ASME Standards Technology, LLC
REQUEST FOR PROPOSALS
RFP No. 17-02

Project Number:	**STEX-0160**
Project Title:	**Elevated Temperature Material Property Compilation for Design-by-Analysis**
Solicitation Date:	**20 June 2017**
Proposal Due Date:	~~**14 July 2017**~~ **25 July 2017**

1 Summary

ASME Standards Technology, LLC ("ASME ST-LLC") is soliciting proposals for the referenced project. The project consists of developing a comprehensive report that compiles existing elevated temperature material property data for the ASME Boiler Pressure Vessel Code ("BPVC") and uploading material property data onto the ASME Material Properties Database.

This Request-for-Proposal ("RFP") and all open RFPs are posted on the ASME ST-LLC webpage: (http://asmestllc.org/ST-LLC_RequestsProposals.html).

2 Background

Design-by-Analysis ("DBA") is distinct from traditional Design-by-Formula ("DBF") in that specific failure modes are defined and detailed analysis is compared to failure mode-specific acceptance criteria. Lower temperature DBA is well-defined (refer to ASME BPVC Section III and ASME BPVC Section VIII Division 2) and has been used for decades. Elevated temperature DBA, which refers to any condition where creep is non-negligible, exists, but has been applied much less frequently than its lower temperature counterpart and continues to evolve as operating conditions become more demanding and challenge the application of both existing elevated temperature DBF and DBA.

ASME BPVC Section III has elevated temperature procedures appropriate for traditional elevated temperature nuclear component design (ASME BPVC Section III, Division 5, Subsection HB, Subpart B and its predecessors), which has been modified for possible inclusion in to a future edition of ASME BPVC Section VIII Division 2. An elevated temperature DBA method for ASME BPVC Section I modernization is also under development which is currently intended to align with ASME BPVC Section VIII Division 2, however, for the continued and expanded use of elevated temperature DBA to support initiatives such as advanced ultra-supercritical fossil power generation and Generation IV high-temperature nuclear reactors, compilation of essential elevated temperature material properties is a critical task for ASME BPVC Section I, III and VIII. A unified material property compilation and development project will ensure baseline consistency between all parts of the BPVC, while still allowing industry-specific design methods. Additionally, a unified effort ensures that available funds are leveraged to the maximum extent possible through avoidance of duplication of effort that could take place if separate book-specific projects were pursued.

This directly supports and is critical to elevated temperature design-by-analysis and modernization efforts currently in progress for BPVC Section I and BPVC Section VIII, and is of direct interest to BPVC Section III as well, particularly for potential application to Class 2 nuclear vessels.

3 Scope of Work

3.1 Summary

This project is to consist of compiling and analyzing elevated temperature material properties for various materials relevant to the ASME BPVC and uploading existing and readily available material property data into the ASME Material Database (the "Database"). The Database was initiated during June of 2012 with the purpose of collecting, interpreting, qualifying, and preparing material properties data to create a database to support BPVC development and maintenance. For this project all creep data shall be presented in parametric equation form as a function of temperature and stress utilizing recognized high-temperature parametric representations. The material properties required for these data sets are:

- Elevated temperature yield strength tensile strength, and other physical properties.
- Creep rupture, average and minimum.
- Creep ductility.
- Elevated temperature continuous cycling fatigue curves.
- Elevated temperature hold time fatigue curves.
- Creep strain vs. time curves

The primary materials needed for this effort are:

- Grade 91 alloy steel.
- Inconel 740H alloy.
- Type 304H stainless steel.
- Type 347H stainless steel.
- Grade 22 alloy steel.
- Grade 92 steel.
- Grade 22V alloy steel.
- Grade 9 Chrome steel.
- Alloy 617 steel.
- ASME SA-516 and SA-299 carbon steels.
- C-1/2Mo steel.
- ASME SA-533/SA-508 steels.
- Type 316H stainless steel.
- 5Cr stainless steel.
- Alloy 800H.
- Grade 11 alloy steel.

Secondary materials of interest include:

- A709
- Grade 23
- Type 321H
- 3 Cr
- Type 410
- Grade 12
- 12 Cr
- B16, B7 bolting
- B8 bolting
- Grade 660
- Alloy 601
- Inconel bolting

The purpose of this effort is to provide readily available material property data without restrictions – that do not require significant manipulation – to obtain the desired parametric forms. Additionally, data that is readily available but requiring significant manipulation and interpretation for the desired parametric form must be identified, and a detailed estimate of the effort required to produce the required format shall be provided for subsequent procurement. The data that is either restricted, and/or expensive (e.g., National Institute for Material Science ("NIMS") and National Research Institute of Metals ("NRIM") creep data sheets), type of data available, and its format shall be summarized in the report for a future project phase. For the purpose of this work, the Independent Consultant shall be responsible for data collection, documentation of findings. The Independent Consultant shall work with ASME staff, ASME ST-LLC staff, and volunteers assigned to the Database to upload packets.

The effort shall be divided into six tasks that show the material properties of interest to be completed for the Primary and Secondary Materials.

- Task 1 (yield and ultimate strengths)
- Task 2 (creep rupture strengths)
- Task 3 (creep ductility)
- Task 4 (high temperature fatigue)
- Task 5 (creep-fatigue)
- Task 6 (full creep curves)

Details of what the Independent Contractor shall perform for each Task are as follows.

Task 1: Elevated temperature yield, tensile strength, and physical properties:

- Readily available data for the 16 primary materials.
- Readily available data for the 12 secondary materials.
- Initial task to support full temperature range allowable stress reconstruction
- Only data up to existing maximum use limit is required, however, wherever data beyond the existing maximum use limit is readily available it shall be reported.
- Identification of sources and restrictions for remaining materials data, including detailed estimate of cost to complete in future phase.

Task 2: Creep rupture, average and minimum:

- Obtain readily available data for the 16 primary materials.
- Obtain readily available data for the 12 secondary materials.
- Expected data sources:
    - Original and updated ASME data packages
    - ASME ST-LLC reports (e.g., STP-NU-035, STP-NU-037, STP-NU-063, STP-NU-019-1)
    - American Petroleum Institute (“API”) API 579-1/ASME Fitness for Service (FFS) (FFS-1, API 530, Welding Research Council (“WRC”) WRC Bulletin 541
    - NRIM/NIMS Creep Data Sheets
    - European Creep Collaborative Committee (“ECCC”) data sheets, BS PD6525
    - Electric Power Research Institute (“EPRI”) publications
    - Oak Ridge National Laboratory (“ORNL”) material property data reports
    - U.S. Department of Energy Office of Scientific and Technical Information Nuclear Systems Materials Handbook
    - Design and Construction Rules for Mechanical Components in high-temperature structures, experimental reactors and fusion reactors (“RCC-MRx”)
- Compilation of data, including digitization where necessary.
- Data analysis, curve fitting, comparison with current allowable stresses through entire temperature range.
- Identification of sources and restrictions for remaining materials data, including detailed estimate of cost to complete in future phase.

Task 3: Creep ductility:

- Readily available data (including weldments) for the 16 primary materials.
- Readily available data (including weldments) for the 12 secondary materials.
- Continuation/extension of Task 2 effort and data sources.
- Creep rupture reduction of area, elongation.
- Data analysis, fitting.
- Identification of sources and restrictions for remaining materials data, including detailed estimate of cost to complete in future phase.

Task 4: Elevated temperature continuous cycling fatigue curves:

- Readily available data for the 16 primary materials.
- Readily available data for the 12 secondary materials.
- NIMS/NRIM Fatigue Data Sheets and ORNL material property reports are expected to be primary sources.
- Only data up to existing use limit is required; available data beyond use limit is optional but beneficial.
- Chemistry, material condition (e.g., heat treatment condition, grain size when available), cyclic strength (cyclic stress-strain curves) and corresponding creep rupture strength shall be captured whenever possible.
- Compilation of data, including digitization where necessary.
- Identification of sources and restrictions for remaining materials data, including detailed estimate of cost to complete in future phase.

Task 5: Elevated temperature hold time fatigue curves:

- Readily available data for the 16 primary materials.
- Readily available data for the 12 secondary materials.
- Continuation and extension of Task 4 effort and data sources.
- Cyclic strength (including evolution with cycling, such as softening) and stress relaxation during dwell shall be reported wherever possible.
- NIMS/NRIM Fatigue Data Sheets, ASME ST-LLC reports and ORNL material property reports are expected to be primary sources.
- Only data up to existing use limit is required; available data beyond use limit is optional but beneficial.
- Chemistry, material condition (see above) and corresponding creep rupture strength shall be captured whenever possible.
- Compilation of data, including digitization where necessary.
- Identification of sources and restrictions for remaining materials data, including detailed estimate of cost to complete in future phase.

Task 6: Creep strain vs. time curves:

- Readily available data for the 16 primary materials.
- Readily available data for the 12 secondary materials.
- Includes traditional creep rupture as well as relaxation testing data.
- Continuation and extension of Task 2 and Task 3 effort and data sources.
- Compilation of data, digitization not assumed/required.
- Identification of sources and restrictions for remaining materials data, including detailed estimate of cost to complete in future phase.

3.2 Deliverables

The Independent Consultant shall be responsible for and provide the following:

1. Report for each of the six tasks that includes material property data packets and a report of findings.
    - All creep data presented in parametric (equation) form as a function of temperature and stress. Recognized high temperature parametric representations such as Larson-Miller shall be utilized, and all underlying material characterization data shall be reported in addition to details of all data analysis. Materials shall be addressed by product form and include data on typical welded joints and processes.
    - Temperature, stress and time limitations shall be specified in all cases; data pedigree and age shall also be noted. Data spanning a range of stress levels shall be provided, supporting loading typical of short term local stress relaxation to long term gross rupture. The data provided shall be consistent with ASME allowable stresses to facilitate baseline compatibility with traditional design-by-formula and the parametric form of the basic data to support development of new design methods. The data itself shall also be in electronic form (i.e., spreadsheet) and documented in a formal report.
2. Comprehensive report compiling all six tasks.
3. Detailed log of available material data packets/sets uploaded in the Database.
4. Prepared material data packets formatted as defined herein uploaded to the Database.

The report and log shall be provided initially as a draft and subsequently as a final that incorporates the comments of ASME ST-LLC and an ASME Peer Review Group (“PRG”). One peer review cycle is anticipated per task and for the report. The Independent Consultant shall then address/respond to all PRG comments and prepare the final report. ASME ST-LLC will assess that comments have been satisfactorily addressed and will work with the Independent Consultant to finalize the document. The results shall be shared with ASME BPVC Section I committee Subgroup Materials, BPVC Section III committee Working Group Elevated Temperature Construction and BPVC Section VIII Working Group Design-by-Analysis. All written deliverables shall be provided as an MS Word file that is formatted in accordance with the ASME ST-LLC Style Guide and the log shall be provided as a MS Excel file. Data packages must be provided in the acceptable format for the upload onto the Database.

3.3 Schedule

The Independent Consultant shall complete the final deliverable within a two-year period of commencing the project.

3.4 Progress Reporting

The Independent Consultant shall provide a brief status report on a monthly basis, via email, to the ASME ST-LLC project manager identified herein. Progress reports shall be presented at ASME BPVC Committee meetings, as requested by ASME ST-LLC.

4 Respondent Eligibility Requirements

ASME ST-LLC is seeking proposals from qualified organizations including, but not limited to, engineering firms, independent consultants, academic institutions, and federally funded research and development centers. In addition to relevant technical qualifications and experience, respondents must possess an understanding of relevant ASME codes and standards.

5 Basis for Selection and Award

ASME ST-LLC will select the winning proposal by evaluating and comparing the merits of each respondent's complete proposal. This process reflects ASME ST-LLC's desire to select application proposal based on its potential to achieve program objectives, rather than solely on evaluated technical merit or cost. Evaluation criteria include, but are not limited to, the following:

- Respondent's technical capabilities
- Respondent's applicable experience
- Proposal price
- Project schedule
- Any exceptions to ASME ST-LLC's standard agreement

ASME ST-LLC reserves the right to award, in whole or in part, any, all, or none of the proposals/respondents answering this solicitation.

6 Contract Terms and Conditions

The contract to perform the Scope of Work will be fixed-price. A form of ASME ST-LLC's standard agreement applicable to this Scope of Work is attached as Attachment 1 to this RFP.

ASME ST-LLC will provide access to applicable ASME codes, standards, and other technical references as needed to perform the Scope of Work.

7 Submission Requirements

7.1 Proposal Due Date

Proposal must be submitted by July 25, 2017. Respondents are encouraged to transmit its proposal well before this deadline.

ASME ST-LLC intends to select the winning proposal within three weeks of the proposal deadline.

7.2 Proposal Preparation Costs

Proposal costs shall be borne by the respondent. This solicitation does not obligate ASME ST-LLC to pay any costs incurred in the preparation and submission of the proposal, in making necessary studies or designs for the preparation thereof, or to acquire, or contract for any services.

7.3 Proposal Clarification

ASME ST-LLC reserves the right to request clarification of the proposal and/or supplemental information. The award may be made after few or no exchanges, discussions, or negotiations. Therefore, all respondents are advised to submit its most favorable application to ASME ST-LLC. ASME ST-LLC reserves the right, without qualification, to reject any or all proposals received in

response to this solicitation and to select any proposal, in whole or in part, as a basis for negotiation and/or award. ASME ST-LLC reserves the right to modify or cancel this solicitation. All questions relating to the solicitation must be submitted to the contact listed in Section 8 herein. Any amendments to the solicitation will be posted on the ASME ST-LLC website previously referenced.

7.4 Treatment of Proprietary Information

A proposal may include technical and/or other data, including trade secrets and/or privileged, confidential commercial or financial information, which the respondent does not want disclosed to the public or used by ASME ST-LLC for any purpose other than proposal evaluation. To protect such data, the respondent shall specifically identify the data or information to be protected.

7.5 Proposal Preparation and Submittal Instructions

ASME ST-LLC may form a committee of subject matter experts to evaluate the technical qualifications of applicants. To help facilitate this evaluation, proposals shall be separated into two separate documents: (1) a Technical Proposal; and (2) a Financial Proposal.

7.5.1 Technical Proposal contents must include:

- Provide organization name and contact information.
- Provide evidence of technical capabilities: credentials, qualifications, capabilities, and experience of individuals and the organization.
- Describe approach to accomplish the Scope of Work (refer to Section 3).
- Demonstrate agreement with the Scope of Work (refer to Section 3).

7.5.2 Financial Proposal contents must include:

- Provide a fixed-price quotation.
- Confirm agreement with the form of agreement attached herein, or state any requested exceptions to same.

7.5.3 The respondent shall submit the Technical Proposal and Financial Proposals files via e-mail to the ASME ST-LLC contact identified in Section 8 of this RFP. Responses must be received on or before the proposal due date identified in Section 7.1 of this RFP.

8 ASME Standards Technology, LLC Contact Information

All correspondence regarding this RFP is to be directed to the following person:

Mr. Luis S. Pulgarin
Project Manager
ASME Standards Technology, LLC
Two Park Avenue
New York, NY 10016
Telephone: 212-591-8584
E-mail: pulgarinl@asme.org

ASME Standards Technology, LLC

Nonexclusive Independent Consultant Agreement for

This Agreement, dated as of [_____], is made between ASME Standards Technology, LLC ("ASME ST-LLC"), a New York not-for-profit corporation with its principal office at Two Park Avenue, New York, New York 10016 and [Independent Consultant TBD], (the "Independent Consultant").

W I T N E S S E T H:

WHEREAS ASME ST-LLC desires to engage the Independent Consultant to develop a comprehensive report that will include the results of weld metal characterization and mechanical testing, recommendations on acceptable weld metal ferrite levels to achieve mechanical properties (strength and toughness) and maximum elevated temperature and exposed temperatures/times to avoid embrittlement for this project; and

WHEREAS the Independent Consultant agrees to accept such engagement and to perform the services hereinafter specified;

NOW, THEREFORE, in consideration of the foregoing and the mutual agreements of the parties contained in this Agreement, it is agreed as follows:

1. Engagement. ASME ST-LLC hereby engages the Independent Consultant, on an as-needed and nonexclusive basis, to perform the services defined in Annex 1 to this Agreement (the "Work").

2. Performance. The Independent Consultant agrees to perform the services set forth above. The Independent Consultant agrees to perform such services professionally and to the best of its ability, to provide its services in an ethical manner, and to avoid conflicts of interest and any appearance thereof. It is understood that the Independent Consultant may obtain other consulting work and, as a result, may be unavailable, from time to time, to perform consulting services for ASME ST-LLC, but the Independent Consultant agrees to adhere to the

ASME ST-LLC Policies on Conflicts of Interest and Ethics (http://stllc.asme.org/Policies.cfm). ASME ST-LLC will not set specific daily schedules. ASME ST-LLC will not provide tools, materials, supplies or equipment necessary for the Independent Consultant to perform the Work except for the necessary codes, standards, and procedures. Neither will ASME ST-LLC reimburse the Independent Consultant for the use of its tools, materials, supplies or equipment. The Independent Consultant shall not engage subcontractors to perform any portion of the Work without the written approval of ASME ST-LLC.

3. Fees. For all services to be rendered by the Independent Consultant to ASME ST-LLC, as required by ASME ST-LLC, the Independent Consultant will receive fees as specified in Annex 2 to this Agreement. It is understood and agreed that the Independent Consultant is performing services as an independent contractor. As a result, ASME ST-LLC will not withhold any tax, of whatever nature, from payments made by ASME ST-LLC to the Independent Consultant. The Independent Consultant is solely responsible for meeting federal, state, or local income tax liabilities. The total charges for all fees and expenses shall not exceed the contract value specified in Annex 2 to this Agreement.

4. Expenses. In addition to the fees provided in Section 3 of this Agreement, ASME ST-LLC shall reimburse to the Independent Consultant for reasonable expenses for the cost of travel to out-of-town Work-specific meetings, subject to the contract maximum specified in Annex 2 to this Agreement. Such reasonable expenses include food, lodging, transportation, and incidental expenses, including, but not limited to, reimbursement for automobile travel incurred with the provision of services hereunder. The Independent Consultant will receive reimbursement for reasonable expenses connected therewith on a cost basis. ASME ST-LLC will reimburse the Independent Consultant for personal automobile travel accomplished within the United States in connection with providing services to ASME ST-LLC at the Internal Revenue Service's standard mileage rate. Other expenses incurred by the Independent Consultant in connection with the Work, such as normal office charges (mail, telephone, computer, and duplication), shall be borne by the Independent Consultant as part of the total compensation for the Work.

5. Terms of Payment. The Independent Consultant shall submit associated invoices and expense statements for acceptance by ASME ST-LLC prior to payment. Invoices shall be submitted monthly and shall clearly identify specific work items performed. Subject to the provisions of Sections 3 and 4 of this Agreement, ASME ST-LLC will reimburse the Independent Consultant for such expenses upon the presentation by the Independent Consultant of proper substantiation of such expenditures. Receipts are not required to be submitted with expense reports; however, receipts shall be retained by the Independent Consultant and made available for audit upon request. Payment shall be 100 percent net due 30 days after receipt of an acceptable invoice from the Independent Consultant.

6. Benefits. The Independent Consultant is not eligible for, and will not receive, any benefits from ASME ST-LLC based on services performed under this Agreement.

7. Copyright and Ownership. The Independent Consultant agrees that ASME ST-LLC specially ordered and commissioned the Work as "work made for hire" as that term is defined in the United States Copyright Act (17 U.S.C. §101), and that for purposes of the copyright laws, ASME ST-LLC shall be deemed the "author" of the Work. If it is determined that the Work is not a work made for hire under the U.S. Copyright laws, then, as of the creation of the Work, the Independent Consultant hereby assigns exclusively and irrevocably to ASME ST-LLC all worldwide, present and future right, title and interest in the Work, including the copyrights and other proprietary rights existing in the Work (including all United States and foreign copyrights, all copyrights under any treaties, conventions, proclamations, or the like, and all extensions of such copyrights; all artistic and literary property rights; all moral rights; all rights to apply for or obtain any registrations for copyright in the Independent Consultant's name; and the right to sue and recover for any infringement of the Work). The Independent Consultant may not reproduce the Work in any form without ASME ST-LLC's prior written permission.

8. Indemnification and Hold Harmless.

a. Obligation of the Independent Consultant – The Independent Consultant shall indemnify, defend and hold harmless ASME ST-LLC and its officers, directors, employees and agents and each of them from any and all claims, actions, causes of action, demands,

liabilities of whatsoever kind and nature including judgments, interest, attorney's fees, and all other costs, fees, expenses and charges which ASME ST-LLC, its officers, directors, employees, agents and each of them, may incur arising out of the negligence, gross negligence or willful or wanton misconduct of the Independent Consultant, its officers, directors, employees or agents.

b. Obligation of ASME ST-LLC – ASME ST-LLC shall indemnify, defend and hold harmless the Independent Consultant and its officers, directors, employees and agents and each of them from any and all claims, actions, causes of action, demands, liabilities of whatsoever kind and nature including judgments, interest, attorney's fees, and all other costs, fees, expenses and charges which the Independent Consultant, its officers, directors, employees, agents and each of them, may incur arising out of the negligence, gross negligence or willful or wanton misconduct of ASME ST-LLC, its officers, directors, employees or agents.

9. Term. It is mutually agreed that the Independent Consultant will commence work on this project immediately upon execution of this Agreement, and continue until completion, estimated as on or about [contract end date]. This termination date may be extended by mutual agreement, which must be confirmed in writing.

10. Termination. ASME ST-LLC shall have the right to terminate this agreement upon 14 days' notice in writing to the Independent Consultant at any time that ASME ST-LLC shall in its judgment decide that such termination is in the best interests of ASME ST-LLC. Conversely, the Independent Consultant shall have the right to terminate this agreement upon 14 days' notice in writing to ASME ST-LLC at any time that the Independent Consultant shall in its judgment decide that such termination is in the best interests of the engineering profession. In the event of such termination, ASME ST-LLC shall pay the Independent Consultant on a pro rata basis for percent of work completed as determined by mutual agreement subject to the provisions of Sections 3 and 4 of this Agreement.

11. Force Majeure. The parties' performance under this contract is subject to acts of God, war, government regulation, terrorism, disaster, strikes, civil disorder, curtailment of transportation facilities, or any other emergency beyond the parties' control, making it inadvisable, illegal or which materially affects a party's ability to perform its obligations under

this contract. Either party may terminate this contract for any one or more of such reasons upon written notice to the other party.

12. Trademark Usage. Independent Consultant may not use any of ASME ST-LLC's trademarks or other identifiers (including the ASME ST-LLC logo) in any manner without ASME ST-LLC's prior written approval or consent. ASME ST-LLC reserves the right to review any approved use of its trademarks and to require changes in any further use, and Independent Consultant agrees to comply with those requirements.

13. Publicity Release and Public Affairs. The Independent Consultant shall not make without prior review and approval of ASME ST-LLC, any publicity release of any nature of general, non-technical information in connection with this Agreement. For purposes of this Agreement, general, non-technical information means any information concerning the existence of the Agreement, the identity of the parties, and the scope and general character of the research or technical activity**.**

14. Entire Agreement. This Agreement entirely supersedes, terminates, and replaces any and all prior agreements between the parties relating to the subject matter hereof and may not be amended except by an instrument in writing signed by both parties to this Agreement.

15. Notices. Any notices hereunder shall be given to the parties at their respective addresses set forth above by registered mail until a new and different address shall be established for either party on the basis of notice given to the other party.

16. Governing Law. This Agreement shall be subject to and governed by the substantive laws of the State of New York (without regard to its conflict of laws rules).

IN WITNESS WHEREOF, ASME ST-LLC has caused this Agreement to be executed on its behalf by its officer thereunto duly authorized and the Independent Consultant has executed this Agreement as of the day and year first above written.

ASME STANDARDS TECHNOLOGY, LLC

By: _____
Name: John J. Koehr
Title: President

INDEPENDENT CONSULTANT

By: _____

Name:
Title:
Social Security or Federal Tax ID number: _____

Annex 1 – Statement of Work

Scope Description

[TBD]

Annex 2 – Financial Terms

Reporting

1 Fees and Expenses

Technical services rate: [_____].

Travel rate (if applicable): [_____].

Travel expenses: [_____].

Contract Maximum: [_____].