



Two Park Avenue

tel 1.212.591.8500

New York, NY

fax 1.212.591.8501

10016-5990

U.S.A.

www.asme.org

June 21, 2018

**Mr. Brian Thomas, Director  
Division of Engineering, Office of Research  
Standards Executive  
Nuclear Regulatory Commission  
Mail Stop T10-A36  
11545 Rockville Pike  
Rockville, MD 20852**

**Subject: Request for NRC Endorsement of ASME Boiler and Pressure Vessel Code, Section III, Division 5**

- References:**
1. ASME Boiler and Pressure Vessel Code, Section III, Division 5, High Temperature Reactors, 2017 Edition
  2. Letter dated November 13, 2017 from Dr. Farshid Shahroghi, AREVA, Inc. to Ralph Hill, Chair, ASME Code Section III
  3. Letter dated April 13, 2018 from Tara Neider, Terrapower, to Ralph Hill, Chair, ASME Code Section III
  4. Letter dated April 23, 2018 from Jacob DeWitte, Oklo Inc. to Ralph Hill, Chair, ASME Code Section III
  5. Letter dated May 16, 2018 from Youssef Ballout, Elysium Industries USA, to Ralph Hill, Chair, ASME Code Section III

Dear Mr. Thomas:

ASME has received the enclosed letters from both industry consortia and individual companies interested in advanced, non-water nuclear reactors. The letters express support for U.S. NRC endorsement of the current ASME Boiler and Pressure Vessel Code rules for the construction of high temperature reactor components.

The consortia represent the interests of the fast reactor, high temperature gas reactor, and molten salt reactor communities. All agree that NRC endorsement of the current ASME high temperature nuclear component rules will increase regulatory certainty for the industry and will increase review efficiency for the new designs on the part of both the NRC and the industry.

“Based on these letters, it may be appropriate for the NRC to consider review and endorsement of the ASME Boiler and Pressure Vessel Code Division 5 at this time.”

The Division 5 rules govern the construction of vessels, storage tanks, piping, pumps, valves, supports, core support structures and nonmetallic core components for use in high temperature reactor systems

and their supporting systems. High temperature reactors include gas-cooled reactors, liquid metal reactors and molten salt reactors (liquid or solid fuel), and the term "construction," as used here, includes materials, design, fabrication, installation, examination, testing, overpressure protection, inspection stamping and certification.

The current Division 5 rules are the culmination of a long process of development initiated approximately five decades ago to support the construction of sodium and gas cooled reactors of the era. This development process has continued with periodic modifications and improvements to the code cases, subsequent subsections and, currently, Section III, Division 5. As with all ASME code rules, this is an ongoing process. Division 5 specifically includes rules addressing both materials of construction (including metals, graphite, and ceramic composites) as well as both time-independent and time-dependent design, which are critical for reactors that contain structures operating at high temperatures where creep effects and changes in material response must be considered.

The U.S. DOE has long supported ASME activities to develop Division 5 to ensure the rules needed for the design and construction of advanced, non-LWR high temperature reactor components are available and eventually endorsed by the NRC.

ASME stands ready to provide assistance, as needed in the course of NRC review and endorsement. If you have any questions in regards to the contents of this letter, please direct them to Mr. Christian Sanna, Director, ASME Nuclear Codes & Standards by telephone (212) 591-8513 or by e-mail [SannaC@asme.org](mailto:SannaC@asme.org).

Very truly yours,



Richard D. Porco, Chair  
ASME Board on Nuclear Codes and Standards

cc:

John Monninger, Director Division of Safety Systems, Risk Assessment & Advanced Reactors Office of  
New Reactors

Matthew Mitchell, Branch Chief Materials and Chemical Engineering, Division of Engineering and  
Infrastructure, Office of New Reactors

Officers of the ASME Board on Nuclear Codes and Standards

Officers of the ASME Standards Committee on Construction of Nuclear Facility Components

Enclosures: References 2, 3, 4, and 5



Two Park Avenue                      tel 1.212.591.8500  
New York, NY                              fax 1.212.591.8501  
10016-5990                      U.S.A.                      www.asme.org

June 21, 2018

**Mr. Brian Thomas, Director  
Division of Engineering, Office of Research  
Standards Executive  
Nuclear Regulatory Commission  
Mail Stop T10-A36  
11545 Rockville Pike  
Rockville, MD 20852**

**Subject:                      Request for NRC Endorsement of ASME Boiler and Pressure Vessel Code, Section III, Division 5**

- References:**
1. ASME Boiler and Pressure Vessel Code, Section III, Division 5, High Temperature Reactors, 2017 Edition
  2. Letter dated November 13, 2017 from Dr. Farshid Shahroghi, AREVA, Inc. to Ralph Hill, Chair, ASME Code Section III
  3. Letter dated April 13, 2018 from Tara Neider, Terrapower, to Ralph Hill, Chair, ASME Code Section III
  4. Letter dated April 23, 2018 from Jacob DeWitte, Oklo Inc. to Ralph Hill, Chair, ASME Code Section III
  5. Letter dated May 16, 2018 from Youssef Ballout, Elysium Industries USA, to Ralph Hill, Chair, ASME Code Section III

Dear Mr. Thomas:

ASME has received the enclosed letters from both industry consortia and individual companies interested in advanced, non-water nuclear reactors. The letters express support for U.S. NRC endorsement of the current ASME Boiler and Pressure Vessel Code rules for the construction of high temperature reactor components.

The consortia represent the interests of the fast reactor, high temperature gas reactor, and molten salt reactor communities. All agree that NRC endorsement of the current ASME high temperature nuclear component rules will increase regulatory certainty for the industry and will increase review efficiency for the new designs on the part of both the NRC and the industry.

“Based on these letters, it may be appropriate for the NRC to consider review and endorsement of the ASME Boiler and Pressure Vessel Code Division 5 at this time.”

The Division 5 rules govern the construction of vessels, storage tanks, piping, pumps, valves, supports, core support structures and nonmetallic core components for use in high temperature reactor systems

and their supporting systems. High temperature reactors include gas-cooled reactors, liquid metal reactors and molten salt reactors (liquid or solid fuel), and the term "construction," as used here, includes materials, design, fabrication, installation, examination, testing, overpressure protection, inspection stamping and certification.

The current Division 5 rules are the culmination of a long process of development initiated approximately five decades ago to support the construction of sodium and gas cooled reactors of the era. This development process has continued with periodic modifications and improvements to the code cases, subsequent subsections and, currently, Section III, Division 5. As with all ASME code rules, this is an ongoing process. Division 5 specifically includes rules addressing both materials of construction (including metals, graphite, and ceramic composites) as well as both time-independent and time-dependent design, which are critical for reactors that contain structures operating at high temperatures where creep effects and changes in material response must be considered.

The U.S. DOE has long supported ASME activities to develop Division 5 to ensure the rules needed for the design and construction of advanced, non-LWR high temperature reactor components are available and eventually endorsed by the NRC.

ASME stands ready to provide assistance, as needed in the course of NRC review and endorsement. If you have any questions in regards to the contents of this letter, please direct them to Mr. Christian Sanna, Director, ASME Nuclear Codes & Standards by telephone (212) 591-8513 or by e-mail [SannaC@asme.org](mailto:SannaC@asme.org).

Very truly yours,



Richard D. Porco, Chair  
ASME Board on Nuclear Codes and Standards

cc:

John Monninger, Director Division of Safety Systems, Risk Assessment & Advanced Reactors Office of  
New Reactors  
Matthew Mitchell, Branch Chief Materials and Chemical Engineering, Division of Engineering and  
Infrastructure, Office of New Reactors  
Officers of the ASME Board on Nuclear Codes and Standards  
Officers of the ASME Standards Committee on Construction of Nuclear Facility Components

Enclosures: References 2, 3, 4, and 5



**HTGR**

Simple Safe Secure

November 13, 2017

Ralph Hill, Chair  
ASME Code Section III  
9037 Firebird Dr.  
Las Vegas, NV 89134-8503  
<[hillr@asme.org](mailto:hillr@asme.org)>

Subject: High Temperature Gas-Cooled Reactor (HTGR) Technology Working Group Support for U.S. NRC Endorsement of ASME Section III, Division 5.

References: Follow-up to the 2017 NRC-DOE Standards Forum

Dear Mr. Hill,

On behalf of the nuclear industry "HTGR Technology Working Group" (HTGR-TWG), I am offering our member company support and encouragement to apply for and obtain U.S. NRC review and subsequent endorsement of high temperature materials standards in the ASME Section III, Division 5.

The U.S. Department of Energy, with support from the nuclear industry, has been involved in research toward development of consensus standards such as ASME Section III, Division 5. We in the high temperature reactor developer community intend to use several materials listed in Division 5, specifically nuclear grade graphite and high temperature alloys such as Alloy-617. Thus, we are eager for the NRC review and endorsement of Division 5. This removes some of the technology, cost, and schedule risks and barriers associated with each of our respective designs.

In the September meeting of the NRC-DOE Standards Forum, industry summarized the need for a predictable and near term endorsement path for Division 5, which establishes design and construction rules for material used in high temperature reactors (liquid metal, gas-cooled, molten salt). NRC gave a brief summary of its efforts in this area, and indicated it will cover the topics remaining to be addressed / resolved for endorsement as an agenda item in the December 14 public meeting.





## HTGR

Simple Safe Secure

Therefore, the HTGR-TWG is expressing our need to begin the NRC code endorsement activities and our support for ASME efforts in this regard. The HTGR-TWG member companies are very interested in continuing to work with the DOE and the NRC, and we look forward to the engaging with the NRC staff during the review and endorsement process.

Sincerely,

Dr. Farshid Shahrokhi, Ph.D.  
Chairman, HTGR - Technology Working Group  
AREVA Inc.  
Lynchburg, VA 24501  
[f.shahrokhi@areva.com](mailto:f.shahrokhi@areva.com)

c:

Brian Thomas, Director  
Division of Engineering  
Office of Nuclear Regulatory Research  
Mail Stop T-10A36  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001  
[Brian.Thomas@nrc.gov](mailto:Brian.Thomas@nrc.gov)

William Corwin  
Department of Energy  
Office of Nuclear Energy  
Advanced Reactor Technologies  
Materials Technology Lead  
[william.corwin@nuclear.energy.gov](mailto:william.corwin@nuclear.energy.gov)

John Monninger, Director  
Division of Safety Systems,  
Risk Assessment and Advanced  
Reactors  
Office of New Reactors  
Mail Stop T-9F41M  
U.S. Nuclear Regulatory Commission  
Washington, DC 20555-0001  
[John.Monninger@nrc.gov](mailto:John.Monninger@nrc.gov)



## ELYSIUM INDUSTRIES



May 16, 2018

Ralph Hill, Chair  
ASME Code Section III  
9037 Firebird Drive  
Las Vegas, NV 89134-8503  
([hillr@asme.org](mailto:hillr@asme.org))

Subject: Elysium Industries USA Support for U.S. Nuclear Regulatory Commission  
Endorsement of ASME Boiler & Pressure Vessel Code, Section III, Division 5

Dear Mr. Hill,

I am writing to let you know that Elysium Industries USA strongly supports and encourages ASME to recommend to the U.S. Nuclear Regulatory Commission (NRC) for its review and subsequent endorsement of the construction rules for High Temperature Reactors contained within Section III, Division 5, of the ASME Boiler & Pressure Vessel Code (BPVC).

Elysium Industries USA is working on a Molten Chloride Salt Fast Reactor (MCSFR). While currently we are working on a design that uses currently qualified materials, we are also considering a future design that requires more salt resistant high temperature materials. An endorsement of Section III Division 5 by NRC would reduce regulatory uncertainty and benefit our company as well as the molten salt industry at large.

Elysium Industries USA gives its full support and looks forward for the NRC endorsement.

Sincerely,

Youssef Ballout  
President  
Elysium Industries USA

Cc:

Brian Thomas, Director, Division of Engineering, Office of Nuclear Regulatory Research  
John Monninger, Director, Division of Safety Systems, Risk Assessment, and Advanced Reactors, Office of New Reactors  
Sue Lesica, Department of Energy, Office of Nuclear Energy



April 23, 2018

Ralph Hill, Chair  
ASME Code Section III  
9037 Firebird Drive  
Las Vegas, NV 89134-8503

Subject: Fast Reactor Working Group Support for U.S. Nuclear Regulatory Commission  
Endorsement of ASME Boiler & Pressure Vessel Code, Section III, Division 5

References: Follow-up to the 2017 NRC-DOE Standards Forum

Dear Mr. Hill,

The Fast Reactor Working Group (FRWG) is offering our member company support and encouragement to ASME to apply for and obtain U.S. Nuclear Regulatory Commission (NRC) review and subsequent endorsement of the high-temperature materials standards contained within Section III, Division 5, of the ASME Boiler & Pressure Vessel Code (BPVC). Specifically, the FRWG is interested in the high-temperature metallic materials discussed in Division 5 within Section III of the ASME BPVC. The NRC's endorsement of this particular division offers potential reduction of risk associated with high-temperature reactor technology, cost, and schedule.

Therefore, the FRWG is expressing need to begin the NRC ASME BPVC, Section III, Division 5 endorsement process and is offering support to ASME in this regard. The FRWG members are looking forward to continuing work with the Department of Energy and the NRC through this review and endorsement process.

Sincerely,

Jacob DeWitte  
CEO and Co-Founder, Oklo Inc.  
Chair, Fast Reactor Working Group

cc:

Brian Thomas, Director, Division of Engineering, Office of Nuclear Regulatory Research

John Monninger, Director, Division of Safety Systems, Risk Assessment, and Advanced Reactors,  
Office of New Reactors

Sue Lesica, Department of Energy, Office of Nuclear Energy





April 13, 2018

Ralph Hill, Chair  
ASME Code Section III  
9037 Firebird Drive  
Las Vegas, NV 89134-8503  
Email: hillr@asme.org  
Dear Mr. Hill,

I wanted to send a short letter to express TerraPower's support of Section III, Division 5, Rules of Construction for High Temperature Reactors, and the NRC's effort to assess and to endorse a set of rules for advanced non-LWR reactors. Although there are still some gaps in Division 5, I appreciate the efforts the ASME BPV Code Committees are taking to close those gaps. It is very valuable to the Advanced Reactor Community to have this Division of the code for aid in the design of high temperature reactors including molten salt and sodium fast reactors. It will be critical to the success in licensing of our advanced reactor designs including the MCFR and the TWR300. It allows us to take into account time dependent phenomena such as creep, creep-fatigue and relaxation to more accurately analyze the performance of the reactors.

TerraPower recognizes that there are opportunities to optimize certain technical aspects of Division 5. Areas of particular interest to TerraPower include extending material allowables from 300,000 hours to 500,000 hours for Division 5 materials (304H, 316H, Alloy 800H), adding new materials (Alloy 617 and Alloy 709), improving and simplifying existing analysis methods, and developing rules for clad and refractory lined components for molten salt reactor applications.

I would firmly endorse the NRC developing a regulatory guide that references this Division of the code as guidance for High Temperature Reactors.

Sincerely,

A handwritten signature in black ink that reads "Tara Neider".

Tara Neider  
Sr. VP Fuels and Project Development

cc: Brian Thomas, USNRC  
John Monninger, USNRC  
Sue Lesica, USNRC  
Sam Sham, Argonne