolant System Leakage, for a fuller description.

[7] See ML053110490 in NRC's online electronic library (ADAMS) at http://adamswebsearch.nrc.gov/scripts/securelogin.pl

The Davis-Besse technical specifications do not allow any pressure boundary leakage. If pressure boundary leakage exists, the technical specifications do not allow time to fix the problem, they require that the Davis-Besse reactor be placed in Mode 3 (hot standby) within six hours. If unidentified leakage exceeds 1 gallon per minute or identified leakage exceeds 10 gallons per minute, the technical specifications allow 4 hours for the operators to reduce leakage below the limit. If they are unsuccessful in reducing the leak rate after 4 hours, then the 6-hour shutdown clock starts.

It is rare for the technical specifications to provide no corrective action time. Most violations of limiting conditions for operation in the technical specifications allow minutes, hours, and in many cases days for corrective actions. Usually, reactor shutdown is required only with the corrective action time expires without the LCO violation being remedied. The following table provides limiting conditions for operation from the Davis-Besse technical specifications[8] along with associated allowable restoration times when the LCOs are not met.

Limiting Condition for Operation	Condition	Remedial Action Time
3.1.2 Reactivity Balance	Measured core reactivity balance not within 1% of predicted value	7 days
3.1.3 Moderator Temperature Coefficient (MTC)	MTC not within limits	0 minutes
3.1.5 Safety Rod Insertion Limits	One safety rod not fully withdrawn	1 hour
3.3.2 Reactor Protection System Manual Trip	One manual reactor trip channel inoperable	48 hours
3.3.2 Reactor Protection System Manual Trip	Two manual reactor trip channels inoperable	1 hour
3.3.4 Control Rod Drive Trip Devices	One or more CRD trip breaker functions inoperable	48 hours
3.3.13 Steam and Feedwater Rupture Control System (SFRCS) Actuation	One or more SFRCS channels of one logic function inoperable	72 hours
3.3.17 Post Accident Monitoring (PAM) Instrumentation	One or more functions in one channel inoperable	30 days
3.3.18 Remote Shutdown System	One or more required functions inoperable	30 days
3.4.10 Pressurizer Safety Valves	One pressurizer safety valve inoperable	15 minutes
3.4.13 Reactor Coolant System Operational Leakage	**Pressure boundary leakage exists**	**0 minutes**
3.4.13 Reactor Coolant System	Unidentified leakage greater than 1	4 hours

[8] These Davis-Besse technical specifications are available in the NRC's online electronic library (ADAMS) using ML082900600. ADAMS can be accessed online at http://www.nrc.gov/reading-rm/adams.html

Limiting Condition for Operation	Condition	Remedial Action Time
Operational Leakage	gallon per minute	
3.4.13 Reactor Coolant System Operational Leakage	Identified leakage greater than 10 gallons per minute	4 hours
3.5.1 Core Flooding Tanks	One core flooding tank inoperable due to boron concentration not within limits	72 hours
3.5.2 Emergency Core Cooling Systems - Operating	One low pressure injection subsystem inoperable	7 days
3.5.4 Borated Water Storage Tank (BWST)	BWST boron concentration not within limits	8 hours
3.6.1 Containment	Containment is inoperable	1 hour
3.6.5 Containment Air Temperature	Containment air temperature greater than 120°F	8 hours
3.6.6 Containment Spray and Air Cooling Systems	One containment spray train inoperable	7 days
3.6.6 Containment Spray and Air Cooling Systems	One containment air cooling train inoperable	7 days
3.7.2 Main Steam Isolation Valves (MSIVs)	One MSIV inoperable	8 hours
3.7.5 Emergency Feedwater (EFW)	One EFW train inoperable for reasons other than inoperable steam supply	72 hours
3.7.9 Ultimate Heat Sink	The ultimate heat sink is inoperable	0 minutes
3.7.10 Control Room Emergency Ventilation System (CREVS)	One CREVS train inoperable	7 days
3.8.1 AC Sources - Operating	One emergency diesel generator inoperable	7 days
3.8.4 DC Sources - Operating	One DC electrical power source inoperable	2 hours

The amount of remedial time provided when an LCO is not met is commensurate with risk – the greater the risk, the less time the reactor can operate with the LCO violated. The table above demonstrates how important it is for Davis-Besse to operate with no pressure boundary leakage. The reactor can continue to operate for:

- 60 minutes with a broken containment,
- 2 days with one of the channels used to manually trip the reactor broken,
- 3 days with a emergency feedwater train out of service,
- 3 days with a core flooding tank out of specification,
- 7 days with a broken emergency diesel generator,

- 7 days with a low pressure injection subsystem inoperable,
- 7 days with the measured reactivity balance of the reactor core more than 1% from the predicted value, and
- 30 days with one or more of the required functions on the remote shutdown system broken.

But if a single drop leaks though the reactor coolant pressure boundary, the technical specifications require that the reactor be shut down within six hours.

Words that are all capitalized, like LEAKAGE and MODE, are defined in Section 1 of the technical specifications to have special meanings (highlighting added):

1.1 Definitions

LEAKAGE

LEAKAGE shall be:

a. Identified LEAKAGE

1. LEAKAGE, such as that from pump seals or valve packing (except RCP seal return flow), that is captured and conducted to collection systems or a sump or collecting tank;

2. LEAKAGE into the containment atmosphere from sources that are both specifically located and known either not to interfere with the operation of leakage detection systems or not to be pressure boundary LEAKAGE; or

3. Reactor Coolant System (RCS) LEAKAGE through a steam generator to the Secondary System (primary to secondary LEAKAGE),

b. Unidentified LEAKAGE

All LEAKAGE (except RCP seal return flow) that is not identified LEAKAGE; and

c. Pressure Boundary LEAKAGE

LEAKAGE (except primary to secondary LEAKAGE) through a nonisolable fault in an RCS component body, pipe wall, or vessel wall.

MODES

MODE	TITLE	REACTIVITY CONDITION (k_{eff})	% RATED THERMAL POWER[(a)]	AVERAGE REACTOR COOLANT TEMPERATURE (°F)
1	Power Operation	≥ 0.99	> 5	NA
2	Startup	≥ 0.99	≤ 5	NA
3	Hot Standby	< 0.99	NA	≥ 280
4	Hot Shutdown[(b)]	< 0.99	NA	280 > T_{avg} > 200
5	Cold Shutdown[(b)]	< 0.99	NA	≤ 200
6	Refueling[(c)]	NA	NA	NA

(a) Excluding decay heat.

(b) All reactor vessel head closure bolts fully tensioned.

(c) One or more reactor vessel head closure bolts less than fully tensioned.

Leakage from a through-wall crack in a control rod drive mechanism (CRDM) nozzle constitutes pressure boundary leakage because it is a nonisolable fault in a reactor coolant system component wall.

The integrity of the reactor coolant pressure boundary has high safety significance. Its failure could render the emergency makeup systems unable to adequately cool the reactor core. Its importance is specifically called out in one of 64 general design criterion provided in Appendix A to 10 CFR Part 50:[9]

> *Criterion 14--Reactor coolant pressure boundary*. The reactor coolant pressure boundary shall be designed, fabricated, erected, and tested so as to have an extremely low probability of abnormal leakage, of rapidly propagating failure, and of gross rupture.

General Design Criterion 14 is reinforced by the NRC's Standard Technical Specifications developed for Babcock & Wilcox reactors like Davis-Besse. The bases for the limiting condition for operation limit on pressure boundary leakage in the current version of the Standard Technical Specifications[10] states:

> *No pressure boundary LEAKAGE is allowed, being indicative of material deterioration. LEAKAGE of this type is unacceptable as the leak itself could cause further deterioration, resulting in higher LEAKAGE. Violation of this LCO could result in continued degradation of the RCPB. LEAKAGE past seals and gaskets is not pressure boundary LEAKAGE.*

Designed to preclude pressure boundary leakage, the existence of any pressure boundary leakage – even a drop – requires that the reactor be placed in Mode 3 within six hours to prevent catastrophic failure.

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[9] See http://www.nrc.gov/reading-rm/doc-collections/cfr/part050/part050-appa.html

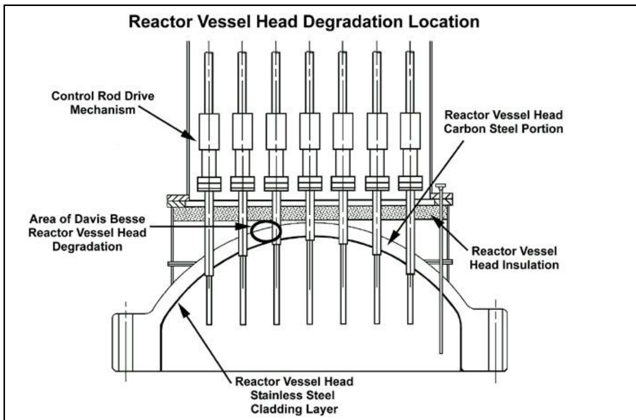
[10] These standard technical specifications are available in the NRC's online electronic library (ADAMS) using ML062510081. ADAMS can be accessed online at http://www.nrc.gov/reading-rm/adams.html

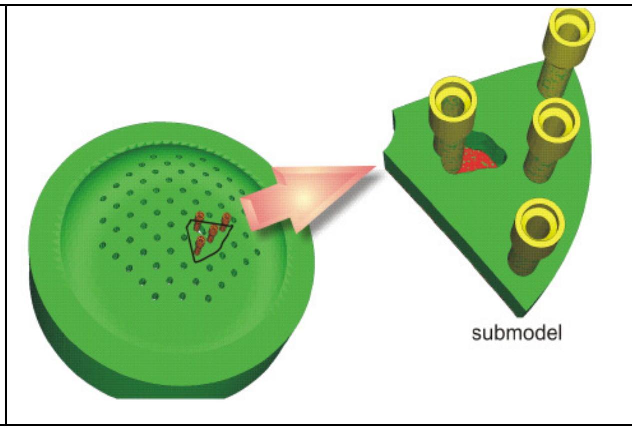
In Mode 3, the reactor is shut down (i.e., the nuclear chain reaction is not self-sustaining) with the temperature of the reactor coolant water equal to or greater than 280°F.

FirstEnergy Nuclear Operating Co. ***EA-05-068; EA-05-066;***
Davis Besse ***EA-05-067; EA-05-071;***
EA-05-072

On April 21, 2005, a Notice of Violation and Proposed Imposition of Civil Penalties in the amount of $5,450,000 was issued for multiple violations (some willful) related to the significant degradation of the reactor pressure vessel head identified in February and March 2002. The significant violations included, (1) operation with reactor coolant system pressure boundary leakage (associated with a Red SDP finding, $5,000,000), (2) failure to provide complete and accurate information (Severity Level I, $110,000), (3) failure to promptly identify and correct a significant condition adverse to quality (Severity Level II, $110,000), (4) failure to implement procedures (Severity Level II, $110,000), (5) failure to provide complete and accurate information (Severity Level I, $120,000), (6) failure to promptly identify and correct a significant condition adverse to quality (associated with a Red SDP finding), (7) failure to implement procedures (associated with a Red SDP finding), and (8) failure to provide complete and accurate information (Severity Level III).

The"*largest single fine ever proposed by the NRC*"[11] was issued to the Davis-Besse licensee for "*failure to properly implement its boric acid corrosion control and corrective action programs, which allowed reactor coolant system pressure boundary leakage to occur undetected for a prolonged period of time, resulting in reactor pressure head degradation.*"[12]





A through-wall crack formed in a nozzle that allowed a control rod drive mechanism (CRDM) mounted on the reactor vessel head (left graphic) to be connected to and move a control rod located within the reactor core. Borated water leaking through this cracked nozzle caused severe corrosion/erosion of the carbon steel reactor vessel head (right graphic) until only a thin stainless steel liner – less than ¼ inch thick and literally bulging outward due to the pressure – prevented a serious loss of coolant accident.

[11] Nuclear Regulatory Commission News Release No. 05-070, "$5,450,000 Fine for Davis-Besse Reactor Vessel Head Violations," April 21, 2005.

[12] Nuclear Regulatory Commission, Letter from Ellis W. Merschoff, Deputy Executive Director for Reactor Programs, to Gary Leidich, President, FirstEnergy Nuclear Operating Company, "Notice of Violation and Proposed Imposition of Civil Penalties - $5,450,000; (NRC Office of Investigations Report No. 3-202-006; NRC Special Inspection Report No. 50-346/2002-08(DRS)); Davis-Besse Nuclear Power Station." April 21, 2005.

In March 2010, workers at Davis-Besse discovered indications that two CRDM nozzles in the reactor vessel head purchased to replace the original head that CRDM nozzle leakage damaged beyond repair have through-wall cracks that leaked borated water onto the carbon steel reactor vessel head.[13]

The moment which the cracks in these two CRDM nozzles propagated through-wall and pressure boundary leakage began has not yet been determined. That the duration of pressure boundary leakage extended six hours is virtually guaranteed. Two separate CRDM nozzles have through-wall crack indications. The odds are vanishingly small that either CRDM nozzle finally cracked through-wall and leaked enough borated water in less than six hours to leave behind the cupful of boric acid before operators placed the Davis-Besse reactor into Mode 3 to enter its current outage. The reactor cooling water contains a small amount of dissolved boric acid, on the order of 2,600 parts per million. It took significantly more than a cupful of leaked borated water to leave behind a cupful of boric acid. And the odds approach zero that both CRDM nozzles developed their through-wall cracks only in the final six hours of the previous operating cycle.

That Davis-Besse was operated again for longer than six hours with pressure boundary leakage from cracked CRDM nozzles represents yet another violation of NRC's regulations. In this case, the licensee violated Criterion XVI in Appendix B, Quality Assurance Criteria for Nuclear Power Plants and Fuel Preprocessing Plans, to 10 CFR Part 50. Criterion XVI, Corrective Action,[14] requires:

> *Measures shall be established to assure that conditions adverse to quality, such as failures, malfunctions, deficiencies, deviations, defective material and equipment, and nonconformances are promptly identified and corrected. In the case of significant conditions adverse to quality, the measures shall assure that the cause of the condition is determined and corrective action taken to preclude repetition. The identification of the significant condition adverse to quality, the cause of the condition, and the corrective action taken shall be documented and reported to appropriate levels of management.*

The CRDM nozzle leakage identified in 2002 clearly constituted "*significant conditions adverse to quality*" – the NRC imposed the majority of its $5.45 million record fine for it. This federal regulation required the licensee to take corrective action to preclude recurrence. The 2010 recurrence demonstrates that Criterion XVI in Appendix B to 10 CFR Part 50 was violated.

In response to the recent discovery, the NRC dispatched a Special Inspection Team to Davis-Besse. The NRC stated that:

> ***BEFORE THE PLANT CAN RESUME OPERATIONS, THE NRC MUST BE SATISFIED THAT THE PROBLEM HAS BEEN ADDRESSED .*** [15]

The NRC did not identify the criteria to be applied or the process to be used in obtaining satisfaction about the problem's resolution, but precedents exist to guide its path.

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[13] Nuclear Regulatory Commission News Release No. III-10-006, "NRC Dispatches Special Inspection Team to Davis-Besse Nuclear Power Plant," March 17, 2010.
[14] See http://www.nrc.gov/reading-rm/doc-collections/cfr/part050/part050-appb.html
[15] Nuclear Regulatory Commission News Release No. III-10-006, "NRC Dispatches Special Inspection Team to Davis-Besse Nuclear Power Plant," March 17, 2010.

In early 1979, the NRC learned about an error in the computer analysis of supports for piping performed for operating nuclear power reactors. The error was non-conservative by under predicting the forces occurring during postulated earthquakes. Consequently, the installed supports might not protect the piping from damage caused by those forces. On March 13, 1979, the NRC evaluated these conditions for the Surry nuclear power plant in Virginia and:

> *… concluded that the public health and safety requires that an orderly suspension of operation of the facility should be effected immediately and that, in order to provide adequate protection of public health and safety the facility operation should be suspended: (1) until such time as the piping systems for all affected safety systems have been reanalyzed for earthquake events to demonstrate conformance with General Design Criterion 2 using a piping analysis computer code which does not contain the error discussed above, and (2) if such reanalysis indicates that there are components which deviate from applicable ASME Code requirements, until such deviations are rectified.*[16]

The NRC issued a Show Cause Order requiring both reactors at Surry to be shut down and remain shut down until the safety concern was resolved. At the time the NRC issued this order, there was no information suggesting that the piping supports installed at Surry were inadequate and would have to be upgraded once the erroneous computer analysis was re-run correctly. But the computer analysis faults prevented the Surry licensee from asserting and the NRC from agreeing that the piping needed to protect public health and safety would remain intact if an earthquake occurred. Adequate protection of public health and safety warranted that the reactors not operate until such assurances could be provided.

The situation at Davis-Besse today is that federal regulations and the plant's operating license require that the reactor not operate for longer than six hours with pressure boundary leakage. Adequate protection of public health and safety is demonstrated by compliance with these requirements. As in the Surry case, the NRC must not allow the Davis-Besse reactor to resume operating until there is reasonable assurance that the reactor will not operate with excessive pressure boundary leakage in the future (e.g., another CRDM nozzle develops a through-wall crack). The status quo is unacceptable – in 2002 and again in 2010 it was discovered that Davis-Besse had operated longer than six hours with pressure boundary leakage. Merely patching these two CRDM nozzles with through-wall cracks and the dozen or so other CRDM nozzles with crack indications does not provide reasonable assurance that Davis-Besse will respond properly the next time that pressure boundary leakage occurs.

UCS determined that at least three viable options exist with which to provide reasonable assurance that the adequate protection standards embodied in NRC's regulations and Davis-Besse's technical specifications will be met. These three options are:

1. To install leakage monitoring equipment that will detect pressure boundary leakage and trigger the shutdown within six hours.

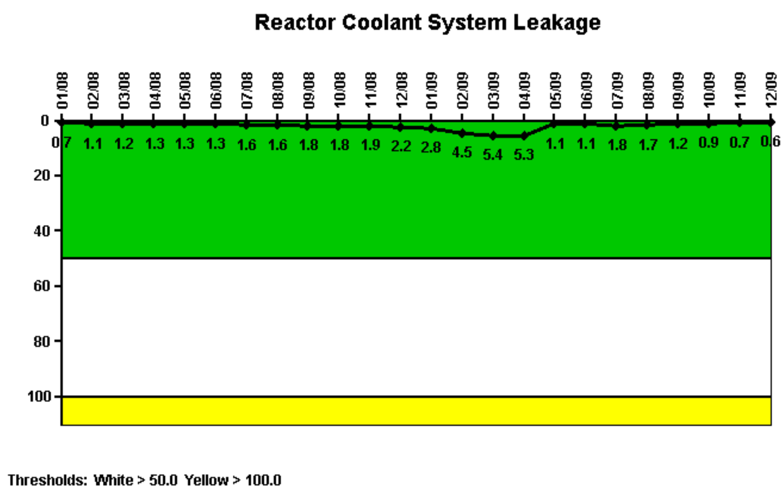
[16] Nuclear Regulatory Commission, Harold R. Denton, Director – Office of Nuclear Reactor Regulation, letter to W. L. Proffitt, Senior Vice President – Nuclear, Virginia Electric & Power Company, March 13, 1979.

2. To use existing leakage monitoring equipment, but assume that any unidentified leakage is pressure boundary leakage.

3. To revise technical specifications to permit pressure boundary leakage.

That the first option is viable has been demonstrated at Davis-Besse when the licensee installed the FLUS monitoring system to detect leakage from the bottom mounted instrumentation.[17] A FLUS monitoring system or a remotely operated camera or other monitoring system for the CRDM nozzles would allow the licensee to comply with the current technical specification probibition against pressure boundary leakage.

That the second option is viable has been demonstrated at Davis-Besse by, among other means, the NRC's Reactor Oversight Process (ROP). One of the performance indicators submitted to the NRC each quarter by the Davis-Besse licensee involves reactor coolant system leakage.[18] Clearly, reactor coolant system leakage is being monitored. This monitoring instrumentation could be used with the new assumption that any leakage is through the pressure boundary. This would be a conservative assumption and would be safer than past assumptions made for Davis-Besse that pressure boundary leakage was the less serious unidentified leakage.



The third option has interesting ramifications. Suppose for a moment that the technical specifications cannot be revised to permit pressure boundary leakage without compromising public health and safety. How then can NRC possibly condone Davis-Besse repeatedly operating with pressure boundary leakage? On the other hand, suppose that the technical specifications can be revised to permit pressure boundary leakage – presumably under certain specified conditions such as location of the leakage, amount of leakage, and duration of the leakage – without compromising public health and safety. How then can the NRC possibly condone Davis-Besse repeatedly operating in violation of its current technical specifications when suitable technical specifications are attainable?

This third option epitomizes the need for the NRC to end the status quo with recurring pressure boundary leakage problems at Davis-Besse. The NRC's mission is to provide adequate protection of public health and safety. The NRC establishes its adequate protection standard through regulations. Contrary to those regulations, Davis-Besse has repeatedly operated for longer than six hours with pressure boundary leakage. With the NRC's adequate protection standard violated, luck was guarding public health and

[17] FirstEnergy, Letter from Mark B. Bezilla, Vice President – Nuclear to Nuclear Regulatory Commission, "Davis-Besse Nuclear Power Station Incore Monitoring Instrumentation Nozzle Inspections," July 30, 2003.
[18] See http://www.nrc.gov/NRR/OVERSIGHT/ASSESS/DAVI/davi_pi.html#BI02

safety. The NRC must not allow Davis-Besse to restart until reasonable assurance exists that adequate protection will be sustained should pressure boundary leakage recur. UCS has identified three options for providing such reasonable assurance, there may be others. The option that must not be on the table is the one involving status quo. This licensee must not be given another chance to expose the public to undue risk by operating Davis-Besse with unacceptable pressure boundary leakage rates.

The Bottom Line

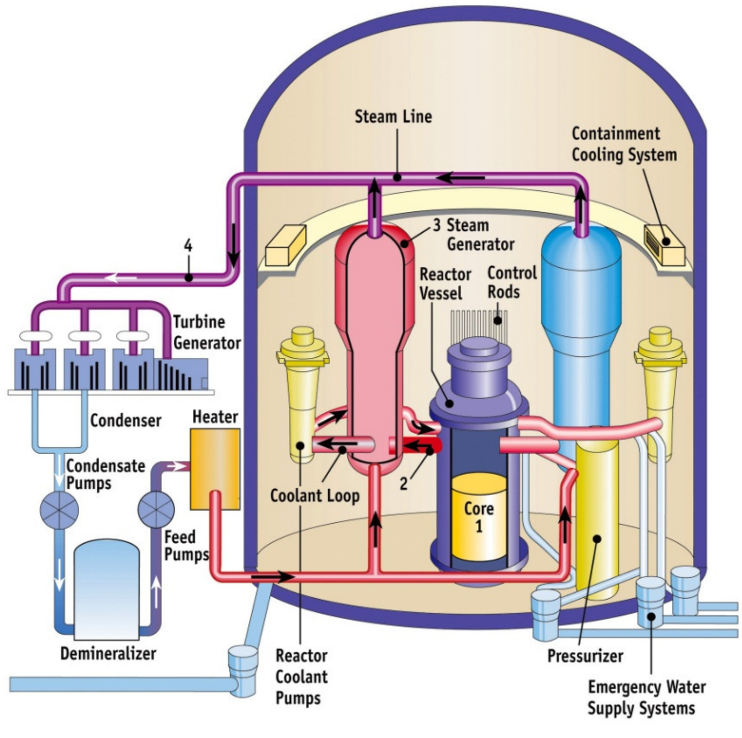
The NRC has stated, in writing, that Davis-Besse will not resume operations until the agency is satisfied that the problem has been addressed. The NRC's regulations establish the adequate protection standard for public health and safety. Compliance with the regulations demonstrates that the standard is met. The NRC must not be satisfied until reasonable assurance exists that Davis-Besse will not be operated in the future with unacceptable pressure boundary leakage. Issuing a Show Cause Order will yield that reasonable assurance, and in doing so provide the NRC the satisfaction it seeks. The Show Cause Order was successfully employed in the Surry case and it can, and should, be successfully employed in the Davis-Besse case.

NRC, like its sister agency NASA, seeks to manage the risk from low probability, high consequence events. NRC might be tempted to sustain the status quo of recurring pressure boundary leakage at Davis-Besse. After all, it has happened on at least two occasions in the past with no one being killed or injured. The problem may be annoying, but it seems not be to life-threatening. But that "normalization of deviance" explains how NASA dismissed concerns about o-ring burn-through on the external fuel tanks of the space shuttles, until Challenger exploded shorting after launch. It also explains how NASA later dismissed concerns about pieces of foam breaking loose and striking shuttle surfaces during launch, until Columbia exploded as it prepared for landing. If NRC truly stands behind its tagline of "Protecting People and the Environment,"[19] it will not permit this licensee to launch Davis-Besse back into operation without reasonable assurance that the adequate protection standards for pressure boundary leakage are being met and will continue to be met. The actions requested in our petition will obtain the necessary reasonable assurances; therefore, the NRC must undertake those actions.

[19] See http://www.nrc.gov/

Reactor Coolant System Leakage

In a pressurized water reactor (PWR) like Davis-Besse, the reactor coolant system consists of the reactor pressure vessel including its head, the steam generators, the pressurizer, and the piping connecting these components. The reactor coolant system is also called the primary loop. The secondary loop carries away steam from the steam generators and returns feedwater to them. The primary loop water flow through thousands of metal tubes inside the steam generators, transferring its heat through the walls of those tubes to boil secondary loop water flowing outside the tubes within the steam generators. There are other systems inside containment that use other loops of water, such as the containment cooling system which removes heat from air conditioning equipment.



Source: U.S. Nuclear Regulatory Commission

Pressure boundary leakage occurs through a crack in the wall of a reactor coolant system pipe or component. Non-pressure boundary leakage would be through a gasket or seal. For example, the reactor coolant pumps are powered by large electric motors. These motors spin pump shafts that propel water through the coolant loops. Flexible seals encircle the pump shafts to prevent reactor coolant water from slipping along the rotating shafts and leaking out. But even with very tight clearances, a small amount of leakage from gaskets, seals, and other sources is expected.

The source of the leakage determines whether it is pressure boundary leakage or non-pressure boundary leakage. Where leakage goes determines whether it is identified or unidentified leakage. Some pumps and valves are equipped with collection devices that route leakage to special tanks. When these special tanks detect incoming water, it can only mean leakage from certain reactor coolant system components. This is identified leakage because one knows that the water is coming from a specific location.

Unidentified leakage is water that collects in places like the sump in the lower floor of containment that could come from various sources. For example, the containment sump can collect water leaking from the reactor coolant system, from the portion of the secondary loop inside containment, and even from other sources like that water supplied to the containment cooling system.

The fourth reactor coolant system leakage limit is primary-to-secondary leakage. If one or more of the metal tubes in the steam generators crack, the higher pressure of the primary loop (over 2,000 pounds per square inch) compared to the secondary loop (around 1,000 pounds per square inch) will cause reactor coolant water to leak into the secondary loop.