IAEA
International Atomic Energy Agency
Atoms for Peace and Development

Regional Workshop on Flow Accelerated Corrosion and Dissimilar Metal Welds

Hosted by

The International Atomic Energy Agency
IAEA Headquarters
Vienna, Austria

14 to 17 April 2025

Ref. No.: ME-RER2019-EVT2402682

Information Sheet

Purpose

The purpose of the workshop is to share information on Flow Accelerated Corrosion (FAC) and Dissimilar Metal Welds (DMW) in Nuclear Power Plants (NPPs). The discussion includes scientific basis and practical measures, operating experience feedback, managerial issues and regulatory aspects.

Working Language(s)

The working language(s) of the event will be English.

Deadline for Nominations

Nominations received after **21 February 2025** will not be considered.

Project Background

The IAEA Regional Project RER2019, Enhancing Capacity for the Subsequent Operation of Nuclear Power Plants Beyond their Existing Long-Term Operation Programmes, seeks to address the multifaceted challenges associated with the extended operation of nuclear power plants (NPPs) beyond their initially planned long-term operation (LTO) periods. With a comprehensive approach, the project emphasizes the development and enhancement of capacities in the region, encompassing legal, technical, managerial, and research considerations. It particularly focuses on challenges related to maintenance effectiveness monitoring, aging management, technical obsolescence, environmental risks, and human resource capacities during the period beyond existing LTO programs. Drawing from past experiences, the project aims to contribute to harmonized knowledge, practices, and enhanced safety levels in the extended operation of NPPs, with a focus on strengthening regional capacities through coordinated efforts among Member States (MSs).

Material failures have long been recognized as problematic for NPP operations, especially for NPPs under LTO. To reduce the likelihood of such failures, a combination of various activities is necessary, including the effective use of operational experiences, continued research into the mechanisms of material failure, increased openness in sharing information, avoidance of complacency, and improvement of management and regulatory systems.

Flow Accelerated Corrosion (FAC) leads to wall thinning (metal loss) of steel piping exposed to flowing water or wet steam in NPPs. The rate of metal loss depends on a complex interplay of parameters such as water chemistry, material composition, and hydrodynamics. Carbon steel piping components that carry wet steam are especially susceptible to FAC and represent an industry-wide problem. Experience has shown that FAC damage to piping at NPPs can lead to costly outages and repairs and can affect plant reliability and safety. The continuing occurrence of FAC failures indicates that plant programs to mitigate FAC should be maintained and improved as necessary, as industry knowledge evolves, and more operational data become available.

Dissimilar metal welds (DMW) are a common feature of light water reactors in connections between ferritic components and austenitic piping systems and other structural elements. The most significant feature of dissimilar metal welds with respect to residual stresses is the difference in the coefficient of thermal expansion between the parent and weld metals. Safety-critical locations include connections from the reactor pressure vessel, steam generator, and pressurizer of the primary circuit, and vessel penetrations, such as for the control rod drive mechanism and instrumentation. Various forms of cracking have been observed in DMWs between piping components in NPPs. Mixed-mode loading, inspection difficulties, variability of material properties, residual stresses, and conservatism of current engineering methods all combine to create problems for structural integrity assessment. Recent operating experience has shown that these welds can be susceptible to various forms of external cracking. When such cracking is detected, usually during non-destructive examination, the operator must assess the situation based on the extent and severity of the reported damage.

FAC and DMW are significant concerns for various types of safety components in NPPs. FAC/DMW are now considered some of the most important issues to be addressed to predict remaining service life and confirm the structural integrity of components as part of the safety assessment for plant life management and safe long-term operation. In this regard, it would be useful and beneficial for Member States to share information and exchange operational experiences on these two important issues.

Expected Outputs

The expected outputs of this workshop will provide guidance to the:

- scientific basis and practical measures to detect and inspect FAC/DMW, and possible recommendations;
- latest good practices and lessons learned associated with FAC/DMWs detection, analysing and mitigation in NPPs, including introducing related computer software and codes;
- relevant managerial issues;
- aspects from regulatory regarding FAC/DMW.

Participation

The event is open to 35 participants from the project participation Member States. Each participating member state can nominate 2 participants from NPP operators/owners or technical support organizations, and 1 participant from the nuclear regulatory body.

Participants' Qualifications and Experience

This workshop is open to junior professionals, who will participate in the NPP operation and R&D department. Participants should be engineers, who are working in nuclear power plants or research institutes that provide support to nuclear power programmes. These might include individuals involved with the ageing management, maintenance, technical services, and quality management.

Structure

The workshop consists of 4 main topics besides opening and closing sessions.

Topic 1: Scientific Basis and Practical Measures

The following topics will be covered by presentations:

- Behaviour and mechanism / inspection and monitoring of pipe thinning and rupture;
- Evaluation methods for FAC in NPPs;
- FAC analysis with software tools;
- Benchmarking of related FAC computer codes;
- In–Service Inspection (ISI) requirements for DMW's different repair techniques.

Topic 2: Operating Experience Feedback

This topic is intending to share information on operating experiences on FAC/DMW involving material and managerial issues affecting long term operation of NPPs. Especially, lectures will cover but not limited to the items as below.

- Prioritizing the susceptible points of pipeline and equipment to FAC for inspection, without utilization of any software package based on simple models for single-phase and two-phase flows;
- Modification of In-Service Inspection (ISI) program considering the FAC;
- Corrective actions and repairing methods for FAC-assisted damages;
- Practical methods utilization for increasing FAC resistance in susceptible components of pipeline;

- Advanced inspection equipment and methods for precise FAC monitoring;
- A practical method to predict and control the SCC in carbon steel pipelines or IGSCC in irradiated pipelines with cladded or dissimilarly welded material.

Topic 3: Managerial Issues

This topic is to share lessons learned on the aspect of successful management systems that have addressed the technical issues associated with FAC/ DMW issues, and to identify outstanding managerial issues in the field. Presentations will cover management system issues such as:

- Managing operational experience
- Qualification of contractors' competence and relationship with contractors
- Management system/ decision making process.
- Assurance of a healthy and safe working environment

Topic 4: Regulatory Aspects

The following topics will be covered by presentations:

- Regulatory vs. non-compulsory inspection
- Regulatory control or monitoring of NPP sub-contractors
- Risk and reliability evaluation of components and piping

Scope and Nature

The following topics will be discussed and presented:

Topic 1: Scientific Basis and Practical Measures
Topic 2: Operating Experience Feedback
Topic 3: Managerial Issues
Topic 4: Regulatory Aspects

The workshop will consist of classroom training, experience sharing discussion. Presentations should be topical and related to practical experiences in implementation FAC/DMW programmes at NPPs. Round table discussions on topical important issues are also foreseen.

Application Procedure

Candidates wishing to apply for this event should follow the steps below:

1. Access the IAEA TALEO page (https://iaea.taleo.net/) and complete the Candidate Profile.

2. Be registered on the Nucleus page of the IAEA (https://nucleus.iaea.org/).

3. Through Nucleus, access the InTouch+ platform where the Profile is completed (My Profile tab) (https://nucleus.iaea.org/Pages/InTouchPlus.aspx).
   NOTE: The email used for TALEO and Nucleus must be the same. If not, the candidate's profile will not appear complete.

4. On the InTouch + platform, the candidate must:

   a. Finalize or update her/his personal details, provide sufficient information to establish the required qualifications regarding education, language skills and work experience ('Profile' tab) and upload relevant supporting documents;

   b. Download and complete the Designation of Beneficiary and Emergency Contact Form, and

upload to InTouch+ ('Profile' tab under the personal section) specifying the document name. If already provided, kindly discard this step; and

c. Search for the relevant technical cooperation event (EVT2402682) under the 'My Eligible Events' tab, answer the mandatory questions and lastly submit the application to the required authority.

NOTE: Completed applications need to be approved by the relevant national authority, i.e. the National Liaison Office, and submitted to the IAEA through the established official channels by the provided designation deadline.

For additional support on how to apply for an event, please refer to the InTouch+ Help page. Any issues or queries related to InTouch+ can be addressed to InTouchPlus.Contact-Point@iaea.org.

Should online application submission not be possible, candidates may download the nomination form for the meeting from the IAEA website.

NOTE: A medical certificate signed by a registered medical practitioner dated not more than four months prior to starting date of the event must be submitted by candidates when applying for a) events with a duration exceeding one month, and/or b) all candidates over the age of 65 regardless of the event duration.

Administrative and Financial Arrangements

Nominating authorities will be informed in due course of the names of the candidates who have been selected, and will at that time be informed of the procedure to be followed with regard to administrative and financial matters.

Selected participants will receive an allowance from the IAEA sufficient to cover their costs of lodging, daily subsistence and miscellaneous expenses. They will also receive either a round-trip air ticket based on the most direct and economical route between the airport nearest their residence and the airport nearest the duty station through the IAEA's travel agency AX Travel Management, or a travel allowance, or they will be reimbursed travel by car/bus/train in accordance with IAEA rules for non-staff travel.

Disclaimer of Liability

The organizers of the event do not accept liability for the payment of any cost or compensation that may arise from damage to or loss of personal property, or from illness, injury, disability or death of a participant while he/she is travelling to and from or attending the course, and it is clearly understood that each Government, in approving his/her participation, undertakes responsibility for such coverage. Governments would be well advised to take out insurance against these risks.

Note for female participants

Any woman engaged by the IAEA for work or training should notify the IAEA on becoming aware that she is pregnant.

The Board of Governors of the IAEA approved new International Basic Safety Standards for Protection against Ionizing Radiation and for the Safety of Radiation Sources. The Standards deal specifically with the occupational exposure conditions of female workers by requiring, inter alia, that a female worker should, on becoming aware that she is pregnant, notify her employer in order that her working conditions may be modified, if necessary. This notification shall not be considered a reason to exclude her from work; however, her working conditions, with respect to occupational exposure shall be adapted with a view to ensuring that her embryo or foetus be afforded the same broad level of protection as required for members of the public.

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