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January 13, 2022

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

Docket No. 99902086 - HDI Spent Fuel Pool Heatup Calculation Methodology

Subject: Holtec Presentation Materials for January 20, 2022, ACRS Subcommittee Meeting (Accident Analysis- T-H Subcommittee)

Reference:

Letter from Holtec International to US NRC, "Holtec Spent Fuel Pool Heat Up Calculation Methodology Topical Report," September 29, 2020 (ML20280A524)

Dear Sir or Madam:

In the Referenced letter, Holtec submitted a Topical Report providing a methodology for calculating Spent Fuel Pool heat up for NRC review and approval. Holtec believes the methodology will be a large benefit in reducing zirconium fire risks in the spent fuel pool.

The Topical Report is scheduled for discussion during the January 20, 2022, ACRS Accident Analysis- T-H Subcommittee Meeting. Holtec is providing the enclosed presentation materials in advance of the meeting.

Enclosure 1 provides the Holtec Presentation for the Closed Session. This enclosure contains information proprietary to Holtec and is therefore supported by an affidavit signed by Holtec which is provided in the Attachment to the letter.

Enclosure 2 provides a non-proprietary, redacted version of the Holtec Presentation for the Closed Session.

Enclosure 3 provides the Holtec Presentation for the Open Session (Public Session) for the subcommittee meeting. Enclosure 3 is non-proprietary.

If you have any questions, please contact me at 856-797-0900 ext. 3578.

Sincerely,

Jean A. Fleming  
VP, Regulatory and Environmental Affairs  
Holtec Decommissioning International



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Enclosures:

- Enclosure 1 Holtec Presentation for the Closed Session January 20, 2022, ACRS Subcommittee Meeting (Holtec Proprietary Withhold Information from Public Disclosure pursuant to 10 CFR 2.390)
- Enclosure 2 Holtec Presentation for the Closed Session January 20, 2022, ACRS Subcommittee Meeting—Redacted (Non-Proprietary)
- Enclosure 3 Holtec Presentation for the Open Session January 20, 2022, ACRS Subcommittee Meeting (Non-Proprietary)
- Attachment Affidavit Pursuant to 10 CFR 2.390 to Withhold Information from Public Disclosure

cc:

Robert Lucas, NRC, NRR/DORL/LLPB  
Dennis Morey, NRC, NRR/DORL/LLPB  
Ekaterina Lenning, NRC, NRR/DORL/LLPB  
Christopher Regan, NRC, NMSS/DFM

Enclosure 1

January 13, 2022, Letter, Holtec Decommissioning International to US NRC

Holtec Presentation for the January 20, 2022, ACRS Subcommittee Meeting

CLOSED SESSION

~~Proprietary Version~~

~~Withhold Information from Public Disclosure Under 10 CFR 2.390~~

(21 Pages Submitted Separately)

Enclosure 2

January 13, 2022, Letter, Holtec Decommissioning International to US NRC

Holtec Presentation for the January 20, 2022, ACRS Subcommittee Meeting

CLOSED SESSION

Redacted Version

(21 Pages)

# **Topical Report: Method for Determining Spent Fuel Assembly Heat Up During a Theoretical Drain Down Event of a Spent Fuel Pool**

**Holtec Presentation to ACRS Subcommittee  
Closed Session (REDACTED VERSION)**

January 20, 2022

# Agenda

- Introductions
- Purpose of the Topical Report
- Problem Description
- Acceptance Criteria and Principal Solution
- Previously used Methodology
- Methodology proposed in Topical Report
- Computational Details
- Summary

## ■ Holtec

- ✔ Kelly Trice – President, Holtec Decommissioning International, LLC (HDI)
- ✔ Jean Fleming – Vice President, HDI Regulatory and Environmental Affairs
- ✔ Andrea Sterdis – Vice President, HDI Decommissioning
- ✔ Stefan Anton – Vice President of Engineering – Technical Expert Group, NPD

# Purpose of the Topical Report

- Provide a methodology to proactively determine the best overall spent fuel pool arrangement to eliminate the risk of a zirc fire as soon as possible after permanent defueling.

- [

4.a, 4.b

]

- Placing the fuel assemblies in a pattern that improves cooling in the fuel pool results in a significant and real safety benefit that can be recognized.



# Problem Description

- During a theoretical beyond design basis drain down event of a spent fuel pool, the cladding of the fuel assemblies would heat up due to the loss of water cooling in the pool.
- If the cladding temperature exceeds a certain value, there is the possibility of an exothermal reaction with the air, possibly resulting in what is commonly called a “zirconium fire” or “zirc fire”.

# Acceptance Criteria and Principal Approach

- The criteria to evaluate if such a condition may occur, used in previous applications and reviewed and approved by NRC, is that a cladding temperature of 900 °C is not exceeded within 10 hours from the drain-down event.
- The principal approach to determine if the condition could occur or not is to perform a transient thermal analysis, and determine the parameters (e.g. cooling time of the fuel assemblies) that needs to be satisfied for the temperature to not exceed the limit within that time.

# Previously used Methodology

- The methodology previously used, and reviewed and approved by NRC, is a transient thermal calculation using the following main conservative assumptions
  1. A single assembly is analyzed
  2. Highest decay heat of all assemblies in the spent fuel pool is applied to that assembly
  3. No lateral heat loss to surrounding assemblies
  4. No air flow through the rack and assembly
  5. No other axial heat loss through the top and bottom of the spent fuel rack
- Implementation is fairly simple
  - ✔ Can be done with a simple analytical calculational approach, or a simple spreadsheet.
- Disadvantages

[ 4.a, 4.b ]

# Methodology proposed in Holtec Topical Report (TR)

- Principal difference between the methodology presented in the TR and the previously used methodology (described on the previous slide) is that [



4.a, 4.b

- ✓ This results in an improvement over the previous method, without significantly increasing the calculational effort.
  - A simple spreadsheet is still all that is needed.

# Methodology proposed in Holtec Topical Report (TR)

- Other conservative assumptions remain unchanged.
  - ✓ No air flow through the rack and assembly (assumption 4)
  - ✓ No other axial heat loss through the top and bottom of the spent fuel rack (assumption 5).

# Calculational Details

4.a, 4.b

# Calculational Details



4.a, 4.b

## Calculational Details – [ ]



4.a, 4.b



# Examples of [ ] values

4.a, 4.b

# Calculational Details – Application [

]



4.a, 4.b



# Summary

- A topical report has been submitted that improves on the method to determine if a zirc fire is possible in a spent fuel pool after the assumed drain-down of the water in the pool.

- [

] 4.a, 4.b

- The method still employs significant conservatisms. Specifically, it still assumes there is no air flow through the rack cell and assemblies after the drain down event.

Enclosure 3

January 13, 2022, Letter, Holtec Decommissioning International to US NRC

Holtec Presentation for the January 20, 2022, ACRS Subcommittee Meeting

OPEN SESSION

Non-Proprietary

(8 Pages)

# **Topical Report: Method for Determining Spent Fuel Assembly Heat Up During a Theoretical Drain Down Event of a Spent Fuel Pool**

**Holtec Presentation to ACRS Subcommittee  
OPEN Session**

January 20, 2022

# Agenda

- Introductions
- Purpose of the Topical Report
- Problem Description
- Acceptance Criteria and Principal Solution
- Previously used Methodology
- Methodology proposed in Topical Report
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# Introduction



## ■ Holtec

- ✔ Kelly Trice – President, Holtec Decommissioning International, LLC (HDI)
- ✔ Jean Fleming – Vice President, HDI Regulatory and Environmental Affairs
- ✔ Andrea Sterdis – Vice President, HDI Decommissioning
- ✔ Stefan Anton – Vice President of Engineering – Technical Expert Group, NPD

# Purpose of the Topical Report

- Provide a methodology to proactively determine the best overall spent fuel pool arrangement to eliminate the risk of a zirc fire as soon as possible after permanent defueling.
- The methodology developed by Holtec can be used to gain a significant and real safety benefit that can be recognized.



# Problem Description

- During a theoretical beyond design basis drain down event of a spent fuel pool, the cladding of the fuel assemblies would heat up due to the loss of water cooling in the pool.
- If the cladding temperature exceeds a certain value, there is the possibility of an exothermal reaction with the air, possibly resulting in what is commonly called a “zirconium fire” or “zirc fire”.

# Acceptance Criteria and Principal Approach

- The criteria to evaluate if such a condition may occur, used in previous applications and reviewed and approved by NRC, is that a cladding temperature of 900 °C is not exceeded within 10 hours from the drain-down event.
- The principal approach to determine if the condition could occur or not is to perform a transient thermal analysis, and determine the parameters (e.g. cooling time of the fuel assemblies) that needs to be satisfied for the temperature to not exceed the limit within that time.

# Previously used Methodology

- The methodology previously used, and reviewed and approved by NRC, is a transient thermal calculation using the following main conservative assumptions
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  2. Highest decay heat of all assemblies in the spent fuel pool is applied to that assembly
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  5. No other axial heat loss through the top and bottom of the spent fuel rack
- Implementation is fairly simple
  - ✔ Can be done with a simple analytical calculational approach, or a simple spreadsheet.

# Summary

- A topical report has been submitted that improves on the method to determine if a zirc fire is possible in a spent fuel pool after the assumed drain-down of the water in the pool.
- The method still employs significant conservatisms. Specifically, it still assumes there is no air flow through the rack cell and assemblies after the drain down event.

Attachment

January 13, 2022, Letter, Holtec Decommissioning International to US NRC

Affidavit for Withholding

(5 Pages Attached)

**AFFIDAVIT PURSUANT TO 10 CFR 2.390**

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I, Jean A. Fleming, being duly sworn, depose and state as follows:

- 1) I have reviewed the information provided in the Holtec presentation prepared for the January 20, 2022 ACRS subcommittee meeting which is sought to be withheld, and am authorized to apply for its withholding.
- 2) The information sought to be withheld is in the Holtec Closed Session Presentation and is provided as Enclosure 1 to this HDI letter dated January 13, 2022. The Closed Session Presentation contains information that is proprietary to Holtec International.
- 3) In making this application for withholding of proprietary information of which it is the owner, Holtec International relies upon the exemption from disclosure set forth in the Freedom of Information Act ("FOIA"), 5 USC Sec. 552(b)(4) and the Trade Secrets Act, 18 USC Sec. 1905, and NRC regulations 10 CFR Part 9.17(a)(4), 2.390(a)(4), and 2.390(b)(1) for "trade secrets and commercial or financial information obtained from a person and privileged or confidential" (Exemption 4). The material for which exemption from disclosure is here sought is all "confidential commercial information", and some portions also qualify under the narrower definition of "trade secret", within the meanings assigned to those terms for purposes of FOIA Exemption 4 in, respectively, Critical Mass Energy Project v. Nuclear Regulatory Commission, 975F2d871 (DC Cir. 1992), and Public Citizen Health Research Group v. FDA, 704F2d1280 (DC Cir. 1983).

**AFFIDAVIT PURSUANT TO 10 CFR 2.390**

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- 4) Some examples of categories of information which fit into the definition of proprietary information are:
- a. Information that discloses a process, method, or apparatus, including supporting data and analyses, where prevention of its use by Holtec's competitors without license from Holtec International constitutes a competitive economic advantage over other companies;
  - b. Information which, if used by a competitor, would reduce his expenditure of resources or improve his competitive position in the design, manufacture, shipment, installation, assurance of quality, or licensing of a similar product.
  - c. Information which reveals cost or price information, production, capacities, budget levels, or commercial strategies of Holtec International, its customers or its suppliers;
  - d. Information which reveals aspects of past, present, or future Holtec International customer-funded development plans and programs of potential commercial value to Holtec International;
  - e. Information which discloses patentable subject matter for which it may be desirable to obtain patent protection.

The information sought to be withheld is considered to be proprietary for the reasons set forth in paragraphs 4.a and 4.b, and 4.c above.

- 5) The information sought to be withheld is being submitted to the NRC in confidence. The information (including that compiled from many sources) is of a sort customarily held in confidence by Holtec International, and is in fact so held. The information sought to be withheld has, to the best of my knowledge and belief, consistently been held in confidence by Holtec International. No public disclosure has been made, and it is not available in public sources. All disclosures to third parties, including any required transmittals to the NRC, have been made, or must be made, pursuant to regulatory provisions or proprietary agreements which provide for maintenance of the information in confidence. Its

## **AFFIDAVIT PURSUANT TO 10 CFR 2.390**

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initial designation as proprietary information, and the subsequent steps taken to prevent its unauthorized disclosure, are as set forth in paragraphs (6) and (7) following.

- 6) Initial approval of proprietary treatment of a document is made by the manager of the originating component, the person most likely to be acquainted with the value and sensitivity of the information in relation to industry knowledge. Access to such documents within Holtec International is limited on a "need to know" basis.
- 7) The procedure for approval of external release of such a document typically requires review by the staff manager, project manager, principal scientist or other equivalent authority, by the manager of the cognizant marketing function (or his designee), and by the Legal Operation, for technical content, competitive effect, and determination of the accuracy of the proprietary designation. Disclosures outside Holtec International are limited to regulatory bodies, customers, and potential customers, and their agents, suppliers, and licensees, and others with a legitimate need for the information, and then only in accordance with appropriate regulatory provisions or proprietary agreements.
- 8) The information classified as proprietary was developed and compiled by Holtec International at a significant cost to Holtec International. This information is classified as proprietary because it contains detailed descriptions of analytical approaches and methodologies not available elsewhere. This information would provide other parties, including competitors, with information from Holtec International's technical database and the results of evaluations performed by Holtec International. A substantial effort has been expended by Holtec International to develop this information. Release of this information would improve a competitor's position because it would enable Holtec's competitor to copy our technology and offer it for sale in competition with our company, causing us financial injury.
- 9) Public disclosure of the information sought to be withheld is likely to cause substantial harm to Holtec International's competitive position and foreclose or reduce the availability of profit-making opportunities. The information is part of



## **AFFIDAVIT PURSUANT TO 10 CFR 2.390**

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Holtec International's comprehensive decommissioning and spent fuel storage technology base, and its commercial value extends beyond the original development cost. The value of the technology base goes beyond the extensive physical database and analytical methodology, and includes development of the expertise to determine and apply the appropriate evaluation process.

The research, development, engineering, and analytical costs comprise a substantial investment of time and money by Holtec International.

The precise value of the expertise to devise an evaluation process and apply the correct analytical methodology is difficult to quantify, but it clearly is substantial.

Holtec International's competitive advantage will be lost if its competitors are able to use the results of the Holtec International experience to normalize or verify their own process or if they are able to claim an equivalent understanding by demonstrating that they can arrive at the same or similar conclusions.

The value of this information to Holtec International would be lost if the information were disclosed to the public. Making such information available to competitors without their having been required to undertake similar expenditure of resources would unfairly provide competitors with a windfall, and deprive Holtec International of the opportunity to exercise its competitive advantage to seek an adequate return on its large investment in developing these very valuable analytical tools.

**AFFIDAVIT PURSUANT TO 10 CFR 2.390**

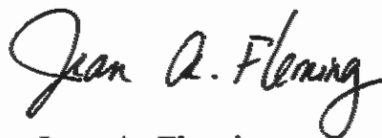
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STATE OF NEW YORK            )  
  ) ss:  
COUNTY OF WESTCHESTER)

Jean A. Fleming, being duly sworn, deposes and says:

That she has read the foregoing affidavit and the matters stated therein are true and correct to the best of her knowledge, information, and belief.

Executed at Westchester, New York, this 13<sup>th</sup> day of January 2022.



Jean A. Fleming  
Holtec Decommissioning International  
Holtec International  
VP, Regulatory & Environmental Affairs

Subscribed and sworn before me this 13<sup>th</sup> day of January,  
2022



STEPHANIE BENTLEY  
NOTARY PUBLIC, STATE OF NEW YORK  
NO. 01BE607724  
QUALIFIED IN DUTCHESS COUNTY  
COMMISSION EXPIRES JULY 15, 2016 2022