Technical Information

Technical Consultation on Severe Accident Analysis for Mobile DG Deployment during Outage using MAAP5

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1. Name of Service

Technical Consultation on Severe Accident Analysis for Mobile DG Deployment during Outage using MAAP5

2. Objectives of Service

The reactor core continues to generate decay heat even after the reactor shutdown, so decay heat must be continuously removed for the safety of nuclear power plant. If the shutdown cooling is lost due to Station Blackout (SBO) during Low Power Shut Down (LPSD) operation, decay heat control fails, resulting in a severe accident and release of radioactive materials into the environment. In the case of Barakah Nuclear Power Plant (BNPP), an Accident Management Program (AMP) is established to cope with SBO condition using 1.5 MW Mobile Diesel Generator (MDG). Therefore, Nawah requested KEPCO E&C to analyze the severe accident during LPSD operation using the MAAP5 code to determine the optimal time required for deploying and using 1.5 MW MDG.

The objective of this service is to provide KEPCO E&C with a certain engineering consulting service for the severe accident analysis for MDG deployment during SBO using MAAP5. The scope of service is to support to develop the severe accident analysis modeling for LPSD operation and to perform the severe accident analysis using MAAP 5.03.

3. Project Description

The severe accident analysis for MDG deployment during Outages is required to determine when the time available for accident mitigation is less than the time required for deployment and use of a 1.5 MW MDG in accordance with the AMP for BNPP.

The project consists of three phase; establishment of analysis modeling, severe accident analysis, and final analysis reflecting review results from Nawah. The scope of this project is to provide the analysis modeling for LPSD operation including analysis methodology, assumption, and input files. The scope of this project also includes providing the severe accident analysis results on scenarios specified with Nawah. The exact accident progress during SBO (e.g. timing of the incipient boiling, uncovery, fuel failure, core melt, relocation, vessel failure), thermal hydraulic behavior of the plant (e.g. CET reading, Cladding/Fuel/RCS Temperature, Core/RCS pressure), and response of plant against the operator actions (e.g SIT gravity injection, External Injection into RCS) will be dealt with in this project.

KEPCO E&C therefore aims to get a technical support with respect to the above items from the Contractor.

4. Scope of Work

Task 1 Establishment of Analysis Modeling for Mid-Loop Operation

- Develop Analysis model for Reduced Inventory (MAAP5 include file)
- Setup analysis methodology, assumption, Input files according to scenarios
- Select sensitivity parameter for major modeling input variables in MAAP5

Scenarios, initial conditions, and assumptions to be analyzed are provided by KEPCO E&C, and are as follows.

- SBO occurs at two initial times from reactor shutdown: 96 hours or 20 days
- The decay heat curve to be used is the ANSI-2005 standard without uncertainty
- RCS initial water level at 1m below Reactor Vessel (RV) Flange
- RCS initial temperature at two sensitivity values: 57.2°C or 48.9°C
- The pressurizer manway is removed
- RV Head vent valves are open
- Pressurizer Head vent valves are open
- Operator action as: No action or SIT gravity drain cases (1 SIT in 30 min)

No	Scenario	T _{SD} for P(t _{SD}) by ANS-2005STD	Initial water L ₀	Initial RCS Temp T ₀ , °C	Operator Action Considered
1	SBO_FAI1	96 hours	FL -1.0 m	48.9	1 SIT Gravity Inj 30 m
2	SBO FAI2	20 days	FL -1.0 m	57.2	No Action

Task 2 Severe Accident Analysis for Mid-Loop Operation

- Perform severe accident analysis on the representative scenarios specified in Task 1 using MAAP5.
- Documentation of the results

5 Documentation of Consulting Results

All products for this consulting service shall be submitted in the form of electronic files. Electronic files of review results shall be submitted by the scheduled date in section 8. The consultation documentation shall include all information for KEPCO E&C's questions made within the individual consulting period. In addition, reference materials when used in doing consulting work shall be identified in each consulting products, and a relevant electronic file may be provided (excluding legally restricted material) as requested by KEPCO E&C.

The Contractor shall not use nor disclose, to any third party, all and any information provided by KEPCO E&C in connection with this Contract. The Contractor shall promptly destroy, upon completion or termination of the Contract, whichever is earlier, all such information including but not limited to prepared, developed or generated information, document, material or any tangible information by the Contractor without retaining a copy of any such information. The Contractor shall upon request, certify in

writing such destruction within reasonable period.

6. Methods of Performance

All the tasks above shall be performed based on technically acceptable and sound basis. The work shall be carried out in close co-operation between the Parties. Documents required for consultation will be provided to Contractor in electronic form and all project data and deliverables shall be in English language unless otherwise agreed. Final deliverables shall be submitted before the end of the technical consultation. Quality Assurance (QA) is not required in this technical consultation.

In order to discuss the matters relevant to the services, correspondences can be made via e-mail or telephone. However, official correspondences shall be communicated via letter. The correspondence containing important issues and/or decisions will be recorded.

Approximately a week prior to the completion of task, the Contractor shall host a technical meeting with KEPCO E&C via video conferencing. The topics to be discussed during the meeting include:

- Presentation of analysis modeling and results
- Review of the service results and conclusions

7. Deliverables

All deliverables shall be submitted within period specified below.

- 1) Memo on analysis modeling and analysis results: within 5weeks from the Execution Date
- 2) Used input files and meeting presentation: within 5 weeks from the Execution Date

8. Work Schedules

The task schedule for activities of Technical Consultation on Severe Accident Analysis for Mobile DG Deployment during Outage using MAAP5 is shown on the following Table.

	Week after Execution Date					
Activity	1st	2nd	3rd	4th	5th	
Task 1. Establishment of Analysis Modeling for Mid-Loop operation						

	Week after Execution Date					
Activity	1st	2nd	3rd	4th	5th	
Task 2. Severe Accident Analysis and Sensitivity Analysis for Mid- Loop operation						

CONSULTATION PERIOD

→ Execution Date of the Contract ~ Execution Date of the Contract+5 weeks