MEMORANDUM TO: Chairman Meserve
Commissioner Dicus
Commissioner Diaz
Commissioner McGaffigan
Commissioner Merrifield

August 16, 2002

FROM: William D. Travers */RA/*
Executive Director for Operations

SUBJECT: STATUS OF REGULATORY EXEMPTIONS FOR DECOMMISSIONING PLANTS (WITS 200100085, WITS 199900133, WITS 199900072)

The purpose of this memorandum is to inform the Commission that, in response to the terrorist attacks on September 11, 2001, and the continued threat environment, the staff reexamined the offsite emergency planning and insurance exemptions granted to decommissioning plants storing spent fuel in their spent fuel pools (SFPs). The staff has determined that, because of the strengthened security at these facilities and the time available to take mitigative actions due to the age of the spent fuel, rescinding these exemptions is not warranted. Further, the staff wishes to notify the Commission that it has discontinued the integrated rulemaking for decommissioning nuclear power reactors and related generic regulatory activities.

The principal risk at decommissioning nuclear power plants is from a postulated, but very unlikely, zirconium fire event involving the spent fuel stored in the SFP. The "Technical Study on Spent Fuel Pool Accident Risk at Decommissioning Nuclear Power Plants," NUREG-1738, concluded that the risk to the public posed by spent fuel stored in SFPs is very low and well within the Commission's safety goals. In the memorandum that forwarded the study to the Commission, dated December 20, 2000, the staff concluded that there was no immediate safety concern and no need for immediate regulatory action for decommissioning plants storing spent fuel in a SFP. These conclusions were based on a review of conditions at each plant and the low probability of the beyond-design-basis conditions necessary to initiate a zirconium fire.

The staff's conclusions have been questioned in light of the terrorist attacks of September 11, 2001. However, based on the security measures put into effect since September 11, together with the time available to take mitigative actions due to the age of the spent fuel, the staff still considers that the likelihood of an act of radiological sabotage resulting in a significant offsite release to be very low. As such, the staff continues to believe that little benefit would be gained by reinstating offsite emergency planning or insurance requirements. The basis for this conclusion is detailed in the attachment.

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In the aftermath of the September 11 terrorist attacks, the Chairman directed the staff to thoroughly reevaluate the NRC's safeguards and physical security programs. Shortly after the terrorist attacks, the staff issued advisories and confirmatory action letter (CAL) guidance to licensees of decommissioning plants to heighten security beyond the level required by their security plans. Licensees responded with voluntary security actions that met or exceeded the NRC guidance. The staff also issued interim compensatory measures (ICMs) by Order on May 23, 2002, that incorporated measures from the advisories as well as additional measures deemed prudent in light of the sustained threat. In addition, the staff developed a comprehensive plan for reviewing all aspects of the Agency's safeguards and physical security programs as documented in SECY-02-0104, "Plan for the Comprehensive Review of Safeguards and Security Programs for NRC-Licensed Facilities and Activities," dated June 14, 2002. Included in the plan are both near term and long term actions related to decommissioning nuclear power plants and spent fuel storage.

In the near term, the staff will continue to assess the threats and potential vulnerabilities at decommissioning plants as part of the overall safeguards and security programmatic review and will make recommendations, as appropriate, for longer term regulatory improvements as outlined in the comprehensive review plan of SECY-02-0104.

In the longer-term, the staff plans to redefine the threat, reevaluate the vulnerability assessments, and develop appropriate regulatory improvements for all NRC-licensed facilities, materials, and activities, including decommissioning plants. To support future decommissioning regulation, the staff will revise and resubmit a policy options paper on decommissioning regulatory issues related to insurance and emergency planning (superseding SECY-01-0100, "Policy Issues Related to Safeguards, Insurance, and Emergency Preparedness at Decommissioning Plants," dated June 4, 2001, WITS 200000126) 3 months after Commission direction is received on staff rulemaking recommendations for decommissioning plant safeguards and security. The current milestone for decommissioning plant physical protection rulemaking is February 2004 as discussed in SECY-02-0104.

In the absence of any anticipated nuclear power plant decommissionings in the near term, the staff believes that there is no immediate need for moving forward with a majority of the decommissioning regulatory improvement work that is currently planned. Specifically, broad scope regulatory improvements for decommissioning nuclear power plants do not appear to be of sufficient priority given an apparent lack of future licensees that would benefit at this time. Due to other higher priorities, resources are being deferred for decommissioning rulemakings that are not currently in progress or not related to security and will not be included in the FY04 and FY05 budgets. The staff also intends to discontinue the Chairman's Tasking Memorandum updates to reactor decommissioning rulemaking. If any plants do unexpectedly shutdown permanently, decommissioning regulatory issues would continue to be addressed through the exemption process in a manner similar to the current practice.

Attachment:
Assessment of Insurance and Emergency Planning Exemptions
for Decommissioning Plants

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permanently, decommissioning regulatory issues would continue to be addressed through the exemption process in a manner similar to the current practice.

Attachment:
Assessment of Insurance and Emergency Planning Exemptions
for Decommissioning Plants

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ASSESSMENT OF
INSURANCE AND EMERGENCY PLANNING
EXEMPTIONS FOR DECOMMISSIONING PLANTS

BACKGROUND

NRC regulations do not distinguish between operating reactors and decommissioning nuclear power plants storing fuel in their spent fuel pools (SFPs) with regards to requirements for insurance, emergency planning (EP), and safeguards. Since decommissioning nuclear power plants retain their Part 50 license after permanent shutdown, these plants are subject to the same requirements as operating reactors. It has been the staff's judgment for many years that the risk from a large offsite radiological release at a decommissioning plant storing spent fuel in the SFP is lower than the risk from an operating reactor and its associated SFP. This judgment was based on consideration of initiating reactor events associated with normal and abnormal operations, design basis accidents, and certain beyond-design-basis accidents. Because of the lower comparative risk of decommissioning plants, the operating reactor requirements in the areas of insurance, EP, and safeguards seem inappropriate when applied to decommissioning plants.

In the early 1990s, the staff developed a thermal-hydraulic criterion for determining when reductions in insurance, EP, or safeguards requirements at decommissioning plants could be permitted. The criterion was used to grant exemptions to most of the decommissioning plants on a case-by-case basis. The criterion was based on demonstrating that spent fuel stored in the SFP would air-cool sufficiently and not reach the zirconium fire ignition temperature if the water in the pool drained. The Commission approved the use of this air-cooling criterion for exempting decommissioning plants from full Price-Anderson insurance coverage in the staff requirements memorandum (SRM) for SECY-93-127, "Financial Protection Required of Licensees of Large Nuclear Power Plants During Decommissioning," dated July 13, 1993. The staff subsequently used the same criterion to grant exemptions from the full requirements for EP and safeguards at decommissioning plants.

In December 2000, the staff completed NUREG-1738, a technical study of spent fuel pool accident risk at decommissioning nuclear power plants. The study concluded that the risk from SFPs is very low and well within the Commission's safety goals. However, an important observation of NUREG-1738 was that the staff could not preclude the possibility of a zirconium fire beyond the time determined by the air-cooling criterion. Specifically, the study concluded that it is not possible to define a generic decay heat level (and, therefore, decay time) beyond which a zirconium fire cannot occur. This is because the geometry of the spent fuel assemblies, the associated air-cooling flow paths, and the resultant heat transfer rates are not predictable following a major dynamic event (such as a beyond-design-basis earthquake or severe sabotage), that could rupture and drain the SFP. As a result, the study concluded that the possibility of a zirconium fire cannot be dismissed even many years after final reactor shutdown. This means that establishing the air-cooling time for the spent fuel in its normal geometry does not exclude the possibility of a zirconium fire.

ATTACHMENT

The recognition that establishing an air-cooling time does not completely preclude the zirconium fire was understood by the staff when it proposed the use of this criterion to the Commission in SECY-93-127. This is confirmed in the following statement from the SECY:

> Accident scenarios involving blockage of coolant channels in conjunction with loss of spent fuel pool water could hypothetically extend further the time at which a zirconium fuel cladding fire could occur. However, in addition to being even lower likelihood than loss of water, air flow to react with the zirconium and disperse fission products would likely be inhibited by such blockage. The staff believes that such sequences approach the strictly hypothetical.

SECY-93-127 dismissed the risk of a zirconium fire that might result from obstructed air-cooling based on the low probability of such a fire and because the zirconium-oxygen reaction would be inhibited due to oxygen-starved conditions. However, over time, this has been misinterpreted by some to imply that a zirconium fire is not possible after the requisite air-cooling decay time has elapsed.

Table 1 lists the decommissioning plants storing spent fuel in their SFPs, the date of final shutdown, the status of exemptions in the areas of insurance, EP, and safeguards, and applicable comments.

In a December 20, 2000, memorandum to the Commission forwarding the NUREG-1738 study, the staff concluded that, based on a review of the conditions at all potentially affected decommissioning plants, there was no immediate safety concern from the finding that a zirconium fire may still be possible and no need for immediate regulatory action. The conclusion was based on the low likelihood of events resulting in uncovered fuel. Nevertheless, in order to proceed with decommissioning regulatory assessments, the staff noted that Commission policy guidance would be needed in the areas of insurance, EP, and safeguards based on the NUREG-1738 findings.

The staff presented its decommissioning policy options to the Commission in SECY-01-0100, "Policy Issues Related to Safeguards, Insurance, and Emergency Preparedness at Decommissioning Plants," dated June 4, 2001. The policy recommendations in this paper were premised on the very low likelihood of a zirconium fire. It was also the staff's judgment that the decommissioning site safeguards policy recommended in the paper would provide a high assurance of adequate protection against radiological sabotage. While this paper was under Commission review, the September 11 attacks took place, raising safeguards implications that had not been previously considered for any nuclear facility. The staff realized that the safeguards recommendations in SECY-01-0100 needed to be reassessed and, on October 25, 2001, advised the Commission that the decommissioning policy options paper should be withdrawn. On October 30, 2001, the Commission approved the staff's request.

In response to the September 11 terrorist attacks, the Commission tasked the staff to conduct a comprehensive reevaluation of agency safeguards policies and requirements. In addition, the staff issued safeguards advisories and confirmatory action letter (CAL) guidance to licensees of decommissioning plants to heighten security beyond the level required by their security plans.

Licensees have responded with voluntary security actions that meet or exceed the NRC guidance. Furthermore, the staff issued Orders on May 23, 2002, that require implementation of interim compensatory measures (ICMs) to provide additional security enhancements at decommissioning plants.

In the longer-term, the staff is performing a comprehensive safeguards and security review that is reevaluating the threat and vulnerability assessments for NRC-licensed facilities, materials, and activities, including decommissioning plants, and will develop appropriate regulatory and rulemaking recommendations. Because EP and insurance policy decisions for decommissioning are integrally tied to security, policy development in these areas should be deferred for decommissioning plants until after programmatic safeguards and security policy is determined. To support future decommissioning regulation, the staff will revise and resubmit a policy options paper on decommissioning regulatory issues related to insurance and emergency planning after Commission direction is received on long-term programmatic regulatory recommendations developed for safeguards and security.

DISCUSSION

The validity of the exemptions granted to the current decommissioning plants storing spent fuel in their SFPs has been questioned because one of the findings in NUREG-1738 does not support the implied basis on which most of the exemptions were granted. Specifically, NUREG-1738 states that the possibility of a zirconium fire persists for an extended period of time, even after the spent fuel can be air-cooled. As stated earlier, the staff concluded in a December 20, 2000, memorandum to the Commission that there were no immediate safety concerns at decommissioning plants storing spent fuel in their SFPs. However, since the September 11 terrorist attacks, the staff has reexamined the status of decommissioning plants to ensure that the terrorist acts have not invalidated this conclusion.

A. Generic Considerations

The following arguments support the case that the current decommissioning plants are safe:

- After the terrorist attacks, the NRC reviewed the security requirements for the decommissioning plants storing spent fuel in their SFPs and established guidelines for increased security measures at these facilities. The NRC staff also had discussions with each decommissioning plant licensee regarding appropriate actions the sites should implement to protect against the current threat environment. The licensees sent letters to the NRC stating that they had either planned or taken actions to strengthen site security. The staff subsequently issued confirmatory action letters (CAL). The CALs were consistent with NRC guidance on (1) the vehicle threat, (2) offsite communications, (3) offsite response commitments, and (4) onsite and offsite response forces. The CAL established standards specific for these items.

- Due to the continuing increased threat environment, the staff issued Orders on May 23, 2002, that require implementation of interim compensatory measures (ICMs) to provide additional security enhancements at decommissioning plants.

- The assessed risk from an event that might result in a zirconium fire at decommissioning plants is low and well within the Commission's safety goals. The risk is low because of the very low likelihood of the initiating events. Although this conclusion does not include risk from radiological sabotage, the enhanced security measures currently in effect together with the Orders imposing ICM's for decommissioning plants and the overall national response to ensure homeland security, the staff believes that the likelihood of an act of radiological sabotage resulting in a significant offsite release is also low.

- The spent fuel at every decommissioning plant will air-cool if the spent fuel pool is drained of cooling water. Although this does not preclude a zirconium fire under significant geometry changes or other cooling-air flow obstructions (such as partial draindown), it does indicate that the conditional probability of a zirconium fire is less than 1, given drainage of the SFP. NUREG-1738 conservatively assumes the conditional probability of a zirconium fire is always 1 if the SFP is drained. This is clearly not the case if the spent fuel can be air-cooled. This implies that even if an unlikely event were to drain the SFP and result in some obstruction to optimal air-cooling heat transfer at the currently decommissioning plants, the chance that a fire might occur is less than certain and will continue to decrease with time.

- If an unlikely event were to drain a decommissioning plant SFP and obstruct the air cooling to the spent fuel assemblies, the staff conservatively estimates that the assemblies would take a minimum of over 25 hours to heat up (adiabatically) to the zirconium fire ignition temperature. The staff believes that this is sufficient time for licensees to implement mitigative or recovery actions to restore cooling. With 25 hours to mobilize resources and obtain expert consultation and recommendations, it is likely that ample emergency response capability could successfully respond to such an event. The staff is still considering the terrorist acts of September 11 and evaluating scenarios that might shorten the spent fuel heatup time. However, a 25-hour nominal time between the loss of any kind of spent fuel cooling to the point of zirconium cladding ignition temperature provides substantial margins for uncertainty in the available delay time before a radiological release might begin.

- Because of the decay time that has elapsed for the spent fuel currently stored in the decommissioning SFPs, the likelihood of an early fatality due to radiological release from a zirconium fire is quite small—even without early evacuation of the public surrounding the site. For early fatalities, the source term of concern from a zirconium fire is ruthenium. Most of the ruthenium has decayed away at the current decommissioning plants. Sensitivity studies in NUREG-1738 predict one early fatality in the population around a generic decommissioning plant, assuming the population is not evacuated until after the release from the zirconium fire. Thus, the immediate consequences from a zirconium fire are very low. The most significant consequences of a zirconium fire would be large societal doses and loss of property issues.

B. Specific Considerations

The staff recently issued Orders requiring interim compensatory measures be implemented at decommissioning plants. The implementation of these Orders will further strengthen the security programs to address the current threat environment. With these security enhancements, the staff believes there is little public health and safety benefit to be gained from rescinding the existing decommissioning plant EP or insurance exemptions as discussed below.

Price-Anderson Insurance Exemptions

The decommissioning facilities that have exemptions to Price-Anderson still maintain some primary liability insurance coverage (ranging from $25 million to $100 million). Full Price-Anderson participation under 10 CFR 140.11 would require the reinstatement of $200 million primary insurance coverage. The staff estimates that requiring full operating reactor primary insurance coverage could cost each decommissioning plant an additional $500,000 per year in premiums. Full Price-Anderson reinstatement would also require the participating licensees to commit to funding a secondary insurance pool called the "secondary retrospective rating plan"—a form of nuclear self-insurance in which the licensee of each facility covered by the plan would be required to contribute as much as $84 million in the event of a nuclear accident or incident that resulted in liabilities that exceeded the primary insurance coverage. As the secondary nuclear insurance pool charges no premium, there is no immediate cost to the decommissioning plants participating in the secondary insurance pool.

Participation in the secondary insurance pool is problematic for decommissioning plants because of the potential financial liability of up to $84 million for any nuclear incident—not just at the decommissioning plant where the incident occurs, but for any operating reactor incident as well as other decommissioning plants. Decommissioning plant licensees view the secondary pool as a disproportionate financial risk relative to their operating reactor counterparts for the following reasons:

- Decommissioning plants do not receive any profit or revenue from their activities yet these facilities would be subject to financial risk from operating reactors events if required to participate in the secondary insurance pool.

- The overall likelihood of an event that could result in offsite liability is greater for an operating plant than for a decommissioning plant.

- Decommissioning plant risk decreases with time.

- By statute, operating power reactors with power levels below 100 megawatts electric are not required to participate in the secondary retrospective pool. Although no power reactors less than 100 MWe are currently operating, the postulated risk from operation together with the risk from freshly discharged fuel in a spent fuel pool of such a facility is arguably greater than the risk from current decommissioning plants that are not operating and are storing spent fuel aged a minimum of five years in their spent fuel pools.

Conversely, even though the likelihood of a zirconium fire at a decommissioning plant spent fuel pool is very low and the consequences from a large radiological release due to a zirconium fire would likely not result in substantial immediate public health and safety effects, such a fire could result in a significant number of latent cancers and large losses of property. The purpose of Price-Anderson is intended to indemnify the public from the financial losses that might result from such unlikely events.

In consideration of the disproportionate insurance burden on decommissioning plants together with the low likelihood and reduced short-term public health consequences of a zirconium fire, it has always been the staff's belief that the overall risk at decommissioning plants does not justify carrying full operating reactor Price-Anderson insurance coverage after the spent fuel has decayed sufficiently.

Because of the finding in NUREG-1738 that the possibility of a zirconium fire can never be fully dismissed, the Commission will eventually need to address the policy issue of when the spent fuel has decayed sufficiently to permit future decommissioning plants to withdraw from full Price-Anderson participation. However, nothing in NUREG-1738 implies that the likelihood of non-sabotage initiated zirconium fire scenarios is greater than believed when the insurance exemptions were initially granted. In addition, the low decay heat levels of the spent fuel and the large amount of time available to take mitigative actions leads the staff to believe that the conditional probability of a zirconium fire, given an initiating event that drains the spent fuel pool, is low at current decommissioning plants.

The terrorist attacks of September 11, 2001, have caused the staff to reconsider the likelihood of scenarios based on radiological sabotage that could result in a zirconium fire at decommissioning plants. While the likelihood of a sabotage-induced zirconium fire is unknown, it may be greater in the current threat environment than had been assumed when the exemptions were initially issued. The level of physical protection measures ultimately established for protecting against radiological sabotage should be sufficient to ensure that the likelihood of a sabotage-induced zirconium fire remains low. The staff believes that the only legitimate justification for reinstating Price-Anderson insurance would be to compensate for security-related uncertainties. However, as noted previously, over 25 hours of time nominally exists to prevent or mitigate most scenarios leading to a zirconium fire. The staff is still evaluating the applicability of some sabotage related scenarios that could reduce this time. There is insufficient basis at this point to justify reinstatement of Price-Anderson insurance.

Based on the actions to strengthen security at decommissioning plants, the staff believes that rescinding existing insurance exemptions is not justified when the very low likelihood of a large offsite radiological release is considered.

Offsite Emergency Preparedness Exemptions

Most decommissioning plants have exemptions from offsite EP requirements on the basis that the spent fuel has decayed long enough to permit air-cooling. As a result of the findings in NUREG-1738, the staff understands that there is still a chance, though very small, that a

radiological release exceeding protective action guidelines could occur due to a zirconium fire. However, there is precedent for reducing or eliminating EP requirements on the basis of alternate considerations. Specifically, some offsite EP exemptions were granted to decommissioning plants that had not demonstrated that the spent fuel had reached the air-cooling time threshold. The staff concluded that these exemptions were acceptable because the fuel had decayed to the extent that there was sufficient time for response actions to mitigate the accident and to protect the public health and safety. The response time was based on thermal-hydraulic calculations of how long it would take to heat the fuel cladding to the zirconium ignition temperature after an event that drained the spent fuel pool and conservatively prevents any cooling of the fuel assemblies (adiabatic heatup). The two sites using this approach (Big Rock Point and Maine Yankee) had fuel heatup times of 14 hours and 10 hours respectively on the date the exemptions were granted. Based on the time that has elapsed since the exemptions were granted, the staff estimates that every decommissioning plant with EP exemptions now has at least 25 hours of heatup time available for mitigative and protective response actions. As stated previously, the staff is still evaluating some sabotage-related scenarios that could shorten this time, however, the current level of emergency planning onsite coupled with a 25-hour nominal time for protective and mitigative response measures, absent some postulated sabotage events, provides substantial margins for uncertainty in the available delay time before a radiological release might begin.

Assuming that evacuation begins after the zirconium fire source term release, conservative calculations estimate one early fatality as an immediate consequence. The most significant consequences include large societal doses and loss of property issues. These consequences are not substantially reduced due to early evacuation. The terrorists acts of September 11, 2001, do not affect this result. Thus, reimposing offsite EP requirements on these plants would provide only a minor increase in the overall protection of the public health and safety. Based on the staff's actions to strengthen the security requirements at decommissioning plants, the staff believes that rescinding existing EP exemptions are not justified by the minimal increase in public health and safety that would be achieved.

Exemption

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Table

Plant	Date of Shutdown	Insurance Exemptions	Emergency Preparedness Exemptions	Security Exemptions	Comments
Big Rock Point	Aug. 29, 1997	None	Yes	Yes	Full Price-Anderson coverage never required because reactor was < 100 MWe
Haddam Neck	Jul. 22, 1996	Yes	Yes	Yes	
Humbolt Bay	Jul. 2, 1976	None	Yes	Yes	Full Price-Anderson coverage never required because reactor was < 100 MWe
Indian Point 1	Oct. 31, 1974	Yes	None	None	Full Offsite EP and Safeguards maintained for Units 2 & 3
La Crosse	Apr. 30, 1987	None	Yes	Yes	-Full Price-Anderson coverage never required. Reactor was < 100 MWe -Zirc fire not relevant stainless-steel-clad fuel
Maine Yankee	Dec. 1996	Yes	Yes	Yes	
Millstone 1	Nov. 1995	None	None	None	Full Offsite EP and Safeguards maintained for Units 2 & 3
Rancho Seco	Jun. 1989	Yes	Yes	Yes	
San Onofre 1	Nov. 30, 1992	Yes	None	Yes	-Full Offsite EP maintained for Units 2 & 3 -Zirc fire not relevant stainless-steel-clad fuel
Trojan	Nov. 9, 1992	Yes	Yes	Yes	
Yankee Rowe	Oct. 1991	Yes	Yes	Yes	
Zion 1& 2	Feb. 21, 1997	Yes	Yes	Yes	