BEFORE THE
UNITED STATES NUCLEAR REGULATORY COMMISSION
COMMISSION MEETING
FEBRUARY 20, 2001

NOTES ON THE TECHNICAL STUDY OF SPENT FUEL POOL ACCIDENT RISK AT DECOMMISSIONING NUCLEAR POWER STATIONS COMPLETED OCTOBER, 2000 - ISSUED JANUARY 2001

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Chairman Merserve,
Members of the Commission,

The technical staff is to be commended for undertaking a report that provides a fresh look at spent pool risks. The report is remarkable not only for what it contains by way of information, but also for its acknowledged limits. The study expresses uncertainties with respect to criticality issues under certain circumstances, boral and boraflex failure, fuel slumping, and oxidation reaction (fuel fire) propagation, for example. We look forward to coupling this study with considerations of other significant risks at decommissioning nuclear power stations, including spent fuel pool risks not included in the study, dry cask storage risks, and risks from other decommissioning activities.

The following "notes" are intended to provide some additional basis for incorporating this study in discussion as the process of risk-informed and decommissioning regulation moves forward.

Realistic Assumptions : Real-World Experience

Many of us have experienced events, or read of events similar to those rated as of very low probability in this study. A 14-ton crane component was dropped over twenty feet, for example, during steam generator removal at Maine Yankee. In the real world, the public may find itself asking, " What is the frequency of heavy load drops during decommissioning at Maine Yankee?" Maine Yankee is not singled out because it is an egregious example. The plant is cited throughout these notes only because it is the plant with which the author is most familiar.

Changing externalities

We believe this study would be improved by a sharper look at changing and site-specific externalities, as listed below. Statistically, some externalities may present little risk, but, in practice, they may swamp other variables.

Site specific considerations

- **Severe weather**

The study should take into consideration anticipated changes in severe weather patterns as, increasingly, weather experts are predicting climatic changes resulting in more severe weather phenomena. It is not enough to look back at weather patterns.

- **Air traffic changes**

The report looks at generic air traffic changes, but neglects the fact that there may be significant local changes. If these numbers are to be included at whatever risk level, they should reflect reality. The Maine Yankee site is flown over by heavy military aircraft including tankers and cargo craft. A few years ago coastal Maine was part of low-level heavy aircraft flight exercises. This constitutes an unanalyzed condition.

- **SFPB's and other SFP structures are not seismically qualified**

The seismic fragility of spent fuel transfer tubes, for example, will be assessed on a plant-by-plant basis, but those numbers will apparently not feed back into the study.

- **A foundation partially embedded in bedrock will not limit draindown due to runoff through backfill, piping tunnels, etc**

The degree to which surrounding bed rock is fractured during blasting and excavation is not taken into account when it is credited with limiting or preventing draindown. Runoff can also feed into porous backfill and nearby sumps, drains, piping tunnels, etc.

SFP collateral damage : Aircraft, Wind-driven missiles, Seismic event, Sabotage

NRC analysis does not appear to take into account collateral damage: the "chain-reaction" effect. For example, a collapsing wall might also knock over a fuel handing crane. Saboteurs might damage water supply systems or bring down a building while using an explosive to rupture a fuel transfer tube.

Exacerbating conditions or events which could adversely affect accident mitigation should be more thoroughly examined:

- **Falling crane or wall results in fuel deformation and blocks air or water coolant flow.**

In 1998, we addressed a letter of concern to NRC regarding the fact the south wall of the Maine Yankee SFPB is a masonry wall; not seismically qualified. In the 1980's Maine Yankee had, at NRC's request, analyzed the consequences of that wall's collapse. The analysis yielded two conclusions: (1) the wall falling flat on the fuel would not significantly deform the fuel, and (2) openings below the end caps of the fuel assemblies would be undamaged and so cooling would continue. This presumed a collapse "hinged" at the foot of the wall, or a loose shower of masonry rubble. We asked NRC to look at a wall collapse in which the wall broke in two sections hinged at the base and midline, thus dropping the upper half of the wall in a vertical posture; knife edge, on to the fuel. It was not considered. The prospect of collapsed fuel under a masonry wall in a partially drained pool appears to us to be as likely a scenario as any. We understand that most SFPBs are not seismically qualified.

- **"Kindling" Effect – materials added to SFP under accident conditions ignited by fuel heat, add heat. Ignition temp <combustion temp.**

The staff has responded to this concern albeit in summary fashion under Comment #69 in appendix 6 of the Report. In its response the staff assumes that foreign objects falling into the SFP would be "small" in size and thus would have an insignificant effect on heat input. When this concern was presented we asked about electrical cables, crane components, and other materials from inside the SFPB. I have observe wooden dunnage (large blocks) stacked next to a decommissioning plant SFP. If these objects are not large enough to merit consideration, we should, perhaps, consider the roofing materials from a typical SFPB. Tar or rubber-based composite roofing at 3 to 4 lbs./sq.ft from a nominal 80X 100 ft. section of roof collapsed onto an overheating SFP could yield several thousand lbs of molten tar or rubber compound running through buckled roof plates and down on to fuel. It would likely liquefy at 350 to 400 degrees, ignite at 500 to 600 degrees, and burn at 1200 to 2000 degrees f, potentially adding enough heat to some fuel to push the fuel cladding past rapid oxidation temperatures. . A molten tar coating would also limit heat dispersion from fuel assemblies. In comment #68, the staff allows that sufficient research has not been performed to define clear limits of propagation once some assemblies reach rapid oxidation temperatures.

- **Recovery from draindown may be hindered by collapsed SFPB and/or fire and/or radiation release.**

This is partially addressed by industry commitments to provide a remotely operated source of make-up water. However, there is the real potential that make-up water flushing through an opening in the SFP will carry sufficient

radioactive material to begin producing high doses at its out fall and runoff. There could well be fuel fines from damaged fuel, and Co-60 crud at husky levels in the runoff. A SFPB roof collapsed over the SFP could hinder access; trap and collect radioactive steam, smoke, and gasses. This should be factored in estimating recovery and/ or response times. Estimated doses to workers, emergency personnel, and the public at site boundary from such runoff or collected pockets of radioactive steam and moisture should be included in accident consequence estimates.

- **Offsite conditions following severe seismic event can be expected to hinder SFP draindown response.**

Any seismic event of sufficient force to fracture a SFP will likely be large enough to damage less robust structures, such as bridges, roadways, rail systems, power and communication systems, hospitals, schools and the like. Effective early response from offsite resources should not be counted on or referenced as support in the case of a severe seismic event.

Other issues

Public input

- **NRC responses to public input appear to be dismissive and perfunctory**

Stakeholders do not get a definitive response to concerns until their concerns in restated and abbreviated form appear in the appendices of the draft document or even in the final document. Often the versions of concerns and responses appearing in the final document appendices deviate far afield from the substance and intent of the original comment. NRC does not appear to have in place an orderly or formalized system for directly addressing stakeholder concerns. We have been in an iterative process with respect to risk informing decommissioning for over a year. There has been ample opportunity for the staff to seek clarification on stakeholder issues but they have not dialogued to gain mutual understanding unless it is with the industry.

- **It appears that the public does not have access that is equal or even comparable to industry access.**

We do not deny that the nuclear industry is entitled to pursue their legitimate interest, however from our perspective, the endless round of special meetings and communication is simply overwhelming. Members of the public simply cannot compete for access with the omnipresence of the Nuclear Energy Institute.

For example, consider the following sequence. On September 27th, I asked for a meeting of NRC staff and public stakeholders on the Technical Study of SFP Risk to, "discuss our perspective on decommissioning issues including (but not limited to) risk in externalities, safeguards, emergency preparedness, human error factors, and establishing a common definition of adequate safety."

As I recall, NRC staff called a few weeks later with a request for more specifics regarding the proposed meeting topics. Before I was able to respond, I met with Dr. Michael Masnik and Stuart Richards of NRR at Haddam Neck, CT on October 17th following a Public LTP meeting. I restated my general concerns and those of other stakeholders. I was then advised that many of the concerns that were raised by stakeholders were being addressed in the Technical Study, which was due on the Commissioners desks within a few weeks. I was further advised that it was probably too late for a meeting to affect the content of the report and agreed to wait on the report's issuance.

On November 17th, I received a letter from Dr. Masnik (dated Nov.7th) advising that I needed to present a written list of proposed topics in order to move forward with a meeting. On November 21st I received electronic notice of a meeting between NRC and NEI scheduled for November 27. No topic specifics were provided. I was informed that no correspondence regarding arrangement for this public meeting was available as this meeting was arranged by a phone call.

I am now told that the Commissioners did not receive the Technical Study until on or about December 20th. The Study was not mailed out to stakeholders until January 18th.

Frankly, it did not occur to me to ask for a meeting on the Technical Study contents prior to the February 20th Commission Meeting. I was therefore taken aback to receive expedited notice of a February 6th NEI/NRC to discuss a January 10th report which might, " affect NRC's Technical Study..."

It does not help that some of the issues we wished to discuss, we had also futilely attempted to raise when questions of SFP risk under decommissioning first surfaced at Maine Yankee Atomic Power Station in 1998. It then took over a year to get only some of our questions <u>inadequately</u> answered. I have recounted some of the same issues, also sidestepped in the <u>Technical Study Responses to Comments</u>, elsewhere in this memorandum.

It is not my intention to place blame for our failure to pursue and satisfy our concerns on individuals within NRC. Moreover, it must be realized that is not easy or simple for the agency to elicit a meaningful public dialogue, one made productive by respectful give and take, and one in which there is accountability. In fact the system fails us, in part, because, unlike the nuclear industry, we don't

have the resources to make it work. The system also fails us, in part, because it is murky and Byzantine seeming to be designed so. We believe the NRC will not achieve increased public confidence until it provides a workable system for meaningful public interaction. Although recent efforts at outreach are commendable, we are certainly not there yet.

- **Issues to be considered are not clearly defined at the beginning of the process**

Many public stakeholders who volunteered their time at the beginning of this process were not clearly informed that the only issue at stake was how quickly could a decommissioning plant abandon its offsite preparedness, de-fang its security, and drop most of its liability insurance. Most of us thought it was about making certain that the public would be protected. We thought it was about looking at risk-informing decommissioning. With a facility handling and processing unprecedented amounts of radioactive wastes, would new specific risks and risk levels for the public and the environment emerge? No, it took awhile to get it clear that centerpiece would be a zirc fire study. Public stakeholders would have been better served if NRC had made a schedule, limits of scope, and priorities more clear at the onset.

- **It should be recognized that material resources of public advocacy organizations are meager**

It is obvious that the NRC staff has worked long and hard to produce the risk study and in doing so has consumed a fair quantity of resources. Although the issue of SFP safety is very important, public advocates simply cannot devote in-house resources commensurate with its importance. The quality of the public dialogue certainly suffers and with it, public confidence. Therefore, we have repeatedly asked NRC to consider establishing an office of Public Ombudsman to relieve some of the pressure on public interest advocates by (1) providing information not readily accessible through the PDR, (2) facilitating communication with NRC offices and personnel, (3) assistance in advocacy. We now repeat that request.

Public outreach and information

- **NRC should provide site local media, potentially affected public, and local/state governments with timely, conclusive information**

In Maine, the State Nuclear Safety Advisor delivered the following message to the State's Advisory Commission on Radioactive waste and Decommissioning on February 12, 2001,

> The NRC's Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants, (issued January 17, 2001)

has very little relevance to MY...the NRC's study ...assumed a seismic or cask drop event always results in a zirc fire...[1]

Clearly, had NRC communicated effectively with Miss Craighead, the Commission could have saved itself the trouble of reviewing the ramifications of the Technical Study today, or in the case specific instance of Maine Yankee, in the future. Let it be noted that MY has a fuel transfer tube which enters the SFP below the level of the top of the fuel and MY has a SFP that shares one pool wall with the Primary Auxiliary Building basement. Both of these features are aggravating conditions for draindown potential. Failure of the shared PAB wall could also lead to partial draindown with worse heat-up projections than total draindown.

Ms.Craighead's observations were before a Commission of the Maine Legislature that can, based on the assertions in Ms. Craighead's report, recommend legislative action.
We believe this example illustrative of the need to communicate promptly and accurately with affected parties when issuing a study of strong public interest.

- **NRC should monitor and counter unjustified public assurances of near absolute safety by licensees and/or NRC personnel**

Maine Yankee Atomic Power Company has loudly and often made it clear to the public and to Maine officials, from the onset, that the company's analysis proves a zirc fire is inconceivable at MY. NRC staffers told Maine legislators in my presence following a public meeting in November of 1998 that a draindown of the MY SFP would not result in a zirc fire. That was at the beginning of this process and at a time when off-site emergency systems were being dismantled. If Maine Yankee's analysis is good enough to justify that representation from NRC staff, then why do an expensive technical study? Failing that, why not base the technical study on Maine Yankee's analysis? Surely, something is awry.
We have yet to hear a NRC spokesman proactively advise the public or the media that an industry spokesman is understating a risk.

Recommendations regarding SFP Risk Study

- **Study should be redone or at the least supplemented to incorporate a serious look at the contributing factors and uncertainties detailed above.**

We believe that assertions that NRC target risk levels are met cannot be credibly sustained in the light of significant data missing from the study and uncertainties

[1] Attachment A, State Nuclear Safety Advisor, Paula Craighead, " NRC's Study of Spent Fuel Pool Accident Risk" February 12, 2001, Office of State Nuclear safety advisor, 38 State House Station, Augusta, Maine 04333-00038.

regarding critical factors of accident initiating events, exacerbating conditions, accident mitigation, and accident consequences.

- **Study should not be the only document risk-informing decommissioning with respect to security, insurance, and off-site planning requirements.**

Whatever the accuracy of this study, it does not include considerations of sabotage or other events, such as resin fire, low-level waste fire, or fuel handling accident, with the potential of off site consequences. These must be analyzed under public scrutiny before any credible representations may be made regarding overall risk.

- **Risk-informing decommissioning must account for potential worker exposures and onsite environmental contamination.**
- **Risk-informing decommissioning must include consideration of, and a public report on, the risks and potential consequences of radiological sabotage at SFPs and ISFSIs.**
  This should include use of explosives and/or incendiaries.

NCRP Draft Report SC 46-41 projects the consequences of 100 kg of 5 year-old PWR fuel dispersed by 1000 lbs of TNT to be 450 RADS (4500 milligray) external dose over 2700 Square Kilometers at 24 hours/post-blast with 600 RADS (6000 milligray) in a plume out to 105 kilometers. This dwarfs a 10 kiloton Improvised Nuclear device (dirty bomb) projected to spread a 450 RAD (4500 milligray) external dose over 47 square kilometers. Whatever NRC's confidence in the robust nature of licensed dry cask systems, in light of the above NCRP figures, we cannot help but to conclude casks vulnerable to sufficient explosives to produce lethal offsite doses. We believe this to be real and serious threat to the public health and safety incorporated in real world decommissioning and a threat on which the public is entitled to have the facts.

Thank you for your attention,

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On behalf of the
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ATTACHMENT (1)

State of Maine

OFFICE OF THE STATE NUCLEAR SAFETY ADVISOR

FEBRUARY 12, 2001

NRC's Study of Spent Fuel Pool Accident Risk

The NRC's "Technical Study of Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants" (issued January 17, 2001) has very little relevance to MY. The primary focus of the Study is a chain of events that could conceivably create a zircaloy fire and a risk of radiological release. In order for such a risk to occur, a seismic event, accident or sabotage would have to cause the spent fuel pool to rapidly lose all its water, thereby exposing the spent fuel to air and permitting the fuel to generate enough heat to cause the zircaloy cladding on fuel rods to burn, thus exposing the spent fuel itself to possible dispersion. The possibility of such a zircaloy fire at Maine Yankee under these conditions is so remote as to be almost non-existent.

First, the NRC's study analyzed a generic facility and assumed a seismic or cask drop event always results in a zirc fire. Even with such an extreme assumption (not peer reviewed), the analyzed risk is well below all NRC safety criteria. Second, due to the Maine Yankee design of a spent fuel pool below grade and founded on bedrock, a complete drain down cannot occur and a partial draindown is recoverable.

Third, the Study only addresses spent fuel pool storage, not dry cask storage. The considerations for dry cask storage are dramatically different. The spent fuel (cooled more than five years when transfered to dry cask) has been specifically analyzed to ensure that there is no possibility of a zircaloy fire. The temperature of the fuel is maintained through convection air circulation around the spent fuel canister. The dry spent fuel storage has significant advantages over wet storage because it is a passive cooling system and does not depend on the mechanical integrity of a wet pool with constantly circulating purified water. Furthermore, if a plant had a leaking fuel pool, the remedy would be to move the SNF to dry cask storage, an operation currently underway at MY.

Fourth, the Study mentions the possibility of sabotage as a risk to the spent fuel pool, but it does not discuss it in any detail. Rather, the Study merely suggests that a further evaluation should be made. Sabotage is a potential risk that warrants consideration, but the risk of sabotage is significantly less for the dry storage planned at Maine Yankee than for the spent fuel pool that the NRC considers in the Study. A wet spent fuel pool is more vulnerable to sabotage because it is dependent on the continuous mechanical integrity of the pool. The ISFSI at Maine Yankee is inherently less vulnerable and will also have security measures designed to prevent sabotage. In addition to appropriate security measures, the State continues to urge MY to persist in the pursuit of movement of the SNF to a place of continuing expertise and management.

In sum, the NRC zirc fire Study has very little relevance to Maine Yankee's decommissioning.

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