

**Technical Consultation on Analysis of Hydrogen
Leakage, Dispersion, and Explosion in Hydrogen
Production Facility with NPP**

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1.0 PURPOSE

KEPCO E&C is considering a nuclear power plant linkage design necessary for producing nuclear clean hydrogen through the installation of hydrogen production facilities.

However, hydrogen gas must meet the U.S. NRC licensing requirement of RG1.91, which describes safe separation distances as combustible and explosive materials.

Therefore, we would like to conduct this Contract to develop a model that can satisfy the requirements through reasonable analysis in the event of an event in a hydrogen production facility. In addition, this can be used not only in nuclear hydrogen but also in general hydrogen facilities.

The scope of service to be performed by the Contractor under this agreement includes the followings.

2.0 TECHNICAL SCOPE OF WORK

Contractor shall provide the following engineering services to KEPCO E&C as described in the following tasks:

Task 1: Development of methodology for analysis of jet release from high-pressure hydrogen containers (or piping)

- i. Analysis of hydrogen release rate considering the leakage angle (0~90 degree)
- ii. Analysis dispersion from the release point
- iii. Prediction of hydrogen concentration distribution based on Cartesian coordinate system (e.g., $C = C(x,y,z)$)
- iv. Development of methodology for puff and plume release scenarios
(Puff : Instant release, Plume : Continuous leak)
- v. Dispersion effects caused by ground reflection or collision of hydrogen and hydrogen-air mixture
- vi. Consideration of meteorological conditions such as wind speed(1.5m/s), atmospheric stability(F).
- vii. Provide the explosive or/and flammable mass according to the distribution sizes (e.g., x,y,z) and distribution for the hydrogen concentration(e.g., 4%~75%) including the reasonable validity.

Task 2: Determination of explosion overpressure prediction methodology.

- i. Determination and basis for predicting overpressure caused by hydrogen explosion
 1. Examination of the applicability of experimental methodologies such as TNT(or ME, and BST) in terms of NPP licensing.
 2. Determination and basis for predicting overpressure due to puff and plume releases
 3. Development of overpressure curves as a function of distance from the overpressure

origin

ii. Determination and basis for setting the overpressure origin

1. Determination and basis for setting the overpressure origin (e.g., LFL, LEL, centroid or others) including the reasonable validity.
2. Setting the overpressure origin according to the location of the ignition source (ground or aerial ignition)

iii. Provide the basis for the decision as above (reference paper, etc.).

Task 3: Technical Meeting

- Video conference for Contract on the details and purpose of Contract and/or results

Task 4: Documentation

- i. Write technical reports for Task 1, 2, and 3.
- ii. Review and comment resolution

3.0 METHOD OF PERFORMANCE

Contract Schedule

The Contract schedule for the basic tasks (Task 1 to 4) shall be carried out for 3(three) months from the Execution Date (the “Contract Performance Period”) of the Contract, as follow.

Tasks	Schedule			Remark
	Execution Date	Execution Date	Execution Date	
	+1M	+2M	+3M	
Task 1 : Development of methodology for analysis of jet release from high-pressure hydrogen containers (or piping)				
Task 2 – Determination of explosion overpressure prediction methodology.				
Task 3 – Technical Meeting				
Task 4 – Documentation				

Method of Performance

- 1) After the Contract date, the Contractor must start the service according to the detailed schedule of 3.0 METHOD OF PERFORMANCE, and KEPCO E&C provides related detailed information for the performance of the work of 2.0 TECHNICAL SCOPE OF WORK - Task 1&2 if necessary. The Contract shall be ended by 3 months from the Execution Date.
- 2) The Contractor shall comply with the security of all information and data provided by KEPCO E&C and shall not provide it to other third parties.

Deliverables

- Draft report: within 2 months after the Execution Date
- Final report: within 3 months after the Execution Date