RAS 3677

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD PANEL

Before Administrative Judges:

Ann Marshall Young, Chair
Dr. Charles N. Kelber
Lester S. Rubenstein

In the Matter of	Docket No's. 50-369-LR, 50-370-LR, 50-413-LR, and 50-414-LR
DUKE ENERGY CORPORATION	ASLBP No. 02-794-01-LR
(McGuire Nuclear Station, Units 1 and 2, Catawba Nuclear Station, Units 1 and 2)	November 29, 2001

CONTENTIONS OF NUCLEAR INFORMATION AND RESOURCE SERVICE

Nuclear Information and Resource Service is filing these contentions, and at the same time offering a Motion to Suspend this proceeding. We find that access to the information needed to fully participate in this process has been so severely limited that in essence, our members as members of the public are being denied their hearing rights.

Nonetheless, we file these contentions. We wish to make clear however that our choice of contentions should in no way cast any judgment by us that other issues are unimportant. This document reflects overall resource issues, including the fact that key information is unavailable to us because of decisions made by the Nuclear Regulatory Commission (NRC) subsequent to the September 11 attacks on New York and Northern Virginia.

1. Duke's License Application is Not Complete

1.1 Completeness and Accuracy of Information 10CFR54.13(b)

The regulation states:

> (a) Information provided to the Commission by an applicant for a renewed license or information required by statute or by the Commission's regulations, orders, or license conditions to be maintained by the applicant must be complete and accurate in all material respects.
>
> (b) Each applicant shall notify the Commission of information identified by the applicant as having, for the regulated activity, a significant implication for public health and safety or common defense and security. An applicant violates this paragraph only if the applicant fails to notify the Commission of information that the applicant has

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> identified as having a significant implication for public health and safety or common defense and security...

There are a number of pieces of information that need consideration with respect to license renewal that are not included in Duke Energy's application. They are enumerated below, with a subsection on the Environment Reports.

1.1.1 MOX Fuel Use Will Have a Significant Impact on the Safe Operation of Catawba and McGuire During the License Renewal Period and Must be Considered in the License Renewal Application

The applicant, Duke Energy, is required to demonstrate, for all structures and components within the scope of license renewal, "that the effects of aging will be adequately managed ... for the period of extended operation," 10 CFR §54.21 (a)(3). In addition, it is required to evaluate all time-limited aging analyses (TLAAs) and demonstrate that they will apply for the period of extended operation, either with or without aging management of the relevant SSC, 10 CFR §54.21(c)(1).

Duke Energy's plan to utilize weapons-grade mixed-oxide (MOX) fuel in Catawba and McGuire will have a significant impact on these assessments and may jeopardize the safe operation of these plants in the license renewal period. Thus use of MOX will require substantial modifications to the aging management plans specified in the license renewal application as submitted, which do not consider the accelerated aging effects of MOX fuel. To avoid unnecessary duplication of work by the NRC staff and to minimize the cost and risk to U.S. taxpayers, who are paying for the MOX fuel program, it is essential that the impact of MOX fuel use on reactor aging be evaluated now in the analyses submitted for the Catawba and McGuire license renewal application.

Basis: Duke Cogema Stone & Webster (DCS), a consortium including Duke Energy, has a contract with the Department of Energy (DOE) to manufacture mixed-oxide (MOX) fuel from weapons-grade plutonium (WG-Pu) and irradiate it at the Catawba and McGuire plants,

commencing in 2008 and continuing for approximately fifteen years. DCS has applied for an NRC license to construct and operate a MOX fuel fabrication plant at the Savannah River Site. It also intends to apply for license amendments to load MOX lead test assemblies in at least one of the four reactors in early 2002, and to apply for license amendments for batch irradiation in all four reactors in 2005.

Due to schedule slippage, it is likely that many of these actions will be delayed. Moreover, additional quantities of WG-Pu may be made available to DCS by DOE as a result of additional reductions in the U.S. nuclear weapon stockpile. Thus the MOX fuel campaign may extend well into the license renewal period.

The Catawba and McGuire license renewal application does not consider the impacts of MOX fuel use. However, the use of MOX fuel in these reactors will have a significant impact on the aging of many reactor structures and components within the scope of license renewal that requires detailed evaluation. The fast neutron flux (E>1.0 MeV) in a full core of WG-MOX would be on the order 20% higher at the beginning of operation than that in a core consisting only of conventional low-enriched uranium (LEU) fuel.1 At a burnup of 20 GWD/MTHM, a Westinghouse study reports that the E>1 MeV neutron flux is about 6% higher in a full WG-MOX core than in an LEU core.2 Gamma-ray sources are about 20% higher in full MOX cores.3 As currently planned by DCS, at equilibrium about 40% of the Catawba and McGuire cores would consist of MOX fuel, resulting in a proportionately smaller but still significant increase in fast neutron flux and heating rates.

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1 G.T. Yahr, *Impact of Conversion to Mixed-Oxide Fuels on Reactor Structural Components*, Oak Ridge National Laboratory report ORNL/TM-13423, April 1997, p.1.
2 Westinghouse Electric Corporation, *Plutonium Disposition in Existing Pressurized Water Reactors*, DOE/SF/19683—6, June 1, 1994, p. 2.1-24.
3 A.J. Frankel, P.C. Rohr and N.L. Shapiro, "PWR Plutonium Burners for Nuclear Energy Centers," paper presented at the American Nuclear Society/Canadian Nuclear Association Joint Meeting, Toronto, CA, June 13-18, 1976, p.12.

A number of aging-related degradation effects of metallic core structures can be accelerated by the increased fast neutron flux and gamma heating associated with MOX fuel. These phenomena include embrittlement, irradiation-assisted stress corrosion cracking (IASCC), creep and thermal fatigue.4 The structures affected include the reactor pressure vessel (RPV), reactor internals and piping.

Thus a number of TLAAs in the license renewal application, including Sections 4.2, "Reactor Vessel Neutron Embrittlement," and 4.3, "Metal Fatigue," must be reevaluated using the parameters appropriate for the planned MOX core.

Duke Energy has said publicly that the license renewal of Catawba and McGuire has a higher priority than the MOX fuel program, and if it were shown that the use of MOX fuel would jeopardize the safe operation of Catawba and McGuire in the license renewal period, then it would not use MOX fuel. Given the significant taxpayer investment in the DCS MOX fuel program to date, it is irresponsible for NRC not to require that Duke Energy evaluate the MOX impact on license renewal before license renewal is granted.

It should be noted here that NIRS is not bringing all the contentions that we would bring on the question of using MOX fuel in these four reactors. We are illustrating the ways in which the question of MOX fuel use intersects with other issues of license renewal.

1.1.2 Security Concerns

The Petitioner contends that the Duke Energy license extension application has not realistically or fully analyzed and evaluated all structures, systems and components required for the protection of the public health and safety from deliberate acts of radiological sabotage. These unanalyzed systems, structures and components include but are not limited to the containment structure, fire protection systems and coolant water intake systems and electrical grid system as primary power supply to plant safety systems for the Catawba and McGuire units.

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4 Yahr (1997), op cit., p.7.

In the wake of the events of September 11, 2001, when the United States was violently attacked, the Nuclear Regulatory Commission appears to have increased concern about nuclear security. It must be noted that on many occasions prior to September 11, many different members of the public have attempted to bring nuclear security issues into focus. International press continues to report that nuclear power plants in the United States are explicitly targeted by Islamic extremist groups for acts of radiological sabotage and mass terrorism. The Associated Press reported on October 24, 2001 in an article "Nuclear Liability Report Left Public" that FBI testimony in the Ramzi Yousef trial in the bombing of the 1993 bombing of the World Trade Center that Islamic extremists are being encouraged to target U.S. nuclear power stations as a high priority targets in a campaign of terrorism. [Hardcopy Exhibit 1, Associated Press, "Nuclear Liability Report Left Public," John Solomon, October 24, 2001]

Duke must also be similarly aware of security concerns, but they have not moved to amend their license renewal application to reflect this awareness. Given the number of news reports that discuss this issue it is not credible that Duke Energy has not considered this. These reports have included a statement by Director General Mohamed El Baradei of the International Atomic Energy Agency on November 1, 2001 that an act of nuclear terrorism is "far more likely" than previously thought. This change of conditions must be factored into this proceeding in a more direct manner than only withholding documents from the intervenors.

It is of particular concern to the Petitioner and a significant point of contention that these issues were never considered in the original licensing proceeding and as such constitutes an age-related regulatory issue adversely affecting public health and safety.

Indeed, 10CFR51(c) (3)(iv) states "the environmental report must contain any new and significant information regarding the impacts of license renewal of which the applicant is aware." Certainly a major direct attack on a nuclear reactor site would result in environmental impacts, and as stated above, there is awareness of this issue.

Certainly also this issue pertains to license renewal since the duration that a target exists impacts the probability and risk that it will be hit. This is especially true since there is ample evidence showing that not only is there an increase in terrorist activity directed at the United States, but there is an overall acceleration in terrorism, and targeting of nuclear facilities in particular[5]. This means that the overall risks of an attack are increasing over time. As stated in NRC Regulations (10CFR54.31(c) "A renewed license will become effective immediately upon its issuance, thereby superseding the operating license previously in effect." Therefore the renewal period commences as soon as the renewal is granted.

Lacking guidance from the Commission, NIRS contends that an adequate security analysis for extending the operating licenses of these reactors must include following possibilities in order to address increasing risks to our members:

1.1.2(a) The vulnerability of the applicant units to air assaults is no longer theoretical: it is frighteningly real. (Indeed, the McGuire reactors are on the approach to the Charlotte airport. NIRS staff has been commercial passengers on very low flight directly over the McGuire site on approach to Charlotte, NC from Augusta, GA. US Airways was the carrier.)

1.1.2(b) The applicant's units security analysis does not consider truck bombs of the scale demonstrated by the attack upon the federal building in Oklahoma City. A significantly larger amount of explosive force can be delivered by a land vehicle than is postulated under the Design Basis Threat as limited analysis for a four wheel drive vehicle no larger than a Sports Utility Vehicle. The applicants' Environmental Report must consider larger trucks (including tractor trailers) and the associated larger explosive yields as potential weapons of sabotage in its

5 Since September 11 there have been hundreds of articles on terrorism, many of which address nuclear installations. The appended Exhibits document has a selection of these labeled Exhibit **1.1.2.** the intent is not

security analysis.

1.1.2(c) Attacks via water, including the possibility of loss of the dams on Lake Norman and Lake Wylie. The NRC and Duke have not analyzed an attack on the McGuire and Catawba nuclear power stations via acts of sabotage and terrorism directed by approach from the water. Such an attack could focus on target sets to include the cooling systems of the reactors. The attack could also be directed against the dams on Lake Wylie and Lake Norman. This constitutes an unanalyzed condition for the safe operation of the reactors. It is of particular concern for the McGuire units because of their reliance on once-through cooling systems and coolant intake inventories of over two million gallons of water per minute. A precipitous drop in the water level on Lake Norman via destruction of the dam system would seriously jeopardize the cooling system for the reactor and fuel integrity.

1.1.2(d) Analysis of impacts of fire as well as direct physical destruction, including a jet plane recently fueled at Charlotte's commercial airport, including impacts on combustible fire penetration seals. This contention is more fully outlined under the Petitioner's contention on inadequate fire barrier penetration seal analysis and fire testing.

1.1.2(e) Impacts on outside containment structures and functions including control room, off-site power service, emergency diesel generators, fuel pool, and emergency access.

1.1.2(f) Attack by multiple coordinated teams with multiple insiders in assistance. The current Design Basis Threat unrealistically limits the applicant units station force-on-force security response capability to a small single team partially aided by a single insider limited only to providing information and not involved in active act of sabotage.

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to be exhaustive, rather, representative.

1.1.2(g) The applicant units have not analyzed and evaluated the socio-economic impact of closure of Lake Norman and / or Lake Wylie for security purposes. The Petitioner contends that new security precautions underway at other nuclear power stations must be addressed by the applicant units in context of their socio-economic impact upon communities and businesses on Lake Norman and Lake Wylie. The Petitioner is aware that such a decision has already been made by Exelon to close all public and recreational access to Lake Clinton as a security precaution for protection of the Clinton nuclear power station[6].

1.1.2(h) Impact of MOX fuel on attractiveness of site for attack given that unused MOX fuel made from weapons grade plutonium is attractive to those seeking weapons usable material.

1.1.2(i) Impact of MOX plutonium fuel on core breach accident scenarios whether directly from attack, or as a result of Station Blackout, factoring the findings of Dr. Edwin Lyman of the Nuclear Control Institute that a major reactor accident with weapons grade MOX in use would result in a 25% increase in latent cancer fatalities compared to the same accident with LEU fuel (http://www.nci.org/).

1.1.2(j) Impact of attractiveness of a site using MOX plutonium fuel for purposes of an attack designed to maximize human suffering and property damage.

1.1.2(k) Upgrade in the assumptions used to assess the resources available to cope with such a disaster – September 11 showed that major infrastructure pieces such as "911" were lost as a

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6 See "Up the Creek at Lake Clinton" by Mike Monson, published online at the News-Gazette November 4, 2001 posted at http://www.news-gazette.com/ngsearch/story.cfm?number=10435 and included in

result of the attacks in New York. Analysis needs to examine possible concomitant losses from any of these attack scenarios at either reactor site. An example is analysis of catastrophic attack on the McGuire Station and possible impacts on Charlotte drinking water drawn from below Lake Norman.

1.1.2(l) Containment structures for Catawba and McGuire Units have not been adequately analyzed. An Associated Press story dated October 24, 2001 has provided new information to the Petitioner regarding the unanalyzed condition and potential vulnerability of the Catawba and McGuire containment structures. The news story states that the NRC has known since 1982 that American nuclear power plants were susceptible to jetliner crash. [Hardcopy Exhibit 1 Associated Press article, "Nuclear Liability Report Left Public," October 24, 2001.}

In the 119-page report prepared by Argonne National Laboratory for the NRC analyzing aircraft crash into nuclear power plants, the government lab recommended that the NRC and nuclear industry pay more attention to thoroughly analyze and evaluate the effect of explosion and fire from airline crash on nuclear safety. [Provided in hard copy Exhibit , AP story]

As a result the applicant has not provide a complete application that raises a number of unreviewed issues as a result of unanalyzed structure, systems and components. Given the clear and present danger, the Duke Energy license renewal application does not provide a complete or reasonable analysis and evaluation on containment structures for the Catawba and McGuire units with regard to impact by postulated external hazard (i.e. aircraft).

As reported in the AP story, the Argonne National Laboratory report to the NRC described the exact speed at which a jetliner would begin to transfer its force into the primary containment and interior structure of a nuclear reactor. The government lab provided NRC and industry with a description of how the concrete containment would spall, scab and eventually perforate

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appended "Exhibits" document.

depending on the aircraft velocity.

"The breaching of some of the plants' concrete barriers may often be tantamount to a release of radioactivity." [Hard copy EXHIBIT 1: AP Story]

By letter from Commissioner Richard Merserve to Congressman Edward Markey dated of October 16, 2001 in responding to questions regarding design criteria for protection of against an aircraft crash, the NRC has established that the Catawba and McGuire containment structures have not been analyzed and evaluated for such an attack. "The NRC has no criterion that requires nuclear power plant containment vessels to be designed to survive the crash of a Boeing 747." [NRC Commissioner Richard Meserve Letter to Congressman Edward Markey , October 16, 2001,provided in hard copy Exhibit 2, p. 4]

In fact, the NRC has not adequately or reasonably evaluated the very real threat that exists today. The NRC published NUREG/CR-5042, "Evaluation of External Hazards on Nuclear Power Plant in the United States," in December 1987 where at Section 6.4 it provides a very limited analysis of aviation accidents on nuclear power plant safety. A "large" aircraft as defined by the NRC report weighs 12,500 pounds (approximately 6 tons) even though the report on page 6-24 observed that a loaded Boeing 727-200 has a maximum take-off weight of 209,500 pounds (approximately 100 tons). The Boeing –767 used by terrorists to effectively destroy the World Trade Center had a total take off weight of 150 tons. The disparity of analysis between a the consequences of a six ton aircraft and a 150 ton aircraft is too great to be left unevaluated for consequence to the public health and safety. [Hardcopy Exhibit 3, NUREG/CR-5042, "Evaluation of External Hazards to Nuclear Power Plants in the United States, December 1987, excerpted]]

1.1.2 (m) Potential for terrorism and an analysis of its impacts should also be factored by the Nuclear Regulatory Commission in a generic manner as NIRS has stated in our "Response to

Blue Ridge Environmental Defense League's Petition to Dismiss Licensing Proceeding, or in the Alternative, Hold it in Abeyance" submitted to the Commissioners on 11-05-2001. We further recommend that it be the occasion for revision of generic assumptions about license renewal and high-level nuclear waste generation (10CFR51.23(a)) since the accretion of high-level nuclear waste in both pool and dry storage on these sites considerably impacts the potential source term from a major attack and radiological release. 10CFR51.23(a) makes it clear that high-level irradiated fuel may be assumed to be at the reactor site for up to 30 years after the reactor ceases operation...indeed the license regime for on-site dry casks actually permits up to 120 years of waste on the site, therefore it should be assumed for purposes of analysis that all of the waste generated by the reactors is on the site in the event of a terrorist attack.

1.1.2(n) The application has not effectively analyzed or evaluated the vulnerability of the electrical grid systems, station switchyards to sabotage and the adverse impact on the public health and safety from terrorist attack on these primary power systems that lie outside the applicant units protected areas.

1.1.3 Climate Change

Duke Energy mentions, and affirms the now globally accepted fact that the collective activity of the human race is in the process of altering the climate of the planet (Climate Change) when suggesting that nuclear power may be a strategy to lower the impact of electrical energy generation on this process[7]. It is also widely understood that mitigation can only change processes in the future, beyond the coming decade or two (and that is optimistic).[8] The effects of

7 For instance, see McGuire Environment Report, page 8-32.

8 There are abundant resources on Climate Change, both from the work of Non-Government Organizations around the world, as well as government sources. A selection includes: U.S. Global Climate Change Research Program http://www.nacc.usgcrp.gov/ and the report: – National Overview http://www.gcrio.org/NationalAssessment/overpdf/3IntroC.pdf

past air emissions will govern the changes in weather patterns now documented, and those in the renewal period. The outlook globally is increasing severity in weather, particularly storms, both in number and intensity and for the Southeastern United States, increased temperature with either increased or constant precipitation.[9]

Duke fails to analyze the multiple impacts these accelerating changes will have on reactor operations, as well as the ways that it will change the type and magnitude of impact that the reactors have on their external surroundings.

Analysis of Climate Change must include an analysis of increased potential for Station Blackout by virtue of projected increased numbers and intensity of hurricanes and tornados and other severe weather. Other factors of Climate Change impact are discussed below with respect to inadequacy of Duke's Environmental Reports.

These factors may be seen as too complex to project and accurately analyze twenty years in the future, however they are really no more complicated than the complex interactions of Duke Energy corporation's financial position, work force capabilities and human factors, cumulative and synergistic events in aging systems and multiple failure pathways that should be factored in the analysis of whether component aging will be successfully managed to meet an ever moving target called "current license basis."

1.1.4 New Information on Risk of (and from) Station Blackout at Catawba and McGuire

Station Blackout contributes the largest share of risk of severe reactor accidents indeed, equal to all other risk contributors combined.10 Therefore, it is important that every aspect of it be considered with regards to severe accident mitigation. Severe accident mitigation was found

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9 The same report above has a section devoted to the Southeastern US:
http://www.gcrio.org/NationalAssessment/overpdf/6SE.pdf

10 "Severe Accident Risks: An Assessment of Five U.S. Nuclear Power Plants" (NUREG-1150, October, 1990). The study states that station blackout accidents contribute a very high percentage of the overall frequency of core damage accidents for both boiling water reactors and pressurized water reactors.

to be a site specific issue (class 2) as evaluated by the NRC in the Generic Environmental Impact Statement on License Renewal and reflected in the license renewal regulations at 10CFR51 Subpart A, Appendix B, Table B-1 "Summary of Findings on NEPA Issues for License Renewal of Nuclear Power Plants:" Severe Accidents.

In the past year (2000) new information concerning station blackout and early containment failure has been published by the Nuclear Regulatory Commission in a report entitled "Assessment of the DCH [Direct Containment Heating] Issue for Plants with Ice Condenser Containments," NUREG/CR-6427. Duke's Catawba and McGuire reactors are featured in the findings of this report. Dr. Edwin Lyman of the Nuclear Control Institute summarized these findings in his document entitled: "PLUTONIUM FUEL AND ICE CONDENSER REACTORS: A DANGEROUS COMBINATION."[11]

Dr. Lyman states:

> "Earlier this year [2000], the Nuclear Regulatory Commission (NRC) released a report that analyzed the risk of containment failure during severe accidents at reactors with "ice condenser" containments. The report, entitled Assessment of the DCH [Direct Containment Heating] Issue for Plants with Ice Condenser Containments, NUREG/CR-6427, finds that "no ice condenser plant is inherently robust to all credible hydrogen combustion events in a SBO accident." It also concludes that "ice condenser plants are at least two orders of magnitude [one hundred times] more vulnerable to early containment failure than other U.S. PWRs" as a result of hydrogen explosions during core melt accidents. This study, which was performed by Sandia National Laboratories (SNL) in Albuquerque, calculated that for accidents in which the hydrogen igniters were not available, such as SBOs, the probability that the containment would rupture as a result of hydrogen combustion is 34% for Catawba and 58% for McGuire. Using the same methodology, previous NRC studies found that the risk of containment failure at large dry containments is less than 0.1%.
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> "SNL found that certain SBO accidents --- namely, those in which the reactor coolant system remains at high pressure at the time that the reactor vessel is breached by molten fuel --- the probability of early containment failure as a result of detonation of pre-existing hydrogen is nearly 100% for both Catawba and McGuire. This means that if one of these sequences were to occur, there would be little difference between the ice condenser plants and nuclear plants without containments like Chernobyl."

11 See Plutonium Fuel and ice Condenser Reactors: A Dangerous Combination, by Edwin S. Lyman, PhD, posted at http://www.nci.org//e/el-ice-condensers.htm

1.1.4 (a) Duke's license renewal application fails to mention NUREG/CR-6427, nor to provide an analysis of the findings of this report with regard to these four ice-condenser reactors.

1.1.4 (b) The risk factors of intentional acts of terror, inadvertent acts of war in the event of armed conflict within the U.S. have not been analyzed with respect to station blackout.

1.1.4(c) The contribution of increased risk of station blackout from acceleration in severe weather associated with Global Climate Change has not been evaluated.

1.1.5 (d) If MOX plutonium fuel is to be used in these reactors, the interaction of MOX and station blackout must also be analyzed, both from the perspective of increased chances of SBO due to sabotage, as well as increased likelihood of accidents and also the consequences of SBO and containment failure with MOX fuel in the core which the Department of Energy has acknowledged in their Final Supplemental EIS on Surplus Plutonium Disposition would lead to a significant increase in latent cancer fatalities compared to a LEU core, supporting the findings of Dr. Edwin Lyman at Nuclear Control Institute[12].

1.1.5 <u>Alternative Mitigation of Station Blackout Caused Accidents Omitted</u>

Mitigation of severe accidents is considered a site-specific issue under the GEIS on Renewal, and 10CFR51.53(c)(3)(ii)(L) states that "If the staff has not previously considered severe accident mitigation alternatives for the applicant's plant (*in this case plants*) in an EIS or related supplement or in an environmental assessment, a consideration of alternatives to mitigate severe accidents must be provided."

An alternative mitigation for Station Blackout (shown in item 1.1.4 to be a highly significant factor for these Duke reactors compared to all other in the United States) would be to provide a dedicated electrical line from the hydroelectric generating dams adjacent to each reactor site (these dams are owned by Duke, on Lake Norman and Lake Wylie).

Emergency diesel generator reliability was studied by NIRS in preparation for the Y2K computer roll over with the arrival of the year 2000. It was found that diesel generators have many problems, and that the NRC's stated 95 % reliability rate is not good enough. Indeed in the last 10 years of the 20th century, diesel generator failure contributed to station blackout at 3 reactor sites and near blackout at several more.13 It would appear that margins of safety have been sufficient to prevent a severe accident due to station blackout to date, however, the compounding factors of terrorism and climate change may reduce this margin into the danger zone.

1.1.5 (a) Given the vulnerability of these reactors as documented in NUREG/CR-6427 and given the preponderance of new factors (terrorism and climate change) that increase the probability of station blackout, it is vital to consider this alternative to reliance solely on emergency diesel generators at Catawba and McGuire. Since these hydro generation units are also owned by a subsidiary of Duke Power, and there are switchyards adjacent to both reactor sites as well, this would not pose a great challenge, and should be analyzed.

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12 Dr. Edwin S. Lyman "Public Health Consequences of MOX Fuel: NRC Reactor Licensing Issues" January, 1999. Posted at http://www.nci.org/i/ib12199.htm

13 Station blackout was reported at plant Votgle in 1990 and Davis Besse in 1999. In the same year the Hunterston B reactor narrowly escaped catastrophe. Turkey point in the wake of Hurricane Andrew was on the brink of generator failure. Several reactors have been documented as having no functioning generator, thankfully at a time when no accident was in progress, nonetheless, against all regulation.

1.1.5(b) Further given the possibility of MOX plutonium fuel use that would significantly increase the consequences of a loss of containment accident, addition of more back-up of power is warranted.

1.1.6 New Information on the Probability and Consequences of Fuel Pool Fires

New information on fuel pool fire has been offered in a current license action on the Millstone Nuclear Power Station No. 3, Facility Operating License NPF-49 (Docket No 50-423-LA-2) is subject to intervention by two citizens organizations, Connecticut Coalition Against Millstone (CCAM) and the Long Island Coalition Against Millstone (CAM). The "Declaration of 31 October 2001 by Dr. Gordon Thompson in Support of A Motion by CCAM/CAM is offered here in the appended Exhibit document. Dr. Thompson gives new information showing that there is an increased risk of fuel pool fire from a partial pool drain-down that has not been previously factored in analysis of fuel pool accidents and further, that the state of the world is a significant contributing factor to increased risk of such an event, particularly due to sabotage. We also contend that climate change is another accelerating factor that could contribute to conditions leading to a fuel pool fire. Acceleration would result in increasing hazard over the renewal period.

10CFR51.23(a) indicates that high-level irradiated fuel may be assumed to be at the reactor site for up to 30 years after the reactor ceases operation. The license regime for on-site dry casks actually permits up to 120 years of waste on the site; therefore it should be assumed for purposes of analysis that all of the waste generated by the reactors is on the site in the event of a fuel pool fire. Even waste that is transferred to dry storage would be impacted by such an event, if only by severe external contamination, impeding routine maintenance and inspection.

1.1.7 New Information on Impact of Radiation

10CFR51(c) (3)(iv) "The environmental report must contain any new and significant information

regarding the impacts of license renewal of which the applicant is aware." While myths about the safety of ionizing radiation at low levels are perpetuated broadly by the nuclear industry, there is ample information available to the contrary. Recent breakthroughs in medicine that are based on the power of extremely low doses of radiation to impact the body. One such report was published by Dr. David A Scheinberg of Memorial Sloan-Kettering Cancer Center in New York in the Journal Science on November 16 and reported in the New York Times the same day. The findings showcase the impact of extremely low doses of radiation: even a single atom of actinium-225 has the capacity to kill a cancer cell. If one atom of a radionuclide kills cancer, certainly it has the potential to harm or kill healthy cells as well, leading to a number of results, including cancer. This new and significant information that is nonetheless in the public realm must be factored in all impacts of license renewal on human health and the environment. Additionally, the cumulative effects and health impacts of loading the environment with persistent radioactivity from ongoing releases must be evaluated with respect to other environmental parameters that are currently changing in an accelerated manner – i.e. they are parameters for which each year increases each year in the potential for their impact. These factors will, therefore, be in greater force during the renewal period than today.

Most factors under acceleration today would have required mitigation in previous decades in order to change the projected impacts that are likely during the renewal period. These include, but are not limited to: ozone depletion (and UVB increase), climate change (changes in water levels, up or down, including drought stress and flood releases of temporarily sequestered radionuclides, change in micro organisms, disease vectors), air emissions resulting in acid rain and other stresses, toxic substance accumulation, and human population as it exacerbates all of these. Each of these factors must be evaluated in the assessment of radiation and health impacts, and were not considered in the applicant's environment report, nor in the Generic Environmental Impact Statement on License Renewal.

1.1.8 All These Factors Must Be Considered

If the factors of terrorist attack, MOX, climate change, new information on fuel pools, station blackout and radiation impacts are excluded from the matter of license renewal of Duke's four ice condenser units, then the provisions in 10CFR51.103(a)(5) that juxtapose environmental impacts with energy planning and "preserving" the options of decision makers become an automatic rubber stamp for nuclear power and license renewal. The fulcrum of future energy demand will in every case appear to outweigh the types of environmental factors currently considered. Nonetheless our member's interests of life, health, livelihood, family and property are threatened by license renewal and extended operation precisely because of these accelerating factors. The longer these reactors operate, the more likely these factors will disrupt those operations. Indeed, 10CFR54.31(d) offers the specter of eternal operation with the option of renewal of the renewed license. It is not credible that future energy demand can only be supplied by nuclear power, nor is it credible to do an evaluation that excludes factors that are likely to determine the outcome of this situation.

1.2 Duke Environmental Reports Not Complete

10CFR51(c) (3)(iv) "The environmental report must contain any new and significant information regarding the impacts of license renewal of which the applicant is aware.

1.2.1 Environmental Reports Do Not Consider Ozone Depletion

Ozone depletion is no secret. It has the potential to greatly impact the Southeastern bioregion, particularly with respect to increased UVB radiation. This is of particular concern since it may impact plants and animals and microbes that are also impacted by discharges of heat, toxic substances and ionizing radiation from Duke's reactors. This is of greatest concern for all endangered and threatened species but should be factored in general as well. Duke Energy fails

to mention ozone depletion in their Environmental Reports submitted for Catawba and McGuire license renewal.[14]

1.2.2 Environmental Reports Do Not Adequately Consider Climate Change

As referenced above, Duke mentions Climate Change once in each of the Environment Reports for Catawba (page 8-29) and McGuire (page 8-32) with regards to their supposition that nuclear power would help reduce climate change. However, they fail to analyze the impact of change in temperature and precipitation on species distribution and habitat factors for the region in general[15] and for endangered and threatened species in particular.

The evaluation of aquatic impacts of the operation of the McGuire reactor and its once through cooling system also lacks any consideration of climate change. Such an evaluation should consider both the changes in precipitation as well as thermal impacts. Since climate change is an accelerating factor in (and of) our environment, the renewal period will be substantially different than the present. Each of these factors has the capacity to change the impact that operation of the McGuire reactors will have on Lake Norman and its biota. Duke has failed to assess these factors in their consideration of entrainment of fish, impingement of fish, and heat shock.

1.2.3 No Biological Assessment for Georgia Aster or Schweinitz's Sunflower in Duke's Environmental Reports

The Fish and Wildlife Service reference the Georgia Aster and Schweinitz's Sunflower as two species of concern on or impacted by the reactor sites. Their letter is provided in the "Exhibits" document appended to these contentions, marked "Exhibit 1.2.3." Duke should include these endangered and challenged species in their analysis, as well as considerations of how

14 A resource on Ozone is the US EPA Fact Sheet web-posted at http://www.epa.gov/docs/ozone/science/sc_fact.html

Duke Energy might act to ensure their survival and recovery. A complete analysis should consider the synergisms that will result from the combination of reactor releases and discharges, ozone depletion and stresses associated with Climate Change.

1.2.4 Environmental Reports Do Not Consider MOX Fuel Use

MOX plutonium fuel use would result in a core that has a significantly greater fraction of plutonium throughout the fueling cycle than a reactor using conventional fuel. Further, as the fuel is irradiated, a higher percentage of actinides will be formed. These changes in the composition of the core will translate into increased plutonium and actinides in all forms of discharge from the reactor. This must be considered in the environmental analysis at every step. An analysis of MOX fuel on thermal discharges should also be done.

2.1 Reactor Aging Analysis Not Adequate

2.1.1 Stud Bolt Contention: Applicant's ignoring of the essential role of stud bolts and stud bolt condition invalidates its Application

The Applicant's submission for extension of the licenses for McGuire and Catawba nuclear stations from 40 to 60 years contains sections concerned with Aging Management Programs, 3.1.2; Time-Limited Aging Analysis, 4.0; Reactor Vessel Neutron Embrittlement, 4.2; and Metal Fatigue, 4.3. A Reactor Vessel Integrity Program is referred to as part of the Aging Management Program, p. 3.1-4. "Reactor Vessel and CRDM (control rod drive mechanism) Pressure Boundary Components" are listed in Table 3.1-1. The first components listed, p. 3.1-11. are "closure head dome, flange, ring and vessel flange". Sixteen more groups of components are listed in the remainder of this part of the table. No reference is made to the bolts that attach the closure head dome to the reactor vessel. Time-Limited Aging Analyses are

15 See note number 9.

described as to content, p. 4.1.1. Definitions are given, p. 4.1.2. The analyses are to involve components, the effects of aging, the time-limited assumptions, matters relevant to making a safety determination, and conclusions related to the capability of the components to perform intended functions, p. 4.1-2. The analyses should show that the effects of aging will be adequately managed to the end of the extended period of operation, p. 4.1-3. Reactor Vessel Neutron Embrittlement is considered in section 4.2. It is required that fracture toughness, pressure-temperature and material surveillance requirements be met and that fracture toughness requirements protect against pressurized thermal shock. Data are provided for Beltline Region Materials, Table 4.2-5. No data are presented for stud bolts. There is no reference to stud bolts in section 4.2.3 on Pressure-Temperature (P-T) Limits. Nor is there such reference in section 4.3, Metal Fatigue. There is a Thermal Fatigue Management Program, 4.3.1.1.

There is no section concerned with stress fatigue although stress changes, and fatigue, can result from thermal fluctuations. Similarly in the final section, Fatigue Environmental Effects, 4.3.1.2, there is no reference to stud bolts. This omission is of critical importance. Applicant's ignoring of the essential role of stud bolts and stud bolt condition invalidates its Application.

The interior of a McGuire or Catawba reactor vessel is exposed to a pressure of about 1000 psi at a temperature of about 550 degrees F during normal operation. The reactor vessel is like a huge cup. It is covered with a lid, which bears 78 nozzles (and four other penetrations, Application) that contain the control rods and carry the control rod drive mechanisms. The peripheral part of the lid is a flange with about 20 holes through which the stud bolts fit. The top of the reactor vessel has a matching flange. It similarly contains threaded holes that receive the stud bolts.

The local public document room was closed in 1999. The NRC public document room, contacted by telephone Nov. 19, 2001, did not have the FSAR's for McGuire or Catawba. The NIRS caller was referred to NRC Project Manager Martin. He referred the caller to Roni

Franovitch who is assigned to this license extension project. She was asked for reactor dimensions and the number and size of the stud bolts which attach the reactor lid to the reactor vessel. She conferred with other staff members and was told that it would be necessary for NIRS to request the ASLB to obtain this information.

As it was desirable, though not necessary, to have this information, reasonable assumptions have been made.

Let us assume that the inside diameter of the reactor is 7 feet (2 x 42 inches); that the radius of stud bolt centers is 3 feet 9 inches (45 inches); that there are 24 stud bolts and that the diameter of the threaded part of the stud bolt is 4 inches. The pressure loading on the stud bolts will be: pi x r x r x p, pi x 42 i x 42 i x 1000 psi which equals 5,541,769 p. The area of the stud bolts bearing this load is pi x 24 x 2 i x 2 I, or 301.6 square inches. The bolt loading is a minimum of the quotient of load by bolt area, 18,474 psi. The load at reactor beltline is r x p / thickness, 42 I x 1000 / 6 or 7000 psi. The bolt load is two to three times that of the pressure vessel. In placing a bolt it is tightened to load it, the preload. I do not know the torque used in tightening the bolts and therefore cannot calculate the preload but it necessarily must exceed the expected load. It is reasonable to assume that the tensile stress, loading, per unit area of the stud bolts during reactor operation is about an order of magnitude greater than that of the vessel body, bottom, and lid.

NIRS contends that this most heavily stressed part of the reactor vessel will be increasingly subject to failure with continued operation. It was designed for about 30 years of operation (it was after the initial proceedings that the operating license was extended to 40 years) and will, hopefully, attain that goal. The finding of unanticipated types of serious damage

to reactor lid penetration nozzles at Oconee raises the question of unanticipated types of damage to stud bolts[16].

NIRS recognizes that any information regarding the embrittlement of stud bolts (and other reactor pressure boundary components) provided by the testing of fluence-exposed capsules will be misleading. The stud bolts are exposed to metal fatigue, due to repetitive loading and unloading resulting from internal pressure changes and temperature changes, which the capsules are not. Stretching of stud bolts in service has been demonstrated by the reduction in preload after operation (Application).

NIRS contends that it is in our interest and in the public interest to avoid another 20 years of operation based on a misleading capsule test and the optimistic assumption that no other factor, such as stress corrosion cracking, will affect the stud bolts.

A meeting of NRC staff on November 8, 2001, 1:00 to 5:00 PM was open to interested parties via teleconference. The subject was the stress corrosion cracking, particularly the unforeseen circumferential-all-the-way-through cracking of a reactor pressure vessel head penetration nozzle. (At about 4:55 PM teleconference listeners were given the opportunity to ask questions. Jess Riley, a NIRS member, asked if there were similar concerns about the cracking of stud bolts. J. I. Zimmerman, who apparently chaired the meeting, replied that this had been an agenda item that was not reached.)

2.1.2 MATERIALS CONTENTION: Duke has not adequately factored unforeseen aging

The findings of the condition of the reactor lid penetration nozzles at two Oconee reactors presented the NRC and Duke Power with occurrences that were unanticipated and not

16 There is a large body of documentation of the cracking of vessel head penetrations at Duke's Oconee reactor, docket number 50-269. Two NRC documents, formerly available on the NRC public website on this issue are provided as Exhibits in hard copy, labeled EXHIBIT 2.1.1A and 2.1.1B. It should be noted that these documents were saved to a NIRS computer hard drive and some frames from the original were lost. NIRS had assumed ongoing access to these documents.

considered in the licensing process[17]. The most dramatic occurrence found to date, and one not only not anticipated but previously thought to be unlikely (if not impossible) is circumferential stress corrosion cracking through the entire thickness of the nozzle wall.

It is apparent that events occur over longer time periods, say 30 years, which are not encountered in the shorter periods of planning, licensing, construction and initial operation. Events have occurred which neither Duke nor NRC foresaw.

None of the parties to this proceeding knows what further adverse changes may take place in the subject reactors in the proposed 20 year period of extended operation. We do not know if an event that gives warning before potentially catastrophic failure, like the accumulations of boric acid on nozzle surfaces that led to the discovery of multiple instances of stress corrosion cracking, will occur. Considering the possible consequences of a major loss-of-coolant-accident that would result from a simultaneous failure of the reactor vessel stud bolts, there should be no extension of the operating license. The instantaneous release of the reactor lid, driven by 3,000 tons of steam pressure, may breach the containment. It is likely that the massive steam release in such a LOCA would exceed the condensation capacity of the ice condensers resulting in a pressure in excess of the containment capability. In any event there would be a fuel meltdown. It is not possible to detail the consequences, but it is likely that Charlotte would become the American Chernobyl. Let us bear in mind that the reactor lid is held in place by about 20 stud bolts. These stud bolts bear about 10 times the stress of any other part of the reactor vessel. They are subject to neutron radiation which all parties involved know embrittles metal, that is reduces its strength. Moreover it is subject to metal "fatigue", another familiar weakening factor that results from cyclic loading. The initial licensing, recognizing the fatigue factor, restricted operation to 200 fuel cycles. There are also questions about weakening the weld metal in the reactor vessel, as at Yankee Rowe, again with fluence and fatigue being recognized factors.

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17 See note number 5.

In view of these major uncertainties, and as yet unencountered failure mechanisms, and considering the consequences of a LOCA, which exceeds the design capability for handling LOCAs, NIRS contends that the NRC should not permit the dangerous experiment of 20 years additional operation of the McGuire and Catawba nuclear plants.

3.1 Duke Energy Fire Barrier Penetration Seal Analysis and Qualification Testing Is Incomplete and Inadequate and Therefore Constitutes Degraded Fire Protection Defense-In-Depth for the Applicant Units

3.1.a The Petitioner contends that the as-built and originally installed fire penetration seals in all four applicant units have not been adequately analyzed and evaluated as qualified rated fire barrier penetration seals in context of fire endurance age-related degradation for the requested license extension.

Each nuclear power station unit has thousands of through-wall penetrations in containment and non-containment walls. These penetrations provide for the passage of a number of structures, systems and components to include electrical penetrations for safe shutdown power, control and instrumentation cables in a wide variety of configurations and sizes of conduits and trays, mechanical penetrations for water and condensate pipes, structural members and seismic gaps. These penetrations must be properly fitted with rated fire barrier penetration material to prevent the passage of fire and hot gas from one fire zone to another zone thereby providing protection to redundant safety systems for safe shut down capability in the event of fire.

The technical basis for NRC regulations governing fire barrier penetration seals is covered under 10 CFR Appendix R Section III.M, the General Design Criteria 3 for "Fire Protection" and Branch Technical Position Auxiliary Power Conversions Systems Branch 9.5-1. The Commission's implementing requirements in 10CFR 50.48 and 10 CFR 50 Appendix R

provide that fire barrier penetration seals shall qualify as rated barriers to be properly tested, configured, installed and maintained.

[Exhibit NRC Final Rule, "Elimination of the Requirement for Noncombustible Fire Barrier Penetration Seal Materials and Other Minor Changes," Federal Register: June 20, 2000 (Volume 65, Number 119, Page 38182-3819/

http://ruleforum.llnl.gov/cgi-bin/downloader/final_lib/280-0092.htm

The Petitioner contends that Duke Energy originally installed a fire-barrier penetration sealant material by the brand name "Firewall 50" and other brand name penetration seal materials manufactured by Western Chemical in all four applicant units.

The Petitioner contends that Duke Energy has not provided fire tests to qualify and demonstrate the one-hour and three-hour fire endurance capability of installed "Firewall 50" penetration seals and other brand name fire barrier sealant material manufactured by Western Chemical as one hour and three-hour rated fire barriers.

The Petitioner contends that Duke has not analyzed nor provided the life expectancy of its "Firewall 50" fire barrier penetration seals.

The Petitioner contends that over the current operational life of the four applicant units Duke Energy has repaired "Firewall 50" penetration seals without providing fire tests to qualify the repaired penetration seals as qualified fire-rated barriers.

The Petitioner, therefore, contends that Duke Energy can not provide an adequate fire safety analysis without first providing the number of the original as-built and/or repaired "Firewall 50" penetrations that remain in the applicant units in unanalyzed aged-condition and also unevaluated by fire test for fire endurance capability as pertains to the susceptibility of safe shutdown capability to fire for the requested license extension.

3.1.b The Petitioner contends that Duke fire barrier penetration seal fire qualification tests

have not adequately evaluated fire barrier penetration seals in all four applicant units for field installed seals that have been replaced.

[Exhibits "Duke Power Cure Time Fire Test Analysis Project Number 00003.23.0084"/ADAMS ML003729033 and Omega Point Laboratories "Experimental Penetration Seal Fire Resistance Test -3 Hour Qualification/ADAMS ML003729114]

The Petitioner contends that Duke has been replacing "Firewall 50" penetration seals with a Dow-Corning RTV silicone foam fire penetration seal material.

The Petitioner contends that Duke has not provided an evaluation for the effective removal of aged "Firewall 50" material from replacement penetration seals.

As provided by Duke Power, Omega Point Laboratory fire tests were performed on new penetration configurations using Dow Corning RTV silicone foam materials rather than simulating a fire test of penetrations previously filled with Firewall 50 material as repaired or replaced. The Petitioner contends that fire tests on new RTV seals do not provide an adequate analyze of actual installed replacement penetration seals in the applicant units. The Duke fire tests do not provide any analysis of how RTV silicone foam material performs after installation into penetrations previously using unanalyzed and unevaluated "Firewall 50" materials. The Duke Power representative fire tests therefore do not give an adequate analysis of representative fire seals as re-installed in the applicant units.

The Petitioner therefore contends that Duke has not presented an adequate fire test evaluation of as-installed replacement fire barrier penetration seals in the applicant units.

3.1.c The Petitioner contends that after Duke Power performed the three-hour fire tests at Omega Point Laboratories they utilized a hose stream test in accordance with requirements of EEEI 634. The referenced test standard is used exclusively for electrical penetrations using a

light shower of a fog nozzle hose stream test. The test required for all other penetrations seals (mechanical, seismic, etc.) is ASTM-E and requires a hose stream test that uses a standardized one and a half inch nozzle at 30 psi.

The Petitioner contends that the Duke Power fire test does not provide an adequate test for standard fire fighting techniques likely to be utilized in the event of fire at the applicant units. The much gentler fog nozzle hose stream test provides for a preserving shower of water and does not simulate the pressure rating behind a standardized play pipe hose stream.

The Petitioner therefore contends that the Duke qualifying fire tests do not provide the appropriate bounding hose stream test for fire barrier penetrations seals in the applicant units to include all mechanical seals.

3.1.d The Catawba and McGuire units also utilize Dow-Corning RTV silicone foam penetration sealant material throughout the units to prevent the spread of fire and hot gases from passage between fire zones within containment and other safety related areas of the plants. The Petitioner contends that RTV silicone foam is a combustible material and when exposed to a postulated fire not only chars but also can harbor a deep-seated fire that can then burn through the penetration.

According to the Associated Press article based on the reading of the Argonne National Laboratory, government lab analysis concluded "It appears that fire and explosion hazards have been treated with much less care." The news story excerpted from the report that "If just 1% of a jetliner's fuel ignited after impact, it would create an explosion equivalent to 1,000 pounds of dynamite inside a reactor building already damaged by the impact." The report goes on to conclude that the ignition of fuel "could create a rather violent explosion environment."

The report has since been removed from public access through the NRC Public Document Room microfiche archive.

[EXHIBIT AP story, October 24, 2001 story]

Contrary to concerns and issues raised by the suppressed Argonne National Laboratory analysis, the NRC has stated that it "believes that it is highly unlikely that fire barriers in a nuclear power plant would be exposed to fires of sufficient temperature and duration such that the silicone fire seals that fail before their rated 1- or 3-hours." [Exhibit NRC Final Rule Changing the Noncombustibility Requirement for Fire Barrier Penetration Seals, Federal Register June 20, 2000 (Volume 65, Number 119 [[Page 38183]]

The Petitioner contends that the fire penetration seals in all four Duke applicant units up have not been rigorously tested and evaluated for the explosive environment and transient combustibles as delivered by deliberate act of sabotage using an commercial jetliner aircraft as identified in the Argonne National Laboratory study and recommendations provided to the NRC (i.e. jet fuel).

NRC fire protection regulations were changed (June 20, 2000) to provide that "combustible" materials can now be used in qualified fire barrier penetration seals. This relaxation of the non-combustibility requirement for fire barrier penetration seals came inspite of the information and analysis provided by Argonne National Laboratories to NRC in 1981 by study recommending that agency seriously analysis the nuclear safety implications of a jet crash explosion and fire on safety of nuclear power plants.

Duke fire barrier penetration seal fire tests for the McGuire and Catawba units were provided by letter to the Commission on June 28, 2000 as industry analysis to qualify and bound the combustible barriers for three hour fire endurance test. On March 02, 2000 Duke Energy conducted fire endurance tests at Omega Point Laboratories on 14 fire seal assemblies. Five of the 14 assemblies failed with burn-through. The Duke failure analysis develops a clear

correlation between test furnace pressure and burn-through rate of the Dow Corning silicone foam fire seals.

[Exhibit -Duke Fire Test Summary/ADAMS ML003728958]

The Petitioner contends that increased positive pressure on these combustible penetration seals will accelerate burn through times.

In light of the Argonne National Laboratory study, the Petitioner contends that the Duke fire analysis does not adequately qualify and bound its combustible fire barrier penetration seals to withstand the positive pressure equivalent from an explosion and fire as a result of a postulated jet airliner crash.

4.1 Socioeconomic Impact Analysis Is Not Adequate

Over the last two decades since the McGuire and Catawba reactors were sited, the population density around the reactors has changed dramatically. Indeed, this is particularly true around the McGuire reactors, where the population density within 20 miles of the reactor site is more than double the density level in at 50 miles from the site (even though this includes portions of metropolitan Charlotte).[18] The same is nearly true of the community around Catawba.[19] The report does not mention that the development leading to this population on Lake Norman was accomplished by a subsidiary of Duke, Crescent Resources.

4.1.1 The concerns brought by NIRS pertaining to the inadequacy of Duke's application with regards to security, aging, severe accident mitigation and plutonium fuel use have not been addressed with respect to these new communities that Duke has actively created around their reactor sites.

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18 See Duke's Environment report for the McGuire Reactors, Table 2-1 on page 2-2
19 See Duke's Environment report for the Catawba Reactors, Table 2-1 on page 2-3

4.1.2 Emergency plans, including evacuation, should no longer rest upon the original license basis.

4.1.3 A socio-economic analysis should include the potential for closure of Lakes Norman and Wylie to public access for security reasons.

4.1.4 A full evaluation should be given of new technologies available to notify the public of emergency situations, with far greater capacity for transmitting information than sirens alone.

5.1 Assumptions on High-Level Nuclear Waste Are Flawed

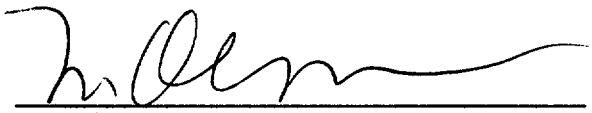
10CFR51.23(a) states: "...Further, the Commission believes there is reasonable assurance that at least one mined geologic repository will be available within the first quarter of the twenty-first century, and sufficient repository capacity will be available within 30 years beyond the licensed life for operation of any reactor to dispose of the commercial high-level waste and spent fuel originating in such a reactor and generated up to that time."

NIRS would like to point out that the use of the term "belief" is appropriate since there is no basis in fact for this generic finding. This belief clearly assumes that the Yucca Mountain repository will open and that either an expanded capacity will be mandated for that site (currently capped at 77,000 MTU while the base-case scenario used by the Department of Energy projected 85,000 MTU from this generation of reactors with no license renewal), or more repositories will be built. Indeed, since there are a great many reactors contemplating license renewal, if they are successful in overcoming terminal aging factors, the total waste generated from existing reactors might well exceed 100,000 MTU. This would almost certainly require multiple repositories since the Yucca site is only rated for about 25,000 MTU under the cool repository regime [insert cite] that is most likely to succeed.

Meanwhile Yucca Mountain is far from an assured site. Legal challenges to new regulations are under way. A license application will certainly be met with intervention. Even if approved, the site and the program are so fraught with technical difficulties, let alone terrorist concerns or actions that it is likely to fail under the weight of one or more accidents or unaccounted expenses.

NRC should provide a basis for their assumptions and consider a revision to this section of the regulations. In any case it is clear that this statement by NRC assumes that the waste generated by any reactor may well reside at the reactor site for up to 30 years after the reactor ceases operation. This assumption should be factored into any analysis of a terrorist strike to the site.

Respectfully Submitted,



Mary Olson
Director of the Southeast Office
Nuclear Information and Resource Service

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD PANEL

Before Administrative Judges:

Ann Marshall Young, Chair
Dr. Charles N. Kelber
Lester S. Rubenstein

In the Matter of	Docket No's. 50-369-LR, 50-370-LR, 50-413-LR, and 50-414-LR
DUKE ENERGY CORPORATION	ASLBP No. 02-794-01-LR
(McGuire Nuclear Station, Units 1 and 2, Catawba Nuclear Station, Units 1 and 2)	NOVEMBER 29, 2001

COMPILED EXHIBITS ASSOCIATED WITH NUCLEAR INFORMATION & RESOURCE SERVICE CONTENTIONS WITH RESPECT TO DUKE LICENSE RENEWAL

EXHIBIT 1.2.3

----- Forwarded by Mark A Cantrell/R4/FWS/DOI on 11/09/01 01:12 PM -----

Mark A Cantrell
11/05/01 03:57 PM

To: jhw1@nrc.gov
cc:
Subject: Comments on McGuire Units 1 & 2

Jim:

Here are comments on McGuire license renewal.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Asheville Field Office
160 Zillicoa Street
Asheville, North Carolina 28801
November 1, 2001

Ms. Cynthia A. Carpenter, Chief

Risk Informed Initiatives, Environmental,
Decommissioning, and Rulemaking Branch
Division of Nuclear Regulatory Improvement Programs
Office of Nuclear Reactor Regulation
Nuclear Regulatory Commission
Washington, DC 20555-0001

Dear Ms. Carpenter:

Subject: McGuire Nuclear Station, Units 1 and 2, License Renewal Project, Mecklenburg County, North Carolina (Docket Nos. 50-369 and 50-370)

We received your letter of October 15, 2001, requesting our comments relative to endangered and threatened species and the subject project. We are providing the following comments in accordance with the provisions of Section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1543) (Act); the Fish and Wildlife Coordination Act, as amended (16 U.S.C. 661-667e); the Bald Eagle Protection Act of 1940 (16 U.S.C. 668-668d); and the Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-712).

According to your letter, the Nuclear Regulatory Commission (NRC) is evaluating an application for renewal of Duke Energy Corporation's license for operation of the McGuire Nuclear Station, Units 1 and 2. According to Duke Energy's application, Duke has not identified any major refurbishment activities; therefore, the license renewals would primarily involve an evaluation of the impacts of continued operation for another 20 years.

Endangered Species

Species in the Project Areas. Enclosed is a list of federally endangered, threatened, and candidate species; designated critical habitat; and Federal species of concern known from Gaston, Lincoln, and Mecklenburg Counties. Federal species of concern are not legally protected under the Act and are not subject to any of its provisions, including Section 7, unless they are formally proposed or listed as endangered or threatened. Since the term of the proposed license renewals may span 20 years, we are including these species in our response to give you advance notification. We do not have records of any listed species from the footprint of the project as depicted on your map.

We do have records of Schweinitz's sunflower (Helianthus schweinitzii), a federally endangered plant species, and Georgia aster (Aster georgianus), a plant species that is currently a candidate for listing as endangered. Both of these plants occur in areas that are likely to be affected, directly and indirectly, by this project. Helianthus schweinitzii occurs in relatively open habitats--road/power line rights-of-way, early successional fields, forest ecotonal margins, forest clearings, etc. Aster georgianus is a perennial that occurs in dry open woods along roadsides, woodland borders, old fields, and pastures

We also have records of the threatened American bald eagle (Halieetus leucocephalus) from the Catawba River area, with nests at Lake Wylie (downstream of the project) and Lake James (upstream of the project). Additionally, foraging and migratory eagles are observed during many times

of the year at Lake Norman, near the McGuire units.

Conservation Measures. Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. "Conservation recommendations" are discretionary agency activities to minimize or avoid the adverse effects of a proposed action to a listed species or critical habitat, to help implement recovery plans, or to develop information that will help better understand the species.

We request that the following conservation recommendations be considered for inclusion by NRC as part of the license renewals:

(1) Duke Power should develop and maintain a detailed map and description of listed species within its project boundaries and rights-of-way.

(2) Duke Power should develop a comprehensive management plan for listed species within its rights-of-way and on their land within the area of this project. Issues that should be addressed include protection, monitoring, and management. A complete map of all known locations of listed species on Duke Power's property should be provided. A regular monitoring plan should be developed and implemented. Appropriate management prescriptions should be developed with the assistance of species experts.

Other Concerns

Migratory Birds. We are concerned about the potential effects of this project on raptors; therefore, we recommend transmission line designs that prevent arcing and flight hazards to raptors. If the transmission lines and other facilities are not already outfitted to reduce potential impacts to raptors, three-phase lines should be "raptor-proofed" with one of the following design modifications:

(1) Separation of phases - This can be accomplished by either lowering the cross arm, using a longer cross arm, or raising the center phase on a pole-top extension. The objective is to separate the phases by at least 60 inches to prevent raptors from making skin-to-skin contact with any two phases.

(2) Insulation - An alternative to vertical separation of phases is to install conductor insulation (commonly, pvc tubing), extending a minimum of 36 inches on either side of the pole-top insulator. This alternative should also include the replacement of metal cross arm braces with wooden or other nonconductive braces.

River and other wetland crossings should be avoided whenever possible. Where unavoidable, lines crossing wetlands should be constructed to maximize visibility of the line to raptors by one of the following design modifications: (1) remove the static line, (2) enlarge the static line to improve visibility to raptors, or (3) mount aviation balls or similar markers on the static line.

What measures can NRC and the licensee incorporate in the project to enhance the project area for waterfowl, raptors, and other migratory birds? Does the licensee have other land that it could set aside for the purposes of enhancing the project area for migratory birds and to mitigate for continued impacts (direct, indirect, and cumulative) to migratory birds and other wildlife?

Aquatic Impacts. What are the impacts of the water intakes on fish entrainment and impingement? What measures can the licensee incorporate into the project to minimize, or mitigate for, these impacts? What measures can the licensee incorporate to minimize, or mitigate for, the impacts of the reservoir and thermal discharges to native aquatic assemblages.

Please keep Mr. Mark Cantrell of our staff apprised of the progress on this project (telephone 828/258-3939, Ext. 227). In any future correspondence pertaining to this matter, please reference our Log Number 4-2-00-120.

Sincerely,

-original signed-

Brian P. Cole
State Supervisor

Enclosure

cc:
Mr. Terence N. Martin, Team Leader, Natural Resources Management, Office of Environmental Policy and Compliance, U.S. Department of the Interior, Office of the Secretary, Washington, DC 20240
Mr. William M. Miller, Duke Power, Environment, Health & Safety, 522 South Church Street, P.O. Box 1006, Charlotte, NC 28201-1006
Mr. Chris Goudreau, Hydropower Relicensing Coordinator, North Carolina Wildlife Resources Commission, 645 Fish Hatchery Road, Marion, NC 28752-9229

---

thanks,

Mark A. Cantrell
U.S. Fish & Wildlife Service
160 Zillicoa Street
Asheville, NC 28801
828/258-3939, ext 227
mark_a_cantrell@fws.gov

"Our mission is working with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people."

CONTENTION 1.1.2 and CONTENTION 1.1.2(l) HARD COPY EXHIBIT 1

Wednesday October 24 6:10 PM ET

Nuclear Liability Report Left Public

By JOHN SOLOMON, Associated Press Writer

WASHINGTON (AP) - The government has known since at least 1982 that American nuclear power plants were susceptible to a jetliner crash yet left a scientific report in a public reading room that identified the specific vulnerabilities of reactors.

The 119-page report was available for public inspection at the Nuclear Regulatory Commission well after the Sept. 11 hijackings despite warnings dating to 1994 that terrorists wanted to strike a U.S. nuclear power plant.

The study, conducted in 1982 by the Energy Department's Argonne National Laboratory, identified the speeds at which a jetliner could begin to pierce the thick concrete containment walls designed to protect a nuclear reactor.

It estimated that if just 1 percent of a jetliner's fuel ignited after impact, it would create an explosion equivalent to 1,000 pounds of dynamite inside a reactor building already damaged by the impact. The report suggested U.S. regulators had underestimated the potential damage from such an explosion.

``It appears that fire and explosion hazards have been treated with much less care,'' the report said. It added: `` The breaching of some of the plant's concrete barriers may often be tantamount to a release of radioactivity.''

An NRC spokesman said Wednesday the report was removed from the reading room earlier this month and that the agency also was scrubbing its Web site of any similarly sensitive documents that could aid terrorists.

The agency also has ordered security improvements at the nation's 103 nuclear plants since Sept. 11 to address concerns like guarding against a suicide hijacker.

NRC spokesman Victor Dricks said such precautions weren't taken before Sept. 11 because ``it was never considered credible that suicidal terrorists would hijack a large commercial airliner and deliberately crash it into a nuclear power plant.''

The federal whistleblower group that discovered the report filed a lawsuit Wednesday asking the NRC and Homeland Security Director Tom Ridge to order immediate security improvements at nuclear power plants.

The National Whistleblower Center asked the NRC to deploy anti-missile weapons at nuclear plants and post armed guards outside spent fuel storage areas, which it said have far less security than reactors but potentially could release lethal amounts of radiation.

Noting the government has known since 1994 that terrorist groups wanted to attack an American nuclear power plant, the center alleged the NRC ``left the public at grave risk'' by keeping the document public and failing to fortify nuclear reactors before Sept. 11.

Ramzi Yousef, the accused mastermind of the 1993 World Trade Center bombing, encouraged followers in 1994 to strike such a plant, officials say. An FBI (news - web sites) agent has testified in court that one of Yousef's followers told him in 1995 of plans to ``blow up'' a nuclear plant. And in 1999, the NRC acknowledged to Congress that it received a credible threat of a terrorist attack against a nuclear power facility.

``The fact of the matter is that no commercial nuclear power plant located within the United States was designed to withstand the impact of a large commercial airliner," the lawsuit said.

The 1982 report described the exact speed at which a jetliner would begin to transfer its force into the primary containment wall and interior structure of a nuclear reactor.

It described how the concrete walls of a reactor building would spall, scab and eventually perforate depending on the speed of the airliner impact. ``Once scabbing begins, the depth of penetration will increase rapidly," it warned.

And it stated U.S. officials who approved nuclear power plant designs had underestimated the potential damage that a secondary explosion of fuel might cause.

If just 1 percent of a jetliner's fuel ignited after impact, it would create an explosion equivalent to 1,000 pounds of dynamite inside a reactor building already damaged by the impact.

The ignition of fuel ``could lead to a rather violent explosion environment," the report warned.

The 1982 study contrasts with statements some U.S. nuclear officials made in the first few days after the Sept. 11 attacks suggesting that American nuclear power plants could withstand the crash of a commercial jetliner.

Ten days after the attacks, the NRC corrected those assertions by saying it could not rule out the possibility that a suicide hijacker could cause structural damage to a plant and force the release of some radioactivity. ``Nuclear power plants were not designed to withstand such crashes," it said.

Rep. Ed Markey, D-Mass., a frequent NRC critic, said the document suggests the government should have prepared to guard against a jetliner crash much earlier.

``This document is disturbing because it makes clear the NRC knows that a nuclear power plant can be successfully attacked by an aircraft and that information has been public for nearly 20 years," Markey said.

-

On the Net:

NRC: http://www.nrc.gov

Whistleblower center: http://www.whistleblowers.org

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October 16, 2001

The Honorable Edward J. Markey
United States House of Representatives
Washington, D.C. 20515-2107

Dear Congressman Markey:

On behalf of the Commission, I am responding to your letter of September 20, 2001, regarding the actions of the U.S. Nuclear Regulatory Commission (NRC) and the nuclear industry in response to the terrorist attacks on September 11, 2001, and your concerns regarding security at nuclear power plants. Although nuclear power plants are among the most hardened and secure civilian facilities in the United States, the recent attacks have focused attention on the need to review policies and practices related to safeguards and physical security measures for civilian nuclear facilities.

Immediately following the terrorist attacks on the World Trade Center and the Pentagon, the NRC advised nuclear power plant licensees to go to the highest level of security, and all promptly did so. With continued uncertainty about the possibility of additional terrorist activities, the Nation's nuclear power plants remain at the highest level of security and the NRC continues to monitor the situation. For the longer term, I, with the full support of the Commission, have directed the NRC staff to thoroughly reevaluate the NRC's safeguards and physical security programs. This reevaluation will be a top-to-bottom analysis involving all aspects of the Agency's safeguards and physical security programs.

Given the nature of the attacks on September 11, the identification of any necessary adjustments to the safeguards and physical security measures for civilian nuclear facilities must involve consultation and coordination with other U.S. national security organizations. The NRC is currently interacting with the Federal Bureau of Investigation, other intelligence and law enforcement agencies, and the Department of Defense to ensure any changes to the NRC's programs are informed by pertinent information from other relevant U.S. agencies.

Because the NRC's reevaluation is ongoing, the enclosed answers to your questions are founded on the information that is available at this time. The Commission appreciates your concern. If you have further comments or questions, please feel free to contact me.

Sincerely,

/RA/

Richard A. Meserve

Enclosure: Responses to Questions

Enclosure 1

RESPONSES TO QUESTIONS

Question 1: *Why did NRC choose to issue a "recommendation" [per Threat Advisory on September 11, 2001, and Information Notice 98-35] instead of an "order"?*

Answer:

All licensees have a continuing regulatory obligation to be able to defend against the Design Basis Threat. A Threat Advisory does not change this fundamental obligation, but merely provides a vehicle to advise licensees to be especially vigilant. Information Notice 98-35, "Threat Assessments and Consideration of Heightened Physical Protection Measures," issued on September 4, 1998, provides information to licensees as to how to respond to a NRC designation of a particular security level in a Threat Advisory. In essence, the Information Notice and a Threat Advisory provide a vehicle to facilitate communication between the NRC and its licensees when rapid actions are required. Forwarding the Threat Advisory on September 11, 2001, and referring to the Security Level 3 measures in the already-distributed Information Notice, allowed quick action on the part of the licensees to respond to the threat environment.

A Threat Advisory serves a different purpose than an order. Issuing an order, rather than a Threat Advisory, would have consumed time and resources and would have been no more effective in achieving the desired result. Nonetheless, the NRC retains the authority to issue orders requiring specific actions by all, or some, of its licensees. The staff has reviewed the actions taken by the licensees as a result of the Threat Advisory of September 11 and concluded that no additional actions were necessary at that time.

Question 2: *How many plants acted to implement the increase to the highest level of security that you recommended? Which plants? What steps did they take? How long do they plan to maintain the elevated level of security? Which plants did not choose to go to the highest level of security and why?*

Answer:

All relevant NRC licensees implemented a heightened security stance, as the NRC advised. The steps generally included increased patrols, augmented security forces and capabilities, additional security posts, heightened coordination with law enforcement and military authorities, and limited access of personnel and vehicles to the site, among other measures. On October 6, the NRC issued a safeguards advisory delineating certain prompt and longer-term additional actions to strengthen licensee capability to respond to a terrorist attack at or beyond the design basis threat. Licensees are currently implementing those actions.

All relevant licensees remain at an elevated security posture. The NRC is coordinating with the Federal Bureau of Investigation, other intelligence and law enforcement agencies, and the Department of Defense to continue to assess the threats and ensure that licensees maintain

the appropriate security level. The results of the ongoing assessments will inform NRC's decisions regarding adjustments in the recommended level of security.

Question 3: *Is the NRC considering mandating changes in security at nuclear power plants? If not, why not? If yes, what will these changes be? Will these changes be permanent, or will they be in place for a limited period of time?*

Answer:

In light of the attacks on September 11, and in response to a tasking memo from the Chairman to the Executive Director for Operations, the staff will undertake a comprehensive review of the NRC's existing regulations and proposed revisions and provide additional recommendations to the Commission. It is premature to predict what changes will be proposed.

Question 4(a): *Did the Canadian and Russian response to the events of September 11, 2001, [relative to their nuclear power plants] constitute a greater or lesser increase in security than the measures recommended by the NRC for American nuclear power plants?*

Answer:

The Commission believes that the baseline security level at U.S. commercial nuclear reactors is very high compared with most other nations. Indeed, many foreign regulators often comment on the impressive security measures and large guard forces evident when they visit our nuclear power plants. We are aware of no other regulator who systematically carries out security inspections involving force-on-force exercises. We understand the Canadian facilities instituted a number of measures in light of the September 11 attacks. Specific details concerning security at Canadian power reactor facilities constitute sensitive information.

The NRC has not exchanged information with the Russian government that would enable an assessment of the security at Russian nuclear power plants.

Question 4(b): *What is the expected time duration of the Canadian and Russian measures?*

Answer:

We do not know the duration of heightened security measures in Canada and Russia.

Question 5: *Would the NRC seek to modify the design-basis threat assumptions to include adversaries willing to commit suicide in their attack?*

Answer:

The NRC has routinely monitored the threat environment since the creation of the design basis threat (DBT) statements in the late 1970s. The willingness of terrorists, or others, to commit

suicide in the course of some criminal act, is an underlying assumption of the DBT and this is not considered to be a new adversary characteristic. The working assumption described in the DBT is that the adversary force is willing to kill or be killed in an attempt to complete its attack. However, the NRC will consider the information developed as a result of the September 11, 2001, event in determining potential adjustments to the DBT.

Question 6(a): *Is the NRC going to reconsider plans to replace the OSRE program with a nuclear industry-designed and managed program to test the adequacy of security measures at individual power plants?*

Answer:

The NRC has not made a decision to terminate the OSRE program. Before September 11, the Commission agreed to a pilot of the industry-designed Safeguards Performance Assessment (SPA) program. That pilot, which is subject to NRC oversight, would be evaluated after one year.

During the conduct of the SPA pilot, the NRC would continue OSRE inspections at a rate of six per year, which would be combined with eight NRC-evaluated SPA inspections. A final Commission decision regarding the method of conducting force-on-force testing would follow formal evaluation of lessons learned during the pilot program and the continuing OSRE program. As a result of the Chairman's tasking memorandum following the September 11 attacks, the entirety of the inspection program will be reexamined.

Question 6(b): *Instead of eliminating the OSRE program, will the NRC consider making OSRE tests more rigorous, with attacking teams more heavily armed than the specifications listed under 10 CFR 73.1?*

Answer:

As directed by the Chairman's tasking memorandum, both the Design Basis Threat and the inspection program will be reexamined.

Question 7: A quick search of the Web turned up a guideline from the Swiss Federal Nuclear Safety Inspectorate (HSK), Guideline HSK-R-102, "Design Criteria for the Protection of Safety Equipment in Nuclear Power Stations Against the Consequences of Airplane Crash." Does the NRC have any design criteria for protection against airplane crashes? If not, why not? If so, does it apply only at plants located within a certain range from airports? If so, why was it not applied to plants all over the country? A recent press report mentioned in passing that nuclear power plant containment vessels are "designed to survive the crash of a falling 747." Where can this specification be found?

Answer:

The Swiss guideline requires that "nuclear power stations shall be protected against the consequences of an airplane crash." The intent is to ensure that "the radiation exposure of the public shall not exceed the limits specified." We understand that the Swiss guideline reflects the heavy density of airline traffic over Switzerland.

The NRC has not routinely required all plants to be designed to withstand a particular aircraft crash, but such considerations have entered into siting evaluations. Those evaluations have considered the probability of accidental air crashes as a screening criterion to determine whether further evaluation is required. Specifically, 10 CFR 100.10, "Factors To Be Considered When Evaluating Sites," requires, in part, that "reactors will reflect through their design, construction, and operation an extremely low probability for accidents that could result in release of significant quantities of radioactive fission products." In addition, for applications after January 10, 1997, 10 CFR 100.20(b) requires that "the nature and proximity of man-related hazards (e.g., airports, dams, transportation routes, military and chemical facilities) must be evaluated to establish site parameters for use in determining whether a plant design can accommodate commonly occurring hazards, and whether the risk of other hazards is very low."

The NRC issued NUREG-0800, "Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants," Section 3.5.1.6, "Aircraft Hazards" (dated July 1981) that defines the Agency's acceptance criteria for siting nuclear power plants near airports and/or airways. The probability of an accidental aircraft crash resulting in radiological consequences greater than the exposure guidelines defined by 10 CFR Part 100 is considered to be acceptably low if the plant meets specified criteria regarding distance from airports, holding patterns, and approach patterns, as well as criteria regarding volumes of air traffic. If the plant does not meet these criteria, a detailed review of accidental aircraft hazards must be performed. If that detailed hazard review cannot demonstrate an acceptably low probability of an aircraft accident resulting in radiological consequences greater than the exposure guidelines defined by 10 CFR Part 100, engineering analyses of aircraft impacts are required. The probability is considered to be acceptably low if the probability, based on a realistic assessment, is less than about 10^{-7} per year (or 10^{-6} per year given a conservative assessment).

If the plant cannot meet the probability criteria, the plant's structures, systems, and components must be designed to withstand the effects of the postulated aircraft impacts and fires without loss of safe shutdown capability, and without a release of radioactivity that would exceed the exposure guidelines defined by 10 CFR Part 100.

The NRC has no criterion that requires nuclear power plant containment vessels to be designed to survive the crash of a falling Boeing 747.

Question 8: *A probabilistic risk assessment in the journal Nuclear Safety of airplane impacts on nuclear power plants yielded a very small probability (4.6 x 10^{-5} %) for the impact of a large airplane (greater than 12,500 lbs) onto a plant that is more than 5 miles away from an airport. But this is assuming an accidental impact. In light of the events on September 11, it is clear that deliberate impacts must be considered. With a capable pilot*

committed to a terrorist attack on a nuclear power plant at the controls, the probability of impact is 100%. What would be the result of a Boeing 767 with a full tank making a direct impact onto a nuclear power plant at full speed? What would be the result of other aircraft, larger or smaller, impacting a nuclear power plant at full speed? Please fully assess the different circumstances of aircraft impacting the containment vessel as well as other reactor support facilities, and consider such factors as full or empty fuel tanks and large or small aircraft.

Answer:

Nuclear power plants have an inherent capability to protect public health and safety through such features as robust containment buildings, redundant safety systems, highly trained operators. These plants are among the most hardened structures in the country and are designed to withstand extreme events, such as hurricanes, tornadoes, and earthquakes. In addition, all NRC licensees with significant radiological material have emergency response plans to mitigate impacts on the public in the event of a release. However, the NRC did not specifically consider attacks by aircraft such as Boeing 757s or 767s, and nuclear power plants were not specifically designed to withstand such crashes. The NRC has not yet performed detailed engineering analyses of a large airliner crash; and thus cannot, at this point, provide an assessment of the likely consequences of such an attack.

The NRC staff is evaluating strategies to assess the effects of a deliberate aircraft impact and the resulting fire and explosion on the reactor containment building and other reactor support facilities. Variables considered in the analyses will include aircraft size and speed, as well as the amount of fuel.

Question 9: *Will the NRC revise its estimates of the likelihood of attacks by aircraft hitting nuclear waste transportation containers or nuclear waste storage facilities, and require licensees to undertake further preparations for such attacks?*

Answer:

As discussed in response to Question 7, above, the previous NRC estimates were based on an accidental airplane crash, not an intentional crash. In response to the terrorist attack of September 11, 2001, the NRC has begun a thorough review of the safeguards and physical security programs. This effort will include input from the national security organizations, the FBI, intelligence and law enforcement agencies, the Department of Defense and others to evaluate the level of threat to which civilian nuclear facilities must be able to respond. It will also consider the results of discussions with these agencies on how to deal with threats beyond the design basis, such as enemy-of-the-state threats.

Question 10(a): *What would happen to spent fuel storage casks if they were subjected to a fire for a full day?*

Answer:

The capacity of spent fuel dry storage casks to withstand a fire for extended time, such as 24 hours, has not been analyzed, given the very low probability that firefighting personnel would be unable to respond within 24 hours. However, previous studies have analyzed worst case impact conditions for aircraft accidents, and these studies have found that most of the aircraft fuel would be dispersed and will burn off in a matter of minutes. Thus, if impacted by a large commercial aircraft, a spent fuel storage cask would not be expected to be appreciably affected by a fire. However, if, as a result of the NRC's review of the terrorist events of September 11, 2001, the NRC determines that additional or revised safety or physical protection actions or requirements need to be taken at independent spent fuel storage installations, the NRC will take appropriate actions to implement those measures.

Question 10(b): *If the protective covering of the cask were burned away, what would happen to the fuel inside?*

Answer:

The concrete and/or steel protective coverings are not readily flammable and will not be burned away. Therefore, the staff believes that a fire will not result in failure of the inner canister. As indicated above, if, as a result of the NRC's review of the terrorist events of September 11, 2001, the NRC determines that additional or revised safety or physical protection actions or requirements need to be taken at independent spent fuel storage installations, the NRC will take appropriate actions to implement those measures.

Question 10(c): *Could we have a Chernobyl-style accident, where the fire carried radioactive materials into the air* [from a spent fuel storage cask]*?*

Answer:

No. Even if a spent fuel storage cask were impacted and penetrated by a commercial aircraft, the resultant effects could never be equivalent to a Chernobyl-type accident because the amount of radioactive material contained within the cask is orders of magnitude less than in an operating reactor, and the mechanisms for dispersal of the material are fewer than were present during the Chernobyl accident. In the event of a crash of a large commercial aircraft, and if the cask were breached, we could not exclude the possibility of localized impacts.

Question 10(d) *Will there be a redesign of spent fuel casks? Why or why not?*

Answer:

As previously stated, if, as a result of the NRC's review of the terrorist events of September 11, 2001, the NRC determines that additional or revised safety or physical protection actions need to be taken or new requirements implemented at independent spent fuel storage installations,

including the design requirements for spent fuel casks, the NRC will take appropriate actions to implement those measures.

Question 11: *The possibility of severe damage due to a fire at a nuclear power plant has been considered in the past. As discussed above, passive barriers in the plants are rated to withstand fires for 1 or 3 hours. Were the specifications made with the crash of a commercial airliner in mind? What changes will you make to the length of time that passive fire barriers need to resist a fire?*

Answer:

The objective of the NRC's current fire protection requirements is to ensure that a single internal fire event does not adversely affect the ability of the plant to achieve and maintain safe shutdown. Fire barriers are only one of the many elements of the defense-in-depth principle that is applied to nuclear power plant fire protection; therefore, licensees do not solely rely on installed fire barriers to achieve and maintain safe shutdown. The specifications for the qualifications of fire barriers installed in nuclear power plants to meet the NRC's objective are founded on the testing protocol described by the American Society of Testing Materials, Standard Test Methods for Fire Tests of Building Construction and Materials (ASTM E-119). This standard is used to measure and describe the properties of fire barrier materials under controlled laboratory conditions. This standard is widely used as the basis for rating the fire barriers that are used in many types of industrial facilities besides nuclear power plants. Increasing the length of time required for passive barriers installed at a nuclear power plant to resist a laboratory fire would not ensure that the fire barriers would be able to protect important safety systems, because the scenario in which a commercial airliner impacts and penetrates a structure would likely also damage the fire barriers as a result of the impact of debris from the aircraft or the damaged structure. Therefore, changes to the length of time that passive barriers need to resist a fire would not, by themselves, be an effective means of addressing the aircraft crash threat.

Question 12: *What is the current status of NRC actions to make potassium iodide available to communities surrounding nuclear power plants, so that in the event of a successful terrorist attack against a U.S. nuclear facility, it could be quickly distributed to local populations? What is the NRC doing to expedite the distribution of sufficient stockpiles of potassium iodide?*

Answer:

In January 2001, the NRC revised a portion of its emergency response regulations to require that consideration be given to including potassium iodide (KI) as a protective measure for the general public to supplement sheltering and evacuation in the event of a severe nuclear power plant accident. In doing so, the Commission found that KI is a reasonable, prudent, and inexpensive supplement to evacuation and sheltering for specific local conditions. The Commission left it to the States to make a final decision on the use of KI as a supplemental measure. But the Commission decided to fund the initial purchases of KI for any State making

a decision to stockpile KI. NRC set aside $400,000 in FY 2001 and has requested similar funding in FY 2002 to purchase KI.

Together with the Federal Emergency Management Agency (FEMA), the NRC has formed a subcommittee to develop and implement a program to distribute potassium iodide (KI) to States which decide to include KI in their range of public protective actions. The use of KI would supplement other protective measures, such as evacuation and sheltering. The NRC/FEMA KI subcommittee has been meeting approximately monthly since January 2001 to develop procedures, processes, and guidance for KI program implementation. Presently, the subcommittee is awaiting the issuance of final Food and Drug Administration (FDA) guidance on dosage and intervention levels, which are needed to complete the NRC KI distribution program. FDA published its draft guidance in January 2001.

The NRC formally requested that a Federal Radiological Protection Coordinating Committee (FRPCC) subcommittee on KI be formed with representatives from the FDA and the Environmental Protection Agency (EPA), as well as the NRC and FEMA. The purpose of the FRPCC KI subcommittee is to expedite review and revision of the Federal KI policy, encourage the finalization of FDA guidance, and coordinate KI implementation issues. That subcommittee had its initial meeting on September 25, 2001. Additionally, as the NRC requested through the FRPCC, FEMA Director Allbaugh sent a letter to the U.S. Department of Health and Human Services (HHS) Secretary Thompson requesting expedited review of the FDA guidance on the use of KI.

The FRPCC KI subcommittee is being used as a forum to discuss and develop recommendations for consideration by the member agencies regarding the impact of the September 11 events on the Federal KI policy, and KI stockpiling and distribution issues. At present, the NRC intends to proceed with implementing its KI distribution program for States that decide to include KI in their range of public protective actions once the FDA guidance is finalized.

Question 13: *In light of last week's events, will the NRC now reconsider its previous support for allowing foreign entities to acquire nuclear power plant operating licenses? Does the NRC foresee any increase in prospective security risks associated with having foreign entities own or control a nuclear facility? If not, why not?*

Answer:

The reasons that the NRC has given Congress for removing the statutory ban on foreign ownership of nuclear power operating licenses remain sound in our view. The current ban in Sections 103d and 104d of the Atomic Energy Act of 1954 (AEA) is unqualified. It applies to all foreign entities, making no distinction between friend, such as the United Kingdom, and foe, such as Iraq. Moreover, the ban fails to accomplish its primary goal of preventing transfer of nuclear power technology because, unlike in 1946 when the statutory ban went into effect, nuclear power technology is well known abroad. In the absence of the ban, there would still be ample protection against an inappropriate licensee because the Commission would still be prohibited from issuing any operating license to a foreign entity if the foreign ownership would

be inimical to the common defense and security or the health and safety of the public. Before making such a determination, the Commission would be able to obtain the views of the Executive Branch.

Question 14(a): *What action, if any, has the NRC taken to evaluate the possibility of "insider threats" to nuclear power plants by members of any terrorist organizations?*

Answer:

Since September 11, 2001, the FBI has provided to the NRC frequently updated lists of individuals who may have ties or information related to terrorist activities. At the request of the FBI, the NRC provided these lists to the nuclear power plants, the nonpower reactor facilities, decommissioning plants, and selected fuel facilities to be checked against utility employment and visitor records. The Nuclear Energy Institute has also been provided the lists to be checked against a database of temporary nuclear utility workers. All results are being provided by NRC to the FBI for resolution. To date, all potential matches have been resolved through the FBI.

Question 14(b): *Who can work at nuclear power plants?*

Answer:

In order to be authorized for unescorted access at a nuclear power plant, an individual must undergo a background screening and investigation pursuant to 10 CFR 73.56, and such workers are subject to ongoing fitness-for-duty requirements. The screening criteria include: (1) a background investigation designed to identify past actions which are indicative of an individual's future reliability within a protected or vital area of a nuclear power reactor; (2) a psychological assessment designed to evaluate the possible impact of any noted psychological characteristics which may have a bearing on trustworthiness and reliability; and (3) behavioral observations, conducted by supervisors and management personnel, designed to detect individual behavioral changes which, if left unattended, could lead to acts detrimental to the public health and safety.

Question 14(c): *What sort of background checks are performed as a condition of employment?*

Answer:

As noted above, there are requirements for background screening and investigation before authorizing an individual to have unescorted access to the site. In accordance with 10 CFR 73.56, the background investigation includes employment history, education history, criminal history, military service, and credit history, as well as a psychological evaluation, interview of developed references, and fitness-for-duty testing. With and without authorization for unescorted access, all individuals working inside the licensee's protected area are subject to continued behavioral observation, as required by 10 CFR 73.56, to identify aberrant behavior or other indications that the individual is, or has become, untrustworthy.

Question 14(d): *Do employees [at nuclear power plants] have to be permanent residents or citizens of the U.S.?*

Answer:

Employees at nuclear power plants do not have to be permanent residents or citizens of the United States.

Question 15: *Does the NRC believe that any new measures are needed to tighten up export controls relating to nuclear materials and nuclear technology, so that such materials and technology do not end up in terrorist hands? If not, why not, and if so, what new measures are necessary?*

Answer:

The NRC's export licensing regulations, including the related decision criteria, are founded on explicit provisions of the Atomic Energy Act of 1954, as amended by the Nuclear Non-Proliferation Act of 1978, the Energy Policy Act of 1992, and other acts. These provisions place strict controls on U.S. exports of nuclear materials and other materials and equipment of significance for nuclear explosive purposes. To date, the NRC's licensing specialists have not identified any of these provisions that should be changed in light of increased concerns about terrorist attacks.

From a broader perspective, the NRC's export regulations are only one of several facets of U.S. and multilateral export controls. The Agency anticipates and is prepared to participate in, interagency reviews involving Executive Branch agencies (such as the Departments of State, Energy, Commerce, Defense, and Transportation) to address those controls that bear on terrorist intentions and acts. The Agency will also support U.S. Government efforts in the Nuclear Suppliers Group and the International Atomic Energy Agency.

Question 16: *10 CFR 50.13 provides that nuclear power plants do not need to be protected "against the effects of (a) attacks and destructive acts, including sabotage, directed against the facility by an enemy of the United States, whether a foreign government or other person..." Since the U.S. is preparing for a war on terrorism, I am concerned that the industry will insist that they do not need to provide defense against any terrorist attacks. Ray Golden, San Onofre business manager for Southern California Edison, recently stated, "We would characterize (the terrorist attacks) as President Bush did." He further states, "We are not certain what could happen to the plant from that type of event, and we cannot protect completely against it. Nor, from a security standpoint, are we required to." In light of the attacks on September 11, do you believe that it is appropriate to change in any way the responsibilities of the NRC and the industry to take appropriate measures to protect the public from the consequences of acts of terrorism directed against nuclear power plants? Why or why not?*

Answer:

The NRC cannot determine at this time what changes may be appropriate regarding the responsibilities of the industry to protect against acts of terrorism and the responsibilities of our homeland security agencies. The NRC has started a full review of its security standards, and that review may bring to light some need to change the division of responsibilities between the government and the private sector. Moreover, our interactions with the newly established Office of Homeland Security and other agencies should help to further clarify where the lines between the industry's responsibilities and the national government's should be drawn.

At present, consistent with 10 CFR 50.13, licensees are not required to protect against offensive military actions by foreign governments (such as aircraft attacks). Such actions have ramifications for the Nation's security (not only the security of an individual facility) and, as a practical matter, may be beyond the defensive capability of private organizations. Protection against these types of attacks may be more appropriately the responsibility of the national defense establishment. On the other hand, 10 CFR 73.1(a)(1) requires that licensees must protect against violent actions by well-trained and well-equipped persons, even those who are supported by a foreign government, if these activities (for example, vehicle bombings) could also be carried out domestically.

CONTENTION 1.1.2(l) HARD COPY EXHIBIT 3

NUREG/CR-5042
UCID-21223

Evaluation of External Hazards to Nuclear Power Plants in the United States

Manuscript Completed: October 1987
Date Published: December 1987

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6.4 AVIATION ACCIDENTS

The effect of an aircraft of sufficient weight, traveling at sufficient speed, crashing at a nuclear powerplant site may result in physical damage and disruption to the plant to the extent that damage to the reactor core damage and release of radioactive material from the reactor core may result. Only physical damage to the plant is considered because there is insufficient hazardous material carried by the aircraft, except for onboard fuel, to affect the plant sufficiently to ultimately cause damage to the reactor core. The fuel aboard the aircraft is considered to be covered by physical damage to plant. No sabotage or deliberate "kamikaze" crashes are considered.

6.4.1 Aviation Safety Requirements

The movement of aircraft in the United States is controlled by the Federal Aviation Administration (FAA) through Title 14 of the Code of Federal Regulations (14 CFR) [Ref. 6.4.1]. Section 121 of 14 CFR regulates commercial aviation in the United States for aircraft capable of carrying more than 30 passengers and/or a payload of more than 7,500 pounds. Section 125 of 14 CFR regulates commercial aviation in the United States for aircraft capable of carrying more than 20 but less than 30 passengers and/or a payload of more than 6,000 but less than 7,500 pounds. Section 135 of 14 CFR regulates commercial aviation in the United States for aircraft capable of carrying less than 20 passengers and/or less than a payload of 6,000 pounds. Section 91 of 14 CFR regulates general aviation, that is, all aircraft not involved in commercial operations.

6.4.2 NRC Acceptance Criteria

The U.S. NRC has issued the following in their Standard Review Plan (SRP) [Ref. 6.4.2] as their acceptance criteria for the siting of nuclear power plants near airports and/or airways. The probability of an aircraft accident resulting in radiological consequences greater than 10 CFR Part 100 exposure guidelines is considered to be less than 10^{-7} per year if the distances from the plant meet all of the requirements listed below:

(a) The plant-to-airport distance D is between 5 and 10 statute miles, and the projected annual number of operations is less than 500 D^2, or the plant-to-airport distance D is greater than 10 statute miles, and the projected annual number of operations is less than 1000 D^2,

(b) The plant is at least 5 statute miles from the edge of military training routes, including low-level training routes, except for those associated with a usage greater than 1000 flights per year, or where activities (such as practice bombing) may create an unusual stress situation,

(c) The plant is at least 2 statute miles beyond the nearest edge of a federal airway, holding pattern, or approach pattern.

The FAA, in compiling airport use statistics, defines an aircraft operation as the airborne movement of aircraft in controlled or noncontrolled airport terminal areas and about given enroute fixes or at other points where counts can be made. There are two types of operations--local and intinerant. Local operations are performed by aircraft which: (a) Operating in the local traffic pattern or within sight of the airport, (b) Are known to be departing for, or arriving from, flight in local practice areas within a 20 mile radius of the airport, and (c) Execute simulated instrument approaches or low passes at the airport. Itinerant operations are all aircraft operations other than local operations [Ref. 6.4.3].

If the above proximity criteria are not met, then a detailed review of the aircraft hazards must be performed. The SRP [Ref. 6.4.2] provides a procedure by which the probability of an aircraft crash can be calculated for various situations.

For Federal airways or aviation corridors that pass through the vicinity of a site, the probability per year of an aircraft crashing into the plant, P_{FA}, is given by the following equation:

Eq. 6.4.1 $P_{FA} = C \times N \times A/W.$

where C = inflight crash rate per mile for aircraft using airway,
N = number of flights per year along the airway,
A = effective area of plant in square miles, and
W = width of airway (plus twice the distance from the airway edge to the site when the site is outside the airway) in miles.

For civilian and military airports and heliports, the probability of an aircraft crashing into site is given by the following equation:

Eq. 6.4.2 $PA = S_L S_M C_j \times N_{ij} x_j A$

where S_L = summation over all flight trajectories, for i = 1 to L, affecting the site,
S_M = summation over all different types of aircraft, for j = 1 to M, using the airport,
C_j = probability per square mile of a crash per aircraft movement, for the jth aircraft,
N_{ij} = number (per year) of movements by the jth aircraft along the ith flight paths, and
A_j = effective plant area (in square miles) for the jth aircraft.

The values for C_j are given by Table 6.4.1 reproduced from Ref. 6.4.2. The data given by Table 6.4.1 for U.S. air carriers and for U.S. Navy (USN)/U.S. Marine Corps (USMC) and U.S. Air Force (USAF) aircraft was first presented by Ref 6.4.4 in 1973. According to Ref. 6.4.4, the bases for this data were aircraft accidents resulting in fatalities that occurred with a few

miles of a runway within a 60-degree reference flight path symmetric about extended centerline of the runway. The U.S. air carrier analysis was based on 80,000,000 movements. The USN/USMC and USAF analyses were based on 55,000,000 and 39,000,000 movements, respectively.

Table 6.4.1

U.S. NRC SRP Probability of Fatal Crash Versus Distance from End of Runway [Ref. 6.4.2]

Distance From End of Runway (miles)	Probability ($\times 10^8$) of a Fatal Crash per Square Mile per Aircraft Movement			
	U.S. Air Carrier	General Aviation	USN/USMC	USAF
0-1	16.7	84	8.3	5.7
1-2	4.0	15	1.1	2.3
2-3	0.96	6.2	0.33	1.1
3-4	0.68	3.8	0.31	0.42
4-5	0.27	1.2	0.20	0.40
5-6	0	NA	NA	NA
6-7	0	NA	NA	NA
7-8	0	NA	NA	NA
8-9	0.14	NA	NA	NA
9-10	0.12	NA	NA	NA

NA indicates that data was not available for this distance.

From Ref. 6.4.2, the effective plant areas are calculated including the following: (a) A shadow area of the plant elevation unpon the horizontal plane based on the assumed crash angle for the different kinds of aircraft and failure modes, (b) A skid area around the plant, taking into account artificial berms or any other man-made and natural barriers, as determined by the characteristics of the aircraft under consideration, and (c) The areas of those safety-related structures, systems and components which are susceptible to impact or fire damage as a result of aircraft crashes.

6.4.3 Hazard to Nuclear Power Plants from Aviation Accidents

All power plant sites are exposed to aviation accident hazards to some extent due to the ability of aircraft to travel practically anywhere. Because of the increased traffic density near airports, plant sites on approaches to airports face higher exposure rate to aviation accident hazards. Generally, it is commercial aviation traffic, as opposed to general aviation, that poses the greatest hazard to nuclear power plants due to their heavier aircraft that travel that higher speeds. However, given the higher traffic density of general aviation traffic, it is not inconceivable that general aviation could pose a greater hazard given the right circumstances. Military aviation traffic could also pose a hazard to a nuclear power plant if the plant is located near a heavy aircraft base such as a bomber or transport base.

The Three Mile Island site is used as an example in an initial screening analysis to demonstrate a method by which plants could determine if further analysis is necessary in order to meet the first figure-of-merit for probability of core damage from aviation accidents.

The methodology presented in Appendix 6.A.1 is used to perform the initial screening analysis.

The Three Mile Island Units 1 and 2 nuclear power plant site in Londonderry Township, Pennsylvania, is located on Three Mile Island in the Susquehanna River about 12 miles southeast of Harrisburg. According to the Three Mile Island Unit 2 Final Safety Analysis Report (FSAR) [Ref. 6.4.5], the Harrisburg International Airport, formerly Olmstead Air Force Base, is located on the north bank of the Susquehanna River about 2 1/2 miles northwest of the site. This airport has one runway, $130^0/310^0$. The FSAR [Ref. 6.4.5] states that aircraft making their final approaches to 310^0 could pass near or over the site although this would not be a standard VFR (Visual Flight Rules) approach. Figure 6.1 shows the Three Mile Island Site and the distance and bearing from the site to the Harrisburg Internaltional Airport [Ref. 6.4.6].

According to the Three Mile Island 2 Safety Evaluation Report (SER) [Ref. 6.4.6], the risk was judged acceptably low for either unit provided that less than 2,400 operations per year were by aircraft in excess of 200,000 pounds, the postulated design basis aircraft. At the time of the assessment, there was one scheduled flight per day by an air carrier using a commercial aircraft in excess of 200,000 pounds and occasional use of the airport by military flights of cargo aircraft in excess of that weight.

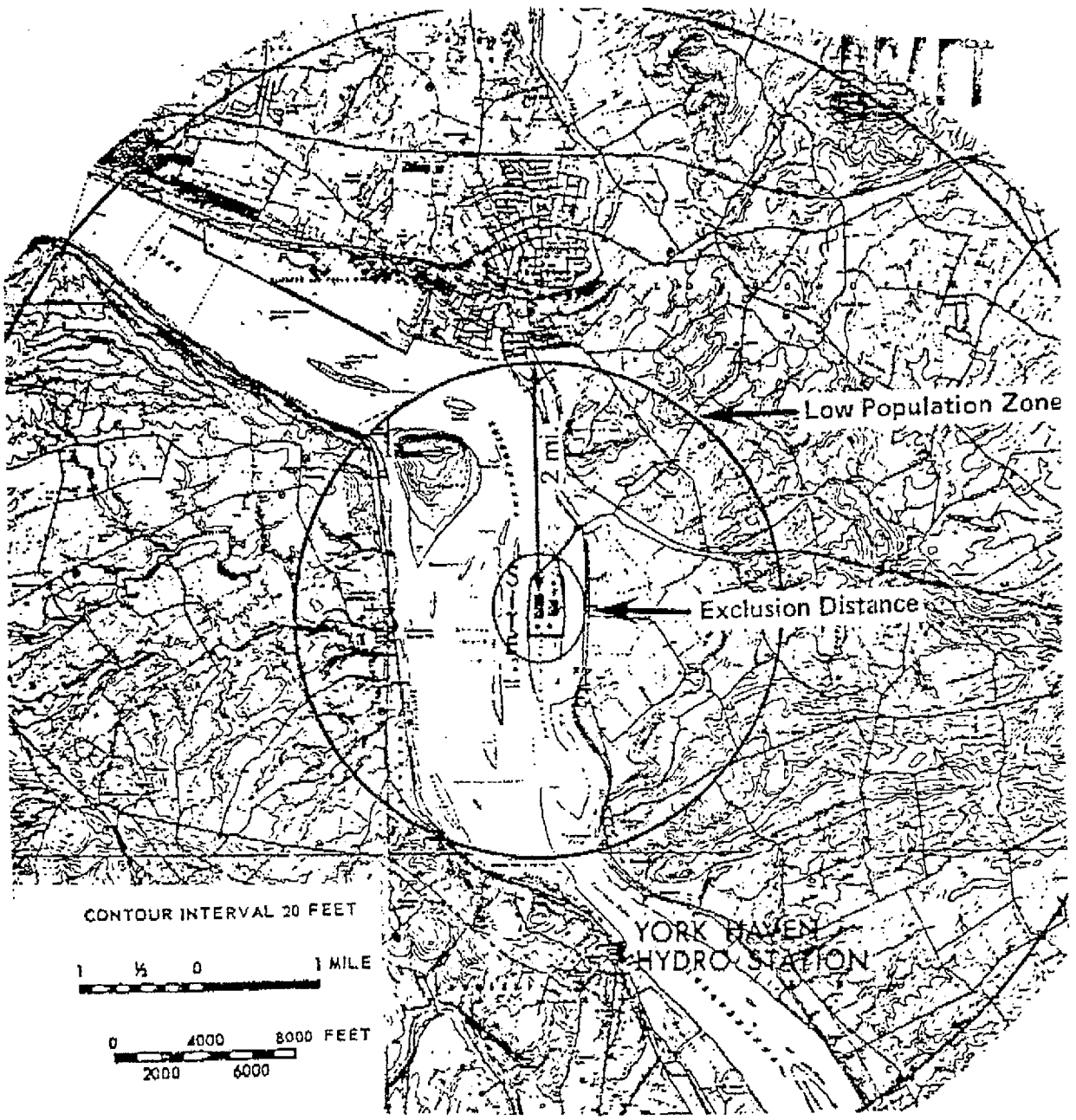


Figure 6.1

Three Mile Island Site [Ref. 6.4.6]

Since the time of that assessment, aircraft types used by U.S. commercial air carriers and traffic density has changed. As Table 6.A.2.6 of Appendix 6.A.2 shows, the earlier models of the Boeing 727, (B727-100), has a maximum takeoff weight of about 169,000 pounds. The later models of the Boeing 727, (B727-200) has a maximum takeoff weight of about 209,500 pounds [Ref. 6.A.2.14 - 6.A.2.15]. Commercial aircraft generally become heavier as new models are introduced due to "stretch-out" of the fuselage for increased passenger capacity, and higher performance engines to compensate for the increased weight and for better fuel economy.

Table 6.A.2.7 of Appendix 6.A.2 shows the type of aircraft used by U.S. commercial air carriers at the Harrisburg International Airport from 1977 to 1985. According to Table 6.A.2.7, an average of 4,687 flights departed from Harrisburg International Airport annually from 1977 to 1985. In 1984, the number of aircraft weighing over 200,000 pounds, departing from the Harrisburg International Airport was 2,075 out of a total of 4,283 for a percentage of 48.4%. In 1985, the number of aircraft weighing over 200,000 pounds, departing from the Harrisburg International Airport was 2,481 out of a total of 5,791 for a percentage of 42.8%.

Also located at the Harrisburg International Airport is the 193rd Special Operations Group of the Pennsylvania Air National Guard [Ref. 6.4.7]. This unit operates the EC-130E, an electronic warfare model of the basic C-130 Hercules, a 4-engined turboprop cargo aircraft. This aircraft has a gross operating weight of 175,000 pounds. The basic design of the C-130 was first developed 36 years ago so its potential replacement by newer, more advanced and heavier aircraft should not be ignored.

Because of the deregulation of the commercial airline industry in 1978, the general trend has been an increase in traffic density. Even small airports, such as Harrisburg, have experienced a general upward trend in commercial airline traffic. Therefore, as 1985 is the most recent year in which data is available for Harrisburg International Airport, it should be most indicative of future operations.

Using 6000 departures per year from the Harrisburg International Airport and assuming that each departure implies a landing and takeoff, there will be 6000 flights that will fly near the Three Mile Island Site each year. If an aircraft lands on runway $130^0/310^0$ towards the Northwest (310^0), it will probably land from the Southeast which implies a landing approach near the Three Mile Island site. If an aircraft lands towards the Southeast (130^0), it will probably take off towards the Southeast which implies a takeoff pattern near the Three Miles Island site.

The Harrisburg International Airport is 2.5 miles from the Three Mile Island site. Assuming only commercial airline accidents within 2.5 miles of the plant site can affect the site, then 6000 flights per year times 5 miles (the flight path 2.5 miles northeast and southwest of the Three Mile Island site) gives 30,000 aircraft miles per year within 2.5 miles of the Three Miles Island site. From Table 6.A.2.2 of Appendix 6.A.2, a commercial aircraft

accident rate (aircraft operating under 14 CFR 121, 125 and 127) of 7.7×10^{-9} is obtained. Multiplying the aircraft miles within 2.5 miles of the Three Mile Island site with the commercial aircraft accident rate gives:

$$30{,}000 \text{ ac miles} \times 7.7 \times 10^{-9} \frac{\text{ac accidents}}{\text{ac miles year}} = 2.3 \times 10^{-4} \frac{\text{accidents}}{\text{year}}$$

Assuming half of the commercial aircraft flights departing the Harrisburg International Airport have an operating weight of 200,000 pounds or greater, then the frequency of a commercial aircraft weighing 200,000 pounds or more having an accident within 2.5 miles of the Three Mile Island site is:

$$1/2 \times (2.3 \times 10^{-4} \frac{\text{accidents}}{\text{year}}) = 1.2 \times 10^{-4} \frac{\text{accidents}}{\text{year}}$$

6.4.4 Power Plant Response to Aviation Accidents

Since the NRC regulations regarding aviation hazards to nuclear power plants are only partly probabilistic in nature and do not relate to core damage or large release frequency, to obtain a probabilistic estimate of the frequency of core damage due to aviation accidents, one must turn to probabilistic risk analysis. Unfortunately, the few PRAs that have considered aviation accidents (Indian Point, Millstone 3, Seabrook, Zion [Ref. 6.4.9 to 6.4.12]) have dismissed aviation accidents on the basis of the aviation accident frequency.

The only probabilistic analysis of a power plant's response to an aircraft crash is a 1971 paper by Chelapati, Kennedy and Wall [Ref. 6.4.8] which modeled aircraft engines as projectiles impacting the plant walls. The aircrafts were divided into two categories, small aircraft and large aircraft.

For small aircraft (less than or equal to 12,500 pounds in weight), the aircraft engines were idealized as projectiles ranging in weight from 230 to 800 pounds with the relative distribution of aircraft engine weight determined from aircraft census. Within five miles of an airport, small aircraft engines were modeled with an impact velocity ranging from 67 to 105 miles per hour. Beyond five miles from an airport, small aircraft engines were modeled with an impact velocity ranging from 67 to 280 miles per hour.

For large aircraft (greater than 12,500 pounds in weight), the aircraft engines were idealized as projectiles ranging in weight from 450 to 4200 pounds with the relative distribution of aircraft engine weight determined from aircraft census. Within five miles of an airport, large aircraft engines were modeled with an impact velocity ranging from 95 to 185 miles per hour. Beyond five miles from an airport, large aircraft engines were modeled with an impact velocity ranging from 175 to 610 miles per hour.

From the distribution of aircraft engine weight, impact velocity, and wall thickness, a probability of wall penetration was obtained. Table 6.4.2 presents the probability of wall penetration for various combinations of aircraft weight, wall thickness and plant location. Note that the frequency of core damage or large release was not calculated.

The assumption that large aircraft will impact with a velocity of less than 185 miles per hour within five miles of an airport is probably reasonable. Federal regulations [14 CFR 91.70, Ref. 6.4.1] control the maximum airspeed of all aircraft below 10,000 feet MSL (mean sea level). The requirements are:

"(a) Unless otherwise authorized by the Administrator, no person may operate an aircraft below 10,000 feet MSL at an indicated airspeed of more than 250 knots (288 m.p.h.).

(b) Unless otherwise authorized or required by ATC, no person may operate an aircraft within an airport traffic area at an indicated airspeed of more than-
(1) In the case of a reciprocating engine aircraft, 156 knots (180 m.p.h.); or
(2) In the case of a turbine-powered aircraft, 200 knots (230 m.p.h.)."

The regulations state further that:

"(c) No person may operate an aircraft in the airspace underlaying a terminal control area, or in a VFR corridor designated through a terminal control area, at an indicated airspeed of more than 200 knots (230 m.p.h.)."

Beyond five miles from an airport, the aircraft impact velocity in an aircraft crash is not easily determined since this speed is not as tightly regulated and terminal control areas vary in their control radius.

Table 6.4.2

Probability of Penetration as a Function of Plant Location and Concrete Thickness [Ref. 6.4.10]

Plant Location	Aircraft Type	Probability of Penetration — Thickness of Reinforced Concrete			
		1 foot	1.5 feet	2 feet	6 feet
<= 5 miles from airport	Small, <= 12,500 lbs.	0.003	0	0	0
	Large, < 12,500 lbs.	0.96	0.52	0.28	0
>= 5 miles from airport	Small, <= 12,500 lbs.	0.28	0.06	0.01	0
	Large, > 12,500 lbs.	1.0	1.0	0.84	0.32

< = defined as less than or equal to.
> = defined as greater than or equal to.

6.4.5 Aviation Accident References

[6.4.1] Title 14 Code of Federal Regulations, Aeronautics and Space (14 CFR) Parts 60 to 139, Revised as of January 1, 1987, Office of the Federal Register, National Archives and Records Administration, Washington, D.C.

[6.4.2] NUREG-0800 (formerly issued as NUREG-75/087) Standard Review Plan for the Review of Safety Analysis Reports for Nuclear Power Plants, LWR Edition, U.S. NRC Office of Nuclear Reactor Regulation, Washington, D.C. July 1981.

[6.4.3] FAA Statistical Handbook of Aviation, Calender Year 1982, U.S. Department of Transportation, Federal Aviation Administration, Office of Management Systems, Information Analysis Branch, Washington, D.C. December 31, 1982.

[6.4.4] "Reactor Siting in the Vicinity of Airfields", D.G. Eisenhut, Transactions of the American Nuclear Society, 1973 Annual Meeting, Chicago, Illinois, June 10-14, 1973, Volume 16, pg. 210-211.

[6.4.5] Three Mile Island Unit 2 Final Safety Analysis Report (FSAR), Metropolitan Edison Company.

[6.4.6] NUREG-0107 Safety Evaluation Report Related to Operation of Three Mile Island Nuclear Station, Unit 2, U.S. Nuclear Regulatory Commission, Office of Nuclear Reactor Regulation, Washington, D.C. September 1976.

[6.4.7] "USAF Almanac", Air Force Magazine, Vol. 70, No. 5. May 1987.

[6.4.8] "Probabilistic Assessment of Aircraft Hazard for Nuclear Power Plants", C.V. Chelapati, R.P. Kennedy, and I.B. Wall, Nuclear Engineering and Design, Vol. 19, pg. 333-364. 1972.

[6.4.9] Indian Point Probabilistic Safety Study, Consolidated Edison Company and Power Authority of State of New York, Pickard, Lowe & Garrick, Inc. 1983.

[6.4.10] Millstone Unit 3 Probabilistic Safety Study, Section, Part 1, Volume 2. August 1983.

[6.4.11] Seabrook Station Probabilistic Safety Assessment, Public Service Company of New Hampshire and Yankee Atomic Electric Company, Pickard, Lowe & Garrick, Inc. Report PLG-0300. 1983.

[6.4.12] Zion Probabilistic Safety Study, Commonwealth Edison Company, Pickard, Lowe & Garrick, Inc. 1982.

Exhibit 2.2.1(g)

"Up the creek at Clinton Lake"

http://www.news-gazette.com/ngsearch/story.cfm?number=10435

By MIKE MONSON
Published Online November 04, 2001

DEWITT – Ed Jurgens and his wife, Laurie, bought the Good Times Bait Shop in DeWitt last July with the idea of making a fresh start.

Jurgens had been working in a machine shop in Crystal Lake, but was laid off in May. Tired of working for other people, he bought the bait shop along Illinois 54, only a few miles from Clinton Lake.

"I was tired of working for someone else and being treated like garbage, like these corporations do any more," he said.

But the terrorist attacks on Sept. 11 dramatically changed Jurgens' business fortunes for the worse – as it did those of a number of other businesses in DeWitt, Farmer City, DeLand and Clinton that cater to boaters who use Clinton Lake.

After the terrorists struck, the U.S. Nuclear Regulatory Commission advised all nu-clear power plants to move to their highest level of security.

Exelon Nuclear, which ope-rates the Clinton nuclear power plant and owns the sprawl- ing, 5,000-acre Clinton Lake, promptly ordered all boats off the lake and closed it.

It remains closed to this day, nearly two months later.

The power plant uses water from the lake to cool the reactor core.

The closure is causing economic hardship for a number of businesses that cater to boaters, who value Clinton Lake because of its size and its lack of restrictions on boat horsepower. Some business owners say they'll have to shut down if the lake isn't reopened by next spring.

Those business owners are lobbying state legislators and Exelon Nuclear to consider reopening at least portions of the lake. But movement toward a reopening was halted on Oct. 24, when the Illinois Department of Nuclear Safety questioned plans to reopen small portions of the lake. Another blow came Monday, when U.S. Attorney General John Ashcroft warned that additional terrorist attacks were possible.

Along with Ashcroft's warning, the Nuclear Regulatory Commission on Monday suggested that nuclear power plants strengthen perimeter security and site security staff and urged them to request the assistance of local and state police and even the National Guard, if necessary, said Sue Gagner, a spokeswoman for the Nuclear Regulatory Commission.

A News-Gazette photographer who went to the Clinton plant Wednesday encountered armed guards carrying M-16 rifles and wearing flak jackets, and concrete barriers directing traffic to a checkpoint. An Illinois State police

patrol car was also visible.

Tom Ortciger, director of the Illinois Department of Nuclear Safety, confirmed that state police have been stationed this week at all six nuclear plants in Illinois.

"They're where they should be," he said.

Gov. George Ryan on Friday ordered Illinois National Guard troops to guard the state's nuclear power plants as well.

Also, the Federal Aviation Administration this week temporarily banned private airplanes from flying within 11.5 miles of the country's 86 nuclear power plants, including the Clinton plant.

The latest developments are discouraging to business owners like Jurgens, who says his business is down 60 percent and only staying afloat at all because of fishermen who fish from the shore.

"I'm into it up to my elbows," he said. "I have no choice but to make a go. If I could do it over, I never would have bought the business. But I'm stuck."

Other businesses also report declines in sales.

Gilbert Kirby, owner of Gibby's Marine Repair in Parnell, along Illinois 54, said he relies heavily on drive-by traffic and that with the lake closed, he has lost that boat repair business. He has been able to get by because a number of boat owners have asked him to winterize their boats early.

But if the lake isn't reopened by next spring, Kirby predicts boaters will move on to another lake, such as Lake Shelbyville, and a number of businesses will close their doors.

Richard Douglas, owner of the Sunset Inn & Suites in Clinton, said he has lost about 25 percent of his normal fall business since Sept. 11. The loss of fishing tournaments has hurt particularly, he said.

"Every time we have a nice weekend, the boaters would have been out," he said.

Doris Reynolds, co-owner of the DeWitt Country Store, a bar and grill, said she has lost more than 50 percent of her business since the lake's closure.

"It's dropped my food sales, my bar sales, it's dropped my bait sales," she said. "All we've got now is your steadies and shore fishermen."

Carolyn Sanders, bookkeeper for the Dockside Marina, said the lake's closure has killed the marina's fall business, which depends heavily on gas sales and boat rentals.

Clinton Mayor Tom Ed-munds said that he understands the need to balance security with the needs of local business. But he said it's important that planning for enhanced security begin now so that the lake, or major portions of it, can reopen next spring.

Edmunds – along with a number of the local business owners – argue that there is a way to protect the plant without closing most of the lake. They said that barriers could be installed north of the plant at the Illinois 54 bridge and south of the plant at what is known as Illinois Power point or beach, where the lake narrows to about 200 yards across.

"This would give them two miles of water to block off permanently if they choose," said DeWitt resident Joe Vandervort, who owned the Good Times Bait Shop before selling it this summer to Jurgens.

Such a move would still leave about 15 miles of the v-shaped lake open,

the business owners say.

But state and Exelon Nuclear officials say that it's too early to say when or how much of the lake can reopen, particularly in light of this week's warnings.

Exelon Nuclear spokeswoman Ann Mary Carley said the company is looking at different options for reopening portions of the lake, but she declined to go into specifics.

"We're continuing to work on it," she said. "We're looking at different options. We don't have all the details worked out, and we won't announce anything until we have."

Exelon Nuclear, based in Warrenville, operates the Clinton nuclear plant and five others in Illinois. AmerGen owns the Clinton plant; AmerGen is owned by Exelon and British Energy.

Ortciger, director of the state Nuclear Safety Department, said Exelon Nuclear was prepared to reopen two small portions of the lake to boat traffic, but his department questioned the move in an Oct. 24 meeting.

"What we had asked was, 'What has changed since Sept. 11 that we should open up that portion of the lake?' " said Ortciger.

He said Exelon Nuclear and the Illinois Department of Natural Resources agreed to talk about what type of security barriers need to be installed before the lake is reopened.

While plant security is a primary concern, Ortciger said the state also is concerned about how businesses around the lake are faring. He said that all parties want to get plans in place to possibly reopen the lake, or portions of it, by this spring.

A number of state representatives have become involved in the issue. State Rep. Jonathan Wright, R-Hartsburg, met with Jurgens and other business owners in DeWitt this past Tuesday.

"We're all trying to find the right balance between security and normalcy, and we're all struggling," Wright said.

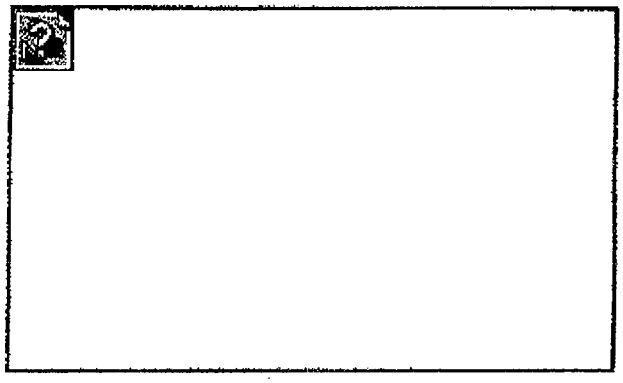
"Clinton is a microcosm of what's going on in the nation."

END OF ELECTRONIC EXHIBIT DOCUMENT

Oconee CRDM Nozzle Cracking

[Alloy-600 Generic Issues | Summer Hot Leg | Nuclear Reactors | NRC Home Page]

Overview



On February 18, 2001, a routine visual inspection of the Oconee Unit 3 Reactor Pressure Vessel head revealed small accumulations of boric acid at the base of several control rod drive mechanism (CRDM) nozzle penetrations. Boric acid deposits were identified around nine of the sixty-nine total CRDM nozzles. The deposit around each of the CRDM nozzles was estimated to be no more than a few cubic inches. Non-destructive testing (NDT) of the nine degraded CRDM nozzles identified a total of 47 recordable crack indications. Dye-penetrant testing (PT) performed in connection with nozzle weld repairs revealed the presence of significant circumferential cracks in two of the nozzles. These cracks extended about 120 and 150 degrees around the circumference of the nozzles above and approximately parallel to the weld. Laboratory analysis confirmed that the cracks initiated from the outside diameter of the nozzle in the nozzle-to-head annulus above the weld. Nine additional nozzles were examined and found to be free of recordable crack indications. The licensee repaired the affected nozzles and restarted Unit 3 on April 24, 2001.

For detailed description of this event please see Information Notice 2001-05 and Licensee Event Report 287/2001-001, Revision 0.

NIRS EXHIBIT 2.1.1 A

EXHIBIT 2.1.1B

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D. C. 20555-0001

April 30, 2001

NRC INFORMATION NOTICE 2001-05: THROUGH-WALL CIRCUMFERENTIAL CRACKING OF REACTOR PRESSURE VESSEL HEAD CONTROL ROD DRIVE MECHANISM PENETRATION NOZZLES AT OCONEE NUCLEAR STATION, UNIT 3

Addressees

All holders of operating licenses for pressurized water nuclear power reactors except those who have ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to the recent detection of through-wall circumferential cracks in two of the control rod drive mechanism (CRDM) penetration nozzles and weldments at the Oconee Nuclear Station, Unit 3 (ONS3).

It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific actions or written response is required.

Description of Circumstances

On February 18, 2001, with ONS3 in Mode 5, Duke Energy Corporation (the licensee) performed a visual examination (VT-2) of the outer surface of the unit's reactor pressure vessel (RPV) head to inspect for indications of borated water leakage. This RPV head inspection was performed as part of a normal surveillance during a planned maintenance outage. The VT-2 revealed the presence of small amounts of boric acid residue in the vicinity of nine of the 69 CRDM penetration nozzles (Figures 1 and 2). Subsequent nondestructive examinations (NDEs) identified 47 recordable crack indications in these nine degraded CRDM penetration nozzles. The licensee initially characterized these flaws as either axial or below-the-weld circumferential indications, and initiated repairs of the degraded areas. NDEs of nine additional CRDM penetration nozzles from the same heat of material were conducted for "extent of condition" purposes, but did not detect recordable indications.(1)

Subsequent dye-penetrant testing (PT) revealed additional indications in two of the nine degraded penetration nozzles. While affecting further repairs of these indications, the licensee identified that each

nozzle had significant circumferential cracks in the nozzle above the weld. Further investigations and metallurgical examinations revealed that these cracks had initiated from the outside diameter (OD) of the CRDM penetration nozzles. The circumferential crack in the #56 CRDM nozzle was through-wall, and the #50 nozzle had pin hole through-wall indications. These cracks followed the weld profile contour, and were nearly 165° in length.

The licensee stated that pre-repair ultrasonic testing (UT) examinations had identified indications in these areas during the initial inspections, but these indications had been misinterpreted as craze cracking with unusual characteristics. The characterization for these two nozzle indications was revised after the initial post-repair PT examinations. The licensee concluded that the root cause for the CRDM penetration nozzle cracking was primary water stress corrosion cracking (PWSCC). This conclusion was based on metallurgical examinations, crack location and orientation, and finite element analyses.

Discussion

The 69 CRDM nozzles at ONS3 are approximately 5 feet long and are J-groove welded to the inner radius of the RPV head, with the lower end of each nozzle extending about 6 inches below the inside of the RPV head (see Figure 2). The nozzles are constructed from 4-inch OD Alloy 600 Inconel procured in accordance with the requirements of Specification SB-167, Section II to the 1965 Edition (including Addenda through Summer 1967) of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code. During initial construction, each nozzle was machined to final dimensions to assure a match between the RPV head bore and the OD of the nozzle. The nozzles were shrink-fit by cooling to at least minus 140 degrees F, inserted into the closure head penetration, and then allowed to warm to room temperature (70 degrees F minimum). The CRDM nozzles were tack-welded and then permanently welded to the closure head using 182-weld metal (see Figure 2). The shielded manual metal arc welding process was used for both the tack weld and the J-groove weld. During weld buildup, the weld was ground and PT inspected at each 9/32 inch of the weld. The final weld surface was ground and PT inspected. The weld prep for installation of each nozzle in the RPV head was accomplished by machining and buttering the J-groove with 182-weld metal.

Axial cracking in pressurized water reactor (PWR) CRDM nozzles has been previously identified, evaluated, and repaired. Numerous small-bore Alloy 600 nozzles and pressurizer heater sleeves have experienced leaks attributed to PWSCC. Generally, these components are exposed to temperatures of 600 degrees F or higher and to primary water, as are the ONS3 CRDM nozzles. However, circumferential cracks above the weld from the OD to the inside diameter (ID) have not been previously identified in the U.S.

An action plan was implemented by the NRC staff in 1991 to address PWSCC of Alloy 600 vessel head penetrations (VHPs) at all U.S. PWRs. This action plan included a review of the safety assessments by the PWR owners groups (Westinghouse Owners Group, Combustion Engineering Owners Group, and Babcock & Wilcox Owners Group) submitted for staff review on June 16, 1993, by the Nuclear Management and Resource Council (NUMARC, now the Nuclear Energy Institute [NEI]).

After reviewing the industry's safety assessments and examining the overseas inspection findings, the NRC staff concluded, in a safety evaluation (SE) dated November 19, 1993, that PWR CRDM nozzle and weld cracking was not an immediate safety concern. The bases for this conclusion were that if PWSCC occurred (1) the cracks would be predominately axial in orientation, (2) the axial cracks would result in detectable leakage before catastrophic failure, and (3) the leakage would be detected during visual examinations performed as part of surveillance walkdown inspections before significant damage to

the RPV head would occur. However, the NRC staff noted concerns about potential circumferential cracking (which would need to be addressed on a plant-specific basis), high residual stresses from initial manufacture and from tube straightening sometimes done after welding, and the need for enhanced leakage monitoring.

By letter dated March 5, 1996, NEI submitted a white paper entitled "Alloy 600 RPV Head Penetration Primary Stress Corrosion Cracking," which reviewed the significance of PWSCC in PWR VHPs, described how the PWR licensees were managing the issue. NEI assumed that the issue was primarily an economic issue rather than a safety issue, and described an economic decision tool to be used by PWR licensees to evaluate the probability of a VHP developing a crack or a through-wall leak during a plant's lifetime. This information would then be used by a PWR licensee to evaluate the need to conduct a VHP inspection at their plant.

To verify the conclusions in the industry's safety assessments, sampling inspections were performed at three PWR units in 1994. The results of these domestic inspections were consistent with the February 1993 analyses by the PWR owners groups, the staff's November 19, 1993, SE, and the PWSCC found in European reactors. On the basis of the results of the first five inspections of U.S. PWRs, the PWR owners groups' analyses, and the European experience, the NRC staff determined that it was probable that CRDM penetrations at other plants contained similar axial cracks, but that such cracking did not pose an immediate- or near-term safety concern. Further, the NRC staff recognized that the scope and timing of inspections may vary for different plants, depending on their individual susceptibility to this form of degradation. In the long term, however, the staff determined that degradation of the CRDM and other RPV head penetrations is an important safety consideration because of the possibility of (1) exceeding the ASME Code safety margins if the cracks are sufficiently deep and continue to propagate during subsequent operating cycles and (2) eliminating a layer of defense in depth for plant safety.

On April 1, 1997, NRC issued Generic Letter (GL) 97-01, "Degradation of Control Rod Drive Mechanism Nozzle and Other Vessel Closure Head Penetrations," which requested addressees to inform the staff of their inspection activities related to VHPs. Based on the industry's GL 97-01 response, which took credit for periodic inspections of the RPV head, the staff agreed that the conclusions in its November 19, 1993, SE remained valid.

The recent identification of significant circumferential cracking of two CRDM nozzles at ONS3 raises concerns about a potentially risk-significant generic condition affecting all domestic PWRs. RPV head penetrations, including CRDM nozzles, provide the function of maintaining the reactor coolant system (RCS) pressure boundary. Cracking of CRDM nozzles and welds is a degradation of the primary RCS boundary. Industry experience has shown that Alloy 600 is susceptible to stress corrosion cracking (SCC). Further, the environment in the CRDM housing annulus will likely be far more aggressive after any through-wall leakage, because potentially highly concentrated borated primary water will become oxygenated, increasing crack growth rates.

The repair activities at ONS3 were extensive. The licensee stated that all flaws would be removed entirely from both weld material and nozzle base metal and repaired prior to plant restart. The licensee plans to perform a thorough visual inspection of the Unit 2 RPV head penetrations during the next outage and is investigating the eventual replacement of the RPV heads on all three units to prevent recurrence of this event. Foreign PWRs in France and Japan have already replaced a number of their RPV heads.

The NRC held a public meeting with the Electric Power Research Institute (EPRI) Materials Reliability Project (MRP) personnel on April 12, 2001, to discuss CRDM nozzle circumferential cracking issues.

During the meeting, the industry representatives said that they were developing a generic safety assessment, recommendations for revisions of near-term inspections, and long-term inspection and flaw evaluation guidelines.

The ONS3 cracking reinforces the importance of examining the upper PWR RPV head area (e.g., visual under-the-insulation examinations of the penetrations for evidence of borated water leakage or volumetric examinations of the CRDM nozzles) and of using appropriate NDE methods (e.g., UT, ET, PT, etc.) to adequately characterize cracks. Presently, licensees are not required to remove RPV head insulation to visually inspect the head penetrations; however, some licensees have recently performed expanded VT-2 examinations by using cameras to inspect between the CRDM nozzles and the insulation.

The NRC has recently developed a Web page to keep the public informed of generic activities on PWR Alloy 600 weld cracking (http://www.nrc.gov/NRC/REACTOR/MRP/index.html). The NRC will update this Web page and assess the need for further generic action as new information becomes available.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

Related Generic Communications

- Generic Letter 88-05, "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants," March 17, 1988
- Generic Letter 97-01, "Degradation of Control Rod Drive Mechanism Nozzle and Other Vessel Closure Head Penetrations," April 1, 1997
- Information Notice 90-10, "Primary Water Stress Corrosion Cracking of INCONEL 600," February 23, 1990
- Information Notice 96-11, "Ingress of Demineralizer Resins Increases Potential for Stress Corrosion Cracking of Control Rod Drive Mechanism Penetrations," February 14, 1996
- NUREG/CR-6245, "Assessment of Pressurized Water Reactor Control Rod Drive Mechanism Nozzle Cracking," October 1994

/RA/

Ledyard B. Marsh, Chief
Events Assessment, Generic Communications and Non-Power Reactors Branch
Division of Regulatory Improvement Programs
Office of Nuclear Reactor Regulation

Technical contacts: Ian Jung, NRR
301-415-1837
E-mail: ixj@nrc.gov

James Medoff, NRR
301-415-2715
E-mail: jxm@nrc.gov

C. E. (Gene) Carpenter, NRR
301-415-2169
E-mail: cec@nrc.gov

Attachments: 1. Figure 1: Oconee Reactor Pressure Vessel Head Map
2. Figure 2: Oconee CRDM Nozzle Penetration (Typical) 3. List of Recently Issued NRC Information Notices

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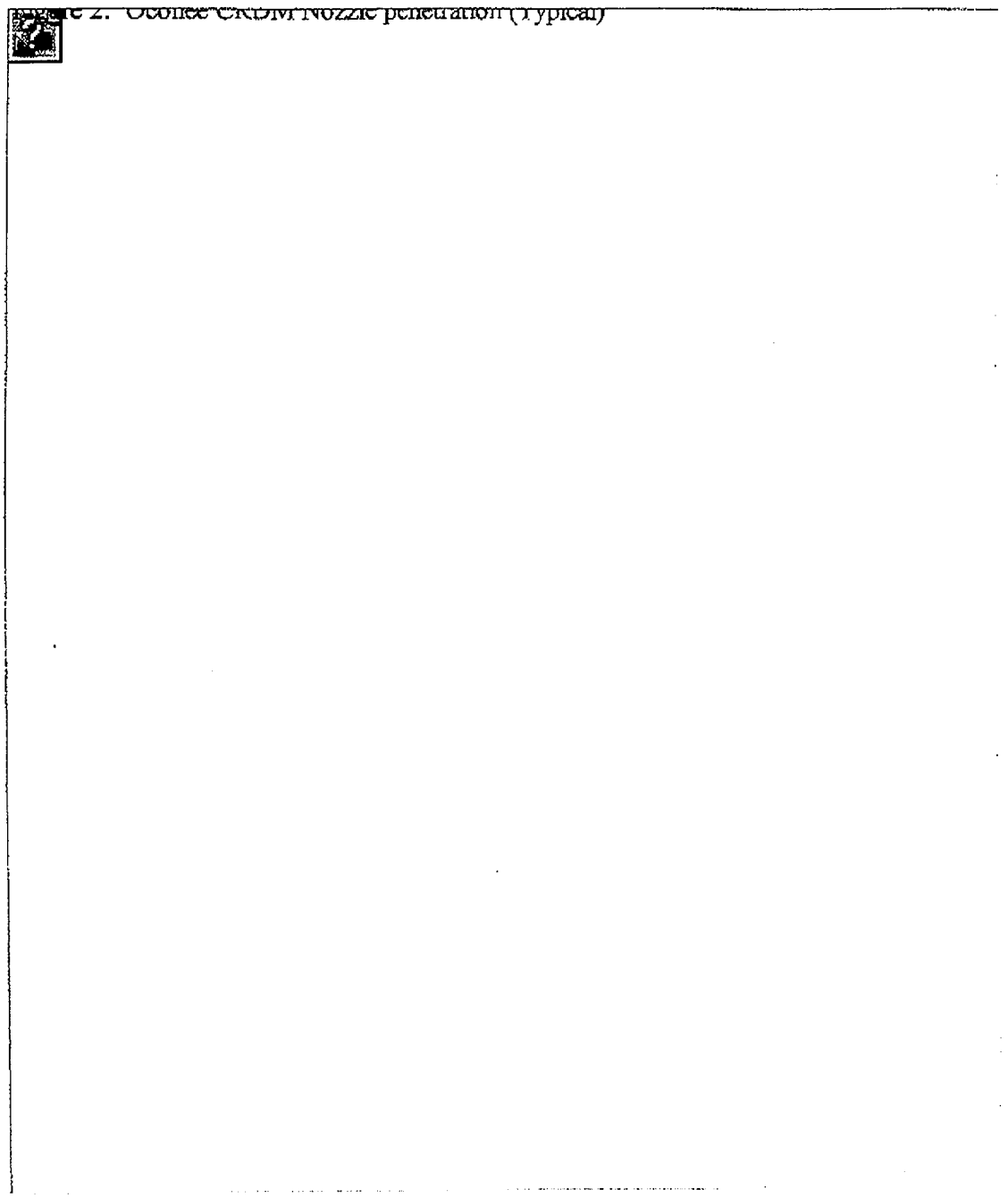
(ADAMS Accession Number ML011160588)

Figure 1: Oconee Reactor Pressure Vessel Head Map

Figure 2: Oconee CRDM Nozzle Penetration (Typical)



1. Axial flaws are flaws that propagate along the inside or outside diameter length of the CRDM nozzle. Below-the-weld circumferential indications are apparent flaws oriented around the circumference of the nozzle, beneath the RPV head and below the area where the nozzle is welded to the RPV head. A recordable indication is one that exceeds the NDE acceptance criteria.

November 29, 2001

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY LICENSING BOARD

In the Matter of	)	
	)	
DUKE ENERGY CORPORATION	)	Docket Nos. 50-369, 370, 413 and 414
	)	
(McGuire Nuclear Station,	)	
Units 1 and 2, and	)	
Catawba Nuclear Station	)	
Units 1 and 2)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of "AMENDED PETITION TO INTERVENE and REPLY TO ARGUMENTS WITH RESPECT TO STANDING" and "CONTENTIONS OF NUCLEAR INFORMATION AND RESOURCE SERVICE" and "MOTION TO SUSPEND LICENSE RENEWAL PROCEEDING PENDING PUBLIC RELEASE OF FINAL SAFETY ANALYSIS REPORTS" and "COMPILED EXHIBITS ASSOCIATED WITH NUCLEAR INFORMATION & RESOURCE SERVICE CONTENTIONS WITH RESPECT TO DUKE LICENSE RENEWAL" in the above-captioned proceeding have been served on the following parties by this 29th day of November, 2001 as ordered on November 15th: hard copy delivered to Parties, by electronic transmission to all, and by US First Class mail to others on the distribution list. Signed originals have been sent by US First Class mail to the Office of the Secretary, including signed original Declaration of Jess Riley and a copy of the previously docketed Declaration of Phyllis St. Clair both of which are also included in the delivery and US Mail distributions since neither is available in electronic format. Additionally, hard copies of other Exhibits have also been provided by delivery and US First Class mail, since they are not available for electronic transmission.

Ann Marshall Young, Chair*
Administrative Judge
Atomic Safety and Licensing Board
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Lisa F. Vaughn, Esq.
Legal Dept. (PBO5E)
Duke Energy Corporation
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Charlotte, NC 28201-1006
(E-mail: lfVaughn@duke-energy.com)

signed

Mary Olson
Nuclear Information & Resource Service
Southeast Office, Asheville, NC

This 29th Day of November, 2001

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

ATOMIC SAFETY AND LICENSING BOARD PANEL

Before Administrative Judges:

Ann Marshall Young, Chair
Dr. Charles N. Kelber
Lester S. Rubenstein

In the Matter of	Docket No's. 50-369-LR, 50-370-LR, 50-413-LR, and 50-414-LR
DUKE ENERGY CORPORATION	ASLBP No. 02-794-01-LR
(McGuire Nuclear Station, Units 1 and 2, Catawba Nuclear Station, Units 1 and 2)	NOVEMBER 29, 2001

COMPILED EXHIBITS ASSOCIATED WITH NUCLEAR INFORMATION & RESOURCE SERVICE CONTENTIONS WITH RESPECT TO DUKE LICENSE RENEWAL

SUPPLEMENTED BY ADDITIONAL NON-ELECTRONIC EXHIBITS HAND DELIVERED 11/29/2001

EXHIBIT 1.2.3

----- Forwarded by Mark A Cantrell/R4/FWS/DOI on 11/09/01 01:12 PM -----

Mark A Cantrell
11/05/01 03:57 PM

To: jhwl@nrc.gov
cc:
Subject: Comments on McGuire Units 1 & 2

Jim:

Here are comments on McGuire license renewal.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Asheville Field Office
160 Zillicoa Street
Asheville, North Carolina 28801
November 1, 2001

Ms. Cynthia A. Carpenter, Chief
Risk Informed Initiatives, Environmental,
Decommissioning, and Rulemaking Branch
Division of Nuclear Regulatory Improvement Programs
Office of Nuclear Reactor Regulation
Nuclear Regulatory Commission
Washington, DC 20555-0001

Dear Ms. Carpenter:

Subject: McGuire Nuclear Station, Units 1 and 2, License Renewal Project, Mecklenburg County, North Carolina (Docket Nos. 50-369 and 50-370)

We received your letter of October 15, 2001, requesting our comments relative to endangered and threatened species and the subject project. We are providing the following comments in accordance with the provisions of Section 7 of the Endangered Species Act of 1973, as amended (16 U.S.C. 1531-1543) (Act); the Fish and Wildlife Coordination Act, as amended (16 U.S.C. 661-667e); the Bald Eagle Protection Act of 1940 (16 U.S.C. 668-668d); and the Migratory Bird Treaty Act of 1918 (16 U.S.C. 703-712).

According to your letter, the Nuclear Regulatory Commission (NRC) is evaluating an application for renewal of Duke Energy Corporation's license for operation of the McGuire Nuclear Station, Units 1 and 2. According to Duke Energy's application, Duke has not identified any major refurbishment activities; therefore, the license renewals would primarily involve an evaluation of the impacts of continued operation for another 20 years.

Endangered Species

Species in the Project Areas. Enclosed is a list of federally endangered, threatened, and candidate species; designated critical habitat; and Federal species of concern known from Gaston, Lincoln, and Mecklenburg Counties. Federal species of concern are not legally protected under the Act and are not subject to any of its provisions, including Section 7, unless they are formally proposed or listed as endangered or threatened. Since the term of the proposed license renewals may span 20 years, we are including these species in our response to give you advance notification. We do not have records of any listed species from the footprint of the project as depicted on your map.

We do have records of Schweinitz's sunflower (Helianthus schweinitzii), a federally endangered plant species, and Georgia aster (Aster georgianus), a plant species that is currently a candidate for listing as endangered. Both of these plants occur in areas that are likely to be affected, directly and indirectly, by this project. Helianthus schweinitzii occurs in relatively open habitats--road/power line rights-of-way, early successional fields, forest ecotonal margins, forest clearings, etc. Aster georgianus is a perennial that occurs in dry open woods along roadsides, woodland borders, old fields, and pastures

We also have records of the threatened American bald eagle (Halieetus leucocephalus) from the Catawba River area, with nests at Lake Wylie (downstream of the project) and Lake James (upstream of the project). Additionally, foraging and migratory eagles are observed during many times of the year at Lake Norman, near the McGuire units.

Conservation Measures. Section 7(a)(1) of the Act directs Federal agencies to utilize their authorities to further the purposes of the Act by carrying out conservation programs for the benefit of endangered and threatened species. "Conservation recommendations" are discretionary agency activities to minimize or avoid the adverse effects of a proposed action to a listed species or critical habitat, to help implement recovery plans, or to develop information that will help better understand the species.

We request that the following conservation recommendations be considered for inclusion by NRC as part of the license renewals:

(1) Duke Power should develop and maintain a detailed map and description of listed species within its project boundaries and rights-of-way.

(2) Duke Power should develop a comprehensive management plan for listed species within its rights-of-way and on their land within the area of this project. Issues that should be addressed include protection, monitoring, and management. A complete map of all known locations of listed species on Duke Power's property should be provided. A regular monitoring plan should be developed and implemented. Appropriate management prescriptions should be developed with the assistance of species experts.

Other Concerns

Migratory Birds. We are concerned about the potential effects of this project on raptors; therefore, we recommend transmission line designs that prevent arcing and flight hazards to raptors. If the transmission lines and other facilities are not already outfitted to reduce potential impacts to raptors, three-phase lines should be "raptor-proofed" with one of the following design modifications:

(1) Separation of phases - This can be accomplished by either lowering the cross arm, using a longer cross arm, or raising the center phase on a pole-top extension. The objective is to separate the phases by at least 60 inches to prevent raptors from making skin-to-skin contact with any two phases.

(2) Insulation - An alternative to vertical separation of phases is to install conductor insulation (commonly, pvc tubing), extending a minimum of 36 inches on either side of the pole-top insulator. This alternative should also include the replacement of metal cross arm braces with wooden or other nonconductive braces.

River and other wetland crossings should be avoided whenever possible. Where unavoidable, lines crossing wetlands should be constructed to maximize visibility of the line to raptors by one of the following design modifications: (1) remove the static line, (2) enlarge the static line to improve visibility to raptors, or (3) mount aviation balls or similar markers on the static line.

What measures can NRC and the licensee incorporate in the project to enhance the project area for waterfowl, raptors, and other migratory birds? Does the licensee have other land that it could set aside for the purposes of enhancing the project area for migratory birds and to mitigate for continued impacts (direct, indirect, and cumulative) to migratory birds and other wildlife?

Aquatic Impacts. What are the impacts of the water intakes on fish entrainment and impingement? What measures can the licensee incorporate into the project to minimize, or mitigate for, these impacts? What measures can the licensee incorporate to minimize, or mitigate for, the impacts of the reservoir and thermal discharges to native aquatic assemblages.

Please keep Mr. Mark Cantrell of our staff apprised of the progress on this project (telephone 828/258-3939, Ext. 227). In any future correspondence pertaining to this matter, please reference our Log Number 4-2-00-120.

Sincerely,

-original signed-

Brian P. Cole
State Supervisor

Enclosure

cc:
Mr. Terence N. Martin, Team Leader, Natural Resources Management, Office of Environmental Policy and Compliance, U.S. Department of the Interior, Office of the Secretary, Washington, DC 20240
Mr. William M. Miller, Duke Power, Environment, Health & Safety, 522 South Church Street, P.O. Box 1006, Charlotte, NC 28201-1006
Mr. Chris Goudreau, Hydropower Relicensing Coordinator, North Carolina Wildlife Resources Commission, 645 Fish Hatchery Road, Marion, NC 28752-9229

---

thanks,

Mark A. Cantrell
U.S. Fish & Wildlife Service
160 Zillicoa Street
Asheville, NC 28801
828/258-3939, ext 227
mark_a_cantrell@fws.gov

"Our mission is working with others to conserve, protect, and enhance fish, wildlife, and plants and their habitats for the continuing benefit of the American people."

Exhibit 2.2.1(g)

"Up the creek at Clinton Lake"

http://www.news-gazette.com/ngsearch/story.cfm?number=10435

By MIKE MONSON
Published Online November 04, 2001

DEWITT – Ed Jurgens and his wife, Laurie, bought the Good Times Bait Shop in DeWitt last July with the idea of making a fresh start.

Jurgens had been working in a machine shop in Crystal Lake, but was laid off in May. Tired of working for other people, he bought the bait shop along Illinois 54, only a few miles from Clinton Lake.

"I was tired of working for someone else and being treated like garbage, like these corporations do any more," he said.

But the terrorist attacks on Sept. 11 dramatically changed Jurgens' business fortunes for the worse – as it did those of a number of other

businesses in DeWitt, Farmer City, DeLand and Clinton that cater to boaters who use Clinton Lake.

After the terrorists struck, the U.S. Nuclear Regulatory Commission advised all nu-clear power plants to move to their highest level of security.

Exelon Nuclear, which ope-rates the Clinton nuclear power plant and owns the sprawl- ing, 5,000-acre Clinton Lake, promptly ordered all boats off the lake and closed it.

It remains closed to this day, nearly two months later.

The power plant uses water from the lake to cool the reactor core.

The closure is causing economic hardship for a number of businesses that cater to boaters, who value Clinton Lake because of its size and its lack of restrictions on boat horsepower. Some business owners say they'll have to shut down if the lake isn't reopened by next spring.

Those business owners are lobbying state legislators and Exelon Nuclear to consider reopening at least portions of the lake. But movement toward a reopening was halted on Oct. 24, when the Illinois Department of Nuclear Safety questioned plans to reopen small portions of the lake. Another blow came Monday, when U.S. Attorney General John Ashcroft warned that additional terrorist attacks were possible.

Along with Ashcroft's warning, the Nuclear Regulatory Commission on Monday suggested that nuclear power plants strengthen perimeter security and site security staff and urged them to request the assistance of local and state police and even the National Guard, if necessary, said Sue Gagner, a spokeswoman for the Nuclear Regulatory Commission.

A News-Gazette photographer who went to the Clinton plant Wednesday encountered armed guards carrying M-16 rifles and wearing flak jackets, and concrete barriers directing traffic to a checkpoint. An Illinois State police

patrol car was also visible.

Tom Ortciger, director of the Illinois Department of Nuclear Safety, confirmed that state police have been stationed this week at all six nuclear plants in Illinois.

"They're where they should be," he said.

Gov. George Ryan on Friday ordered Illinois National Guard troops to guard the state's nuclear power plants as well.

Also, the Federal Aviation Administration this week temporarily banned private airplanes from flying within 11.5 miles of the country's 86 nuclear power plants, including the Clinton plant.

The latest developments are discouraging to business owners like Jurgens, who says his business is down 60 percent and only staying afloat at all because of fishermen who fish from the shore.

"I'm into it up to my elbows," he said. "I have no choice but to make a go. If I could do it over, I never would have bought the business. But I'm stuck."

Other businesses also report declines in sales.

Gilbert Kirby, owner of Gibby's Marine Repair in Parnell, along Illinois 54, said he relies heavily on drive-by traffic and that with the lake closed, he has lost that boat repair business. He has been able to get by because a number of boat owners have asked him to winterize their boats early.

But if the lake isn't reopened by next spring, Kirby predicts boaters will

move on to another lake, such as Lake Shelbyville, and a number of businesses will close their doors.

Richard Douglas, owner of the Sunset Inn & Suites in Clinton, said he has lost about 25 percent of his normal fall business since Sept. 11. The loss of fishing tournaments has hurt particularly, he said.

"Every time we have a nice weekend, the boaters would have been out," he said.

Doris Reynolds, co-owner of the DeWitt Country Store, a bar and grill, said she has lost more than 50 percent of her business since the lake's closure.

"It's dropped my food sales, my bar sales, it's dropped my bait sales," she said. "All we've got now is your steadies and shore fishermen."

Carolyn Sanders, bookkeeper for the Dockside Marina, said the lake's closure has killed the marina's fall business, which depends heavily on gas sales and boat rentals.

Clinton Mayor Tom Ed-munds said that he understands the need to balance security with the needs of local business. But he said it's important that planning for enhanced security begin now so that the lake, or major portions of it, can reopen next spring.

Edmunds – along with a number of the local business owners – argue that there is a way to protect the plant without closing most of the lake. They said that barriers could be installed north of the plant at the Illinois 54 bridge and south of the plant at what is known as Illinois Power point or beach, where the lake narrows to about 200 yards across.

"This would give them two miles of water to block off permanently if they choose," said DeWitt resident Joe Vandervort, who owned the Good Times Bait Shop before selling it this summer to Jurgens.

Such a move would still leave about 15 miles of the v-shaped lake open, the business owners say.

But state and Exelon Nuclear officials say that it's too early to say when or how much of the lake can reopen, particularly in light of this week's warnings.

Exelon Nuclear spokeswoman Ann Mary Carley said the company is looking at different options for reopening portions of the lake, but she declined to go into specifics.

"We're continuing to work on it," she said. "We're looking at different options. We don't have all the details worked out, and we won't announce anything until we have."

Exelon Nuclear, based in Warrenville, operates the Clinton nuclear plant and five others in Illinois. AmerGen owns the Clinton plant; AmerGen is owned by Exelon and British Energy.

Ortciger, director of the state Nuclear Safety Department, said Exelon Nuclear was prepared to reopen two small portions of the lake to boat traffic, but his department questioned the move in an Oct. 24 meeting.

"What we had asked was, 'What has changed since Sept. 11 that we should open up that portion of the lake?' " said Ortciger.

He said Exelon Nuclear and the Illinois Department of Natural Resources agreed to talk about what type of security barriers need to be installed before the lake is reopened.

While plant security is a primary concern, Ortciger said the state also is

concerned about how businesses around the lake are faring. He said that all parties want to get plans in place to possibly reopen the lake, or portions of it, by this spring.

A number of state representatives have become involved in the issue. State Rep. Jonathan Wright, R-Hartsburg, met with Jurgens and other business owners in DeWitt this past Tuesday.

"We're all trying to find the right balance between security and normalcy, and we're all struggling," Wright said.

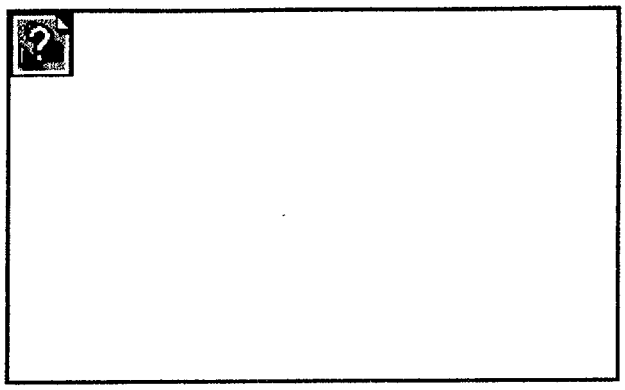
"Clinton is a microcosm of what's going on in the nation."

END OF ELECTRONIC EXHIBIT DOCUMENT

Oconee CRDM Nozzle Cracking

[Alloy-600 Generic Issues | Summer Hot Leg | Nuclear Reactors | NRC Home Page]

Overview



On February 18, 2001, a routine visual inspection of the Oconee Unit 3 Reactor Pressure Vessel head revealed small accumulations of boric acid at the base of several control rod drive mechanism (CRDM) nozzle penetrations. Boric acid deposits were identified around nine of the sixty-nine total CRDM nozzles. The deposit around each of the CRDM nozzles was estimated to be no more than a few cubic inches. Non-destructive testing (NDT) of the nine degraded CRDM nozzles identified a total of 47 recordable crack indications. Dye-penetrant testing (PT) performed in connection with nozzle weld repairs revealed the presence of significant circumferential cracks in two of the nozzles. These cracks extended about 120 and 150 degrees around the circumference of the nozzles above and approximately parallel to the weld. Laboratory analysis confirmed that the cracks initiated from the outside diameter of the nozzle in the nozzle-to-head annulus above the weld. Nine additional nozzles were examined and found to be free of recordable crack indications. The licensee repaired the affected nozzles and restarted Unit 3 on April 24, 2001.

For detailed description of this event please see Information Notice 2001-05 and Licensee Event Report 287/2001-001, Revision 0.

NIRS EXHIBIT 2.1.1 A

EXHIBIT 2.1.1 B

UNITED STATES
NUCLEAR REGULATORY COMMISSION
OFFICE OF NUCLEAR REACTOR REGULATION
WASHINGTON, D. C. 20555-0001

April 30, 2001

NRC INFORMATION NOTICE 2001-05: THROUGH-WALL CIRCUMFERENTIAL CRACKING OF REACTOR PRESSURE VESSEL HEAD CONTROL ROD DRIVE MECHANISM PENETRATION NOZZLES AT OCONEE NUCLEAR STATION, UNIT 3

Addressees

All holders of operating licenses for pressurized water nuclear power reactors except those who have ceased operations and have certified that fuel has been permanently removed from the reactor vessel.

Purpose

The U.S. Nuclear Regulatory Commission (NRC) is issuing this information notice to alert addressees to the recent detection of through-wall circumferential cracks in two of the control rod drive mechanism (CRDM) penetration nozzles and weldments at the Oconee Nuclear Station, Unit 3 (ONS3).

It is expected that recipients will review the information for applicability to their facilities and consider actions, as appropriate. However, suggestions contained in this information notice are not NRC requirements; therefore, no specific actions or written response is required.

Description of Circumstances

On February 18, 2001, with ONS3 in Mode 5, Duke Energy Corporation (the licensee) performed a visual examination (VT-2) of the outer surface of the unit's reactor pressure vessel (RPV) head to inspect for indications of borated water leakage. This RPV head inspection was performed as part of a normal surveillance during a planned maintenance outage. The VT-2 revealed the presence of small amounts of boric acid residue in the vicinity of nine of the 69 CRDM penetration nozzles (Figures 1 and 2). Subsequent nondestructive examinations (NDEs) identified 47 recordable crack indications in these nine degraded CRDM penetration nozzles. The licensee initially characterized these flaws as either axial or below-the-weld circumferential indications, and initiated repairs of the degraded areas. NDEs of nine additional CRDM penetration nozzles from the same heat of material were conducted for "extent of condition" purposes, but did not detect recordable indications.(1)

Subsequent dye-penetrant testing (PT) revealed additional indications in two of the nine degraded penetration nozzles. While affecting further repairs of these indications, the licensee identified that each

nozzle had significant circumferential cracks in the nozzle above the weld. Further investigations and metallurgical examinations revealed that these cracks had initiated from the outside diameter (OD) of the CRDM penetration nozzles. The circumferential crack in the #56 CRDM nozzle was through-wall, and the #50 nozzle had pin hole through-wall indications. These cracks followed the weld profile contour, and were nearly 165° in length.

The licensee stated that pre-repair ultrasonic testing (UT) examinations had identified indications in these areas during the initial inspections, but these indications had been misinterpreted as craze cracking with unusual characteristics. The characterization for these two nozzle indications was revised after the initial post-repair PT examinations. The licensee concluded that the root cause for the CRDM penetration nozzle cracking was primary water stress corrosion cracking (PWSCC). This conclusion was based on metallurgical examinations, crack location and orientation, and finite element analyses.

Discussion

The 69 CRDM nozzles at ONS3 are approximately 5 feet long and are J-groove welded to the inner radius of the RPV head, with the lower end of each nozzle extending about 6 inches below the inside of the RPV head (see Figure 2). The nozzles are constructed from 4-inch OD Alloy 600 Inconel procured in accordance with the requirements of Specification SB-167, Section II to the 1965 Edition (including Addenda through Summer 1967) of the American Society of Mechanical Engineers (ASME) Boiler and Pressure Vessel Code. During initial construction, each nozzle was machined to final dimensions to assure a match between the RPV head bore and the OD of the nozzle. The nozzles were shrink-fit by cooling to at least minus 140 degrees F, inserted into the closure head penetration, and then allowed to warm to room temperature (70 degrees F minimum). The CRDM nozzles were tack-welded and then permanently welded to the closure head using 182-weld metal (see Figure 2). The shielded manual metal arc welding process was used for both the tack weld and the J-groove weld. During weld buildup, the weld was ground and PT inspected at each 9/32 inch of the weld. The final weld surface was ground and PT inspected. The weld prep for installation of each nozzle in the RPV head was accomplished by machining and buttering the J-groove with 182-weld metal.

Axial cracking in pressurized water reactor (PWR) CRDM nozzles has been previously identified, evaluated, and repaired. Numerous small-bore Alloy 600 nozzles and pressurizer heater sleeves have experienced leaks attributed to PWSCC. Generally, these components are exposed to temperatures of 600 degrees F or higher and to primary water, as are the ONS3 CRDM nozzles. However, circumferential cracks above the weld from the OD to the inside diameter (ID) have not been previously identified in the U.S.

An action plan was implemented by the NRC staff in 1991 to address PWSCC of Alloy 600 vessel head penetrations (VHPs) at all U.S. PWRs. This action plan included a review of the safety assessments by the PWR owners groups (Westinghouse Owners Group, Combustion Engineering Owners Group, and Babcock & Wilcox Owners Group) submitted for staff review on June 16, 1993, by the Nuclear Management and Resource Council (NUMARC, now the Nuclear Energy Institute [NEI]).

After reviewing the industry's safety assessments and examining the overseas inspection findings, the NRC staff concluded, in a safety evaluation (SE) dated November 19, 1993, that PWR CRDM nozzle and weld cracking was not an immediate safety concern. The bases for this conclusion were that if PWSCC occurred (1) the cracks would be predominately axial in orientation, (2) the axial cracks would result in detectable leakage before catastrophic failure, and (3) the leakage would be detected during visual examinations performed as part of surveillance walkdown inspections before significant damage to

the RPV head would occur. However, the NRC staff noted concerns about potential circumferential cracking (which would need to be addressed on a plant-specific basis), high residual stresses from initial manufacture and from tube straightening sometimes done after welding, and the need for enhanced leakage monitoring.

By letter dated March 5, 1996, NEI submitted a white paper entitled "Alloy 600 RPV Head Penetration Primary Stress Corrosion Cracking," which reviewed the significance of PWSCC in PWR VHPs, described how the PWR licensees were managing the issue. NEI assumed that the issue was primarily an economic issue rather than a safety issue, and described an economic decision tool to be used by PWR licensees to evaluate the probability of a VHP developing a crack or a through-wall leak during a plant's lifetime. This information would then be used by a PWR licensee to evaluate the need to conduct a VHP inspection at their plant.

To verify the conclusions in the industry's safety assessments, sampling inspections were performed at three PWR units in 1994. The results of these domestic inspections were consistent with the February 1993 analyses by the PWR owners groups, the staff's November 19, 1993, SE, and the PWSCC found in European reactors. On the basis of the results of the first five inspections of U.S. PWRs, the PWR owners groups' analyses, and the European experience, the NRC staff determined that it was probable that CRDM penetrations at other plants contained similar axial cracks, but that such cracking did not pose an immediate- or near-term safety concern. Further, the NRC staff recognized that the scope and timing of inspections may vary for different plants, depending on their individual susceptibility to this form of degradation. In the long term, however, the staff determined that degradation of the CRDM and other RPV head penetrations is an important safety consideration because of the possibility of (1) exceeding the ASME Code safety margins if the cracks are sufficiently deep and continue to propagate during subsequent operating cycles and (2) eliminating a layer of defense in depth for plant safety.

On April 1, 1997, NRC issued Generic Letter (GL) 97-01, "Degradation of Control Rod Drive Mechanism Nozzle and Other Vessel Closure Head Penetrations," which requested addressees to inform the staff of their inspection activities related to VHPs. Based on the industry's GL 97-01 response, which took credit for periodic inspections of the RPV head, the staff agreed that the conclusions in its November 19, 1993, SE remained valid.

The recent identification of significant circumferential cracking of two CRDM nozzles at ONS3 raises concerns about a potentially risk-significant generic condition affecting all domestic PWRs. RPV head penetrations, including CRDM nozzles, provide the function of maintaining the reactor coolant system (RCS) pressure boundary. Cracking of CRDM nozzles and welds is a degradation of the primary RCS boundary. Industry experience has shown that Alloy 600 is susceptible to stress corrosion cracking (SCC). Further, the environment in the CRDM housing annulus will likely be far more aggressive after any through-wall leakage, because potentially highly concentrated borated primary water will become oxygenated, increasing crack growth rates.

The repair activities at ONS3 were extensive. The licensee stated that all flaws would be removed entirely from both weld material and nozzle base metal and repaired prior to plant restart. The licensee plans to perform a thorough visual inspection of the Unit 2 RPV head penetrations during the next outage and is investigating the eventual replacement of the RPV heads on all three units to prevent recurrence of this event. Foreign PWRs in France and Japan have already replaced a number of their RPV heads.

The NRC held a public meeting with the Electric Power Research Institute (EPRI) Materials Reliability Project (MRP) personnel on April 12, 2001, to discuss CRDM nozzle circumferential cracking issues.

During the meeting, the industry representatives said that they were developing a generic safety assessment, recommendations for revisions of near-term inspections, and long-term inspection and flaw evaluation guidelines.

The ONS3 cracking reinforces the importance of examining the upper PWR RPV head area (e.g., visual under-the-insulation examinations of the penetrations for evidence of borated water leakage or volumetric examinations of the CRDM nozzles) and of using appropriate NDE methods (e.g., UT, ET, PT, etc.) to adequately characterize cracks. Presently, licensees are not required to remove RPV head insulation to visually inspect the head penetrations; however, some licensees have recently performed expanded VT-2 examinations by using cameras to inspect between the CRDM nozzles and the insulation.

The NRC has recently developed a Web page to keep the public informed of generic activities on PWR Alloy 600 weld cracking (http://www.nrc.gov/NRC/REACTOR/MRP/index.html). The NRC will update this Web page and assess the need for further generic action as new information becomes available.

This information notice requires no specific action or written response. If you have any questions about the information in this notice, please contact one of the technical contacts listed below or the appropriate Office of Nuclear Reactor Regulation (NRR) project manager.

Related Generic Communications

- Generic Letter 88-05, "Boric Acid Corrosion of Carbon Steel Reactor Pressure Boundary Components in PWR Plants," March 17, 1988
- Generic Letter 97-01, "Degradation of Control Rod Drive Mechanism Nozzle and Other Vessel Closure Head Penetrations," April 1, 1997
- Information Notice 90-10, "Primary Water Stress Corrosion Cracking of INCONEL 600," February 23, 1990
- Information Notice 96-11, "Ingress of Demineralizer Resins Increases Potential for Stress Corrosion Cracking of Control Rod Drive Mechanism Penetrations," February 14, 1996
- NUREG/CR-6245, "Assessment of Pressurized Water Reactor Control Rod Drive Mechanism Nozzle Cracking," October 1994

/RA/

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Attachments: 1. Figure 1: Oconee Reactor Pressure Vessel Head Map
2. Figure 2: Oconee CRDM Nozzle Penetration (Typical) 3. List of Recently Issued NRC Information Notices

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(ADAMS Accession Number ML011160588)

Figure 1: Oconee Reactor Pressure Vessel Head Map

Figure 2: Oconee CRDM Nozzle Penetration (Typical)

1. Axial flaws are flaws that propagate along the inside or outside diameter length of the CRDM nozzle. Below-the-weld circumferential indications are apparent flaws oriented around the circumference of the nozzle, beneath the RPV head and below the area where the nozzle is welded to the RPV head. A recordable indication is one that exceeds the NDE acceptance criteria.

November 29, 2001

UNITED STATES OF AMERICA
NUCLEAR REGULATORY COMMISSION

BEFORE THE ATOMIC SAFETY LICENSING BOARD

In the Matter of	)	
	)	
DUKE ENERGY CORPORATION	)	Docket Nos. 50-369, 370, 413 and 414
	)	
(McGuire Nuclear Station,	)	
Units 1 and 2, and	)	
Catawba Nuclear Station	)	
Units 1 and 2)	)	

CERTIFICATE OF SERVICE

I hereby certify that copies of "AMENDED PETITION TO INTERVENE and REPLY TO ARGUMENTS WITH RESPECT TO STANDING" and "CONTENTIONS OF NUCLEAR INFORMATION AND RESOURCE SERVICE" and "MOTION TO SUSPEND LICENSE RENEWAL PROCEEDING PENDING PUBLIC RELEASE OF FINAL SAFETY ANALYSIS REPORTS" and "COMPILED EXHIBITS ASSOCIATED WITH NUCLEAR INFORMATION & RESOURCE SERVICE CONTENTIONS WITH RESPECT TO DUKE LICENSE RENEWAL" in the above-captioned proceeding have been served on the following parties by this 29th day of November, 2001 as ordered on November 15th: hard copy delivered to Parties, by electronic transmission to all, and by US First Class mail to others on the distribution list. Signed originals have been sent by US First Class mail to the Office of the Secretary, including signed original Declaration of Jess Riley and a copy of the previously docketed Declaration of Phyllis St. Clair both of which are also included in the delivery and US Mail distributions since neither is available in electronic format. Additionally, hard copies of other Exhibits have also been provided by delivery and US First Class mail, since they are not available for electronic transmission.

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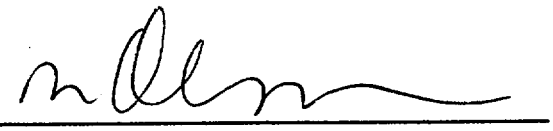

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This 29th Day of November, 2001