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10 CFR 50.12
10 CFR 50.54(w)(1)

June 22, 2020

U.S. Nuclear Regulatory Commission
Attn: Document Control Desk
Washington, DC 20555-0001

Oyster Creek Nuclear Generating Station
Renewed Facility Operating License No. DPR-16
Docket No. 50-219 and 72-15

Subject: Request for Exemption from 10 CFR 50.54(w)(1), Concerning On-site Property Damage Insurance

References:
1. Letter from U.S. Nuclear Regulatory Commission to Exelon, "Oyster Creek Nuclear Generating Station - Exemption from the Requirements of 10 CFR 50.54(w)(1), Concerning Onsite Property Insurance (EPID L-2019-LLE-0007)," dated June 12, 2019, (ADAMS Accession Nos. ML19129A320)
2. NRC Oyster Creek Nuclear Generating Station Exemption, 10 CFR 50.54(w) Onsite Property Damage Insurance, dated June 12, 2019 (ADAMS Accession No. ML 19129A102)
3. Commission Paper, SECY-96-256, "Changes to the Financial Protection Requirements for Permanently Shutdown Nuclear Power Reactors, 10 CFR 50.54(w) and 10 CFR 140.11 dated December 17, 1996 (ADAMS Accession No. ML 15062A483)
4. Letter from Holtec Decommissioning International, LLC (HDI) to U.S. Nuclear Regulatory Commission, "Report on Status of Decommissioning Funding for Reactors and Independent Spent Fuel Storage Installations," dated March 31, 2020 (ADAMS Accession No. ML 20091M858)

By letter dated June 12, 2019, the U.S. Nuclear Regulatory Commission (NRC) granted an exemption from the requirements of 10 CFR 50.54(w)(1) (References 1 and 2) for Oyster Creek Nuclear Generating Station (OCNGS) to reduce the onsite insurance requirements for the facility. The exemption permitted OCNGS to lower the minimum required onsite insurance to $50 million once the spent fuel in the OCNGS Spent Fuel Pool (SFP) was deemed to no longer

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be susceptible to a zirconium fire. The approved exemption became effective at OCNGS on June 29, 2019 as approved by the NRC in References 1 and 2.

Pursuant to 10 CFR 50.12, "Specific exemptions," Holtec Decommissioning International, LLC (HDI) requests a permanent exemption from 10 CFR 50.54(w)(1) for OCNGS to reduce the required onsite insurance from $50 million to $10 million. This exemption request is based on HDI providing evidence that a worst-case contaminated liquid storage tank rupture or fuel handling accident would cost well less than $10 million to clean up. The Enclosure to this letter and the Attachment to the Enclosure provide the request for exemption and the supporting calculations.

The underlying purpose of 10 CFR 50.54(w)(1) is to require sufficient property damage insurance to ensure adequate funding of onsite post-accident recovery, stabilization and decontamination costs following an accident at an operating nuclear power plant. The requirements of 10 CFR 50.54(w)(1) were developed taking into consideration the risks associated with an operating nuclear power reactor, including the potential consequences of a release of radioactive material from the reactor.

As noted in the NRC Exemption permitting the insurance reduction to $50M (Reference 2), the regulation does not take into consideration the reduced potential for, and consequences of, such nuclear incidents at a permanently shutdown and defueled facility, such as OCNGS. For a permanently shutdown and defueled reactor, nuclear accidents involving the reactor and its associated systems, structures and components are no longer possible. Furthermore, reductions in the probability and consequences of non-operating reactor nuclear incidents are substantially reduced because: 1) the decay heat from the spent fuel decreases over time, which reduces the amount of cooling required to prevent the spent fuel from heating up to a temperature that could compromise the ability of the fuel cladding to retain fission products, and 2) the relatively short lived radionuclides contained in the spent fuel, particularly volatile components like iodine and noble gasses, decay away, thus reducing the inventory of radioactive materials available for release.

The NRC staff has generically evaluated the legal, technical, and policy issues regarding the financial protection requirements for large nuclear power plants that have been permanently shut down. The results of these evaluations were summarized in SECY-96-256, “Changes to Financial Protection Requirements for Permanently Shutdown Nuclear Power Reactors, 10 CFR 50.54(w) and 10 CFR 140.11” (Reference 3). In SECY-96-256, it is stated that $50 million is an adequate level of onsite property damage insurance to cover cleanup costs resulting from contaminated radwaste storage tank rupture which bounds the spent fuel handling accident. However, as demonstrated in the Enclosure to this letter and the Attachment to the Enclosure, given the current configuration of the OCNGS site, HDI has conservatively calculated the cost of remediation of the worst-case tank rupture or a fuel handling accident to be less than $10 million, and therefore $10 million is more than sufficient to cover cleanup costs of these remaining potential accidents.

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Furthermore, the current cost to decommission OCNGS as shown in the 2020 HDI annual decommissioning cost estimate provided in Reference 4, demonstrates that there is additional financial margin to further supplement the $10M in insurance if needed.

The exemption requested in this letter is permissible under 10 CFR 50.12 because it is authorized by law, will not present an undue risk to the public health and safety, is consistent with the common defense and security, and present special circumstances.

This letter contains no new regulatory commitments.

Should you have any questions or require further information, please contact me at (856) 797-0900, x3813.

Respectfully,

Andrea L. Sterdis

Digitally signed by Andrea L. Sterdis
DN: cn=Andrea L. Sterdis, c=US, o=HDI, ou=Holtec Decommissioning International, email=andrea.sterdis@holtec.com
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Andrea L. Sterdis
Vice President, Regulatory and Environmental Affairs
Holtec Decommissioning International, LLC

Enclosure:

Request for Exemption from 10 CFR 50.54(w)(1) Concerning Onsite Property Damage Insurance

Attachment to Enclosure:

Radiation Protection Calculation and Position Paper “CST Spill Scenario” OC-20-009, June 4, 2020

cc:

USNRC Regional Administrator, Region I
USNRC Project Manager, NMSS - Oyster Creek Nuclear Generating Station
USNRC Region I, Lead Inspector - Oyster Creek Nuclear Generating Station
Assistant Commissioner, Air Quality, Energy and Sustainability, NJ DEP
Assistant Director Radiation Protection Element, NJ Bureau of Nuclear Engineering

Enclosure to Letter HDI-OC-20-053

HDI Request for Exemption from 10 CFR 50.54(w)(1)

Concerning Oyster Creek Nuclear Generating Station

Onsite Property Damage Insurance

1.0 SPECIFIC EXEMPTION REQUEST

By letter dated June 12, 2019, the U.S. Nuclear Regulatory Commission (NRC) granted an exemption from the requirements of 10 CFR 50.54(w)(1) for Oyster Creek Nuclear Generating Station (OCNGS) to reduce the onsite insurance requirements for the facility (References 1 and 2). The exemption permitted OCNGS to lower the minimum required onsite insurance to $50 million once the spent fuel in the OCNGS Spent Fuel Pool (SFP) was deemed to no longer be susceptible to a zirconium fire. The approved exemption became effective on June 29, 2019 as approved by the NRC in References 1 and 2.

Pursuant to 10 CFR 50.12, "Specific exemptions," Holtec Decommissioning International, LLC (HDI) requests a permanent exemption from 10 CFR 50.54(w)(1) for OCNGS to reduce the required onsite insurance from $50 million to $10 million. This exemption request is based on OCNGS providing evidence that a worst-case contaminated liquid storage tank rupture or spent fuel handling accident would cost well less than $10 million to clean up, including contaminated soil remediation. The Attachment to this Request for Exemption provides the supporting calculations that conservatively demonstrate this remediation cost.

As demonstrated below, the requested exemption is permissible under 10 CFR 50.12 because it is authorized by law, will not present an undue risk to the public health and safety, is consistent with the common defense and security, and special circumstances are present.

2.0 BACKGROUND

On September 17, 2018, OCNGS permanently ceased power operations and by letter dated September 25, 2018, (Reference 3), Exelon certified that all fuel had been permanently removed from the OCNGS reactor vessel and placed in the spent fuel pool (SFP).

By letter dated June 12, 2019, the NRC granted OCNGS an exemption from the requirements of 10 CFR 50.54(w)(1) (References 1 and 2) allowing Oyster Creek to lower the minimum required onsite insurance to $50M 285 days after permanent cessation of power operations. The exemption became effective on June 29, 2019 which was 285 days following the September 17, 2018 permanent cessation of power operations at Oyster Creek.

3.0 BASIS FOR EXEMPTION REQUEST

As discussed above, HDI is requesting an exemption from 10 CFR 50.54(w)(1) that would allow OCNGS to lower the minimum required onsite insurance from $50 million to $10 million.

The underlying purpose of 10 CFR 50.54(w)(1) is to require sufficient property damage insurance to ensure adequate funding of onsite post-accident recovery, stabilization and decontamination costs following an accident at an operating nuclear power plant. The requirements of 10 CFR 50.54(w)(1) were developed taking into consideration the risks associated with an operating nuclear power reactor, including the potential consequences of a release of radioactive material from the reactor.

As noted in the NRC Exemption permitting the insurance reduction to $50M (Reference 2), the regulation does not take into consideration the reduced potential for, and consequences of, such nuclear incidents at a permanently shutdown and defueled facility, such as OCNGS. For a permanently shutdown and defueled reactor, nuclear accidents involving the reactor and its associated systems, structures and components are no longer possible. Furthermore, reductions in the probability and consequences of non-operating reactor nuclear incidents are substantially reduced because: 1) the decay heat from the spent fuel decreases over time, which reduces the amount of cooling required to prevent the spent fuel from heating up to a temperature that could compromise the ability of the fuel cladding to retain fission products, and 2) the relatively short lived radionuclides contained in the spent fuel, particularly volatile

components like iodine and noble gasses, decay away, thus reducing the inventory of radioactive materials available for release.

The NRC staff has generically evaluated the legal, technical, and policy issues regarding the financial protection requirements for large nuclear power plants that have been permanently shut down. The results of these evaluations were summarized in SECY-96-256, "Changes to Financial Protection Requirements for Permanently Shutdown Nuclear Power Reactors, 10 CFR 50.54(w) and 10 CFR 140.11" (Reference 4). In SECY-96-256, it is stated that $50 million is an adequate level of onsite property damage insurance to cover cleanup costs resulting from contaminated radwaste storage tank rupture which bounds the spent fuel handling accident. However, as demonstrated in this Enclosure and the Attachment to this Enclosure, given the current configuration of the OCNGS site, HDI has conservatively calculated the cost of remediation of the worst-case tank rupture or a fuel handling accident to be less than $10 million, and therefore $10 million is more than sufficient to cover cleanup costs of these remaining potential accidents.

Furthermore, the current cost to decommission OCNGS as shown in the 2020 HDI annual decommissioning cost estimate provided in Reference 5, demonstrates that there is additional financial margin to further supplement the $10M in insurance if needed.

4.0 TECHNICAL EVALUATION

As discussed above, HDI is requesting an exemption from 10 CFR 50.54(w)(1) that will lower the minimum required onsite insurance from $50 million to $10 million.

Following the termination of reactor operations at OCNGS and the permanent removal of the fuel from the reactor vessel, the postulated accidents involving failure or malfunction of the reactor and supporting structures, systems and components are no longer applicable.

Consequences of Contaminated Liquid Storage Tank Rupture

As shown in the Attachment to this Exemption Request (CST Spill Scenario, OC-20-009), given a worst-case scenario spill from the largest radiologically impacted outdoor tank without a containment, the cost to remediate the spill would be, at most, $9 million, which is below the requested $10 million of required onsite insurance.

Consequences of a Spent Fuel Handling Accident

Based upon the demonstrated reduced cost for remediation of a worst-case contaminated liquid storage tank rupture, the remaining bounding accident cost identified in SECY-96-256 becomes a spent fuel handling accident. This accident constitutes the drop of a single assembly, resulting in 100% rod rupture, with a stated estimated onsite cleanup cost between $9 and 24 million. These values were derived in NUREG/CR-6451 (Reference 6) by extrapolation from data presented in the NUREG/CR-2601 (Reference 7) for a minor loss of cooling accident with far more significant consequences and greater extent of remediation needed. Although the value in NUREG/CR-2601 was ultimately scaled down, escalated, and multiplied for contingency within NUREG/CR-6451 to arrive at the final value of $24 million, HDI has further determined that this value assumed necessary for onsite remediation of a spent fuel handling accident is in significant excess of the expected cost, based Holtec International's recent work of a similar nature. HDI has determined the costs associated with cleanup following such a spent fuel handling accident to be conservatively bounded by $5,000,000. This value is inclusive of all necessary tooling (<$2,000,000), hardware (<$2,500,000),

and labor costs (<$500,000). It is noted that some potential activities that may be required, such as rack removal and pool floor surveys and clean up, are already included as base scope in the decommissioning effort and therefore do not represent additional cost. In further confirmation of Holtec International's first-hand knowledge of these costs, HDI also requested a budgetary estimate from a trusted nuclear supplier for remediation and recovery services and that estimate is also well below the $5,000,000 noted here.

5.0 JUSTIFICATION FOR EXEMPTIONS AND SPECIAL CIRCUMSTANCES

In accordance with 10 CFR 50.12, "Specific exemptions," 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 and 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. These special circumstances include, among other things, that 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.

5.1 Exemptions

A. The exemptions are authorized by law

10 CFR 50.12 allows the U.S. Nuclear Regulatory Commission (NRC) to grant exemptions from the requirements of 10 CFR Part 50.

A similar exemption was previously approved for OCNGS by the NRC on June 12, 2019 (References 1 and 2). The proposed exemption is not contrary to the Atomic Energy Act of 1954, as amended, or the Commission's regulations. Therefore, the exemption is authorized by law.

B. The exemptions will not present an undue risk to public health and safety

The requirements of 10 CFR 50.54(w)(1) and the existing level of onsite insurance coverage are predicated on the assumption that the reactor is operating. However, OCNGS permanently ceased power operations on September 17, 2018, and certified that the reactor had been permanently defueled on September 25, 2018 (Reference 3). The permanently defueled status of the facility results 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 purpose of this exemption request is to request an exemption from the requirements of 10 CFR 50.54(w)(1) for OCNGS to lower the minimum required onsite insurance from $50 million to $10 million.

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 risk and reduced cost consequences of potential nuclear incidents at OCNGS in a permanently defueled condition. Therefore, granting the requested exemption will not present an undue risk to the health and safety of the public.

C. The exemptions are 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 OCNGSs ability to physically secure the site or protect special nuclear material. Physical security measures at OCNGS are not affected by the requested exemption. Therefore, the proposed exemption is consistent with the common defense and security.

5.2 Special Circumstances

Pursuant to 10 CFR 50.12(a)(2), the NRC will not consider granting an exemption to its regulations unless special circumstances are present. HDI has determined that special circumstances are present because the plant has been permanently shut down and defueled and the radiological source term at the site has been reduced from that associated with reactor power operation. With the reactor power plant permanently shut down and defueled, the design basis accidents and transients postulated to occur during reactor operation are no longer possible. In particular, the potential for a release of a large radiological source term to the environment from the high pressures and temperatures associated with reactor operation no longer exist. Furthermore, the spent fuel stored in the OCNGS SFP is no longer susceptible to a zirconium fire (Reference 2).

A. 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. (10 CFR 50.12(a)(2)(ii))

The underlying purpose of 10 CFR 50.54(w)(1) is to require sufficient property damage insurance to ensure funding of onsite post-accident recovery stabilization, and decontamination costs following an accident at an operating nuclear power plant. The requirements of 10 CFR 50.54(w)(1) were developed taking into consideration the risks associated with the operation of an operating nuclear power reactor, including the potential consequences of a release of radioactive material from the reactor. However, the regulation does not take into consideration the reduced potential for, and consequences of, nuclear incidents at permanently shutdown facilities.

The proposed reduction in the level of onsite insurance coverage from $50 million to $10 million would continue to serve the underlying purpose of the rule by requiring a level of financial protection commensurate with the significant reduction in the probability and consequences of nuclear incidents at OCNGS. Consistent with the NRCs conclusions documented in SECY-00-145, "Integrated Rulemaking Plan for Nuclear Power Plant Decommissioning" (Reference 8), the proposed reduction in the level of onsite insurance coverage would continue to require sufficient property damage insurance to ensure funding for onsite post-accident recovery, stabilization, and decontamination costs in the unlikely event of an accident at OCNGS.

Therefore, application of the requirement to maintain $50 million in onsite insurance coverage is not necessary to achieve the underlying purpose of this rule and special circumstances are present as defined in 10 CFR 50.12(a)(2)(ii).

B. 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. (10 CFR 50.12(a)(2)(iii))

Continued application of the requirement to maintain $50 million in onsite insurance coverage for OCNGS would result in undue hardship and costs being incurred by the OCNGS decommissioning trust fund for the purchase of unnecessary levels of onsite insurance coverage. An insurance coverage of $10 million is shown to be an adequate amount to cover the cost of a contaminated storage tank rupture or spent fuel handling accident at OCNGS.

Therefore, compliance with the rule would result in an 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 and the special circumstances required by 10 CFR 50.12(a)(2)(iii) exist.

6.0 PRECEDENT

The NRC has approved numerous exemptions that allow a reduction in the required onsite insurance amount for decommissioning power reactors based on the reduction of accident risk. Accident risk is assessed based on NRC documentation and reviews of changing facility conditions. As risks are reduced and accident liabilities are quantified exemptions to operating plant requirements have been granted.

As stated in the previously approved exemption for OCNGS (References 1 and 2) once the zirconium fire risks from the irradiated fuel stored in the SFP are of negligible concern $50 million in onsite insurance coverage is consistent with the maximum estimated cleanup costs for the recovery from the rupture of a large liquid radwaste storage tank or a spent fuel handling accident. In recognition of the current configuration at Oyster Creek, HDI has conservatively quantified the maximum cleanup recovery cost from the referenced remaining accidents at well less than $10M.

7.0 ENVIRONMENTAL ASSESSMENT

The proposed exemption meets the eligibility criterion for categorical exclusion set forth in 10 CFR 51.22(c)(25), because the proposed exemption involves: (i) no significant hazards consideration; (ii) no significant change in the types or significant increase in the amounts of any effluents that may be released offsite; (iii) no significant increase in individual or cumulative public or occupational radiation exposure; (iv) no significant construction impact; (v) no significant increase in the potential for or consequences from radiological accidents; and (vi) the requirements from which the exemption is sought involve: (H) surety, insurance or indemnity requirements.

Therefore, pursuant to 10 CFR 51.22(b), no environmental impact statement or environmental assessment need be prepared in connection with the proposed exemption.

(i) No Significant Hazards Consideration Determination

HDI has evaluated the proposed exemption to determine whether or not a significant hazards consideration is involved by focusing on the three standards set forth in 10 CFR 50.92 as discussed below:

1. Does the proposed exemption involve a significant increase in the probability or consequences of an accident previously evaluated?

   Response: No.

   The proposed exemption is administrative in nature. It has no effect on structures, systems, and components (SSCs) and no effect on the capability of any plant SSC to perform its design function. The proposed exemptions would not increase the likelihood of the malfunction of any plant SSC.

   When the exemptions become effective, there will be no credible events that would result in doses to the public beyond the exclusion area boundary that would exceed the Environmental Protection Agency (EPA) Protective Action Guides (PAGs). The probability of occurrence of previously evaluated accidents is not increased, since most previously analyzed accidents will no longer be able to occur and the probability and consequences of the remaining Fuel Handling Accident (FHA) are unaffected by the proposed amendment.

   Therefore, the proposed exemption does not involve a significant increase in the probability or consequences of an accident previously evaluated.

2. Do the proposed exemptions create the possibility of a new or different kind of accident from any accident previously evaluated?

   Response: No.

The proposed exemption does not involve a physical alteration of the plant. No new or different type of equipment will be installed and there are no physical modifications to existing equipment associated with the proposed exemption. Similarly, the proposed exemption will not physically change any SSCs involved in the mitigation of any accidents. Thus, no new initiators or precursors of a new or different kind of accident are created. Furthermore, the proposed exemption does not create the possibility of a new accident as a result of new failure modes associated with any equipment or personnel failures. No changes are being made to parameters within which the plant is normally operated, or in the setpoints which initiate protective or mitigative actions, and no new failure modes are being introduced.

Therefore, the proposed exemption does not create the possibility of a new or different kind of accident from any accident previously evaluated.

3. Do the proposed exemptions involve a significant reduction in a margin of safety?

Response: No.

The proposed exemption does not alter the design basis or any safety limits for the plant. The proposed exemption does not impact station operation or any plant SSC that is relied upon for accident mitigation. Therefore, the proposed exemption does not involve a significant reduction in a margin of safety.

Based on the above, HDI concludes that the proposed exemption presents no significant hazards consideration, and, accordingly, a finding of "no significant hazards consideration" is justified.

(ii) There is no significant change in the types or significant increase in the amounts of any effluents that may be released offsite.

There are no expected changes in the types, characteristics, or quantities of effluents discharged to the environment associated with the proposed exemption. There are no materials or chemicals introduced into the plant that could affect the characteristics or types of effluents released offsite. In addition, the method of operation of waste processing systems will not be affected by the exemption. The proposed exemption will not result in changes to the design basis requirements of SSCs that function to limit or monitor the release of effluents. All the SSCs associated with limiting the release of effluents will continue to be able to perform their functions. Therefore, the proposed exemption will result in no significant change to 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.

The proposed exemption does not involve any physical alterations to the plant configuration or any changes to the operation of the facility that could lead to a significant increase in individual or cumulative occupational radiation exposure.

(iv) There is no significant construction impact.

No construction activities are associated with the proposed exemption.

(v) There is no significant increase in the potential for or consequences from radiological accidents.

See the no significant hazards considerations discussion in Item (i)1. above.

(vi) The requirements from which exemption is sought involve: (H) surety, insurance or indemnity requirements.

The requirements from which the exemption is sought involve financial protection and the indemnification and limitation of liability of licensees pursuant to Section 170 of the Atomic Energy Act of 1954, as amended and 10 CFR 50.54(w)(1).

8.0 CONCLUSION

Pursuant to the provisions of 10 CFR 50.12, HDI is requesting a permanent exemption from 10 CFR 50.54(w)(1) for OCNGS to reduce the minimum required onsite insurance from $50 million to $10 million. Based on the considerations discussed above, the requested 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. In addition, special circumstances are present as set forth in 10 CFR 50.12.

9.0 REFERENCES:

1. Letter from U.S. Nuclear Regulatory Commission to Exelon, “Oyster Creek Nuclear Generating Station—Exemption from the Requirements of 10 CFR 50.54(w)(1), Concerning Property Insurance (EPID L-2019-LLE-0007),” dated June 12, 2019, (ADAMS Accession No. ML1929A320)
2. NRC Oyster Creek Nuclear Generating Station Exemption, 10 CFR 50.54(w) Onsite Property Damage Insurance, dated June 12, 2019, (ADAMS Accession No. ML19129A102)
3. Letter from Michael P. Gallagher, Exelon Generation Company, LLC to U.S. Nuclear Regulatory Commission - "Certification of Permanent Removal of Fuel from the Reactor Vessel for Oyster Creek Nuclear Generating Station," dated September 25, 2018 (ADAMS Accession No. ML18268A258)
4. Commission Paper, SECY-96-256, "Changes to the Financial Protection Requirements for Permanently Shutdown Nuclear Power Reactors, 10 CFR 50.54(w) and 10 CFR 140.11,” dated December 17, 1996 (ADAMS Accession No. ML15062A483)
5. Letter from Holtec Decommissioning International, LLC (HDI) to U.S. Nuclear Regulatory Commission, "Report on Status of Decommissioning Funding for Reactors and Independent Spent Fuel Storage Installations,” dated March 31, 2020 (ADAMS Accession No. ML20091M858)
6. NUREG/CR-6451, “A Safety and Regulatory Assessment of Generic BWR and PWR Permanently Shutdown Nuclear Power Plants,” Prepared by Brookhaven National Laboratory, dated August 1997 (ADAMS Accession No. ML082260098)
7. NUREG/CR-2601, “Technology, Safety and Costs of Decommissioning Reference Light Water Reactors Following Postulated Accidents, Volume 1,” Prepared by Pacific Northwest Laboratory, dated November 1982 (ADAMS Accession No. ML14023A049)
8. Commission Paper, SECY-00-145, "Integrated Rulemaking Plan for Nuclear Power Plant Decommissioning,” dated June 28, 2000 (ADAMS Accession No. ML003721626)

Enclosure Letter HDI-OC-20-053

Attachment

OC-20-009, Revision 1, dated June 16, 2020

Radiation Protection Calculation and Position Paper

CST Spill Scenario

RADIATION PROTECTION CALCULATION AND POSITION PAPER

TITLE: CST SPILL SCENARIO

Prepared by: / Date	Reviewed by: / Date	Corporate Challenge Complete	Approved by: / Date
J. McCarthy, CHP / 16 June 2020	A. Farenga 16 JUNE 2020	N/A	K. Wolf 6/16/20

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ACRONYM AND SYMBOL LIST	
ALARA	As Low As Reasonably Achievable
CHP	Certified Health Physicist
cm	centimeter
CST	Condensate Storage Tank
DWST	Demineralized Water Storage Tank
ESW	Emergency Service Water
ft	foot
g	gram
gal	gallon
HSA	Historical Site Assessment
in	inch
lb	pound
m	meter
MARSSIM	Multi-Agency Radiation Survey and Site Investigation Manual
MDC	Minimum Detectable Concentration
mL	milliLiter
NUREG	Nuclear Regulation
PA	Protected Area
pCi	picoCurie
RCA	Radiological Controlled Area
RMA	Radioactive Materials Area
SRRS	Standard Records Retention Schedule
UTM	Universal Transverse Mercator
μCi	microCurie
$	dollars
%	percentage

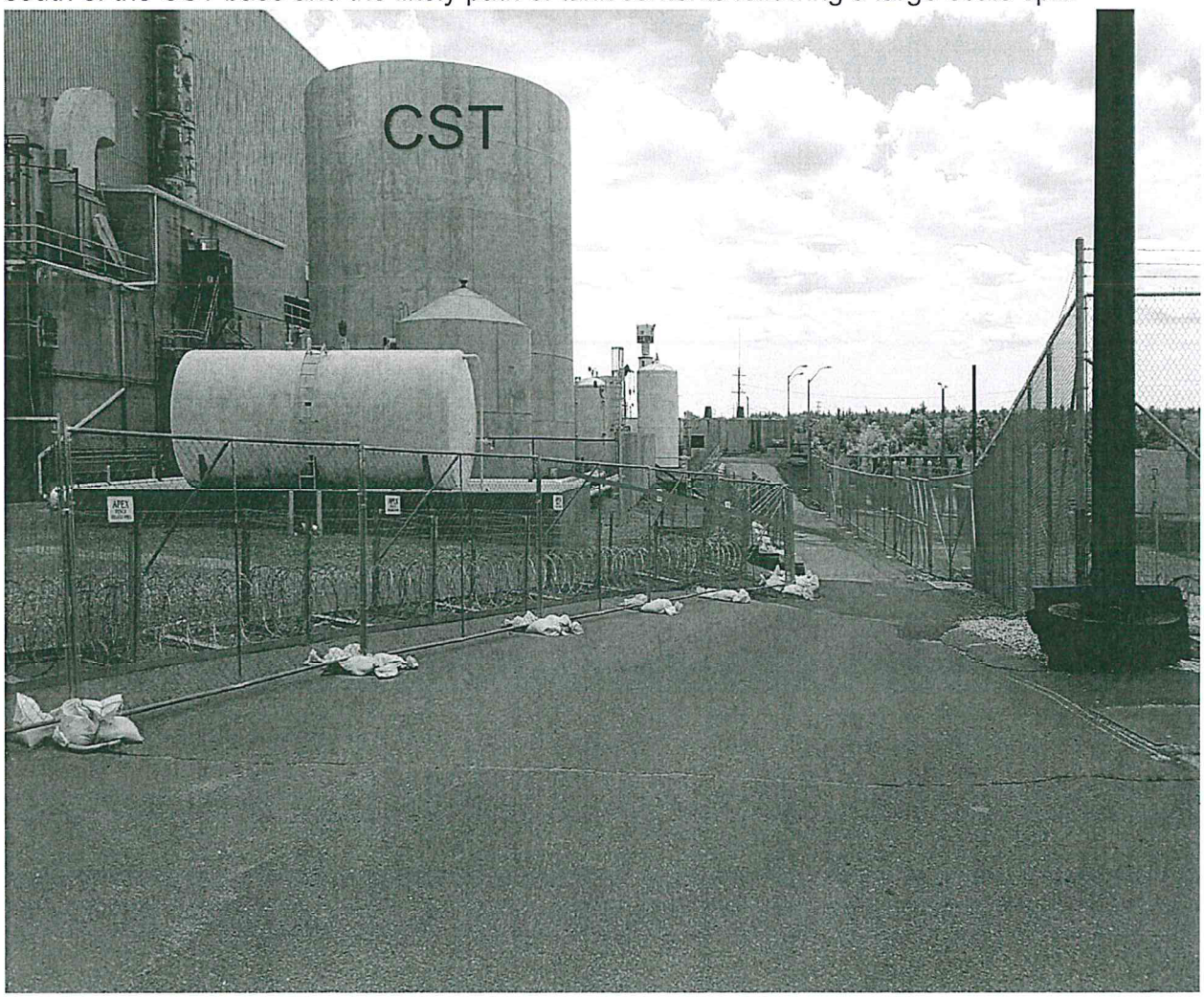
1.0 PROBLEM OR ISSUE STATEMENT

Determine the mass and volume of soil that could be potentially contaminated and require remediation given a worst-case spill scenario from the largest radiologically impacted outdoor tank without a containment. Estimate disposal cost for a conservative worst-case scenario.

2.0 BACKGROUND OR INTRODUCTION

There are several radiologically impacted outdoor tanks listed in Section 7.2.1.2 of the HSA. The tanks of interest are the CST, DWST, chemical waste (2), and high purity sample (2). The CST represents the bounding case due to 1) largest volume, 2) lack of containment, and 3) location and elevation relative to soil including the discharge canal and other media.

Figure 1: CST facing south. Depiction shows the decreased elevation west and south of the CST base and the likely path of tank contents following a large-scale spill.



3.0 METHODOLOGY (LIST MATERIALS)

A. Obtain current radiological surveys and chemistry data for the CST.

B. Determine bounding volume of potentially contaminated soil.

C. Determine disposal cost.

D. No materials were required.

4.0 ASSUMPTIONS

A. Soil is the only media impacted by this scenario.

Riprap, small rock, asphalt, and wood although present were not included.

B. The CST is at 500,000 gal, which is 95% of full capacity (actual volume was 85,556 gal 20 April 2020).

C. Total tritium (H^3) available for release is 9.7×10^5 μCi (from the 15 April 2020 chemistry results).

$^3H_{activity} = 5.1 \times 10^{-4}$ μCi $mL^{-1} \times 3.785 \times 10^3$ mL $gal^{-1} \times 500{,}000$ gal $= 9.7 \times 10^5$ μCi.

D. Total ^{60}Co available for release is 6.1×10^2 μCi (actual ^{60}Co was below the MDC from the 30 April 2020 chemistry results).

^{60}Co was considered "present" at the concentration reported for the MDC, which is conservative.

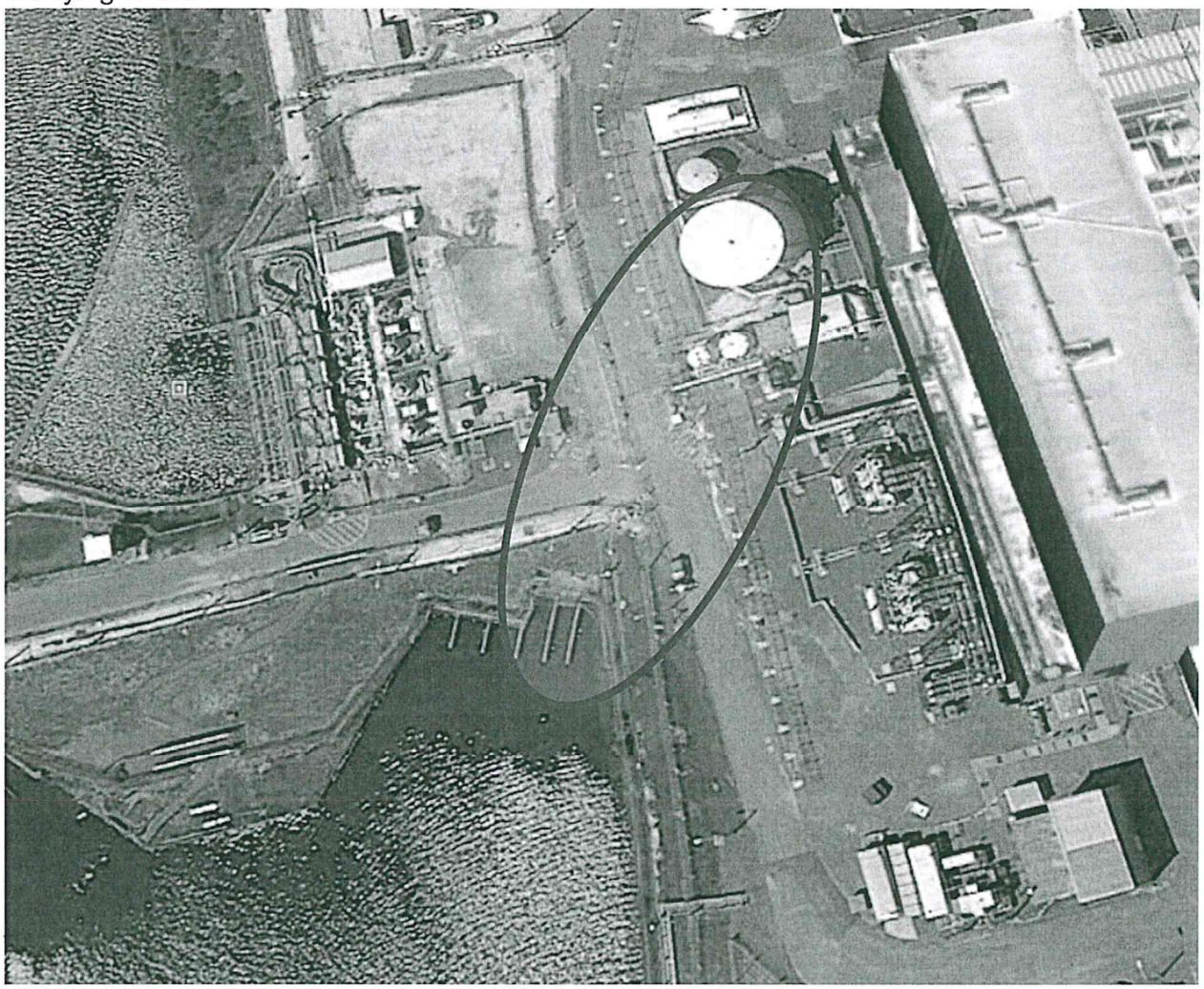
$^{60}Co_{activity} = 3.21 \times 10^{-7}$ μCi $mL^{-1} \times 3.785 \times 10^3$ mL $gal^{-1} \times 500{,}000$ gal $= 6.1 \times 10^{-2}$ μCi.

E. Soil density (2.35 g cm^{-3}), porosity, hydraulic conductivity and gradient, soil thickness, radionuclide mobility and concentration are assumed constant throughout the contaminated zone.

F. No holdup, ponding, or diverting of liquid due to structures or topography.

G. The flow is primarily downward towards the discharge canal. Although some liquid will remain on the roadway, most will either flow down the storm drain, enter the ESW concrete cable vault, or enter the discharge canal.

Figure 2: CST showing maximally affected areas west and east. Oval shape assumed given contour and location of the CST relative to the discharge canal and low-lying areas.



5.0 RESULTS OR CONCLUSIONS

The volume of potentially contaminated soil was around 3,820 m^3, which is a conservative and bounding estimate. The amount of radioactivity released is conservative since it assumed almost six times the existing tank volume.

The total estimate to dispose of the material as radioactive waste is roughly 9,700,000 dollars and this is using the very conservative assumptions of 1) 95% CST capacity, 2) all CST contents released, 3) uniform distribution of radioactivity over a large area with no small areas of elevated radioactivity, and 4) impacted contamination zone is all soil. This is a conservative and bounding estimate.

In reality a CST spill under current conditions would probably **not** require remediation. Present CST level is 17% of what was used in this evaluation, and therefore the potential volume available for release is much lower than that assumed. Spent fuel pool samples have shown a decline in radioactivity concentration due to the lack of production and radioactive decay following permanent shut down and defueling.

With roughly 50% of the affected area paved or covered with rip rap the majority of the liquid released would likely be routed to the discharge canal and accounted for as an overboard discharge. The discharge canal could pass final status survey (FSS) **without** large scale remediation based on 1) actual volume released, radionuclides, and concentration, 2) actual distribution of radioactivity laterally and vertically, and 3) through the use of the elevated measurement comparison (EMC) and area factor correction for small areas of elevated activity, or 4) an ALARA evaluation described by NUREG-1727 Appendix D (Reference B) demonstrates that further reduction of residual radioactivity is unnecessary considering the undesirable effects or costs of the remedial action to satisfy the release criteria for the discharge canal.

6.0 DISCUSSION

The CST, also known as T-11-1, is a vertical vented tank with a capacity of 525,000 gallons. The CST provides makeup volume for the condensate system. The CST centerline geographical coordinates are using the UTM coordinate system is zone 18s, easting 567890.47 m, northing 4407446.62 m.

The CST is outside the RCA and within the PA. The CST is in a fenced, posted RMA due to the shine dose from the bottom of the tank. There are permanent shielding blocks in the east and north; the shield blocks at the tank are two-foot-high; and the shield blocks along the east fence are five foot high. The CST has contained reactor coolant, condensate system water, and fuel pool water.

During refuel outages the CST received higher activity water from reactor cavity drain down via the condenser hotwells. This is the major source of the high activity sludge that settled on the bottom of the CST. The CST was decontaminated reducing the CST from a high radiation source to a radiation area source.

It is important to recognize that the Site goal for water management is to eliminate outdoor water storage tanks for radioactive liquids. The torus will be the main reservoir for radioactive liquids until the spent fuel pool is empty and it and other systems are drained and retired in place. Therefore, corrosion and wear, fission products are not expected to increase significantly (less than an order of magnitude). Tritium is not expected to increase above spent fuel pool levels due to lack of production (i.e., no tertiary fission or neutron activation of lithium-6 (^{6}Li)).

7.0 CALCULATION

The screening values for soil ^{60}Co and tritium are 3.8×10^{0} pCi g^{-1} and 1.1×10^{2} pCi g^{-1} respectively. (Reference C) The unity rule or sum of the fractions (SOF) is given by:

$$SOF = \frac{H(conc)}{H(SL)} + \frac{Co(conc)}{Co(SL)} \qquad \text{Equation 1}$$

Where,

SOF	≡	Sum of the fractions, unitless
H(conc)	≡	^{3}H soil concentration in pCi g^{-1}
H(SL)	≡	^{3}H screening level = 1.1×10^{2} pCi g^{-1}
Co(conc)	≡	^{60}Co soil concentration in pCi g^{-1}
Co(SL)	≡	^{60}Co screening level = 3.8×10^{0} pCi g^{-1}

Soil concentration is determined by:

$$Conc = \frac{Act}{mass} \qquad \text{Equation 2}$$

Where,

Conc	≡	soil concentration in pCi g^{-1}
Act	≡	Activity in pCi
mass	≡	contaminated zone mass in g

Solving for the mass which results in the sum of fractions being equal to unity, and thus requiring remediation:

H(conc)/H(SL)/mass + Co(conc)/Co(SL)/mass ≥ 1, requiring remediation

The contaminated zone mass is:

mass = $(9.7 \times 10^5\ \mu Ci \times 1 \times 10^6\ pCi\ \mu Ci^{-1}) / 1.1 \times 10^2\ pCi\ g^{-1}$

$+ (6.1 \times 10^2\ \mu Ci \times 1 \times 10^6\ pCi\ \mu Ci^{-1}) / 3.8 \times 10^0\ pCi\ g^{-1}$

$= 8.98 \times 10^9$ g or about 1.98×10^7 lb

The contaminated zone volume is:

$8.98 \times 10^9\ g \times (2.35\ g\ cm^{-3})^{-1} \times 1 \times 10^{-6}\ m^3\ cm^{-3} = 3.82 \times 10^3\ m^3$

Estimated cost to dispose of as radioactive waste.

Table 1: Disposal cost parameters

$ 0.35 per lb	Disposal Operation Facility pricing
1.98×10^7 lb	weight of soil to be remediated and disposed as radioactive waste
$ 7,000 per load	transportation, permits, container rental
50,000 lb per load	to keep the total load under 80,000 lb

The cost for disposal:

$\$ 0.35\ lb^{-1} \times 1.98 \times 10^7\ lb = \$ 6.9 \times 10^6$

The cost for transportation, etc.:

$\$ 7{,}000\ load^{-1} \times 2.0 \times 10^{-5}\ load\ lb^{-1} \times 1.98 \times 10^7\ lb = \$ 2.8 \times 10^6$

Total estimate is roughly 9,700,000 dollars under the very conservative assumptions of 1) 95% CST capacity, 2) all CST contents released, 3) uniform distribution of radioactivity over a large area, and 4) impacted contamination zone is all soil.

8.0 REFERENCES

A. NUREG-1575 Multi-Agency Radiation Survey and Site Investigation Manual

B. NUREG-1727 NMSS Decommissioning Standard Review Plan Appendix D ALARA Analyses

C. NUREG-1757 Volume 1 Appendix Table B.2 Screening Values (pCi/g) of Common Radionuclides for Soil Surface Contamination Levels

9.0 APPENDICES OR ATTACHMENTS - NONE