June 23, 2011

Tokyo Electric Power Company

Regarding Installment of the Reactor Building Cover and Accessory Equipment at Fukushima Daiichi Nuclear Power Station Unit 1

１． Purpose of installment of the Reactor Building Cover

The status of Fukushima Daiichi Nuclear Power Station Unit 1 is that the upper part above top floor of reactor building(operating floor) is opened and it is concerned that evaporation of water vapor, which contains radioactive materials and flying of debris and dust caused by weather. On the other hand, towards installing the construction, which can contain radioactive materials and shield from radiation ray, it is unable to complete the construction with short term of period because the structure must meet the required performance and is necessary to install accessory equipment. As emergency countermeasure, we will install the reactor building cover to contain flying of radioactive materials.

This installment of the reactor building cover is stated as countermeasure "Ⅱ. Mitigation （４） Mitigation of Release of Radioactive Materials to Atmosphere and from Soil" of "Roadmap towards Restoration from the Accident at Fukushima Daiichi Nuclear Power Station" dated April 17th, 2011.

２. Advantageous Effects of installment of Reactor Building Cover

Installing the reactor building cover （including accessory equipment）, following advantageous effects are expected：

（４） To contain radioactive materials, which being discharge from reactor building to the air.

（５） To prevent inrush of rainwater etc to reactor building.

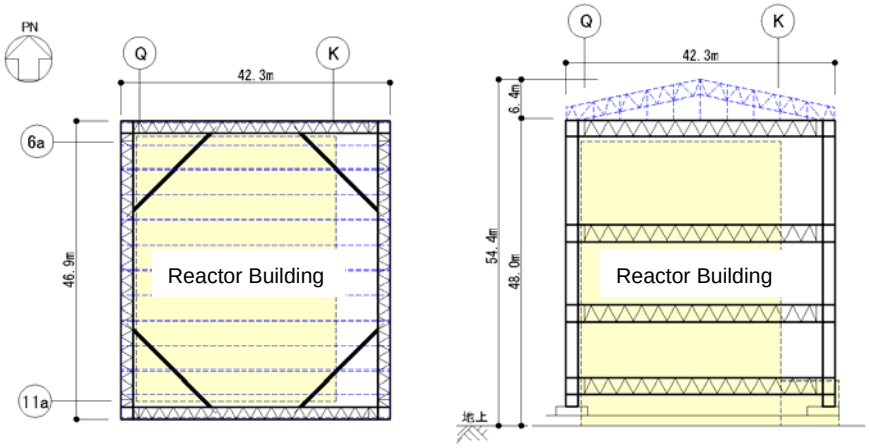
（６） To figure out radioactive materials concentration, which being discharged from reactor building to inside the cover.

３. Install Policy of the Reactor Building Cover

（１）Outline of the Building

While we will select as much as air tightness materials as reactor building cover to contain radioactive materials, as this is emergency countermeasure, we will adopt the design and construction measure as we can possibly soon achieve installment.

Flat dimension is rectangular as approx. 47m (NS direction) × approx. 42m (EW direction) and height is approx. 54m from ground. Main construction is steel construction. Wall surface and roof surface are planed to be cover with waterproof membrane material. We will set up slop at roof surface and the upper side of wall surface to prevent the inrush of rainwater. Also, in order to prevent the blowing and hoisting of wind in the time of typhoon, we will set weight at the membrane edge of bottom of reactor building cover.



Plan View of Roof　　6a framing elevation

（2）Outline of the Construction

Reactor building cover is the cover to contain the flying of radioactive material to the outside of reactor building. Considering the effect to the reactor facilities, we will design the cover following with the Building Standard Act.

a． Design Load

External force condition when we analyze structural intensity and safety in the time of normal, snow, storm and earthquake are as follows:

①Snow Load；Depth of snow 30cm, Unit load 20N/m²/cm

②Wind Pressure；Standard velocity 25m/s

③Seismic Load；Horizontal seismic coefficient 0.2

Considering emergency counter measure as in-service period with regard to the calculation of wind pressure, we adopted lowering wind velocity in recurrence interval of 10 years. This wind velocity is above the average maximum wind velocity (17m/s) in 10 minutes, which is observed in the past 35 year at the area nearby.

Setting of earthquake load and snow load is complied with the Building Standard Act. Horizontal seismic coefficient of 0.2, which is used to set seismic load, is corresponding to C class of seismic force, which is established by Nuclear Power Station Seismic Design Technical Guide.

b． Intensity Review of Structure

We will use 3D machining frame model for composing load with regard to the analysis of stress. Semi-steel of column, joist and angle brace is collected as beam component and, roof part and membrane is considered of only weight as nonstructural element. Rigidity is not considered. Stress analysis is implemented for long-term normal load, short-term wind press and seismic force. As a profile review result of column and joist, we confirmed they will be below allowable stress intensity.

c． Review of Groundwork

Since reactor building cover's groundwork is installed at the ground level or exsited building's(Control Building, Radiation Waste Treatment Facility) superior surface of roof

slab, we review for the slip case, which horizontal load acted. Against shear force, which affect to the column base, we confirmed sufficient margin to slip friction.

Also, since south surface of column base is supported by the ground level, which is structured with cradle at superior surface of existed buildings' roof slab, we review for the existed building's punching shear and confirmed sufficient margin of bearing resistance of column.

d. Review of Membrane

Membrane materials for roof surface and wall surface are vinyl chloride resin coating polyester fiber fabric. Intensity review of membrane is implemented against wind pressure. Stress intensity to membrane due to wind pressure is below allowable stress and confirmed that there is sufficient margin to the standard velocity.

(3) Accessory Equipment

In order to contain the discharge of radioactive materials from reactor building to the air, we will install the reactor building cover as well as exhaust duct (including filter). Vacuuming internal gas from the roof of reactor building cover and then, it will lead to the filter unit through the exhaust duct, which is installed outside the reactor building cover. Filter unit is composed of pre-filter, heating coil, high performance particle filter, charcoal filter for iodine, fan etc. Blow up exhaust duct will discharge the gas, which gas contain radioactive materials collected by each filter. We will install 6 sets of filter units as air volume is approx. 10,000m^3/h (2 sets are for backup) and they will be operated at total of approx. 40,000m^3/h air amount.

Water injection to the spent fuel pool is being conducted through the internal pipes of reactor building. We will install water injection nozzle(it can change the direction) at the roof of reactor building cover to inject water through the top of the spent fuel pool. We will connect them with pipes and horses to the feed-water system located outside the reactor building cover.

Also, we will set thermometers to measure the temperature inside of the reactor building cover and cameras to observe the status of water injection to the spent fuel pool. We will set the instruments to measure radioactive material inside the reactor building cover and concentration of radioactive material discharged to the air through blow up duct. We will also set the facility to measure hydrogen concentration inside the reactor building cover.

Facility Name	Composition ・ Location etc
Suction Opening	Location : North ceiling inside the cover
Filter Unit	Location : Set 6 Units at the outside of west side of reactor building (2 sets are for backup)

	Composition:Pre-filter,charcoal filter for iodine(efficiency 90%), High performance particle filter (efficiency97%), Heating coil, Fan Filter dose meter (set to the high performance particle filter), Filter differential manometer(pre-filter, charcoal filter for iodine, set to the high performance particle filter)
Exhaust Duce (Blow up Exhaust Duct)	Location : Set at the downstream of filter unit (Diameter : approx. 1m, Height : approx. 4m)
Camera	Location : 6 at the circumference of upper operating floor (3 are for backup) Objective:View status of water injection to the pool and inside the cover
Thermometer	Location : 2 at roof (1 is for backup), 2 at the height of operating floor (1 is for backup)
Instruments for measuring radioactive material concentration	Measuring object : Near the corner of operating floor (3 locations), near opening section of instruments hatch, upper space of spent fuel pool, upper space inside the cover and concentration of radioactive materials before discharging the air
Hydrogen concentration meter	Measuring object : Hydrogen concentration inside the upper space of the cover Location : 2 sets at the downstream of filter unit (1 set is for backup)

(4) Others

a. Consideration to tsunami

Tsunami will be dealt with by the coastal levee that will be constructed before the completion of the installment of the reactor building cover.

b. Consideration to fire

The possibility of fire would be limited since there is no fire in the reactor building cover. However, in order to prevent the spread of fire to the reactor building in the case of fire we put vinyl-chloride-resin-coated polyester fabric onto the wall and roof panels, which has higher level of inflammability than “Level of Inflammability 2” described in JIS A 1322-1966“Inflammability Test of Thin Materials for Buildings”. In the case of fire at the operating floor, water spray would be conducted by opening the cover roof or shutter.

c. Inhibition of the spread of radioactive substances

In order to inhibit the spread of radioactive substances in the case of the partial break or collapse of the reactor building cover we will spray inhibitor to the outside wall and the top floor of the reactor building (operating floor) beforehand.

d. Impact from hydrogen

While hydrogen will be generated through the radiolytic decomposition of water in the fuel of the reactor and the spent fuel pool, the possibility that the density of hydrogen in the cover increases is thought to be very low because the generated amount of hydrogen will be small enough compared with the air exhaust rate 40,000m3/h, it will be mixed with gas in the cover and the gas inlet of the exhausting facility is placed at the ceiling. In the case that the density of hydrogen reaches the flammable density limit, it will be released to the outside by opening the cover roof or shutter.

4. Risks stemmed from the installation of the reactor building cover

(1) Risks stemmed from the installation

In installing the reactor building cover the following risks are considered.

a. The reactor building cover becomes damaged by external force (seismic force or wind pressure) over design load, which would spill over to the reactor building.
b. The environment (temperature, humidity) in the reactor building becomes worse due to temperature or moisture in the reactor building cover.
c. The schedules of the restoration work and the installation work get delayed due to the mutual interference.
d. The plan of the following restoration works is influenced.

We will proceed with the installation of the reactor building cover, taking into account countermeasures against these risks as much as possible.

a. Spillover effect to the reactor building by the damage of the reactor building cover

The rector building cover is designed and structured based on the Building Standards Act, considering the period of use as an emergency measure. However, we will examine the collapse mechanism in the case that external force over design load occurs and will confirm no spillover effect to the reactor building happens in that case.

As a result of gradually increasing load analysis, posts will not slide to collapse by wind pressure or seismic force before the collapse of the frame. Preparing for the increased amount of slide, we will install a stopper on the cover in order to prevent the deformation, making the concrete wall of the reactor building suspend the cover. This stopper is expected to prevent the slide of the cover and the collapse of the frame, and have no significant impact on the spread preventing ability of the radioactive substances. In this case, the reactor building will have the load of the cover. However, the weight of the rector building cover is small enough compared with the weight of the reactor building (total weight of the rector building cover/ weight at mass point of the reactor building (weight of the

foundation exclusive) = approx. 4%) , and the impact on the natural period that indicates vibration charasteristics is approx. 2%. On the other hand, the shear strain of the quake-resistant wall of the reactor building against Design Basis Ground Motion Ss-1 and Ss-2 is $0.12*10^{-3}$ at a maximum, which is low enough compared with the evaluation standard ($4.0*10^{-3}$).
Sliding resistance of the frame is about 1.8 times of the designed load and 3.0 times of the designed seismic force, which indicates enough safety against earthquakes or storms. As such, while the reactor building will have the load of the cover in the case that external force over design load (earthquakes, storms) occurs, it is considered that the spillover effect will be very small.

b. Impact on the environment in the reactor building
It is supposed that the temperature in the reactor building will increase due to the installation of the reactor building cover. On the other hand, the exhaust facility of the reactor building cover is supposed to intake outside air through the interstice of the cover. Hence, we will deal with this risk by installing spot air conditioners at each work place according to the season, if necessary.
The humidity inside of the cover will increase due to the evaporation from the spent fuel pool, but 40,000m3/h will be concurrently replaced with air from outside. Since the ventilation amount is larger that the evaporation amount from the pool, it is not supposed that the temperature inside of the reactor building will significantly increase.

c. Interference with other restoration works
We will proceed with the work plan by coordinating the process and the yard in order to avoid the situation that the installation work of the reactor building cover interferes with other restoration works for cooling the reactor and the spent fuel pool. Since water injection to the spent fuel pool has been conducted through the internal piping arrangement of the reactor building, the installation work of the cover and the water injection will not interfere with each other. However, in substitution for water injection by a concrete pumping vehicle as an alternative way of water injection we will install water injection pipes ad hoses to the reactor building cover and monitoring cameras inside of the cover so that we can confirm the situation of water injection by the injection nozzles and the situation of the operating floor.

d. Influence to the following restoration works
Considering the following restoration works such as the removal of spent fuel and the installation of radiation shielding containers, we will use iron frames for the posts and beams and membrane material for the walls and roof and will adopt demolishable structure based on the assumption that all or a part of the reactor building cover will be demolished. When we demolish all or a part of the reactor building cover, we will proceed with it by considering the impact on the surrounding environment.

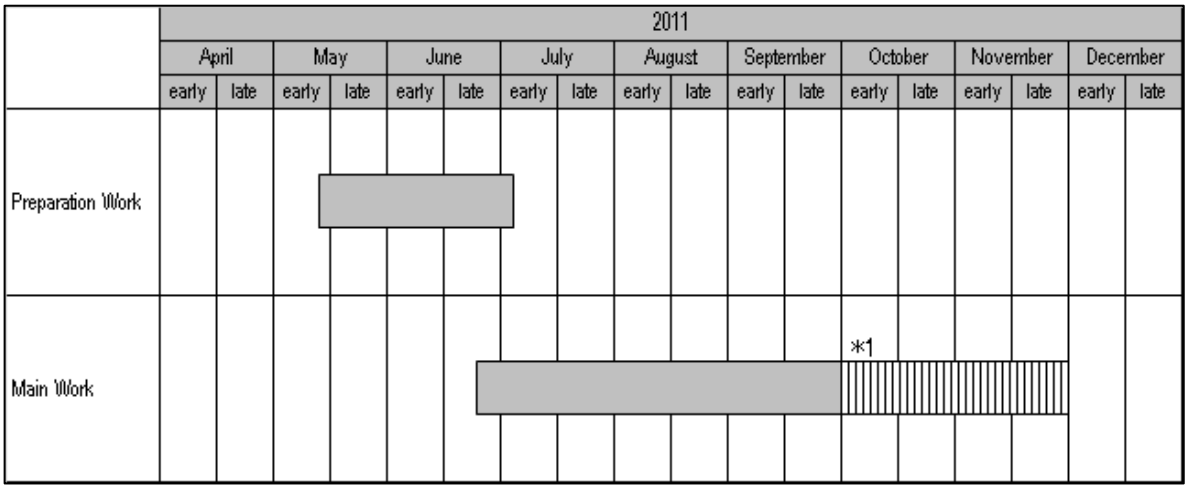
５．Execution Scheme

The Reactor Building Cover made its member a large component unit with built-in joint member to reduce assembly. By employing this execution scheme, shortening of work period and reduction of radiation exposure is expected. At implementing execution scheme, security of workers and reduction of radiation exposure will be carefully examined.

６．Process Planning

・Preparation Work；Shallow draft quay preparation, Crawler crane road preparation

・Main Work；Reactor Building Cover Installment, Exhaust Draft Installment



＊1 In the case bad weather condition or high radiation was affected

７．Operation and Maintenance

（１）Operation

Start and stop operation of draft fan in the filter unit will be done from the site operation panel set beneath the filter unit and in the case of trip of draft fan due to some failure, spare fan will start automatically. System component for the site operation panel will be draft fan operation status (start and stop), alarm (draft fan failure, electrical heater (heating coil) failure, power source failure), inside cover temperature, hydrogen density and radiation density and for the Main Anti-earthquake Building (or in the previous administration building) will be alarm, remote camera, inside cover temperature, hydrogen density and radiation density.

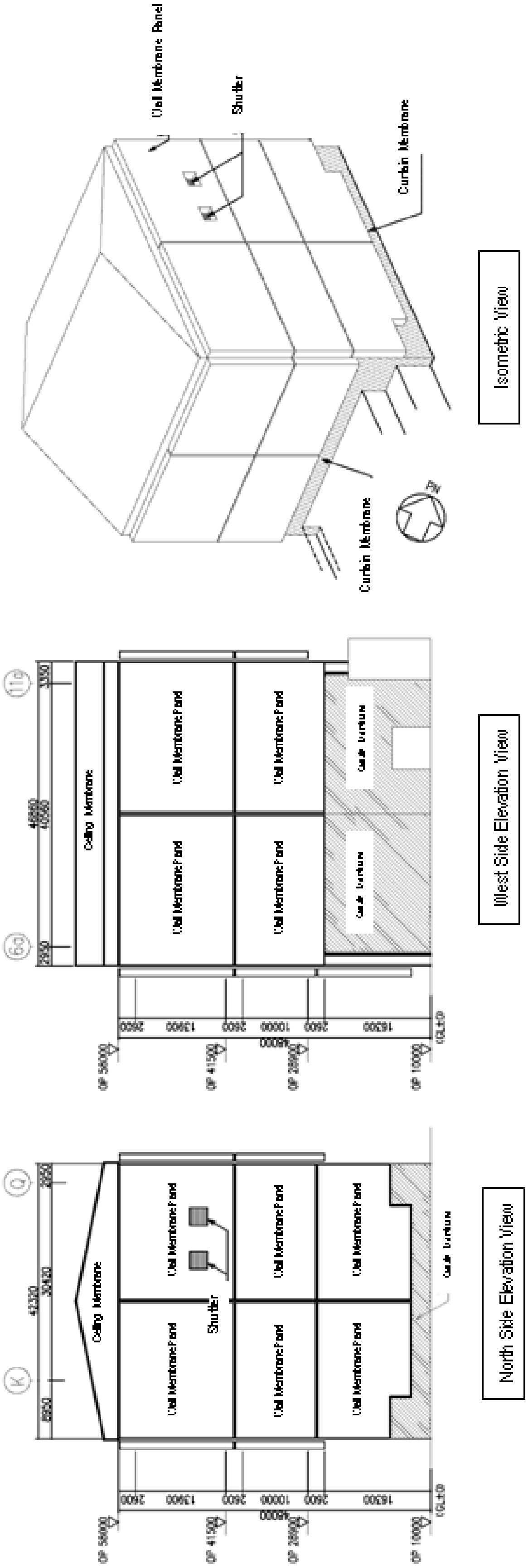
Radioactive material is expected to be emitted inside the cover through the reactor pressure vessel, containment vessel and opening mouth of operating floor (equipment hatch) and transit to above the pool from the spent fuel pool water. Thus, sampling pipe will be placed in 3 places near the corner of operating floor (also placed near southeast corner in the future), one place neat the equipment hatch and one place above spent fuel pool that enable induction at each place. And radioactive density measuring pipe for upper space radiation and before discharge (after filtering) will be installed in the exhaust air duct. Each sampling pipe will be connected to

the radiation meter and measure radiation density of radioactive material discharged from the reactor building to evaluate impact to the surrounding environment.

（2） Maintenance

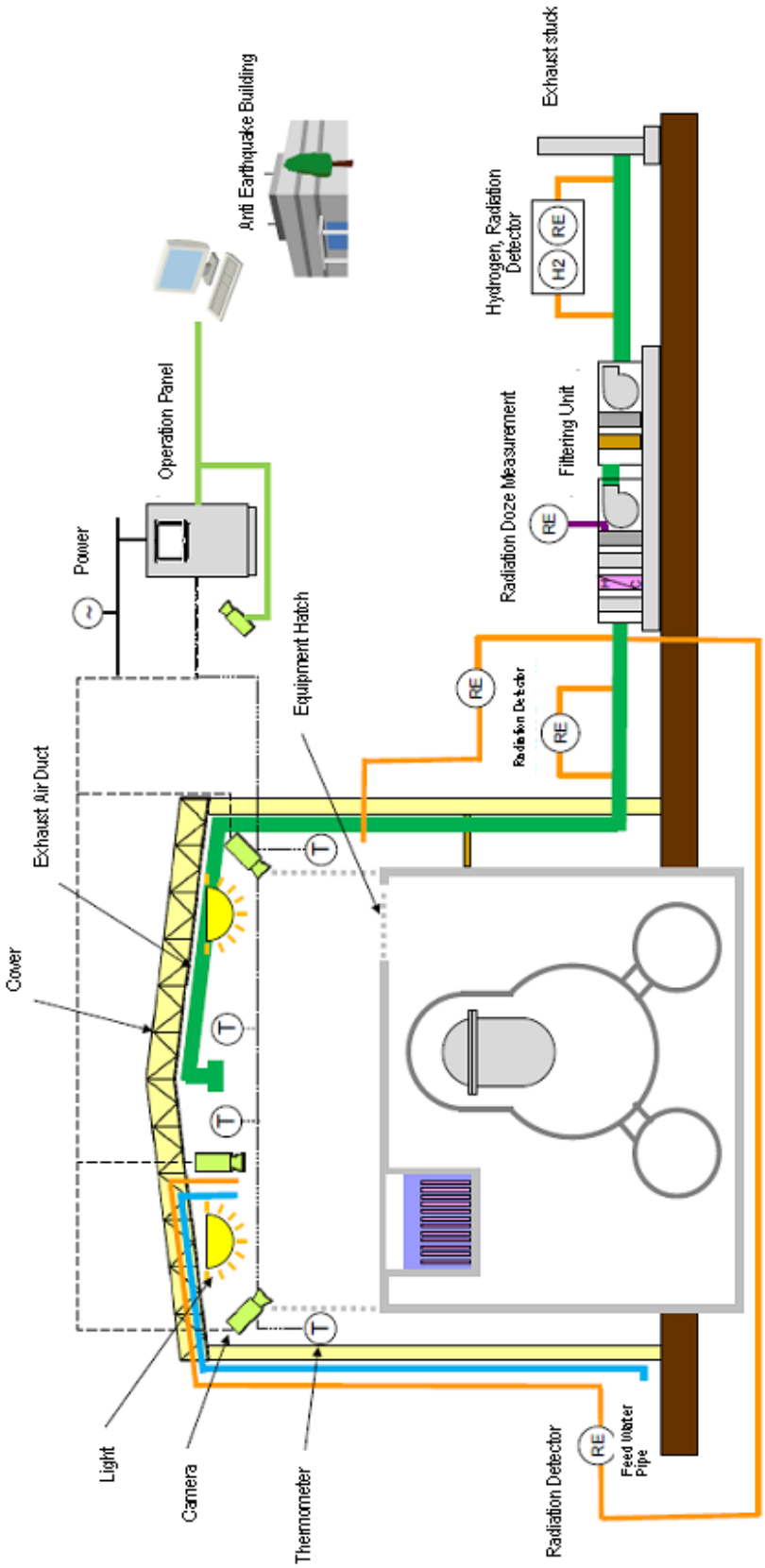
Consumables for exhaust facility such as packing will be replaced appropriately if necessary. Filters will be replaced at an appropriate timing by checking differential pressure or radiation doze. Testing and proofreading will be made to the radiation doze detector properly.

End



Reactor Building Cover Unit 1 Fukushima Daiichi Nuclear Power Station

Elevation View/Isometric View



Reactor Building Cover Exhaust facility and Monitoring Facility