5.0 SUMMARY AND CONCLUSIONS

The results of this report estimated the generic frequency of events leading to zirconium fires at decommissioning plants to be less than $3x10^{-6}$ per year for a plant that implements the design and operational characteristics assumed in the risk assessment performed by the staff. This frequency was estimated based on the assumptions that the characteristics of the 10 IDCs proposed by NEI (See Appendix 6) and the four SDAs identified in Sections 3 and 4 of the report would be implemented. This estimate could be much higher for a plant that does not implement these characteristics. The most significant contributor to this risk is a seismic event which exceeds the design basis earthquake. However, the overall frequency of this event is within the staff recommended pool performance guideline (PPG) identified in this report for large radiological releases due to a zirconium fire of $1x10^{-5}$ per year. As discussed below, zirconium fires are estimated to be similar to large early release accidents postulated for operating reactors in some ways, but less severe in others.

The thermal-hydraulic analysis presented in Appendix 1 demonstrates that the decay heat necessary for a zirconium fire exists in typical spent fuel pools of decommissioning plants for a period of several years following shutdown. The analysis shows that the length of time over which the fuel is vulnerable depends on several factors, including fuel burn-up and fuel storage configuration in the SFP. In some cases analyzed in Appendix 1, the required decay time to preclude a zirconium fire is 5 years. However, the exact time will be plant specific; therefore, plant-specific analysis would be needed to demonstrate shorter zirconium fire vulnerabilities.

The consequence analysis presented in Appendix 4 demonstrates that the consequences of a zirconium fire in a decommissioning plant can be very large. The integrated dose to the public is generally comparable to a large early release from an operating plant during a potential severe core damage accident and early fatalities are very sensitive to the effectiveness of evacuation. For a decommissioning plant with about one year of decay time, the onset of radiological releases from a zirconium fire is significantly delayed compared to those from the most limiting operating reactor accident scenarios. This is due to the relatively long heat up time of the fuel. For many of the sequences leading to zirconium fires, there are very large delay times due to the long time required to boil off the large spent fuel pool water inventory. Thus, while the consequences of zirconium fires are in some ways comparable to large early releases from postulated reactor accidents, the time of release occurs much later following initiation of the accident. Therefore, this analysis indicates that for the slowly evolving SFP accident scenarios at decommissioning plants, there is a large amount of time to initiate and implement protective actions, including public evacuation, in comparison to an operating reactor accident sequences.

In summary, the risk assessment shows low numerical risk results in combination with satisfaction of the safety principles as described in R.G. 1.174, such as defense-in-depth, maintaining safety margins, and performance monitoring. The staff concludes that under the assumptions of this study there is a low level of public risk from SFP accidents at decommissioning plants. In addition, the study shows that after a period of one year following final shutdown, the low likelihood that a zirconium fire would occur, in combination with the long time frames available for taking off-site protective actions, provides a basis for relaxation of emergency planning requirements.

Sections 4.3.2 and 4.3.3 addressed the report's implications on security and insurance provisions at decommissioning plants. For security, the risk insights can be utilized to assess

what target sets are important to protect against sabotage. However, any reduction in security provisions would be constrained by an effectiveness assessment of the safeguards provisions against a design basis threat. Therefore, the staff concludes that some level of security is required as long as the fuel in the SFP is exposed to a sabotage threat. For insurance, the reports points out that no definitive criteria exists that would allow relaxation on the basis of low event probability alone while the potential for a zirconium fire exists. Finally, inconsistencies were identified in current regulations regarding vehicle-borne bomb threats and insurance indemnification requirements for ISFSIs and decommissioning nuclear power plants. These inconsistencies should be revisited during the overall integration of rules for decommissioning plants.