# Tungsten balls charge method radiation shield system

Mitsubishi Heavy Industries, LTD. : Takeshi Ueda Kazushige Hayashi
Nuclear Plant Service Engineering Co., Ltd. : Yukihide Shimazu

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MHI, Kobe Shipyard & Machinery Works

# Tungsten balls charge method radiation shield system (1/13)

## 1. Introduction

Tungsten balls charge method radiation shield system has been developed for the purpose of reducing the installation workload, the radiation exposure and the harmful waste materials in the maintenance of systems at nuclear power plants.

## 2. Characteristics

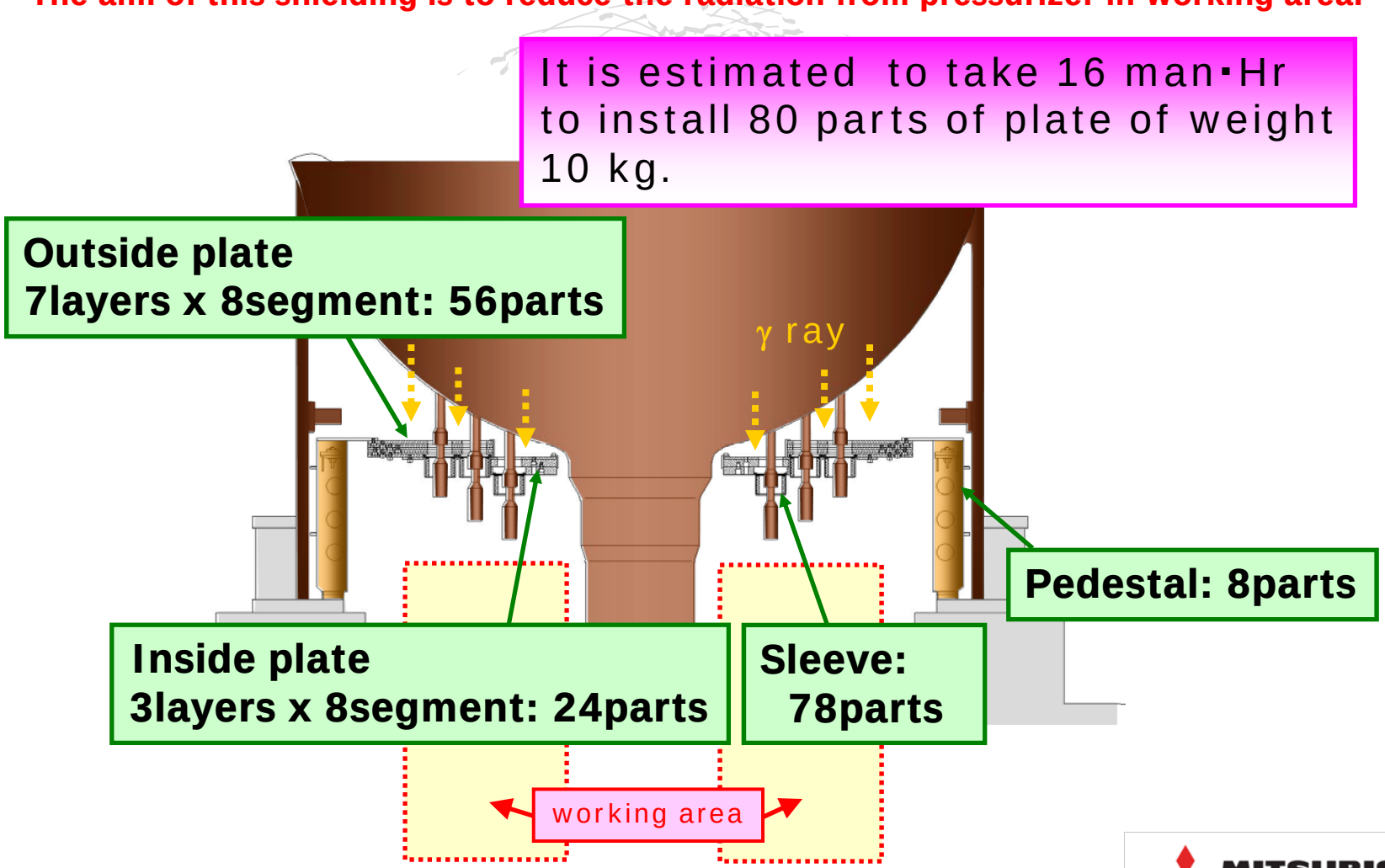
- Far reduction of radiation exposure in the installation/ removal of shields
  (Far reduction of work ... Approx 1/10 by lead plate of 3 cm or equivalent)
- Pb-free ... Using tungsten balls
- Can be applied in wider scope by changing the structure of jacket.

# Tungsten balls charge method radiation shield system (2/13)

## 3. Initial plan; Metal plate shielding for pressurizer

**The aim of this shielding is to reduce the radiation from pressurizer in working area.**

It is estimated to take 16 man･Hr to install 80 parts of plate of weight 10 kg.



# Tungsten balls charge method radiation shield system (3/13)

## 4. Issue of metal plate shielding

**(1) 80 sheets of plate of weight 10 kg are installed.**

- Man-hour : **Large**
- Safety risk : **Large**
- Component damage risk : **Large**

**(2) 16 hours to install/remove (by two workers)**

(Amount of radiation exposure: **Large**)

**It is necessary to make shield container light-weight and reduce man-hours.**

# Tungsten balls charge method radiation shield system (4/13)

## 5. Concept of new shielding

**(1) Jacket type**

- Light-weight and can be installed and removed to target easily.
- Reduced number of parts

**(2) Charging tungsten balls to jacket by pump remotely**

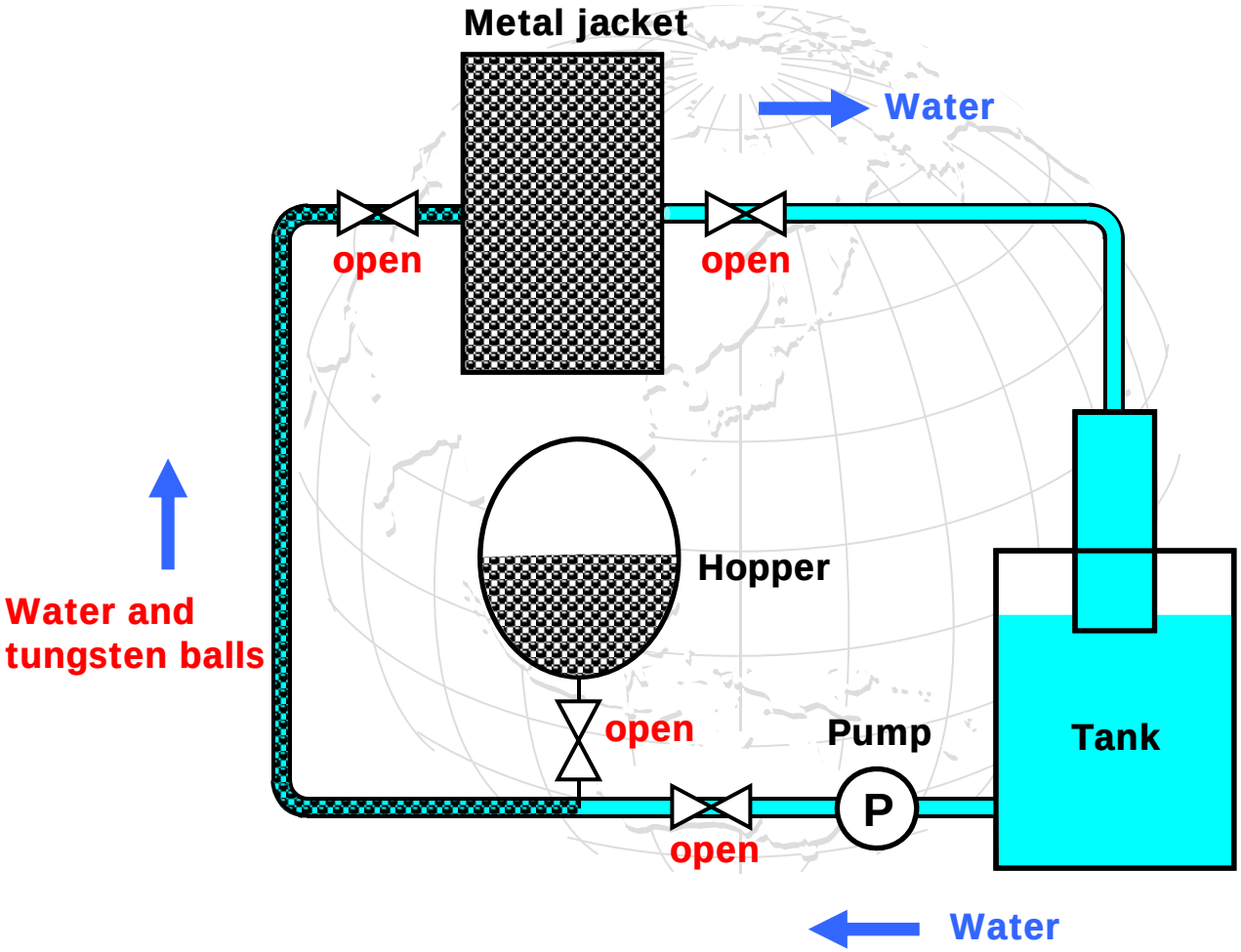
- Far reduced handling of heavy loads
- From a place approx 20 m away, including the high/low difference

**(3) Pb free**

- No harmful waste materials are used.

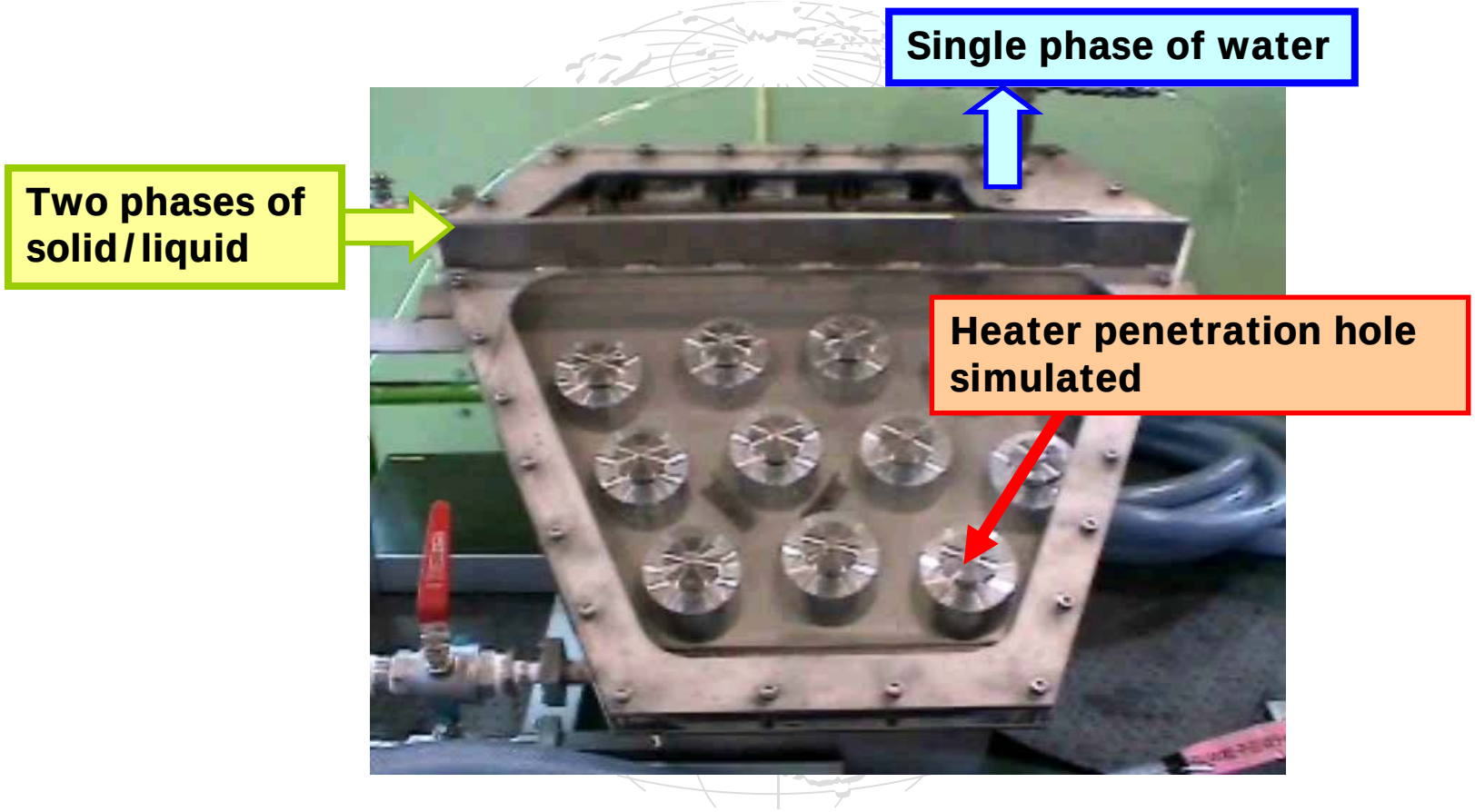
# Tungsten balls charge method radiation shield system (5/13)

## 6. System for element test



# Tungsten balls charge method radiation shield system (6/13)

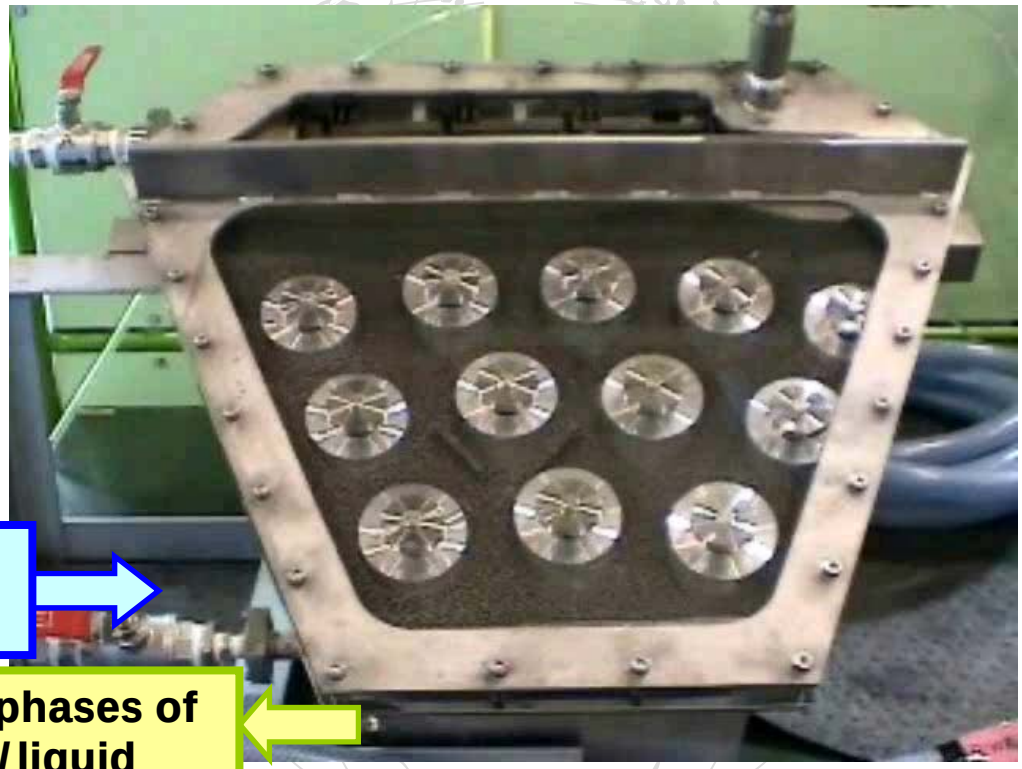
## 7. Visualization test (tungsten balls charged)




Charging test

# Tungsten balls charge method radiation shield system (7/13)

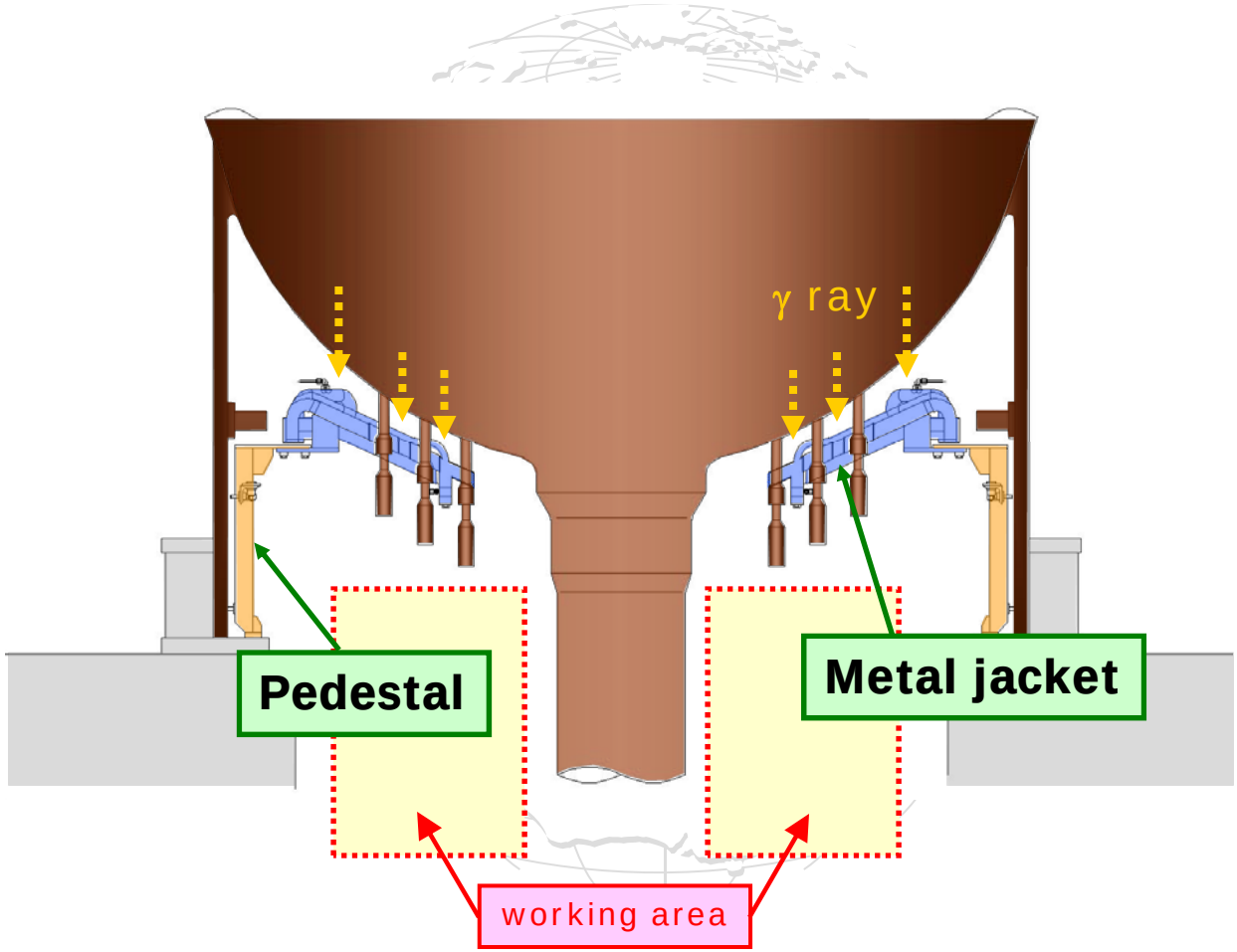
## 7. Visualization test (tungsten balls recovered)




Recovering test

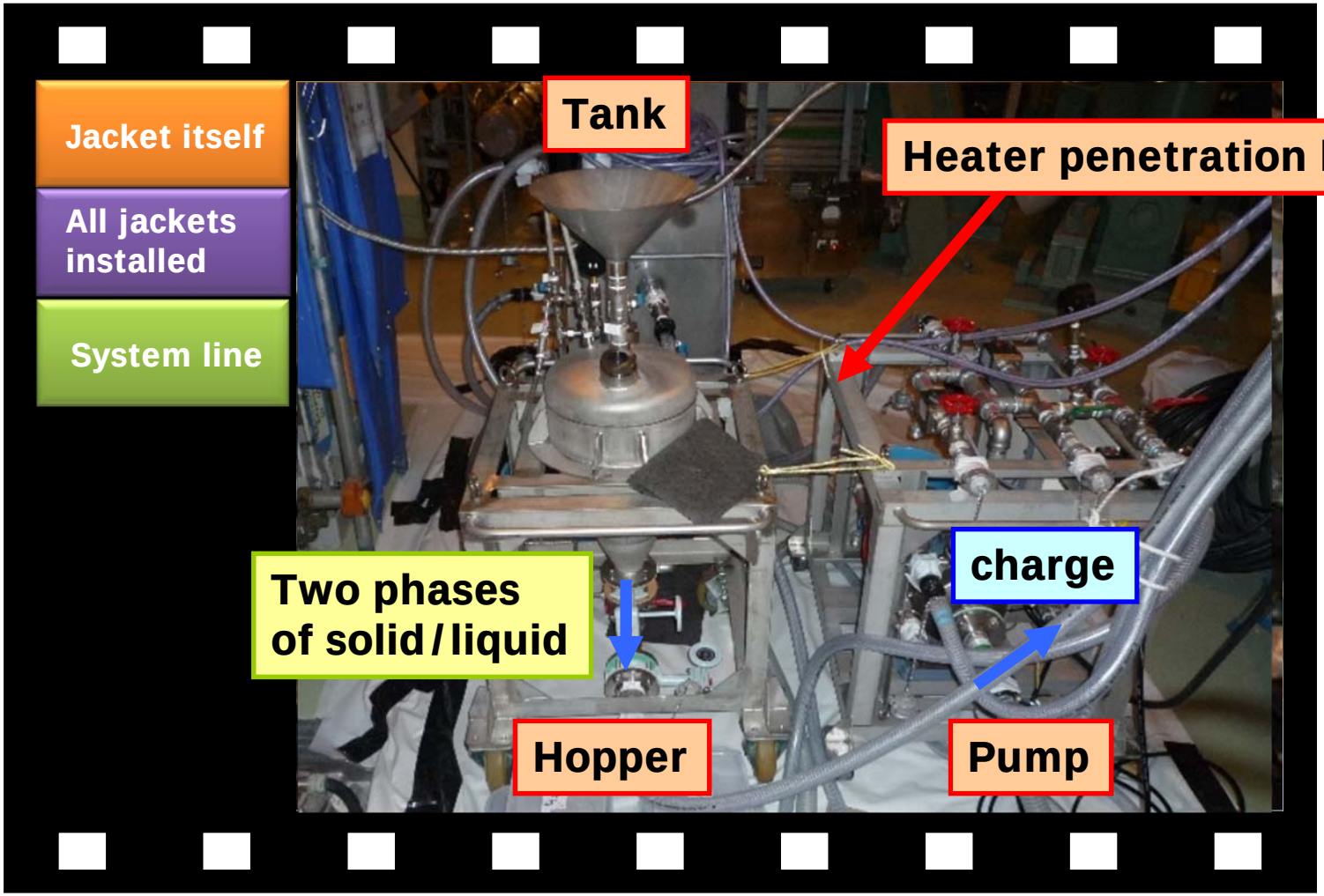
# Tungsten balls charge method radiation shield system (8/13)

## 8. Application to pressurizer



# Tungsten balls charge method radiation shield system (9/13)

## 8. Application to pressurizer



# Tungsten balls charge method radiation shield system (10/13)

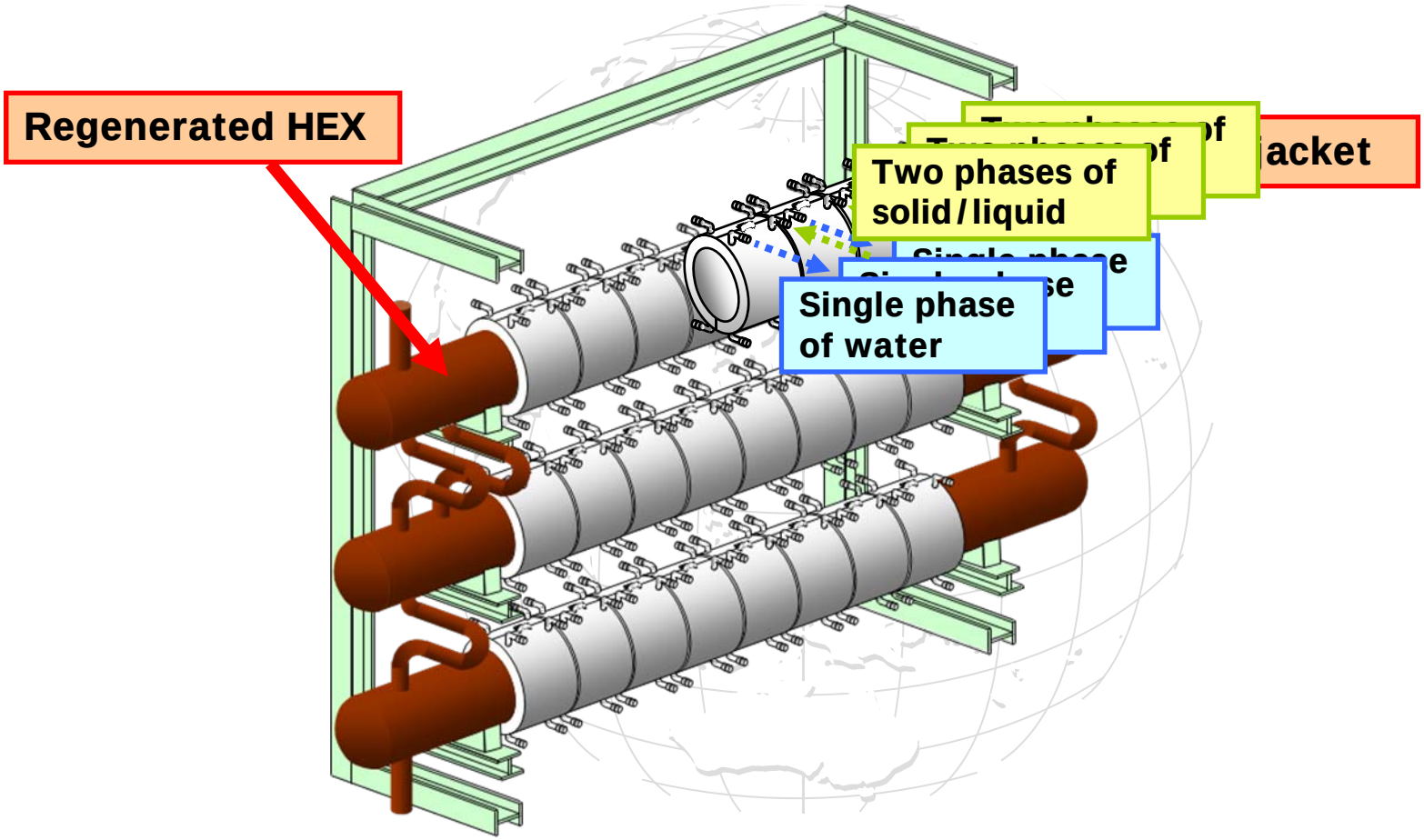
## 9. Comparison of shielding type

| | | Installation | Charge | Recover | Removal | Total | Reduction effect |
|---|---|---|---|---|---|---|---|
| Time | Plate | 8 hours x 2 workers | - | - | 8 hours x 2 workers | 16 hours x 2 workers | Approx 1/2 |
| | New | 1 hour x 2 workers | 2 hours x 3 workers | 2 hours x 3 workers | 1 hour x 2 workers | 8 hours x 2 workers | |
| Exposure | Plate | 28 man · mSv | - | - | 28 man · mSv | 56 man · mSv | Approx 1/7 |
| | New | 3 man · mSv | 1 man · mSv | 1 man · mSv | 3 man · mSv | 8 man · mSv | |

**Succeeds in making light-weight shield container, and reducing man-hours, amount of radiation exposure!**

# Tungsten balls charge method radiation shield system (11/13)

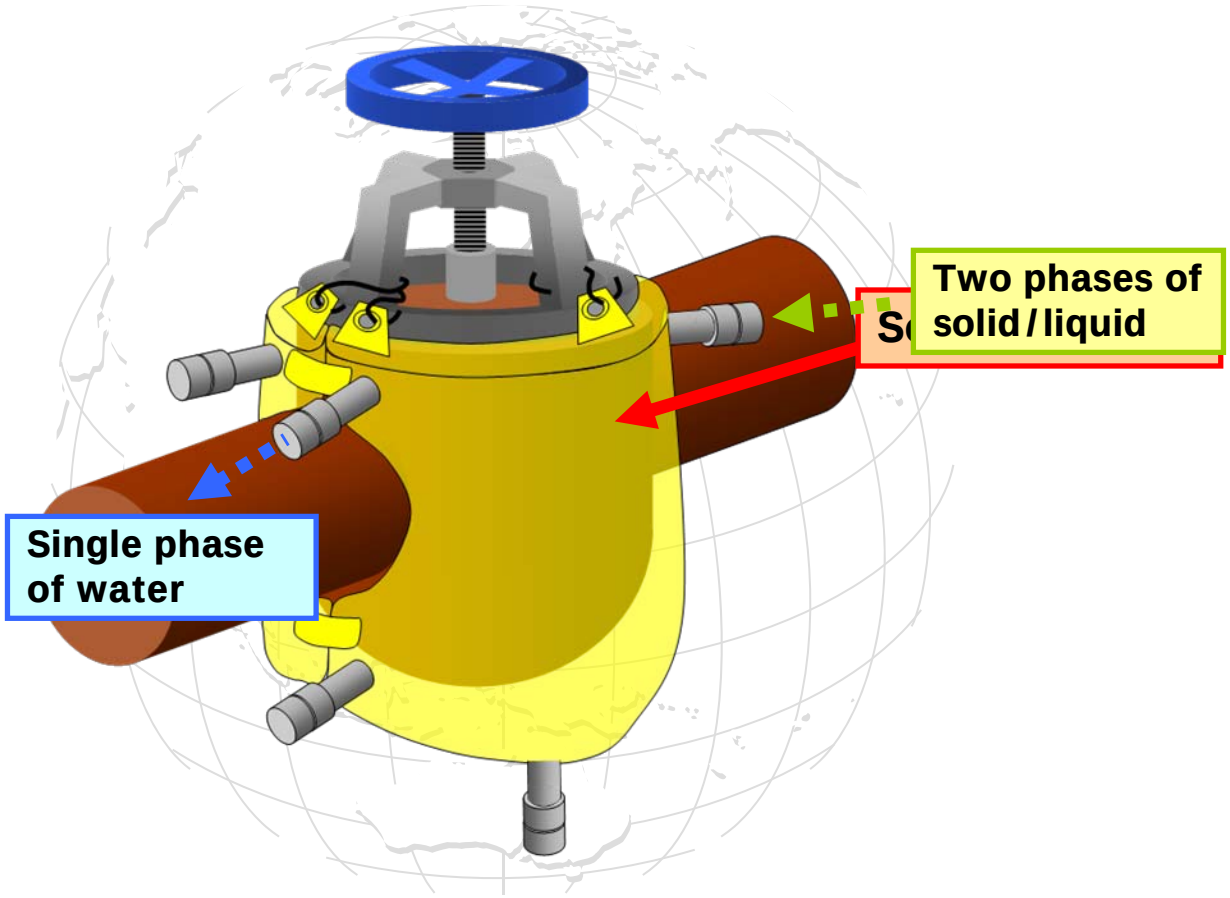
## 10. Other application image




**Hard jacket (regenerative heat exchanger)**

# Tungsten balls charge method radiation shield system (12/13)

## 10. Other application image




**Soft jacket**

# Tungsten balls charge method radiation shield system (13/13)

## 11. Conclusions

- Tungsten balls charge method radiation shield system can reduce the exposure and workload of its installation/removal.
- We MHI will further promote various advanced techniques including Tungsten balls shielding technique to flexibly meet needs of operating plants based on the principle of ALARA.