Regarding the Injection of Nitrogen into the Primary Containment Vessel (PCV) of Unit 2 of Fukushima Dai-ichi Nuclear Power Station, the Tokyo Electric Power Co. Inc.

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Nuclear and Industrial Safety Agency

1. Background

At Unit 2 of the Tokyo Electric Power Co. Inc.'s (TEPCO) Fukushima Dai-ichi Nuclear Power Station (NPS), the injection water is ongoing for cooling the reactor, and TEPCO is planning to proceed with cooling until the reactor reaches a cold shutdown. Furthermore, in addition to injecting water, TEPCO is planning to implement injecting nitrogen into the Primary Containment Vessel (PCV) similar to Unit 1 for the purpose of preventing a hydrogen explosion.

For this reason, the Nuclear and Industrial Safety Agency requested TEPCO to submit a report regarding the necessity and safety of implementing the injection of nitrogen into the PCV, pursuant to the provisions of Article 67 paragraph 1 of the Act on the Regulation of Nuclear Source Materials, Nuclear Fuel Materials and Reactors.

2. Evaluation by NISA

NISA made the following confirmations and evaluations based on the report submitted by TEPCO.

(1) Necessity for the injection of nitrogen

As the pressure of the PCV of Unit 2 is equivalent to atmospheric pressure, there is significant leakage arising. Consequently, the hydrogen that results from the water radiolysis, mixed with the steam that is generated from the injected water by the decay heat, is leaking out from the PCV. At this time, the possibility for a hydrogen explosion to occur inside the PCV is extremely low.

On the other hand, at the stage after the cooling of the reactor has progressed, the quantity of steam will be reduced and since the

hydrogen resulting continuously from the water radiolysis may accumulate inside the PCV, TEPCO is planning to supply nitrogen to prevent the hydrogen concentration from reaching the inflammable limit.

Based on the above, NISA determined that TEPCO could prevent a hydrogen explosion from occurring by supplying the appropriate quantity of nitrogen with respect to the hydrogen quantity resulting from the water radiolysis, which will render it possible to control the increase of hydrogen concentration even at the stage after the cooling of the reactor.

(2) Safety for the injection of nitrogen

(a) Implementation procedures and effect of preventing a potential hydrogen combustion

The hydrogen quantity resulting from the water radiolysis inside the PCV was assessed and it was determined that the necessary nitrogen volume injected was 13Nm^3 every hour to ensure the hydrogen concentration does not reach the concentration level that could lead to an explosion. In addition, the equipment has the required discharge pressure to inject the nitrogen into the PCV. Furthermore, if the concentration of nitrogen falls for any reason, NISA confirmed that the system can automatically discontinue supplying the nitrogen.

Next, NISA confirmed that there were specific procedures in place for monitoring the pressure and for careful opening operations of the injection valve, such that the steam inside the PCV would not condense. In addition, NISA also confirmed that sufficiently pure nitrogen (having purity higher than 99%) could be injected.

(b) Impact on the surrounding environment by the conceivable radioactive materials that can be pushed out from the PCV by the injection of nitrogen

As the pressure of the PCV is, at present, almost the same as atmospheric pressure, the estimated steam resulting from the decay heat is 2500m^3 every hour. It is possible to believe that the gas resulting from mixing this steam and the injected nitrogen

could leak from the PCV, but the quantity of radioactive materials contained in the gas that could be leaked is unchanged from the quantity before injecting the nitrogen. Therefore, NISA confirmed that there would be no additional impact on the surrounding environment. Nevertheless, TEPCO, as a precaution, is planning to reinforce its monitoring of the impact on the environment due to the injection of nitrogen.

Moreover, since the pressure of the PCV due to the injection of nitrogen will not increase, NISA confirmed that there will neither be any effect on the leakage of injected water into the reactor building expected to arise if damage to the suppression chamber were to occur.

(c) Hypothetically, if sudden hydrogen combustion occurred inside the PCV, the impact on the surrounding environment by the conceivable radioactive materials

As a precaution, TEPCO also evaluated the environmental impact in the event of the occurrence of sudden hydrogen combustion, in a hypothetical situation. Accordingly, even if the quantity of radioactive materials in a gaseous phase pushed out from the PCV to the outside is assumed, NISA confirmed that the assessment at the site boundaries would be around 3×10^{-4} mSv, which is far less than the public dose limit of 1mSv.

(d) Management of workers exposure when building the connection of the nitrogen injection apparatus to the PCV

For the actual connection of the provisional line for the injection of nitrogen, NISA confirmed that TEPCO has selected locations in the areas where the dose is as low as possible based on the dose measurement results by detailed surveys, and confirmed by dose maps waiting places and work flow lines; as well, NISA confirmed that workers with expert knowledge of the site are planning to implement these operations under time management.

Based on the above, NISA determined that TEPCO's implementation of the emergency measures pursuant to Article 64

paragraph 1 of the Nuclear Regulation Act was a valid assessment by TEPCO and NISA concluded that TEPCO actions were necessary measures to avoid the risk.

3. Future Action

As to the injection of nitrogen, Nuclear Safety Inspectors will confirm as necessary whether the injection of nitrogen is appropriately implemented as indicated in the details of TEPCO's report.

(Attachment 1)

Injection line to the PCV of Unit 2