<div align="center">**Stakeholders Meeting**</div>

Project Title: Fatigue Life and Fracture Assessment of Piping Components under Operating Conditions

Date: 10th August 2023   **Platform: MS Teams**

<div align="center">**Project Summary**</div>

Pipelines used in various industries such as oil & gas and nuclear are subjected to distress due to repeated loading and degradation due to environmental action during their operation or service life leading to fatigue fractures. Pipelines do possess inherent defects owing to various reasons such as manufacturing, welding, dent, stress concentration, etc. The fracture behavior of piping component with a crack in the weld portion is influenced by the mechanical properties of the neighbouring zones (base metal, weld metal, and heat affected zone), the loading conditions and geometry of pipe and weld thickness, which make the structural integrity of pipelines a formidable challenge. Fracture mechanics has been effectively applied for evaluating the crack growth life and remaining strength of deteriorating structures. However, the major challenges in applying fracture mechanics are obtaining the parameters such as stress intensity factor (SIF) and fracture toughness. These parameters aim to measure the magnitude of stress concentration at crack tips reverberating the effects of loading and crack geometry, and it is applicable when the plastic zone at the crack tip is small. The existing procedures for the fracture assessment of pipelines are based on simplified analytical methods and these are derived based on a load-based approach. For complex geometries under varying environmental conditions, it is very difficult to derive the analytical expression for SIF. Various numerical methods have been developed to determine SIF, such as extended finite element method (XFEM), scaled boundary finite element method (SBFEM), the boundary element method (BEM), and phase field method (PFM). Each method has its own merits and limitations. In recent years, soft computing techniques which are machine learning (ML) based algorithms, are being used to generate patterns and hypotheses that relate the input, like materials, process, or geometry information to the output mechanical quantities of interest for material and process design in different engineering applications. This project aims at the development of advanced methodologies for fatigue life and fracture assessment of piping components. The proposed work involves a novel energy-based approach to predict the fracture parameters in conjunction with machine learning algorithms.

Envisaged Deliverables:

- Development of energy-based models to evaluate fracture parameters and fatigue life of piping components
- Methodology to evaluate SIF under combined bending and torsion and fatigue life assessment
- Evaluation of plastic collapse load and development of J-R curves for welded pipes
- Remaining life assessment of pipes with combined defects subjected to cyclic internal pressure
- Methodology for crack growth and residual strength prediction of piping components under variable amplitude loading
- Development of AI/ML based models to estimate fracture parameters and fatigue life of piping components

Beneficiaries: Oil and gas industry including refineries; nuclear industry; thermal and hydel power industry

Meeting Link: https://teams.microsoft.com/l/meetup-join/19%3ameeting_MTcyMjY5YWItNDE0NS00NjBkLThiYTItMGM2MjZjNWY1ZjE2%40thread.v2/0?context=%7b%22Tid%22%3a%22b867f20e-8a9c-4603-b5ab-39c3840dfb64%22%2c%22Oid%22%3a%229b7c40a8-f015-44ec-86a8-36dc58393e04%22%7d

Programme Schedule

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Stakeholders Meeting on ***"Fatigue Life and Fracture Assessment of Piping Components under Operating Conditions"*** *10th August 2023 @ 14.00 Hrs - 17.00 Hrs (IST)*	
Coordinators	Dr. A. Ramachandra Murthy Dr. S. Vishnuvardhan
Date of event	**10th August 2023 (Thursday)**
Time (Hrs)	**Programme Details**
14.00 - 14.10	*Welcome address by* Dr. N. Anandavalli, Director, CSIR-SERC
14.10 - 14.20	Facilities and Expertise at Fatigue & Fracture Laboratory (FFL), CSIR-SERC Dr. S. Parivallal, Chief Scientist & Head, FFL, *CSIR-SERC*
14.20 - 14.35	Fatigue Life and Fracture Assessment of Piping Components under Operating Conditions - Importance of the Study and Industry Relevance Dr. A. Ramachandra Murthy, Senior Principal Scientist, FFL, *CSIR-SERC*
	Stakeholder Perspective (Line Ministry/Govt. Depts.)
14.35 - 14.45	Representative from NTPC
	Shri G. Prabhakar, Chief Engineer, NPCIL, Mumbai
	Stakeholder Perspective (Academia)
14.45 - 15.10	Dr. G. Raghava, Professor, *NMIT, Bengaluru*
	Dr. N. Narasaiah, Professor, *NIT Warangal*
	Dr. S. Senthil Kumaran, Professor, *CEG Campus, Anna University, Chennai*
	Dr. K. L. Radhika, Professor, *Osmania University, Hyderabad*
	Stakeholder Perspective (Industry/Research Institutes)
15.10 - 15.35	Shri Partha Bose, DGM-NG P/L (O&M) GAIL (India) Limited
	Representative from HAL
	Shri. Neeraj Gupta, Chief General Manager (Mechanical) *Ircon International Limited, New Delhi*
	Dr. Ramadas Chennamsetti, *R&D Establishment (Engineers), Pune*
15.35 - 15.45	**Break**
	Panel Discussion
15.45 - 16.45	***Chairperson*** Dr. Vikas Kumar, Former Director, *DMRL, Hyderabad*
	Co-Chairperson Dr. S. Sivaprasad, Chief Scientist, *CSIR-NML, Jamshedpur*
	Dr. K. Gopalakrishna, *CSIR-NML, Jamshedpur* Dr. S. A. Krishnan, *IGCAR, Kalpakkam* Dr. Ramadas Chennamsetti, *R&D Establishment (Engineers), Pune* Dr. Sanjeev Saxena, Senior Principal Scientist, *CSIR-AMPRI, Bhopal* Shri Suranjit Kumar, *BARC, Mumbai* Shri. R. S. Elango Maran, *HAL, Bengaluru* Dr. M. Ananda Rao, *CSIR-NML Chennai Unit*

	Dr. T Jothi Sarvanan, Visiting Assistant Professor, *IIT Bhubaneswar*
	Dr. J. Kalyan Raman, Assistant Professor, *Mahindra University, Hyderabad*
	Shri. Anuj Kumar Shukla, *M/s. Leviat, Thane*
	Shri. Totan Sadhukan, *M/s. Vossloh Cogifer Turnouts India Ltd., Hyderabad*
	Summary by Chairperson
16.45 - 16.55	*Closing remarks by* Dr. N. Anandavalli, Director, CSIR-SERC
16.55	Vote of thanks