



**The Association for Materials Protection and
Performance**

**Request for Proposals
Corrosion Considerations in Ammonia Fuel
Systems for the Marine Sector**

AMPP RFP Number: RFP AR 2026-01

Issued: August 14, 2026

Proposal Submission Deadline: September 25, 2026

Proposal Evaluation Period: September 25 – October 16, 2026

Finalist Interviews (if needed): Week of October 19, 2026

Selection Notification: Friday October 30, 2026

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Commented [SO1]: Stuart has suggested adding "© AMPP 2025 " I'm unclear if that is appropriate.

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Section 1: Background and Purpose

1.1 Background

As the marine industry intensifies efforts to reduce greenhouse gas emissions, the adoption of alternative fuels is reshaping the corrosion risk landscape for critical engine and fuel storage systems. Among these alternatives, ammonia presents a promising low-emission option; however, its corrosive properties, particularly its tendency to induce stress corrosion cracking in steel substrates, pose significant challenges. As the maritime sector evaluates ammonia as a viable fuel, understanding and addressing its corrosive behavior is essential to ensuring the safety and longevity of marine vessels.¹⁻⁴

The transition to ammonia as a marine fuel represents a paradigm shift that requires comprehensive evaluation of materials compatibility, corrosion mechanisms, and protective strategies. While substantial knowledge exists from decades of ammonia handling in industrial applications, the unique operating conditions of maritime environments, including dynamic loading, vibration, cyclic temperature variations, and saltwater exposure, create distinct challenges that warrant focused investigation.⁵⁻⁹ A comprehensive understanding of the current expertise of corrosion in ammonia will be necessary to identify knowledge gaps relevant to the use of ammonia as an alternative marine fuel.

1.2 Purpose

The purpose of this project is to conduct a comprehensive literature review of the corrosion and materials degradation risks applicable to the use of ammonia as a marine fuel. The literature review should include journal articles, materials selection practices, corrosion control methods, and industry standards. It should focus on the issues that can be expected in this new application.

1.2.1 Objectives

- Systematically review and synthesize existing research, industry experience, and technical data related to ammonia-induced corrosion and degradation in marine fuel systems. This technical review should include long-term industry experience from onshore facilities and cargo carriage, test methods for assessing susceptibility to environmentally assisted cracking in ammonia service, and relevant historical data.
- Identify gaps in current knowledge, test protocols, standards, and best practices specific to ammonia marine fuel applications.
- Assess the applicability and limitations of existing consensus standards for ammonia marine fuel service.
- Develop a prioritized roadmap for standards development, research needs, and cross-sector collaboration.

- Provide actionable recommendations for potential subsequent efforts to address the most critical gaps identified.

1.2.2 Technical Questions to be Addressed

- What corrosion mechanisms are most likely to affect ammonia marine fuel systems, including synergistic mechanisms and adjacent materials?
- Which materials have demonstrated adequate performance, and what material failures are documented in similar ammonia service environments? Consider the influence of contamination and any additives (i.e. water addition, dual-fuel system contamination, etc.)
- What are the critical knowledge gaps that could impact safe implementation of ammonia fuel systems?
- Where can existing industry knowledge from ammonia handling (process industries, refrigeration) be applied to maritime applications, and what are the limitations?
- What standards, practices, or research are needed to support safe and reliable ammonia fuel system design and operation?

1.2.3 Expected Outcomes

The results of this project will be published as a publicly available technical guidance that will benefit the entire maritime industry by:

- Providing a comprehensive technical foundation for understanding corrosion risks in ammonia marine fuel systems.
- Identifying where existing standards can be applied and where standards development is needed for testing, materials selection, fuel analysis, or other sources of concern.
- Enabling informed decision-making by all stakeholders.
- Facilitating collaboration between the maritime sector and industries with established ammonia handling experience.
- Establishing a prioritized framework for future research and standards development activities.
- Recommending specific next steps for subsequent efforts to address critical gaps.

1.3 Location of Work

Applications from international teams will be accepted. The location of work will be at the discretion of the selected team. This is a desk-based study requiring literature review, data synthesis, and analysis rather than laboratory testing. Regular virtual collaboration with AMPP staff is required throughout the project duration.

1.4 Proposal Submission Requirements

1.4.1 Required Format

A signed electronic copy of the response to this RFP must be submitted before the submission deadline set forth in Section 1.4.2. All proposals shall be:

- Submitted in Adobe PDF format.
- Written in English.
- Include all information and materials required under Section 6:.

The proposal narrative, excluding the cover sheet, résumés, budget worksheet, schedule, and references, shall not exceed fifteen (15) US letter-size pages using a minimum 11-point font with one-inch (25 mm) margins.

1.4.2 Submission Deadline and Method

Proposals shall be submitted via electronic mail to: research@ampp.org

Submission Deadline: 5:00 PM Eastern Time, September 25, 2026

Submissions received after this deadline will be considered non-responsive and will not be evaluated.

1.4.3 Questions and Clarifications

All questions regarding this RFP shall be submitted in writing via email.

Questions Due: 5:00 PM Eastern Time, September 11, 2026

Submit Questions to: research@ampp.org

AMPP will consolidate all questions and provide written responses to all prospective proposers within five business days. No individual responses will be provided. Questions and answers will be posted anonymously. Questions received less than five business days before the submission deadline may not be answered.

1.4.4 Selection Timeline

- Proposal Submission Deadline: September 25, 2026
- Proposal Evaluation Period: September 28 – October 16, 2026
- Finalist Interviews (if needed): Week of October 19, 2026
- Selection Notification: Friday, October 30, 2026
- Contract Execution Target: December 1, 2026

AMPP reserves the right to adjust this timeline as needed.

Commented [S02]: Stuart comment: In order for AMPP to respond and permit bidders to act upon the received information - should the end date questions be 15 working days (US) prior to submission date which gives us 5 days to respond, and about 7-8 days for bidders to consider and incorporate in their bid as likely it will need sign-off internally their end?

Commented [S03R2]: I don't have a strong opinion on the timing. If questions posed seem to warrant additional time the proposal deadline could be extended instead of building in more time.

Section 2: Project Scope

2.1 Scope Overview

The scope of this research project is limited to literature review of damage mechanisms and materials degradation induced by the ammonia service environment for storage and use as a marine fuel. The study will primarily address shipboard systems as well as cargo and fuel handling operations.

2.2 Technical Areas to be Addressed

The research shall comprehensively address the four technical areas presented below. All technical areas must be included in the project.

2.2.1 Technical Area 1: Fuel Transfer and Bunkering Operations

- Materials selection for transfer hoses, couplings, and bunkering equipment.
- Corrosion risks during ship-to-ship and shore-to-ship transfer operations.
- Compatibility of gaskets, seals, and elastomeric components with ammonia.
- Temperature and pressure considerations during fuel transfer.
- Emergency disconnect systems and material requirements.
- Potential for stress corrosion cracking in bunkering infrastructure.

2.2.2 Technical Area 2: Onboard Vessel Ammonia Fuel Storage

- Storage tank materials and coating systems.
- Synergistic effects of fatigue loading and corrosive environment (corrosion fatigue).
- Thermal cycling impacts on material integrity.
- Vapor space corrosion considerations.
- Impact of water content on corrosion rates and mechanisms.
- Welded joint susceptibility and inspection requirements.
- Pressure vessel integrity under dynamic marine loading conditions.
- Long-term material performance and life prediction.

2.2.3 Technical Area 3: Fuel Distribution Systems

- Piping materials and joining methods.
- Valve and fitting materials selection.
- Flow-induced corrosion and erosion-corrosion mechanisms.
- Isolation and safety system material requirements.

2.2.4 Technical Area 4: Engine Component Susceptibility

- Fuel injection system materials compatibility.
- Combustion chamber and valve materials exposure to ammonia.
- Unique considerations of the engine service environment including high temperatures and combustion products.
- Water compatibility issues in engine fuel systems.

- Post-combustion corrosion from ammonia combustion products.

2.3 Standards and Regulatory Landscape

The literature review shall also include analysis of:

2.3.1 Standards Landscape Assessment

The research shall include a review of the existing standards, specifications, and codes landscape for ammonia handling and marine fuel systems. This review should identify:

- Relevant consensus standards organizations active in this space (e.g., ISO, ASTM, ASME, and other industry standards development organizations).
- Standards and specifications for the supply of ammonia as a cargo or fuel.
- Classification society rules and guidelines relevant to ammonia fuel systems.
- Materials selection and testing standards applicable to ammonia service.
- Coating, lining, and protective system standards for ammonia containment.
- Inspection and monitoring practice standards.
- Industry codes for pressure vessels, piping, and fuel handling systems.

Note on Literature Access: *Proposers should describe their approach to accessing standards documents, scientific and engineering articles, and conference proceedings in their proposal. Proposers are encouraged to utilize institutional access to standards databases where available, or to propose working with publicly available standards summaries, regulatory references, and technical literature that discusses standards requirements. Detailed clause-by-clause analysis of proprietary standards documents is not required; rather, the focus should be on understanding what types of standards exist, their general applicability, and where gaps exist. AMPP will provide access on request to any AMPP standards, technical papers, and publications needed at no additional cost to the project.*

2.3.2 Standards Gap Analysis

- Assessment of which types of existing standards appear directly applicable to ammonia marine fuel service.
- Identification of standards that may be adaptable with modifications.
- Areas not covered or inadequately covered by standards for the unique marine ammonia fuel environment.

2.3.3 Regulatory Framework

- International Maritime Organization (IMO) requirements.
- SOLAS (Safety of Life at Sea) considerations.
- Flag state requirements.
- Port state control considerations.
- Regional regulatory variations.

2.4 Cross-Sector Knowledge Transfer

The research shall identify relevant knowledge and best practices from industries with extensive ammonia handling experience, including but not limited to:

- Ammonia production and fertilizer manufacturing.
- Ammonia refrigeration systems.
- Ammonia storage and distribution terminals.
- Chemical process industries.
- Opportunities and limitations for transferring this knowledge to the maritime sector.

2.5 Exclusions

The following items are explicitly excluded from this scope:

- Performance of laboratory testing or experimental work.
- Failure mechanisms not caused by ammonia.
- Detailed engineering design of specific systems.
- Economic or financial feasibility analysis.
- Comprehensive life cycle assessment.
- Detailed operational procedures development.
- Crew training requirements.

Section 3: Deliverables

The deliverables will include progress meetings, detailed research report, and a presentation. Those deliverables are described in details below.

3.1 Progress Meetings

Attend monthly virtual progress meetings with AMPP staff throughout the project duration. These meetings will provide opportunities to:

- Review progress and preliminary findings e.g. citation hits, quantity and quality of information obtained and any problems arising in each of the defined areas for review.
- Adjust research direction as needed.
- Ensure deliverables will meet industry needs.
- Address questions or concerns.

A 1-2 pages written progress update shall be provided two business days prior to each progress meeting.

3.2 Detailed Research Report

Deliver a comprehensive technical report suitable for public distribution. The report must include:

3.2.1 Executive Summary (1-2 pages)

- Concise overview of key findings.
- Critical gaps and priority recommendations.

3.2.2 Methodology and Assumptions

- Explanation of research approach and literature search strategy.
- Sources consulted and selection criteria.
- Limitations and assumptions.
- Data quality assessment.

3.2.3 Comprehensive Literature Review

- Organized by technical area (storage, transfer, engine systems, etc.).
- Synthesis of existing knowledge from maritime and non-maritime sectors.
- Identification of conflicting information or uncertainties.

3.2.4 Detailed Findings and Analysis

- Corrosion mechanisms specific to ammonia marine fuel service.
- Materials performance data and compatibility assessment.
- Critical operating parameters affecting corrosion behavior.
- Comparative analysis of ammonia versus other alternative marine fuels (methanol, LNG, hydrogen) regarding corrosion considerations.
- Case studies or lessons learned from existing ammonia-fueled vessels or pilot projects.

Commented [S04]: From Stuart: For non-AMPP material, any desire to cite graphics etc. from a source will require Copyright release by the holder (which can take months)... do we want to a) Comment that they must obtain any necessary copyright clearance to include such material (including AMPP's right to distribute the report containing same) - because it is different for Academics and b) If this cannot be obtained in the required time, generate replacement graphic or cite where in the reference it can be found?

Commented [S05R4]: I would put something like this in the T&C rather than in this deliverables section but I thought the comment was worth inclusion.

3.2.5 Standards Gap Analysis

A detailed assessment identifying:

- Types of existing standards that appear directly applicable to ammonia marine fuel systems (with representative examples).
- Types of existing standards that could potentially be adapted with modifications.
- Areas where standards appear to be lacking (critical gaps).
- Priority ranking of standards development needs based on safety criticality, technical feasibility, and industry timeline.
- Recommended approaches for addressing each gap (e.g., new standard development, revision of existing standards, adoption/adaptation of standards from other sectors).
- General assessment of which standards development organizations are best positioned to address specific gaps.

3.2.6 Research Needs and Prioritization

- Identification of technical knowledge gaps requiring further research.
- Prioritization framework for research activities including recommendations for subsequent studies.
- Recommended research approaches (modeling, testing, field studies).
- Estimated scope and timeline for priority research activities.

3.2.7 Stakeholder and Collaboration Opportunities

- Mapping of key stakeholders in ammonia marine fuel development (classification societies, engine manufacturers, shipbuilders, fuel suppliers, operators, standards development organizations).
- Opportunities for collaboration across the maritime industry and with other sectors.
- Cross-sector collaboration opportunities with ammonia process industries.
- Recommended industry engagement strategies to advance ammonia marine fuel safety.

3.2.8 Strategic Value and Applications

A brief section describing how the findings can be used by various industry stakeholders:

- Classification societies developing ammonia fuel system rules.
- Shipowners and operators evaluating ammonia fuel adoption.
- Equipment manufacturers designing ammonia fuel systems.
- Standards development organizations prioritizing new work items.
- Researchers identifying critical knowledge gaps.
- Regulators developing safety frameworks.

3.2.9 Comprehensive References

- Complete bibliography, with DOIs if applicable.
- Categorization of references by topic and relevance.
- Appendices (as appropriate).

3.2.10 Report Formatting and Production

The report shall be professionally written in English, thoroughly referenced, and suitable for public distribution to classification societies, regulatory bodies, and industry stakeholders. Editing and formatting will be the responsibility of the contractor in compliance with publication formatting guidelines provided by AMPP staff. The report shall be delivered in Microsoft Word format with professionally formatted tables, figures, and graphics.

3.2.11 Report Draft Review Process

Submit a draft report for AMPP review at 75% completion of the study and prior to the end of the sixth month of the project timeline. AMPP will provide consolidated comments within two weeks of draft submission. The contractor shall address all comments and provide a response matrix documenting how each comment was addressed.

3.3 Presentation

Deliver a 45-60 minutes presentation summarizing the research results in a virtual session to be scheduled by AMPP. The presentation should be suitable for a technical audience including industry practitioners, standards development organizations, classification societies, and researchers. Provide a slide deck (Microsoft PowerPoint format) suitable for use by AMPP and others in the maritime industry to present the results at conferences, technical meetings, and in discussions with stakeholders.

Commented [SO6]: Stuart comment: REQUIRE they use the AMPP citation manager format and doi referencing per our web site

Commented [SO7R6]: I am not sure that this is the right place, but we will want to plug in specifics about the citation format or a link to this specifics

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Commented [SO9]: This is included below in section 3.2

Section 4: Project Timeline and Milestones

4.1 Project Duration

The total project duration shall be eight (8) months from the contract execution date. Proposers should specify their proposed timeline within this range based on their approach and resource availability.

4.2 Key Milestones

The milestones described in Table 1 shall be met.

4.3 Regular Check-in Schedule

Monthly check-in meetings (30-60 minutes) will be scheduled throughout the project, or as mutually agreed. The contractor shall propose a specific meeting schedule in their proposal (see 3.1).

Table 1. Project Milestones

Milestone	Timeframe	Deliverable
Project Kickoff Meeting	Within 2 weeks of contract execution	Kickoff presentation and detailed work plan
Initial Literature Review Complete	Month 2	Summary memo of sources identified and preliminary assessment
Mid-Project Review	Months 3-4	Draft findings outline and gap analysis framework
75% Draft Report	Months 5-6	Draft report for AMPP review
Final Report Submission	Months 6-7	Complete final report including recommendations for subsequent research
Final Presentation	Months 6-8	Virtual presentation to AMPP and invited stakeholders

Section 5: Budget

AMPP has allocated a maximum budget of **\$50,000 USD** for this project. Proposals exceeding this amount will not be considered. Proposers shall submit an itemized budget using the budget worksheet template provided in Attachment A. The budget should include:

- Personnel costs (labor hours by role and hourly rates).
- Subcontractor costs (if applicable).
- Literature acquisition costs (document purchases, database access fees).
- Other direct costs.
- Indirect costs/overhead (clearly stated percentage).

Section 6: Required Proposal Content

Proposals must include all of the following components in the order specified:

6.1 Cover Page

Include:

- RFP title.
- Proposer organization name and address.
- Principal investigator name and contact information.
- Date of submission.
- Signature of authorized representative.

6.2 Executive Summary (1 page)

Provide a concise overview of:

- Your understanding of the project objectives.
- Your proposed approach.
- Key qualifications of your team.
- Why your team is uniquely qualified for this work.

6.3 Organization Description (1-2 pages)

Describe your organization including:

- Type of organization (university, research institute, consulting firm, etc.).
- Relevant experience with ammonia systems, marine applications, or corrosion research.
- Resources available to support this work.
- Previous work with AMPP or similar organizations (if any).

6.4 Background and Objectives (1-2 pages)

Demonstrate your understanding of:

- The context and importance of this research for the marine industry.
- The technical challenges associated with ammonia as a marine fuel.
- The need for standards and best practices to support safe ammonia fuel adoption.
- How this work will benefit the broader maritime community.

6.5 Technical Approach (4-6 pages)

Provide a detailed description of your proposed methodology including:

6.5.1 Literature Search Strategy

- Databases and sources to be consulted (specify which you have institutional access to).
- Search terms and inclusion/exclusion criteria.

- Approach to accessing publicly available technical literature, conference proceedings, and research reports.
- Strategy for reviewing standards landscape with consideration of document purchase costs.
- Approach to engaging subject matter experts or industry contacts (if planned).

6.5.2 Analysis Framework

- How you will organize and synthesize information.
- Your approach to assessing data quality and resolving conflicting information.
- Methods for conducting gap analysis.
- Approach to prioritization and roadmap development.

6.5.3 Stakeholder Engagement (if applicable)

- Plans to consult with industry experts, classification societies, or other stakeholders.
- Approach to validation of findings.

6.5.4 Subsequent Research Recommendations Development

- Approach to identifying and prioritizing critical gaps that warrant follow-on work.
- Framework for developing actionable subsequent research recommendations.
- Methodology for estimating scope and resources for proposed next steps.

6.5.5 Quality Assurance

- Internal review processes.
- How you will ensure comprehensive coverage of the scope.

6.5.6 Risk Management

- Potential challenges in executing the work.
- Mitigation strategies.

6.6 Project Team (3-5 pages plus resumes)

6.6.1 Team Structure

- Organization chart showing team roles.
- Allocation of responsibilities among team members.
- Management and coordination approach.

6.6.2 Team Member Qualifications

For each team member, describe:

- Role on this project.
- Relevant expertise and experience.
- Anticipated level of effort (percentage of time or hours).

6.6.3 Relevant Project Experience

Provide brief descriptions (one page each) of two to three previous projects that demonstrate your team's relevant capabilities. For each project include:

- Project title and client.
- Objectives and scope.
- Role of team members who will work on this project.
- Outcomes and deliverables.
- Relevance to the current RFP.

6.6.4 Resumes

Provide resumes (maximum three pages each) for all key team members. Resumes should emphasize relevant experience and qualifications.

6.7 Work Plan and Schedule (2-3 pages)

Provide a detailed work plan including:

- Breakdown of major tasks and subtasks.
- Milestone schedule aligned with Table 1 in Section 4.2.
- Proposed check-in meeting schedule.
- Dependencies and critical path.
- Gantt chart or similar visual representation.

6.8 Budget (using Attachment A template)

Submit a detailed, itemized budget using the provided template. The budget narrative should justify major cost elements and explain assumptions.

6.9 References

Provide contact information for three professional references from organizations for whom you have performed similar work. Include:

- Organization name.
- Contact person name and title.
- Email and phone number.
- Brief description of work performed.

Section 7: Selection Process

7.1 Evaluation Criteria

Proposals will be evaluated based on the criteria presented in Table 2. The evaluation committee will consist of AMPP staff and members representative of the various expertise covered by the requested proposal.

Table 2. Proposal Evaluation Criteria

Criteria	Description
Understanding of Background and Objectives	Demonstrates clear understanding of the project context, strategic objectives, and the importance of the work
Technical Approach and Methodology	Quality, comprehensiveness, and feasibility of the proposed research methodology; appropriateness of literature search strategy; soundness of analysis framework; quality of gap analysis and prioritization approach
Team Qualifications and Experience	Relevant expertise in ammonia systems, marine applications, and/or corrosion science; strength of team composition; quality of past project experience; qualifications of key personnel
Work Plan and Schedule	Clarity and completeness of work plan; feasibility of schedule; adequacy of quality assurance measures; realistic milestone definitions
Budget	Cost reasonableness and competitiveness; clarity of budget justification; appropriate allocation of resources; value for investment
Overall Proposal Quality	Clarity of writing; organization and completeness; attention to RFP requirements; professionalism of presentation

7.2 Evaluation Process

- Initial screening for responsiveness and completeness.
- Detailed evaluation against criteria in Table 2.
- Possible finalist interviews (at AMPP's discretion).
- Reference checks for top-ranked proposals.
- Final selection and negotiation.

7.3 Selection Authority

AMPP reserves the right to:

- Accept or reject any or all proposals.
- Waive minor irregularities in proposals.
- Request clarifications or additional information.
- Negotiate scope, schedule, or budget with selected proposer.
- Award to other than the lowest-cost proposal.
- Cancel this RFP at any time.

7.4 Privacy and Confidentiality

The contractor may have access to confidential and proprietary information of AMPP. The contractor agrees to:

- Maintain the confidentiality of all AMPP information not in the public domain.
- Use such information only for purposes of performing the contracted work.
- Return or destroy all confidential information upon project completion.

AMPP will treat all proposals as confidential to the extent permitted by law. However, AMPP may share proposals with evaluation committee members and advisors under appropriate confidentiality agreements.

7.5 Subcontracting

Subcontracting is permitted but must be disclosed in the proposal. The prime contractor remains responsible for all work quality and deliverables. AMPP approval is required for any subcontractor changes after contract award.

7.6 Constraints and Requirements

7.6.1 Conflict of Interest

Proposers must disclose any actual or potential conflicts of interest, including:

- Financial interests in companies that may benefit from the research outcomes.
- Consulting relationships with classification societies or marine fuel suppliers.
- Other relationships that could bias the research.

AMPP will evaluate disclosed conflicts and determine if they can be managed or if they disqualify the proposer.

7.6.2 Ethics and Integrity

All work must be conducted with the highest standards of research ethics and integrity. This includes:

- Accurate representation of sources and findings.
- No plagiarism or fabrication of data.
- Disclosure of limitations and uncertainties.
- Objective analysis free from commercial bias.

7.7 Proposal Validity

Proposals shall remain valid and open for acceptance for 120 days from the submission deadline. The proposer may not withdraw or modify the proposal during this period without AMPP's consent.

7.8 Costs of Proposal Preparation

AMPP will not reimburse proposers for any costs associated with preparing or submitting proposals or participating in the selection process.

Section 8: References

1. Kim, K., Roh, G., Kim, W. & Chun, K. A Preliminary Study on an Alternative Ship Propulsion System Fueled by Ammonia: Environmental and Economic Assessments. *JMSE* **8**, 183 (2020).
2. Zincir, B. A Short Review of Ammonia as an Alternative Marine Fuel for Decarbonised Maritime Transportation. in (Kayseri-Turkey, 2020).
3. Rodrigues, V., Monteiro, A., Díaz Reigosa, D., Ferreira, J. & Wu, X.-Y. Ammonia as a fuel for shipping and aviation: Opportunities, environmental benefits and risks. *Renewable and Sustainable Energy Reviews* **239**, 117156 (2026).
4. Gallucci, M. The Ammonia Solution: Ammonia engines and fuel cells in cargo ships could slash their carbon emissions. *IEEE Spectr.* **58**, 44–50 (2021).
5. Solami, B. H. et al. Modelling of Ammonia Cracking for Low-Carbon Hydrogen Production. in (AMPP, Kingdom of Saudi Arabia, 2025).
6. Loginow, A. W. Detection and Diagnosis of Stress-Corrosion Cracking in Ammonia Tanks. in (NACE, Houston, TX, USA, 1976).
7. Lunde, L. & Nyborg, R. Stress Corrosion Cracking of Different Steels in Liquid and Vapourous Ammonia. in (NACE, San Francisco, California, 1987).
8. Abdullah, M. O., Zen, J. & Yusof, M. Stress Corrosion Cracking, Crack Growth Prediction, and Risk-Based Inspection of Industrial Refrigerated Ammonia Tanks. *Corrosion* **67**, 046001-1-046001-12 (2011).
9. Yanagimoto, F., Shiotani, K., Sakakibara, Y., Watanabe, Y. & Tada, E. Stress Corrosion Cracking of Steels in Liquid Ammonia: A Comprehensive Literature Review. *International Journal of Hydrogen Energy* **120**, 89–100 (2025).

Section 9: Attachment A: Budget Worksheet Template

The budget template is provided as a separate Excel spreadsheet. Please use the template to submit the proposed budget.