NUCLEAR REGULATORY COMMISSION

Docket No. 50-285

Omaha Public Power District

Fort Calhoun Station, Unit No. 1

Exemption

I. Background.

The Fort Calhoun Station, Unit 1 (FCS) site is located midway between Fort Calhoun and Blair, Nebraska, on the west bank of the Missouri River. The FCS facility includes one Combustion Engineering pressurized water reactor licensed to operate at power levels not to exceed 1500 megawatts thermal. The distance from the reactor containment to the nearest site boundary is approximately 910 meters (.6 miles). Except for the city of Blair and the villages of Fort Calhoun and Kennard, the land use within the 10-mile radius of FCS is devoted to general farming.

Omaha Public Power District (OPPD) is the holder of Renewed Facility Operating License No. DPR-40. The license provides, among other things, that the facility is subject to all rules, regulations, and orders of the NRC now or hereafter in effect.

By letter dated June 24, 2016 (Agencywide Documents Access and Management System (ADAMS) Accession No. ML16176A213), OPPD submitted a certification pursuant to part 50 of title 10 of the *Code of Federal Regulations* (10 CFR) paragraph 50.82(a)(1)(i) to the NRC indicating that it would permanently shut down FCS by December 31, 2016. On October 24, 2016, OPPD permanently ceased power operations at FCS. On November 13, 2016, OPPD submitted a certification pursuant to 10 CFR 50.82(a)(1)(ii) that it had permanently removed all fuel from the FCS reactor vessel and placed the fuel into the FCS spent fuel pool (SFP)

(ADAMS Accession No. ML16319A254). Accordingly, upon docketing the certificates pursuant to 10 CFR 50.82(a)(2), the FCS renewed facility operating license no longer authorized operation of the reactor or emplacement or retention of fuel in the reactor vessel. However, the licensee remains authorized to possess and store irradiated nuclear fuel. Irradiated fuel is currently being stored onsite in a SFP and in independent spent fuel storage installation (ISFSI) dry casks.

II. Request/Action.

Under 10 CFR 50.12, "Specific exemptions," OPPD has requested an exemption from 10 CFR 50.54(w)(1) by a letter dated April 28, 2017 (ADAMS Accession No. ML17118A337). The exemption from the requirements of 10 CFR 50.54(w)(1) would permit OPPD to reduce its onsite property damage insurance to $50 million.

The regulation in 10 CFR 50.54(w)(1) requires each licensee to have and maintain onsite property damage insurance to stabilize and decontaminate the reactor and reactor site in the event of an accident. The onsite insurance coverage must be either $1.06 billion or whatever amount of insurance is generally available from private sources (whichever is less).

The licensee stated that the risk of an accident at a permanently shutdown and defueled reactor is much less than the risk from an operating power reactor. Since the license no longer authorizes reactor operation or emplacement or retention of fuel in the reactor vessel at FCS, there are no events that would require the stabilization of reactor conditions after an accident. Similarly, the risk of an accident that would result in significant onsite contamination at FCS is also much lower than the risk of such an event at an operating reactor. Therefore, OPPD requested an exemption from 10 CFR 50.54(w)(1) effective April 7, 2018, that would permit a reduction in its onsite property damage insurance from $1.06 billion to $50 million,

commensurate with the reduced risk of an accident at the permanently shutdown and defueled FCS reactor.

III. Discussion.

Pursuant to 10 CFR 50.12, the Commission may, upon application by any interested person or upon its own initiative, grant exemptions from the requirements of 10 CFR Part 50 when 1) the exemptions are authorized by law, will not present an undue risk to public health or safety, and are consistent with the common defense and security; and 2) any of the special circumstances listed in 10 CFR 50.12(a)(2) are present.

The financial protection limits of 10 CFR 50.54(w)(1) were established after the Three Mile Island accident out of concern that licensees may be unable to financially cover onsite cleanup costs in the event of a major nuclear accident. The specified $1.06 billion coverage requirement was developed based on an analysis of an accident at a nuclear reactor operating at power, resulting in a large fission product release and requiring significant resource expenditures to stabilize the reactor conditions and ultimately decontaminate and cleanup the site.

The NRC developed these cost estimates from the spectrum of postulated accidents for an operating nuclear reactor and the consequences of any associated release of radioactive material from the reactor. Although the risk of an accident at an operating reactor is very low, the consequences can be large. In an operating reactor, the high temperature and pressure of the reactor coolant system (RCS), as well as the inventory of relatively short-lived radionuclides, contribute to both the risk and consequences of an accident. With the permanent cessation of reactor operations at FCS and the permanent removal of the fuel from the reactor core, such accidents are no longer possible. As a result, the reactor, RCS, and supporting systems no longer operate and, therefore, have no function related to the storage of the irradiated fuel.

Hence, postulated accidents involving failure or malfunction of the reactor, RCS, or supporting systems are no longer applicable.

During reactor decommissioning, the principal radiological risks are associated with the storage of spent fuel onsite. In its December 16, 2016 (ADAMS Accession No. ML16356A578), exemption request, OPPD describes both design-basis and beyond-design-basis events involving irradiated fuel stored in the SFP. The staff independently evaluated the offsite consequences associated with various decommissioning activities, design basis accidents, and beyond design basis accidents at FCS, in consideration of its permanently shut down and defueled status. The possible design-basis and beyond design basis accident scenarios at FCS show that the radiological consequences of these accidents are greatly reduced at a permanently shut down and defueled reactor, in comparison to a fueled reactor. Further, the staff has used the offsite radiological release limits established by the U.S. Environmental Protection Agency (EPA) early-phase Protective Action Guidelines (PAGs) of one roentgen equivalent man (rem) at the exclusion area boundary in determining that any possible radiological releases would be minimal and would not require precautionary protective actions (e.g., sheltering in place or evacuation).

The staff evaluated the radiological consequences associated with various decommissioning activities, and design basis accidents at FCS, in consideration of permanently shut down and defueled status of FCS. The only design-basis accidents that could potentially result in an offsite radiological release at FCS, following its permanent shutdown and defueling, are the Fuel Handling Accident (FHA) and rupture of a large liquid radioactive waste tank. OPPD performed an analysis demonstrating that 10 days after shutdown, the radiological consequences of a FHA would not exceed the limits established by the EPA PAGs at the exclusion area boundary. In case of a rupture of a large liquid radioactive waste tank in the December 16, 2016 letter, the FCS radioactive waste disposal system is designed such that any spillage or leakage of radioactive waste would be retained within the facility. After 18 months of

decay, the only isotope remaining in significant amounts, among those postulated to be released from the gaseous release associated with a liquid waste tank failure (LWTF), would be Krypton 85. The resulting skin dose from the release of Krypton 85 would make an insignificant contribution to the total effective dose equivalent, which is the parameter of interest in the determination of EPA PAGs for sheltering or evacuation. Accordingly, based on the time that FCS has been permanently shutdown (approximately 18 months), the staff has determined that the possibility of an offsite radiological release from design-basis accidents that could exceed the EPA PAGs has been eliminated.

The only beyond design-basis event that has the potential to lead to a significant radiological release at a permanently shut down and defueled (decommissioning) reactor is a zirconium fire. The zirconium fire scenario is a postulated, but highly unlikely, accident scenario that involves the loss of water inventory from the SFP, resulting in a significant heat-up of the spent fuel and culminating in substantial zirconium cladding oxidation and fuel damage. The probability of a zirconium fire scenario is related to the decay heat of the irradiated fuel stored in the SFP. Therefore, the risks from a zirconium fire scenario continue to decrease as a function of the time that FCS has been permanently shut down.

The NRC previously determined that a lesser amount of onsite property damage insurance coverage can be authorized based on analysis of the zirconium fire risk. In response to SECY-96-256, “Changes to Financial Protection Requirements for Permanently Shutdown Nuclear Power Reactors, 10 CFR 50.54(w)(1) and 10 CFR 140.11,” dated December 17, 1996 (ADAMS Accession No. ML15062A483), the Commission issued Staff Requirements Memorandum dated January 28, 1997 (ADAMS Accession No. ML15062A454), and supported the staff’s recommendation that, among other things, would allow permanently shutdown power reactor licensees to reduce commercial onsite property damage insurance coverage to $50 million when the licensee was able to demonstrate the technical criterion that the spent fuel could be air-cooled if the SFP was drained of water and to account for the postulated rupture of

a large liquid radiological waste tank at the FCS site, should such an event occur. The staff has used this technical criterion to grant similar exemptions to other decommissioning reactors (e.g., Maine Yankee Atomic Power Station, published in the *Federal Register* on January 19, 1999 (64 FR 2920); Zion Nuclear Power Station, published in the *Federal Register* on December 28, 1999 (64 FR 72700), and Vermont Yankee Nuclear Power Station, published in the *Federal Register* on April 25, 2016 (81 FR 24136)).

In SECY-00-0145, "Integrated Rulemaking Plan for Nuclear Power Plant Decommissioning," dated June 28, 2000, and SECY-01-0100, "Policy Issues Related to Safeguards, Insurance, and Emergency Preparedness Regulations at Decommissioning Nuclear Power Plants Storing Fuel in Spent Fuel Pools," dated June 4, 2001 (ADAMS Accession Nos. ML003721626 and ML011450420, respectively), the staff discussed additional information concerning SFP zirconium fire risks at decommissioning reactors and associated implications for onsite property damage insurance. Analyzing when the spent fuel stored in the SFP is capable of adequate air-cooling is one measure that demonstrates when the probability of a zirconium fire would be exceedingly low.

The licensee's analyses referenced in its exemption request demonstrate that under conditions where the SFP water inventory has drained and only air-cooling of the stored irradiated fuel is available, there is reasonable assurance as of April 7, 2018, which is approximately 18 months after the permanent shutdown of the facility, that the FCS spent fuel will remain at temperatures far below those associated with the onset of zirconium cladding rapid oxidation. In addition, the licensee's adiabatic heat-up analyses demonstrate that as of April 7, 2018, there would be at least 10 hours after the loss of all means of cooling (both air and/or water), before the spent fuel cladding would reach a temperature where the potential for a significant offsite radiological release could occur. The licensee maintains strategies and equipment to cool the spent fuel in the unlikely event coolant is lost, and the 10-hour adiabatic heating time would provide sufficient time for personnel to respond with on-site equipment to

restore a means of spent fuel cooling. In OPPD's letter dated December 16, 2016, the licensee furnished information concerning its SFP inventory makeup strategies, in the event of a loss of SFP coolant inventory. The multiple strategies for providing makeup to the SFP include: using existing plant systems for inventory makeup; an internal strategy that relies on the fire protection system with redundant pumps (one diesel-driven and electric motor-driven); and onsite diesel fire truck that can take suction from the Missouri River. These strategies are maintained by a license condition. The licensee also stated that, considering the very low-probability of beyond design-basis accidents affecting the SFP, these diverse strategies provide defense-in-depth and time to mitigate and prevent a zirconium fire, using makeup or spray into the SFP before the onset of zirconium cladding rapid oxidation.

By letter dated October 4, 2017 (ADAMS Accession No. ML17277B679), OPPD provided a response to an NRC staff request to address air-cooling of fuel in a drained pool. In the attachment to this letter, the licensee compared FCS fuel storage parameters with those used in NRC generic evaluations of fuel cooling included in the following documents:

- NUREG/CR-4982, "Severe Accidents in Spent Fuel Pools in Support of Generic Safety Issue 82," June 1987; and
- NUREG/CR-6451, "A Safety and Regulatory Assessment of Generic BWR [Boiling-Water Reactor] and PWR [Pressurized-Water Reactor] Permanently Shutdown Nuclear Power Plants," April 1997 (ADAMS Accession No. ML082260098).

The analysis described in NUREG/CR-6451 determined that natural air circulation would adequately cool fuel that has decayed for 17 months after operation in a typical PWR. The licensee found that the FCS fuel assemblies have a 20 percent lower power density during operation at power, a 10 percent lower peak burnup, and lower uranium enrichment, resulting in a much lower decay heat rate per assembly than those used in the analysis described in NUREG/CR-6451. The licensee determined that the FCS spent fuel storage racks have a

higher storage density than those used in the NUREG/CR-6451 analysis. However, the licensee's analysis demonstrated that the lower decay heat will be sufficient to offset the higher storage density compared to the benchmark. The NRC staff reviewed this information and determined that the conclusion that the analysis presented in NUREG/CR-6451 would bound the fuel storage conditions at FCS was reasonable. Therefore, at 18 months after permanent shutdown, which will be reached by the requested effective date of April 7, 2018, the fuel stored at the FCS SFP would be adequately air-cooled in the unlikely event the pool completely drained.

In the NRC staff's safety evaluation of the licensee's request for exemptions from certain emergency planning requirements dated December 11, 2017 (ADAMS Accession No. ML17263B198), the NRC staff assessed the OPPD accident analyses associated with the radiological risks from a zirconium fire at the permanently shut down and defueled FCS site. For the very unlikely beyond design-basis accident scenario where the SFP coolant inventory is lost in such a manner that all methods of heat removal from the spent fuel are no longer available, the staff found there will be a minimum of 10 hours from the initiation of the accident until the cladding reaches a temperature where offsite radiological release might occur. The staff finds that 10 hours is sufficient time to support deployment of mitigation equipment, consistent with plant conditions, to prevent the zirconium cladding from reaching a point of rapid oxidation.

Based on the above discussion and the basis provided in SECY-96-256, the NRC staff determined $50 million is an adequate level of onsite property damage insurance for the FCS decommissioning reactor, once the spent fuel in the SFP is susceptible to exceedingly low probability of a zirconium fire due to adequate air-cooling, is provided in SECY-96-256. The staff has postulated that there is still a potential for other radiological incidents at a decommissioning reactor that could result in significant onsite contamination besides a zirconium fire. In SECY-96-256, the NRC staff cited the rupture of a large contaminated liquid

storage tank, causing soil contamination and potential groundwater contamination, as the most costly postulated event to decontaminate and remediate (other than a SFP zirconium fire). The postulated large liquid radiological waste storage tank rupture event was determined to have a bounding onsite cleanup cost of approximately $50 million. Therefore, the staff determined that the licensee's proposal to reduce onsite insurance to a level of $50 million would be consistent with the bounding cleanup and decontamination cost, as discussed in SECY-96-256, to account for the postulated rupture of a large liquid radiological waste tank at the FCS site, should such an event occur.

A. Authorized by Law.

The regulation in 10 CFR 50.54(w)(1) requires each licensee to have and maintain onsite property damage insurance of either $1.06 billion or whatever amount of insurance is generally available from private sources, whichever is less. In accordance with 10 CFR 50.12, the Commission may grant exemptions from the regulations in 10 CFR Part 50, as the Commission determines are authorized by law.

As explained above, the NRC staff has determined that the licensee's proposed reduction in onsite property damage insurance coverage to a level of $50 million is adequate, consistent with the basis provided in SECY-96-256. Moreover, the staff concluded that as of April 7, 2018, sufficient irradiated fuel decay time will have elapsed at FCS to decrease the probability of an onsite and offsite radiological release from a postulated zirconium fire accident to negligible levels.

The NRC staff has determined that granting of the licensee's proposed exemption will not result in a violation of the Atomic Energy Act of 1954, or other laws, as amended. Therefore, based on its review of OPPD's exemption request, as discussed above, and consistent with SECY-96-256, the NRC staff concludes that the exemption is authorized by law.

B. No Undue Risk to Public Health and Safety.

The onsite property damage insurance requirements of 10 CFR 50.54(w)(1) were established to provide financial assurance that following a significant nuclear accident, onsite reactor conditions could be stabilized and the site decontaminated. The requirements of 10 CFR 50.54(w)(1) and the existing level of onsite insurance coverage for FCS are predicated on the assumption that the reactor is operating. However, FCS is a permanently shutdown and defueled facility. The permanently defueled status of the facility has resulted in a significant reduction in the number and severity of potential accidents, and correspondingly, a significant reduction in the potential for and severity of onsite property damage. The proposed reduction in the amount of onsite insurance coverage does not impact the probability or consequences of potential accidents. The proposed level of insurance coverage is commensurate with the reduced consequences of credible nuclear accidents at FCS. Therefore, the NRC staff concludes that granting the requested exemption will not present an undue risk to the health and safety of the public.

C. Consistent with the Common Defense and Security.

The proposed exemption would not eliminate any requirements associated with physical protection of the site and would not adversely affect OPPD's ability to physically secure the site or protect special nuclear material. Physical security measures at FCS are not affected by the requested exemption. Therefore, the proposed exemption is consistent with the common defense and security.

D. Special Circumstances.

Under 10 CFR 50.12(a)(2)(ii), special circumstances are present if the application of the regulation in the particular circumstances would not serve the underlying purpose of the rule or is not necessary to achieve the underlying purpose of the rule. The underlying purpose of

10 CFR 50.54(w)(1) is to provide reasonable assurance that adequate funds will be available to stabilize reactor conditions and cover onsite cleanup costs associated with site decontamination, following an accident that results in the release of a significant amount of radiological material. Because FCS is permanently shut down and defueled, it is no longer possible for the radiological consequences of design-basis accidents or other credible events at FCS to exceed the limits of the EPA PAGs at the exclusion area boundary. The licensee has evaluated the consequences of highly unlikely, beyond-design-basis conditions involving a loss of coolant from the SFP. The analyses show that as of April 7, 2018, the likelihood of such an event leading to a large radiological release is negligible. The NRC staff's evaluation of the licensee's analyses confirm this conclusion.

The NRC staff also finds that the licensee's proposed $50 million level of onsite insurance is consistent with the bounding cleanup and decontamination cost, as discussed in the basis provided in SECY-96-256. Therefore, the staff concludes that the application of the current requirements in 10 CFR 50.54(w)(1) to maintain $1.06 billion in onsite insurance coverage is not necessary to achieve the underlying purpose of the rule for the permanently shutdown and defueled FCS reactor.

Under 10 CFR 50.12(a)(2)(iii), special circumstances are present whenever compliance would result in undue hardship or other costs that are significantly in excess of those contemplated when the regulation was adopted, or that are significantly in excess of those incurred by others similarly situated.

The NRC staff concludes that if the licensee was required to continue to maintain an onsite insurance level of $1.06 billion, the associated insurance premiums would be in excess of those necessary and commensurate with the radiological contamination risks posed by the site. In addition, such insurance levels would be significantly in excess of other decommissioning reactor facilities that have been granted similar exemptions by the NRC.

The NRC staff finds that compliance with the existing rule would result in an undue hardship or other costs that are significantly in excess of those contemplated when the regulation was adopted and are significantly in excess of those incurred by others similarly situated.

Therefore, the special circumstances required by 10 CFR 50.12(a)(2)(ii) and 10 CFR 50.12(a)(2)(iii) exist.

E. Environmental Considerations.

The requested exemption includes surety, insurance, or indemnity requirements, and belongs to a category of actions that the Commission, by rule or regulation, has declared to be a categorical exclusion, after first finding that the category of actions does not individually or cumulatively have a significant effect on the human environment. Specifically, the exemption is categorically excluded under 10 CFR 51.22(c)(25)(vi)(H). In addition, the NRC staff has determined that there would be no significant impacts to biota, water resources, historic properties, cultural resources, or socioeconomic conditions in the region. As such, there are no extraordinary circumstances present that would preclude reliance on this categorical exclusion. Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement need be prepared in connection with the approval of this exemption request.

Under 10 CFR 51.22(c)(25), granting of an exemption from the requirements of any regulation of Chapter I to 10 CFR is a categorical exclusion provided that (i) there is no significant hazards consideration; (ii) there is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite; (iii) there is no significant increase in individual or cumulative public or occupational radiation exposure; (iv) there is no significant construction impact; (v) there is no significant increase in the potential for or consequences from radiological accidents; and (vi) the requirements from which an exemption is sought involve: surety, insurance, or indemnity requirements.

The Director, Division of Operating Reactor Licensing, Office of Nuclear Reactor Regulation, has determined that approval of the exemption request involves no significant hazards consideration because reducing the licensee's onsite property damage insurance for FCS does not 1) involve a significant increase in the probability or consequences of an accident previously evaluated; or 2) create the possibility of a new or different kind of accident from any accident previously evaluated; or 3) involve a significant reduction in a margin of safety. The exempted financial protection regulation is unrelated to the operation of FCS. Accordingly, there is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite; and no significant increase in individual or cumulative public or occupational radiation exposure. The exempted regulation is not associated with construction, so there is no significant construction impact. The exempted regulation does not concern the source term (i.e., potential amount of radiation in an accident), nor mitigation. Therefore, there is no significant increase in the potential for, or consequences of, a radiological accident. In addition, there would be no significant impacts to biota, water resources, historic properties, cultural resources, or socioeconomic conditions in the region. The requirement for onsite property damage insurance involves surety, insurance, and indemnity matters. Therefore, pursuant to 10 CFR 51.22(b) and 51.22(c)(25), no environmental impact statement or environmental assessment need be prepared in connection with the approval of this exemption request.

IV. Conclusions.

Accordingly, the Commission has determined that, pursuant to 10 CFR 50.12(a), the exemption is authorized by law, will not present an undue risk to the public health and safety, and is consistent with the common defense and security. Also, special circumstances are present. Therefore, the Commission hereby grants OPPD an exemption from the requirements of 10 CFR 50.54(w)(1), to permit the licensee to reduce its onsite property damage insurance to a level of $50 million.

The exemption is effective beginning April 7, 2018.

Dated at Rockville, Maryland, this 29th day of March, 2018.

For the Nuclear Regulatory Commission.

/RA/

Joseph G. Giitter, Director,
Division of Operating Reactor Licensing,
Office of Nuclear Reactor Regulation.