# INSPECTION OF FUEL CLADDING AND METAL GASKET IN METALLIC DRY CASK AT TOKAI No.2 POWER STATION

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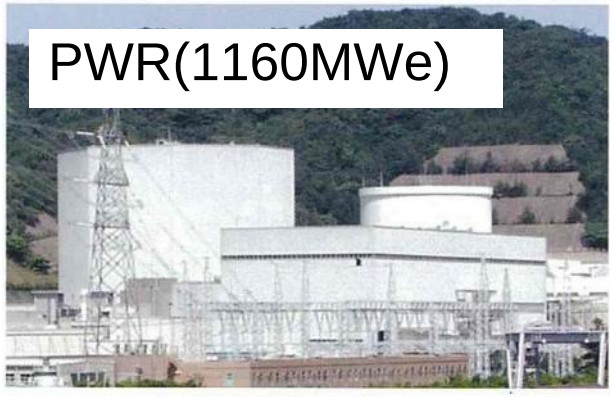
# THE JAPAN ATOMIC POWR COMPANY

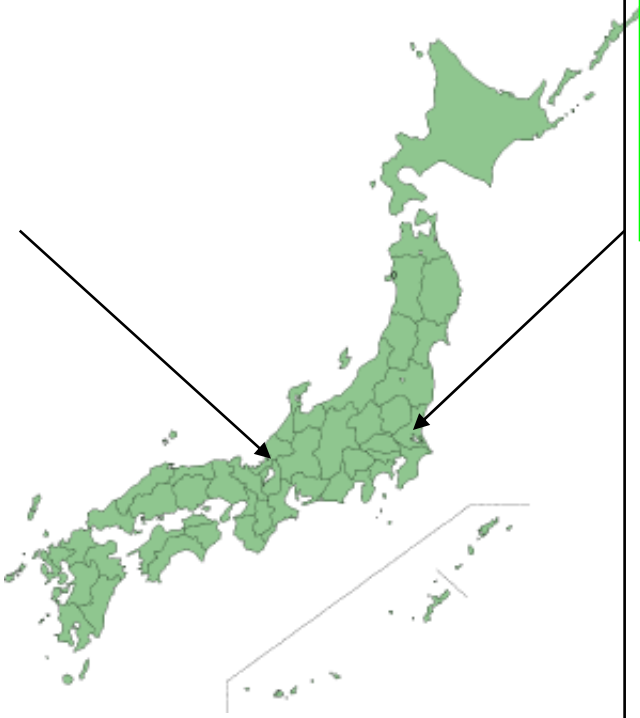
BWR(357MWe)

Tsuruga Power Station Unit 1
Japan's first light water reactor

PWR(1160MWe)



Tsuruga Power Station Unit 2
Japan's first advanced standard pressurized water reactor



BWR(1100MWe)

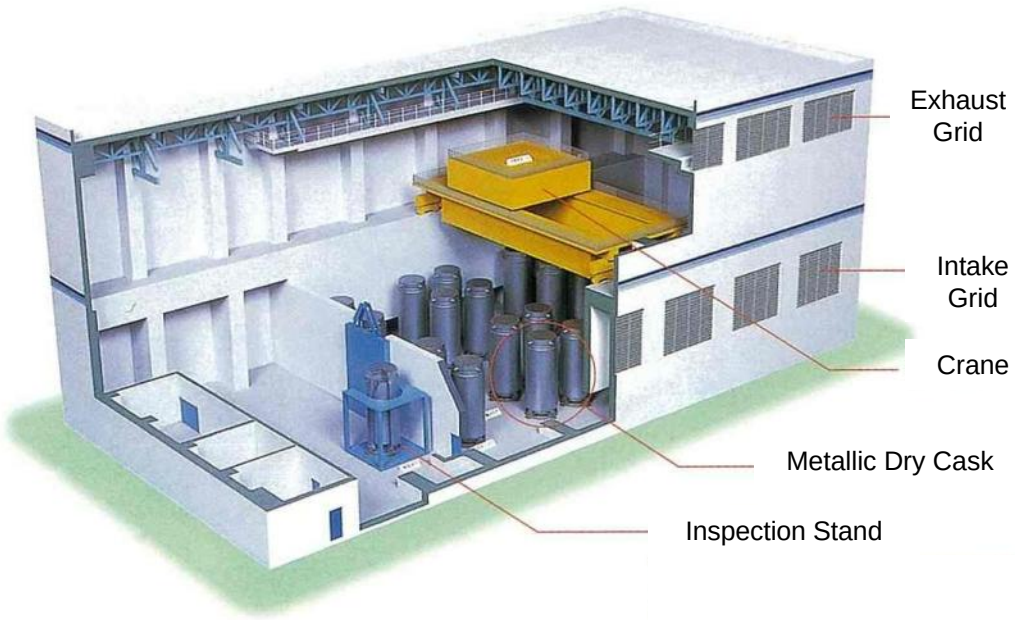
Tokai No. 2 Power Station
Japan's first large-scale nuclear power plant

GCR(decommissioning)

Tokai Power Station
— Japan's first commercial nuclear power plant

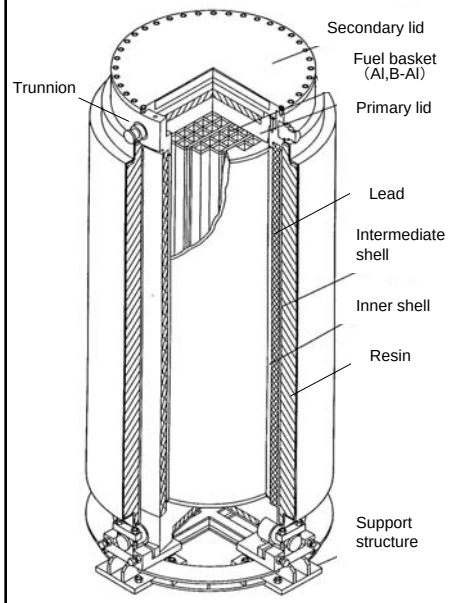
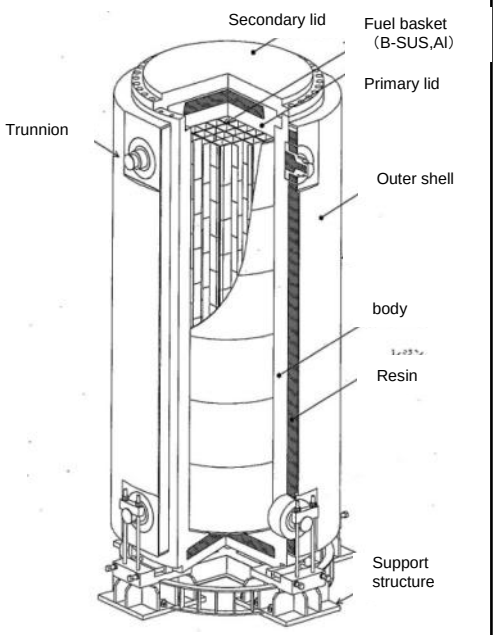
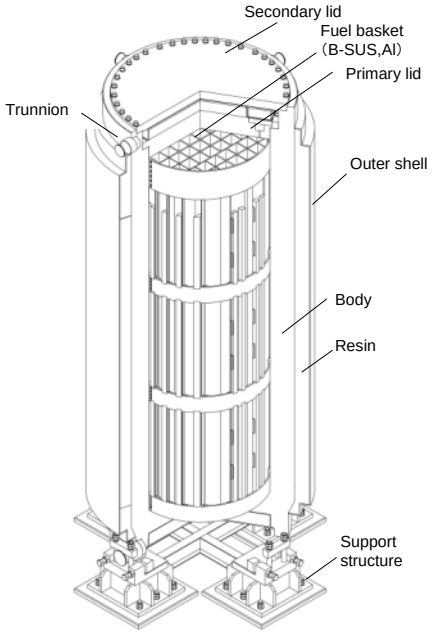
JAPC has four nuclear power plants.
TOKAI No.2 power station has the spent fuel dry cask storage facility.

# SPECIFICATIONS OF DRY CASK STORAGE FACILITY(1/2)




| | |
|---|---|
| Cask number | 24 casks can be stored.<br>（There are 17 casks now.） |
| Cooling method | Natural Circulation |
| Storage state | Vertically Standing |

# SPECIFICATIONS OF DRY CASK STORAGE FACILITY(2/2)

| Cask | No.1～15 | No.16～17 | No.18～21 |
|---|---|---|---|
| Cask type (Air view) |  |  |  |
| Manufacturer | Hitachi Zosen | Hitachi GE | Toshiba |
| Number of fuel | 61 | | |
| Storage fuel type | 8×8, new8×8, new8×8Zr liner, High burnup8×8 | | |
| Cooling time of fuel | 7-9 years | | |
| Status | Loaded | Empty and Reserve | Under manufacturing |

# *Background of this study*

- The metallic dry cask storage of spent fuel started in December 2001 at TOKAI No.2 power station.
- JAPC promised regulation authority to investigate the cask and fuel in the licensing process of metallic dry cask.
- Tokyo electric company and JAPC are planning intermediate fuel storage in a facility Away-From-Reactor.
- The Nuclear Safety Commission in Japan demanded that electric company should investigate the integrity of metallic dry cask storage in 2002.
- The investigation of metallic dry cask storage of spent fuel was done only in Idaho National Laboratory and FUKUSHIMA DAI-ICHI NPP of Tokyo electric company.
- In the investigation of FUKUSHIMA DAI-ICHI, White coloring was observed on the metallic gasket.

# *Objective*

The objective of inspection of metallic dry cask which had stored spent fuel for seven years, is to confirm follows.

(1) Aging performance of sealing

(2) Integrity of fuel cladding

# *The outline of inspection*

1. Time：January,2009

2. Place：The reactor building of TOKAI No.2 power station

3. Target cask：one of the first storage four casks

（storage time are seven years）

4.Item：

(1)Cover gas sampling（to detect Kr-85）

(2)Visual inspection of spent fuel（for two assemblies）

(3)Visual inspection of sealing surface on the primary lid

(4)Visual inspection of metallic gasket for the primary lid

(5)Sealing performance test of primary lid

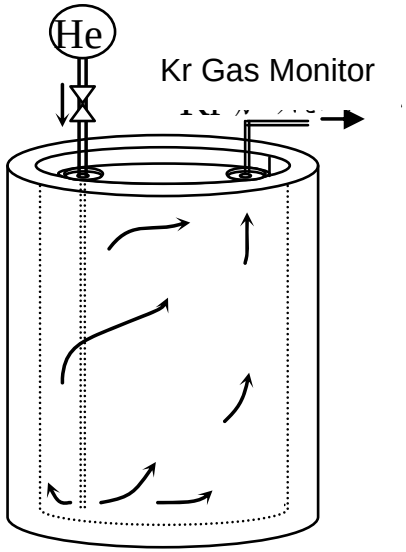
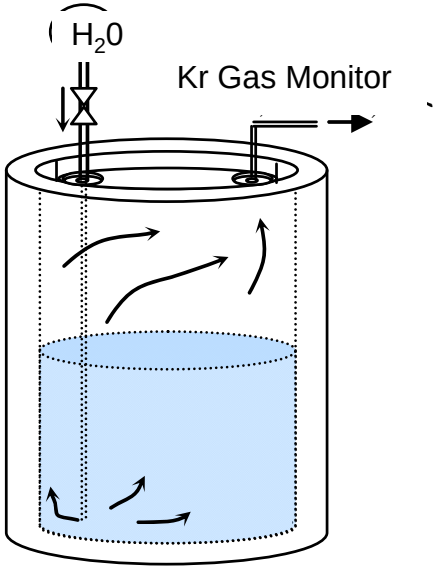
# *The profile of inspected cask and spent fuel*

| | | | | |
|---|---|---|---|---|
| Cask | Storage start | | January,2002 | |
| | Period of storage | | Approx. 7years | |
| | Heating value (calculated) | At the beginning of storage | Approx. 13ｋW | |
| | | At the inspection | Approx. 10ｋW | |
| | Burn up of spent fuel | | Approx. 31,800～ Approx. 33,500MWd/t | |
| | Type of loading spent fuel | | new8×8Zr liner | |
| Spent fuel | ID | | HTK016 | TLJ011 |
| | Type of spent fuel | | new8×8Zr liner | |
| | Burn up | | Approx. 33,500MWd/t | Approx. 33,500MWd/t |

※1 Two spent fuel assemblies were selected to see highest burn up in the cask.
※2 The limiting burn up of new8×8Zr liner is 40,000MWd/t.

# *The result of inspection*

## *-cover gas sampling（to detect Kr-85）-*

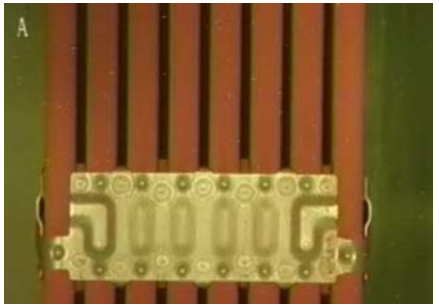
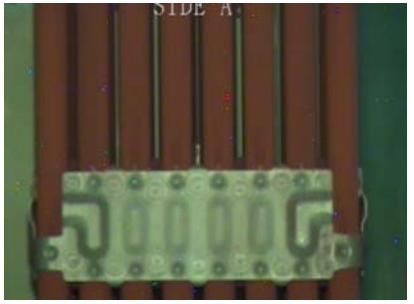
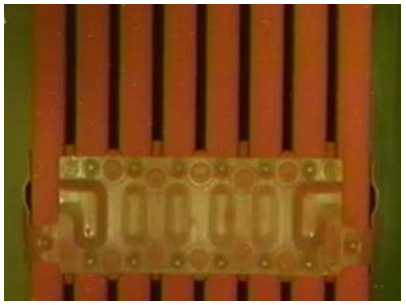
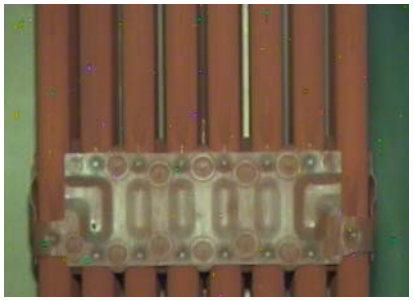
| Stage | Substitution of cover gas | Feeding of water |
|---|---|---|
| image |  |  |
| Kr-85 | Not detected | Not detected |

Result and Evaluation

The integrity of spent fuel cladding during the storage and while feeding water was confirmed.

# *The result of inspection*

## *-visual inspection of spent fuel -*

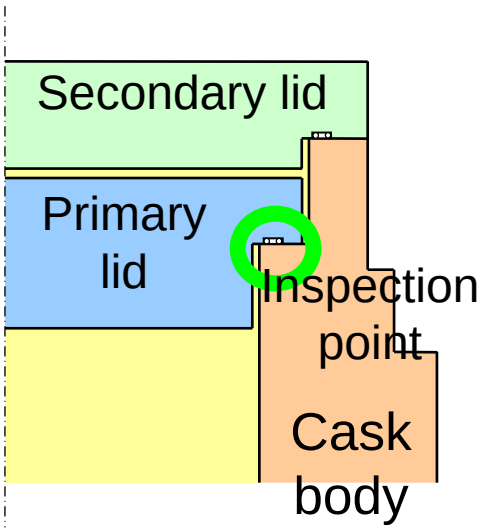
| HTK016 | |
|---|---|
| Before loading（October,2001） | At the inspection（January,2009） |
|  |  |
| **TLJ011** | |
| Before loading （October,2001） | At the inspection （January,2009） |
|  |  |

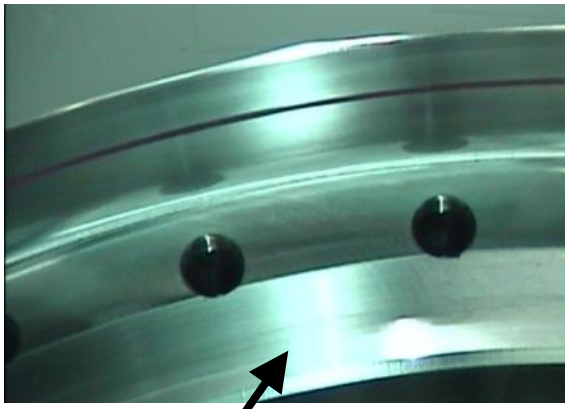
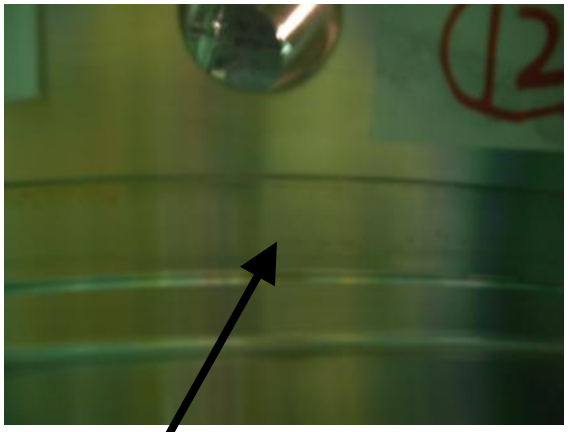
## Result and Evaluation

- The appearance of spent fuel remains the same as observed at the storage started.
- The integrity of spent fuel appearance was confirmed.

# *The result of inspection*

## *-visual inspection of sealing surface on the primary lid-*




| Sealing surface of cask body | Sealing surface of primary lid |
|---|---|
|  Sealing surface |  Sealing surface |

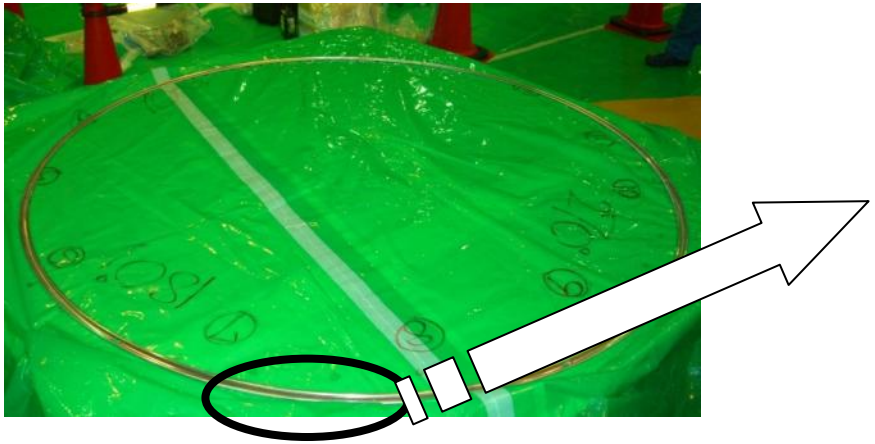
### Result and Evaluation

- No scratch, crack or oxidation was observed.
- The integrity of sealing surface was confirmed.

# *The result of inspection*

## *-visual inspection of metallic gasket for the primary lid-*

Appearance of metallic gasket for the primary lid




※The reason of partially looking red is reflection of lighting

## Result and Evaluation

- No scratch, crack or oxidation was observed.
- The integrity of metallic gasket was confirmed

# *The result of inspection*

## *-sealing performance test of primary lid -*

| | Leak rate | |
|---|---|---|
| | Primary lid | Secondary lid |
| Right after loading （January 2002） | $1.6 \times 10^{-10}$Pa・m$^3$/s | $1.1 \times 10^{-6}$Pa・m$^3$/s |
| At the inspection （January 2009） | $9.0 \times 10^{-11}$Pa・m$^3$/s | $1.9 \times 10^{-7}$Pa・m$^3$/s |
| The criterion of inspection before use | $1.6 \times 10^{-7}$Pa・m$^3$/s | $6.0 \times 10^{-6}$Pa・m$^3$/s |

### Result and Evaluation

- The sealing performance was nearly the same as obtained at the storage starting.
- The leaktightness of sealing was confirmed.

# *Concluding Remarks*

The inspection of metallic dry cask which had served for 7 years indicates following items.

(1) The integrity of spent fuel cladding in the cask was confirmed. No change in appearance of spent fuel was observed.

(2) The integrity of primary sealing surface and metallic gasket was confirmed. The sealing performance was confirmed.

(3) Since no oxidation, or no sealing degradation was observed, the fuel loading procedure considering the desiccation was validated.