



Union of Concerned Scientists

Citizens and Scientists for Environmental Solutions

July 3, 2002

Mr. John A. Grobe, Chairman
Davis-Besse 0350 Panel
United States Nuclear Regulatory Commission
801 Warrenville Road
Lisle, IL 60532-4351

Mr. Edwin M. Hackett, Assistant Team Leader
Davis-Besse Reactor Vessel Head Degradation Lesson-Learned Task Force
United States Nuclear Regulatory Commission
Washington, DC 20555-0001

**SUBJECT: DICKENS OF A STORY: GHOSTS OF PAST, PRESENT, AND FUTURE
 AT DAVIS-BESSE**

Dear Mr. Grobe and Mr. Hackett:

The Union of Concerned Scientists (UCS) continues to examine the Davis-Besse near-miss loss-of-coolant-accident. We recently obtained a number of documents from the NRC's Public Document Room that shed additional light on the matter. In case our review doesn't cover ground you have already been over, we are passing along things we have discovered to the Davis-Besse 0350 Panel and the Lessons Learned Task Force. We have not enclosed the source documents. Since we obtained them from the NRC's Public Document Room, we assume that they are readily available to you. If you have any problems fetching the documents, let me know and I can send along copies.

What Does the NRC Mean by "Acceptable"?

In its Final Root Cause Report dated April 18, 2002, First Energy reported that the NRC had inspected the boric acid corrosion program at Davis-Besse and judged it acceptable. This conclusion appears to have been based on this NRC statement:

"The purpose of this letter is to advise you that our audit of your boric acid corrosion prevention program has resulted in an acceptable finding and we now consider this issue to be closed."¹

The NRC sent two NRC staffers and a consultant from Brookhaven National Laboratory to Davis-Besse between September 11-13, 1989. The report issued following their inspection did indeed contain the aforementioned "acceptable" statement, but it also contained this statement:

¹ Thomas V. Wambach, Senior, Project Manager – Project Directorate III-3, Office of Nuclear Reactor Regulation, Nuclear Regulatory Commission, to Donald C. Shelton, Vice President – Nuclear, Toledo Edison Company, "Prevention of Boric Acid Corrosion at Davis-Besse Nuclear Power Plant (Generic Letter 88-05), (TAC No. 68915)." February 8, 1990.

"The following areas of boric acid corrosion prevention could be enhanced at the Davis-Besse plant:

- a) System and operations engineers who perform boric acid leak inspections should have some formal training prior to performing the inspections.
- b) Inspections performed by the system and operations staff should be documented formally."

The consultant who accompanied the NRC inspectors to Davis-Besse and nine other nuclear plants subsequently authored a report for the NRC. In that report, he stated:

"The plant audits showed a considerable variance in the mode and quality of boric acid corrosion programs between utilities. The degree of importance of a boric acid corrosion control program also varied considerably between plants. In the plants where a reasonably high priority was given to the problem, the leaks were identified and corrective actions taken in a timely manner."²

In Table 2 of his report, the consultant graded the boric acid corrosion programs in nine areas. Davis-Besse was Plant #9 in his tabulation. He assigned Davis-Besse grades of "2" in the areas of "Procedure for Damage Evaluation" and "Training of Inspectors." According to Section 5.3, "Evaluation of Audit Results," a grade of "2" meant "Unsatisfactory." Only two plants received lower overall scores than Davis-Besse. The majority of plants (seven) received better overall scores than Davis-Besse.

UCS was disappointed to discover that the NRC determined that two of nine (22.2 percent) of the boric acid corrosion program elements were unsatisfactory, yet still accepted it. **In fact, if we understand the consultant's report correctly, Davis-Besse could have been graded "unsatisfactory" in all nine elements and still received an "acceptable" finding from the NRC.** Talk about unsatisfactory! The NRC did not ask, yet alone require, Davis-Besse to remedy the elements of its program determined to be unsatisfactory. In many ways, this is worse than not knowing that their program was bad. The NRC knew it was bad and accepted it that way.

UCS-09a Why did the NRC "accept" the boric acid corrosion program at Davis-Besse after determining that over 20 percent of the program was "unsatisfactory"?

UCS-09b If the 0350 Panel determines that restart is "acceptable," will "acceptable" rely on one or more NRC findings of "unsatisfactory" conditions at Davis-Besse? In other words, will "acceptable" and "unsatisfactory" stop being synonymous to the NRC?

How Did Davis-Besse Accomplish What Cher Wanted to Do, Turn Back Time?

The NRC staff concluded its heightened regulatory efforts for the plant were necessary as a *"result of the series of problems that formed a long history of ineffective and inadequate attention and direction in the operation and maintenance of the Davis-Besse facility."*

² C. J. Czajkowski, Brookhaven National Laboratory, "Survey of Boric Acid Corrosion of Carbon Steel Components in Nuclear Plants." NUREG/CR-5576, June 1990.

While this conclusion appears contemporary, it actually applied to a June 9, 1985, loss of feedwater event at Davis-Besse.³ That event, according to the NRC, resulted in a conditional core damage frequency of 3.6×10^{-2} , an extraordinarily high risk given that other near-misses have values in the 1×10^{-5} to 1×10^{-7} range. In fact, the NRC reported that only two other events at Babcock & Wilcox nuclear plants like Davis-Besse had as higher or higher risk in recorded history. Those events were a March 20, 1978, loss of power at the Rancho Seco nuclear plant in California (permanently shut down in the early 1990s due to safety and economic concerns) and a September 9, 1977, loss of feedwater event at Davis-Besse. The 1977 event at Davis-Besse also had the extraordinarily high conditional core damage frequency of 3.6×10^{-2} .⁴ This was not surprising considering that it was the same event and the company had done nothing to lessen the risk after the first near-miss.

As the NRC itself concluded, chronic and systemic management problems caused the very, very serious near-miss at Davis-Besse in 1985. The NRC must share some responsibility for that near-miss because it was a virtual repeat of a 1977 near-miss at Davis-Besse that the NRC tolerated without any upgrades at the facility. The NRC must have concluded that the “unsatisfactory” 1977 near-miss was “acceptable” until lightning struck a second time in 1985.

As the company’s root cause team concluded and NRC’s AIT confirmed, chronic and systemic management problems caused the very, very serious near-miss at Davis-Besse in 2002. The NRC must share some responsibility for that near-miss because the agency “accepted” a boric acid control program in 1990 that it knew was “unsatisfactory” in over 20 percent of the areas evaluated.

UCS-10a How many times must the people living around Davis-Besse be subjected to American Roulette?

UCS-10b What tangible steps will NRC take to prevent chronic and systemic management problems from causing yet another very, very serious near-miss—or worse—at Davis-Besse?

Why Should Anyone Believe the NRC’s Ouija Board?

As UCS documented two years ago,⁵ the risk assessments performed for nuclear power plants are fundamentally flawed. Among other deficiencies, the risk assessments assume there is a negligible chance of reactor vessel damage. UCS went to the NRC’s Public Document Room on June 28, 2002, to examine the plant-specific risk assessment for Davis-Besse submitted by the plant’s owner in March 1993. We wanted to confirm that potential reactor vessel damage had been downplayed in the Davis-Besse risk assessment as it had been in the dozen-plus risk assessments we have reviewed for other nuclear plants. But UCS was denied access to this document by the NRC.

The Significance Determination Process (SDP) used by NRC to evaluate the safety impact of the reactor vessel damage at Davis-Besse is almost exclusively based on the “secret” plant-specific risk assessment.⁶

³ Nuclear Regulatory Commission, Press Release No. 87-24, “NRC Staff Reduces \$900,000 Fine Against Davis-Besse by \$450,000,” February 12, 1987.

⁴ Nuclear Regulatory Commission, NUREG-1231, “Safety Evaluation Report related to Babcock & Wilcox Owners Group Plant Reassessment Program,” November 1987.

⁵ David Lochbaum, Union of Concerned Scientists, “Nuclear Plant Risk Studies: Failing the Grade,” August 2000.

⁶ Douglas V. Pickett, Senior Project Manager, Nuclear Regulatory Commission, to Guy C. Campbell, Vice

The NRC's SDP worksheets for Davis-Besse are 49 pages long, including the transmittal letter, cover sheet, and table of contents. It refers to the Davis-Besse risk assessment approximately 43 separate times. In fact, it has only two references: (1) the Davis-Besse risk assessment, and (2) NRC staff paper SECY-99-007A titled "Recommendations for Reactor Oversight Process Improvements (Follow-up to SECY-99-007)." The SECY paper claimed that the new oversight program would be scrutable, transparent, and based on publicly available information. But the NRC does not allow the public to look at the information it uses to assign safety significance to events. Shame on the agency! UCS would request that the NRC staff revise SECY-99-007A to reflect its actual rather than intended practices, but the agency would probably classify the revised document "confidential" and hide it from the public, too.

UCS located a publicly-available, at least for the moment, document addressing the treatment of reactor vessel damage:⁷

Because of the stringent design and surveillance practices applied to reactor pressure vessels in the U.S., failure of the reactor pressure vessel has traditionally been considered incredible. Containments for U.S. nuclear power plants are not designed to withstand the loads associated with gross rupture of the reactor pressure vessel.

Davis-Besse demonstrated the utter fallacy of assuming "stringent" surveillance practices. That the reactor vessel at Davis-Besse did not fail is due more to luck than the skill of either the plant owner or the NRC. Reactor vessel damage has occurred and will likely occur again. It is non-conservative and just plain foolhardy to pretend that it will not. Someday, the good luck may run out.

Yet the NRC used the flawed, deficient, and non-conservative risk assessment last fall to justify deferral of the mandated inspection for CRDM nozzle damage. And it is this risk assessment that the NRC is now using to determine the safety significance of the reactor vessel head damage at Davis-Besse. **Yep, the agency is using a risk assessment specifically discounting reactor vessel damage as a possibility to determine the significance of reactor vessel damage.** That's at least two stops past absurd on the sheer folly train.

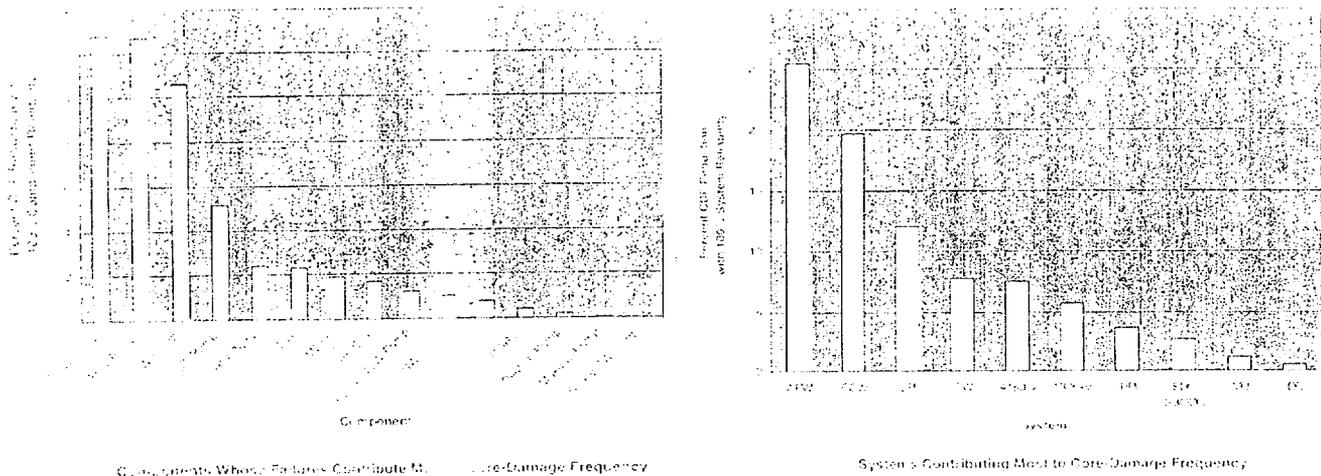
The NRC's revised reactor oversight program is allegedly risk-informed. It purportedly uses risk insights to focus plant owner and NRC attention towards the most safety significant areas. For example, the plant-specific risk assessments determine the importance of a system or component by calculating the chances of reactor core damage with and without it. The importance values are then sorted to distinguish the highest risk systems/components from those having the least risk. The NRC's inspectors select systems and components from the top of that list for their audits.

President - Nuclear, First Energy Nuclear Operating Company, "Davis-Besse Nuclear Power Station - Site-Specific Worksheets For Use in the Nuclear Regulatory Commission's Significance Determination Process," March 14, 2000.

⁷ Nuclear Regulatory Commission, NUREG/CR-6042 Rev. 2, "Perspectives on Reactor Safety."

But because the risk assessment gave a nearly a zero percent chance of reactor vessel failure, the reactor vessel is not even on the list. It ain't at the top, it ain't at the bottom, it ain't on the list at all. Thus, even if the NRC inspectors went to "bottom fish" and pick the least important systems components on the list, they still will not audit the reactor vessel.

Yesterday, UCS found a 1999 update to the Davis-Besse risk assessment in the NRC's ADAMS on-line library.⁷ This document confirms our suspicions. The chances of reactor vessel failure was deemed to be 4.5×10^{-7} per reactor year. By arbitrarily assigning an artificially low value that has no real basis, the reactor vessel did not even make the list of risk significant systems and components. What made the list?



The math wizards at Davis-Besse report that the spare service water (SW) pump has essentially no risk relevance, but it is still—according to their goofy Ouija board at least—far more important than the measly oil reactor vessel head. This focus-pocus doesn't even pass the laugh test.

The fundamentally flawed risk assessments are more than mere mathematical miscues. Their output is heavily relied upon by the NRC's revised reactor oversight program. The "garbage" produced by the fundamentally flawed risk assessments thus corrupts the entire reactor oversight program. It prevents NRC inspectors from auditing reactor vessel integrity. It prevents NRC inspectors from auditing ice-condensers. It prevents NRC inspectors from auditing other areas non-conservatively omitted from the risk assessments. It blinds NRC inspectors from adequately protecting the American public from nuclear plant risks. It is "unsatisfactory" and "unacceptable" and "unjustifiable."

UCS-11a Will the NRC allow the public to look at the 1993 Davis-Besse risk assessment?

UCS-11b Out of curiosity, why did the NRC staff use the old 1993 Davis-Besse risk assessment to develop its Significance Determination Process worksheets when the updated 1999 plant safety assessment was readily available? Did the staff prefer to use an old "secret" report instead of a recently updated version that the public could obtain?

⁷ Probabilistic Risk Assessment Unit, Design Basis Engineering, First Energy Nuclear Operating Company, "Probabilistic Safety Assessment for the Davis-Besse Nuclear Power Station," October 1999.

- UCS-11c **If the Davis-Besse risk assessment remains “secret” but it the basis for the SDP call, why should the public believe any NRC pronouncement on safety significance derived, in large part, on “secret” information?**
- UCS-11d **If the Davis-Besse risk assessment remains “secret,” will the NRC retain the 0350 Panel in place following restart indefinitely to compensate for the public being unfairly excluded from access to this key information?**
- UCS-11e **Will the NRC require the Davis-Besse risk assessment to incorporate the real risk from reactor vessel failure before the plant restarts?**
- UCS-11f **When the NRC revamp its reactor oversight program to enable its inspectors to audit areas non-conservatively omitted from the plant-specific risk assessments?**

Did First Energy repeat Callaway’s mistakes?

NRC Region IV cited the owner of the Callaway nuclear plant in Missouri with a violation of occupational radiation exposure control requirements.⁹ NRC Region IV was disenchanted because:

“As described in Section 2OS2 of this report, six jobs that accrued more than 5 person-rem each during Refueling Outage 10 exceeded their projected job doses by more than 50 percent because of a number of performance problems.”

Radiation Work Permit RWP 2000-5132 was written by plant workers at Davis-Besse on April 6, 2000, to cover the vessel head cleaning task during the 12th refueling outage. It estimated a total job dose of 100 mRem. Due to various performance problems encountered during the task (evidenced by Condition Reports CR 2000-0994 on April 16th, CR 2000-0995 on April 16th, and CR 2000-1037 on April 17th, the estimated total job dose was revised upward again and again to a final estimate of 600 mRem. RWP 2000-5132 was closed on April 25, 2000, after the vessel head cleaning was completed. The total actual dose was 224 mRem, over 100 percent higher than the original guesstimate.

While 224 person-mRem is lower than 5-plus person-rem, Callaway and Davis-Besse both experienced initial radiation exposure estimates significantly below actual radiation exposure estimates. The falsely low estimates impeded informed decision-making on shielding, mock-ups, and other means of limiting overall worker exposures. In addition, part of the reason for the higher-than-planned radiation exposures at Davis-Besse is the failure of management to install MOD 94-0025, which would have facilitated inspection and cleaning of the reactor vessel head. The as-low-as-reasonably-achievable (ALARA) regulation was seemingly violated by First Energy’s repeated decisions to defer MOD 94-0025 from outage to outage and allow workers to soak up radiation while struggling to inspect and clean the reactor vessel head.

And it’s not like Davis-Besse has an exemplary radiation protection program. If media accounts are accurate, contract workers at Davis-Besse carried little radioactive “souvenirs” with them to contaminate apartments and motels across the US of A.

⁹ Arthur T. Howell, III, Director - Division of Reactor Safety, Nuclear Regulatory Commission, to Garry L. Randolph, Vice President and Chief Nuclear Officer, Union Electric Company, “Callaway Plant -- NRC Inspection Report No. 50-483/00-17,” October 4, 2000.

UCS-12a Did First Energy violate the ALARA regulation by repeatedly deferring MOD 94-0025?

UCS-12b Does NRC Region III have a different approach to worker radiation safety than NRC Region IV, given the fact that Callaway was cited for the same poor radiation control practices that Region III let Davis-Besse get away with?

Is First Energy merely recycling excuses and promises?

As you know, I attended two of the three public meetings conducted by the NRC in Oak Harbor, Ohio on June 12, 2002. I heard Mr. Lew Myers and Mr. Randy Fast of First Energy repeatedly speak of the need to catch up to the rest of the industry. Mr. Fast outlined more than once a scheme to bench-mark programs at Davis-Besse against the industry's best. Mr Myers, on at least two occasions, remarked that his operators needed to break their silence when they notice leaks and problems inside containment.

This all sounds really nice. It also sounded really nice all the times we've heard it in the past. The company needs to back up its words with deeds. After the company missed several opportunities to figure out that boric acid corrosion was damaging valve RC-2 inside containment in 1999, First Energy informed the NRC:

"As noted in the IR [NRC inspection report], following the determination that boric acid corrosion was the most likely cause for the missing nuts on the body-to-bonnet bolting of valve RC-2, a thorough evaluation of the issue was conducted and extensive, effective corrective actions were developed. Greater sensitivity to the effects of boric acid corrosion on plant equipment were noted in the IR and integration of these insights into plant processes and operational philosophy are being institutionalized by: 1) developing a revision to the Boric Acid control program and the Work Process Guidelines on plant leakage, including the benchmarking of industry standards and practices, to reflect higher standards for monitoring, evaluating, documenting and controlling boric acid leakage; and, 2) providing additional training to management and the technical staff to address the technical issues of boric acid control, the DBNPS Boric Acid Control Program and requirements, lessons learned from the RC-2 event, and industry experience. **We will continue to stress the use of a questioning attitude and conservative decision-making in managing and resolving identified issues.**"¹⁰ [emphasis added by UCS here, but apparently not by First Energy there]

Prior to joining UCS, I worked as a consultant on PSE&G's Salem 2 restart project in 1995/1996. Salem was then in the regulatory doghouse for non-conservative decision-making. To roll out expectations on questioning attitude and conservative decision-making, PSE&G instituted many measures to back up the really nice slogans it sent to NRC. For example, senior managers conducted a series of informal luncheons with first-line supervisors and workers. To complement training sessions, PSE&G added a column titled "Catch of the Week" to its weekly employee newsletter highlighting issues raised by workers. This attention not only reinforced to workers that management did indeed want to hear about problems, but it also helped calibrate workers to the important threshold question for reporting problems. In short, PSE&G backed up its nice-sounding words with meaningful, tangible actions.

¹⁰ Guy C. Campbell, Vice President – Nuclear, First Energy Nuclear Operating Company, to Nuclear Regulatory Commission, "Response to Inspection Report Number 50-346/98021 (DRP)," July 1, 1999.

UCS-13 **What tangible actions has First Energy taken to back up its rosy proclamations and assertions about “questioning attitude and conservative decision-making”?**

Will the NRC enforce existing regulations?

The NRC recently reported that “*the licensee for Davis-Besse did not have a regulatory commitment to clean the reactor pressure vessel (RPV) head.*”¹¹ UCS is more than a little baffled by this announcement. To be perfectly frank, we do not believe it to be true. During the NRC public meeting conducted in the Commissioner’s Auditorium on March 20, 2002, UCS presented information to the NRC staff. Among that material (which only consisted of five pages so it should not have been overwhelming) was this statement:

Davis-Besse UFSAR Section 5.2.3.2, Materials Exposed to Reactor Coolant, page 5.2-15 states
“All materials exposed to the reactor coolant exhibit corrosion resistance for the expected service condition. ... Sensitized stainless steel weld overlay (cladding) is permitted.”

Lest anyone think we “cut and paste” words out of context to suit our purposes, here’s the precise wording from the UFSAR itself:

5.2.3.2 Materials Exposed to Reactor Coolant

All materials exposed to the reactor coolant exhibit corrosion resistance for the expected service conditions. The materials used, as given in Table 5.2-10, are 304SS, 316SS, Inconel (Ni-Cr-Fe), or weld deposits with corrosion resistance equivalent to or better than the other materials listed. These materials were chosen because they are compatible with the reactor coolant. The RCPB contains no furnace-sensitized, wrought austenitic stainless steel. Sensitized stainless steel weld overlay (cladding) is permitted.

The carbon steel exterior surface of the reactor vessel head is neither corrosion-resistant nor clad with stainless steel. Thus, when highly corrosive boric acid crystals were discovered on this surface, the Davis-Besse UFSAR—as an absolute minimum—required it to be cleaned. After all, it was clearly material exposed to reactor coolant. The existing Davis-Besse design and licensing bases clearly and unequivocally require boric acid to be cleaned off the reactor vessel head. If First Energy, for whatever reason, wanted to leave the boric acid on the exterior surface of the reactor vessel head, they had to either comply with the requirements in UFSAR Section 5.2.3.2 or legally change it. Ignoring that requirement year after year should not have been an option.

UCS-14a **Will the NRC require First Energy to conform with UFSAR Section 5.2.3.2 or revise UFSAR Section 5.2.3.2 to match what the company does about boric acid before restart?**

UCS-14b **If the NRC truly believes that First Energy, or any other nuclear plant owner, lacks a regulatory commitment to clean the reactor vessel head of highly corrosive material that can cause catastrophic failure, shouldn’t the agency undertake as Job #1 getting that regulatory commitment? If not, why not?**

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¹¹ Anthony J. Mendiola, Chief - Section 2 Project Directorate III, Nuclear Regulatory Commission, to Paul M. Blanch, June 19, 2002.

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The discovery of significant reactor vessel head damage occurring as a result of years of neglect would seem to undermine confidence in both the plant owner and the NRC. But it doesn't have to yield that result. The company and the NRC could demonstrate with deeds rather than words that this is a learning opportunity. Or they could sustain the business-as-usual attitudes that created this near-disaster by accepting unsatisfactory conditions and blithely dismissing true safety hazards. We hope for the former but will be monitoring closely for signs of the latter.

Sincerely,

A handwritten signature in black ink that reads "David A. Lochbaum". The signature is written in a cursive, flowing style.

David Lochbaum
Nuclear Safety Engineer
Washington Office