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Usage of the Port of Fukushima Daiichi Nuclear Power Station (Necessity of Marine Transportation)

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Tokyo Electric Power Company

Provided below is our answer to an inquiry about the necessity of the usage of the port of Fukushima Daiichi Nuclear Power Station. The transportation of equipment and materials via ground transportation is deemed unfeasible due to the following reasons. We appreciate your understanding for marine transportation.

Reasons why ground transportation is unfeasible

1. Interference with the existing roads, etc.

- Considering the restrictions of height (4.1m), length (12.0m) and width (2.5m), there are obstacles such as the bridge over JR railway, pedestrian overpass, bridge and electric wires on the transportation route.
- The strength of bridges, etc. is not sufficient for transporting objects which weigh approx. 100 tons (Max.).

2. Necessity of assembly outside of the power station site in prior to carry-in

- Objects are to be assembled beforehand (even if they can be transported separately) for the purpose of improving construction accuracy and reducing workers' exposure dose by minimizing assembly work done at the site.

Marine transportation plan

As the works towards the stabilization of Fukushima Daiichi Nuclear Power Station below require transportation of large facilities/equipment, the marine transportation of the equipment/materials is deemed necessary.

1. Cover installation on Unit 4 Reactor Building
2. Cask transportation for temporary storage of spent fuels
3. Installation of miscellaneous solid waste incineration facility
4. Transportation of other construction materials, etc.

Steel pipe sheet piles for impermeable wall installation and recovery work of the shallow draft quay and construction materials for fuel removal at Unit 3 and others are also planned to be transported.

Past cases of marine transportation

Marine transportation via workboat was performed for 23 days (once every two days) from February 12 to March 22, 2013, for the bottom gill net replacement at the port entrance.

1. Necessity of marine transportation for cover installation on Unit 4 Reactor Building

The cover installation on Unit 4 Reactor Building is ongoing towards the fuel removal to be started in mid November 2013 (which is one month ahead of the initial roadmap). The steel members (columns, beams, exterior panels, etc.) which are the main materials for the crane support structure are to be assembled in the yard near Onahama Port and then transported to Fukushima Daiichi Nuclear Power Station through Onahama Port via marine transportation as large materials.

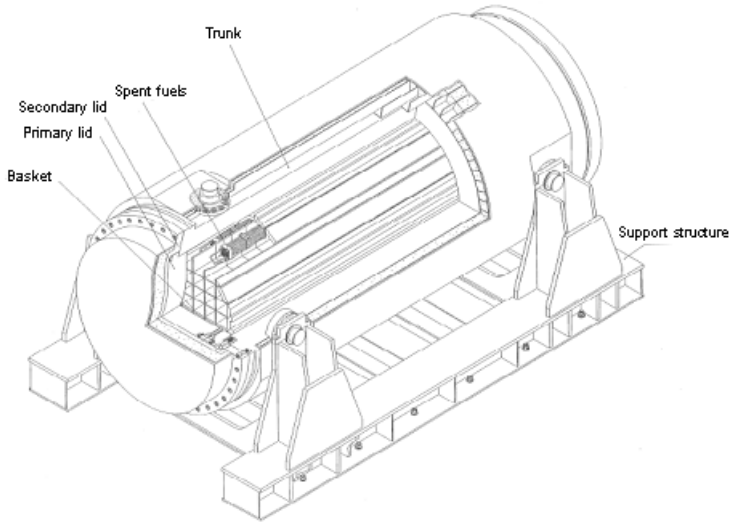
<u>Specifications of the assembled steel members</u>
[Maximum dimensions of steel members]
Column (B type, square): 3m x 3m x 25mm
Beam (B type, square): 3m x 3m x 25mm
[Maximum length of steel members (weight)]
Column: 13.5m (60.9t)
Beam: 21.0m (72.6t)
*The total weight: 4,030t
[Number of steel members]
38 columns and 49 beams

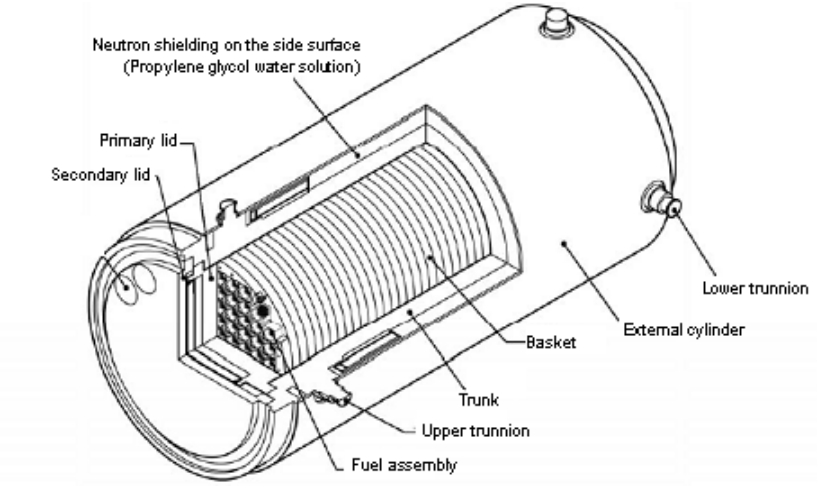
Photo: Transportation of steel members in the power station site (transported via special transportation vehicles)

Steel members are assembled beforehand for the purpose of minimizing assembly work in the power station site and reducing the workers' exposure dose. The specifications of the steel members above do not allow for ground transportation via regular public road.

2. Necessity of marine transportation of casks

The weight of a cask (including the mount) in which sound spent fuels taken out of the common pool are stored exceeds 100t and special vehicles such as a large trailer is required for ground transportation.





Item	Dry storage cask (Medium)	Dry storage cask (Large)
Weight (t) (Including the fuels)	Approx. 96	Approx. 115
Total length (m)	Approx. 5.6	Approx. 5.6
Outer diameter (m)	Approx. 2.2	Approx. 2.4
Number of fuels to be stored	37	52
Number of units	4 (Existing) + 8 (Additional)	5 (Existing) + 3 (Additional)
Fuels allowed to be stored	8x8 fuels (Burnup: 30,000MWd/t or less) New-type 8x8 fuels (Burnup: 33,500MWd/t or less) New-type 8x8 zirconium liner fuels (Burnup: 36,500MWd/t or less) Cooling period: 4 years or more (for the 9 existing units) Cooling period: 13 years or more (for the 11 additional units)	

Item	Transport/storage cask A	Transport/storage cask B
Weight (t) (Including the fuels)	Approx. 119	Approx. 119
Total length (m)	Approx. 5.4	Approx. 5.3
Outer diameter (m)	Approx. 2.5	Approx. 2.5
Number of fuels to be stored	69	69
Fuels allowed to be stored	8x8 fuels, new-type 8x8 fuels, new type 8x8 zirconium liner fuels Cooling period: 18 years or more	New type 8x8 zirconium liner fuels Cooling period: 18 years or more

In the case of transporting casks to Fukushima Daiichi Nuclear Power Station via ground transportation

Assuming a case of transporting a cask from Fukushima Daini Nuclear Power Station to Fukushima Daiichi Nuclear Power Station via ground transportation, the strength of a bridge in the transportation route was evaluated. As a result, it was confirmed that the bridge needs to be reinforced to allow for ground transportation which will require a certain amount of time. Thus, we would like to gain your understanding for marine transportation.

[Example of evaluation]

Name	① Transportation vehicle load bending moment (kNm)	② Design live load bending moment (kNm)	Safety factor (②/①)
Kumakawa Bridge	2264	1351	0.6

Ground transportation route from Fukushima Daini Nuclear Power Station to Fukushima Daiichi Nuclear Power Station

Transportation of a dry storage cask in the power station site

Kumakawa Bridge

東京電力 TEPCO

3. Necessity of marine transportation for the installation of miscellaneous solid waste incineration facility

The miscellaneous solid waste incineration facility is intended for incineration and volume reduction of radioactive waste such as workers' tools which is planned to start operations in the second half of FY 2014. The radioactive waste is to be reduced (in volume) to one several tenth or less through incineration and stored in drums. To ensure safety, the facility is designed to prevent the release of radioactive materials through decontaminating the exhaust gas by filters, etc. As you can see in the following list, the ground transportation of the target equipment is unfeasible due to interference with the elevated JR railway and pedestrian overpass. Thus, marine transportation will be necessary.

List of equipment to be loaded for the miscellaneous waste incineration facility installation at Fukushima Daiichi Nuclear Power Station (Planned)

Equipment	Dimensions (mm)	Weight (tons/unit)	Number of units
Incinerator	Φ3900 × 10200	Approx. 33	2
Secondary combustor	12400 × (3400 × 4900) □	Approx. 13	2
Exhaust gas cooler	Φ4200 × 11400	Approx. 14	2
Top part of the exhaust gas cooler	Φ2600 × 3200	Approx. 3	2
Incinerator cover	9200 × (5100 × 5200) □	Approx. 11	2
Entrance hood	3700 × 4800 × 1500	Approx. 10	2
Connecting duct between equipment	Φ1600 × 4200	Approx. 9	2
Bug filter	3500□ × 13800	Approx. 28	2
Slaked lime silo	3000□ × 8700	Approx. 8	1
Other accessories	-	Approx. 5	1 set