

# **Technical Consultation for Optimum Flaw Evaluation Methodology of Reactor Vessel Internal**

**2020. 02**

**Flaw Evaluation of Reactor Vessel Internal Sub-components  
for Korean Nuclear Power Plants**



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## **1. GENERAL INFORMATION OF THE SERVICE**

Current version of Sec. XI of ASME code does not provide the flaw evaluation methodology and flaw acceptance criteria of reactor vessel internal (hereinafter denoted as RVI). Therefore, EPRI and Westinghouse in US have developed a sort of guidelines for the flaw evaluation methodology, and published as MRP-227 and WCAP-17096.

KEPCO E&C has been developing the flaw evaluation methodology and flaw acceptance criteria of RVI sub-components for Korean WEC and CE type operating plants being based on MRP-227 and WCAP-17096. In this project, the sub-components which are classified as the primary in MRP-227 are considered for CE and WEC type plants. Also, general methodology in WCAP-17096 NP will be applied for fracture mechanics analysis to determine allowable flaw sizes of each sub-component.

In order to perform the fracture mechanics analysis for various sub-components of RVI, 1) stress intensity factor solutions as well as J-integral solutions, 2) fracture toughness data such as  $K_{IC}$  and J-R curves, 3) crack growth rates for fatigue, stress corrosion cracking and irradiation assisted stress corrosion cracking are necessary.

Since the current version of Sec. XI of ASME code does not provide these data mentioned above, KEPCO E&C would like to determine the optimum data and methodology on these three areas via technical consulting.

## **2. SCOPE OF THE SERVICE**

The Contractor shall identify various fracture mechanics parameters and provide technical justifications for their applicability, as follows:

The stress intensity factor solutions as well as J-integral solutions shall be applicable to various geometries (i.e. flat plate, shallow cylinder, solid bar, thin tube, etc.). In addition, technical justification for applicability of suggested solutions shall be provided in order to prepare future licensing activities.

The fracture toughness data and crack growth rates shall be applicable to typical austenitic stainless steel base metal and welds. In addition, technical justification for applicability of suggested data shall be provided in order to prepare future licensing activities.

Task	Activity	
<b>Task 1</b>	Optimum K/J-integral Solutions	<ul style="list-style-type: none"> <li>● Identification of stress intensity factor (K) Solutions for RVI Components</li> <li>● Identification of J-integral Solutions for RVI Components</li> <li>● Technical Justification for Solution Applicability</li> </ul>
<b>Task 2</b>	Optimum Fracture Toughness Data	<ul style="list-style-type: none"> <li>● Identification of <math>K_{IC}</math> for RVI Components</li> <li>● Identification of J-R Curves including <math>J_{IC}</math> for RVI Components</li> <li>● Technical Justification for Applicability</li> </ul>
<b>Task 3</b>	Optimum Crack Growth Rate	<ul style="list-style-type: none"> <li>● Identification of Fatigue Crack Growth for RVI Components</li> <li>● Identification of Stress Corrosion Crack Growth for RVI Components</li> <li>● Identification of Irradiated Assisted Stress Corrosion Crack Growth for RVI Components</li> <li>● Technical Justification for Applicability</li> </ul>
<b>Task 4</b>	Consulting Report and Technical Meeting	<ul style="list-style-type: none"> <li>● Interim Report</li> <li>● Technical Meeting at Contractor's Office (at least two days)</li> <li>● Final Report</li> </ul>

### 3. METHODS OF PERFORMANCE

#### A. Consulting Schedule

The consulting period for the tasks (Task 1 to 4) is 4 months from the Execution Date (contract signing), as follows:

Tasks	Month from the Contract Signing			
	1	2	3	4

Task 1 Optimum K/J-integral Solutions				
Task 2 Optimum Fracture Toughness				
Task 3 Optimum Crack Growth Rate				
Task 4 Consulting Report/Technical Meeting				

## **B. Method of Performance**

The Contractor shall start the consulting service in accordance with the schedule shown as the above schedule, immediately after signing of the Contract agreement. The Contractor shall keep confidential all the data and information from this Contract, and shall not divulge them to any third parties.

The Contractor shall provide the interim report within three months after signing the Contract. KEPCO E&C will provide comments on the interim report within two weeks after receiving the interim report. The Contractor shall provide the final report incorporating the comments by KEPCO E&C within four months after signing the Contract.

Technical meeting between KEPCO E&C and the Contractor shall be held at the Contractor's Office after submitting the interim report to KEPCO E&C. The duration of technical meeting shall be two days at least.

## **C. Deliverables**

- Interim Report will be provided by three months after Contract Signing.
- Final Report will be provided by four months after Contract Signing.

## **4. PAYMENT**

- A.** The Contractor shall submit an invoice to KEPCO E&C after completion of delivery of the final report.
- B.** KEPCO E&C shall pay the accepted amount of the invoice to the Contractor within thirty (30) days after the receipt of the Contractor's invoice.

## **5. REQUIREMENTS FOR BID**

The requirements for this bid shall be the following:

- A. Experience on the EPRI research projects for PWR reactor vessel internal
- B. Experience of the similar project to perform the integrity evaluation of PWR reactor vessel internal based on the MRP-227

Each bidder shall satisfy the two requirement above mentioned.