S-P3-2

Study on Maintenance, Recycle, and Radioactive Waste Management of Fusion Reactor
Part II: Whole image of radioactive maintenance target
核融合炉の保守・リサイクル・バックエンド対策に関する検討
２．保守対象（放射化物）の全体像

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DT fusion neutron will activate structural materials surrounding the plasma, and tritium fuel will contaminate a lot of equipment and will spread widely in the site. The most important safety issue is how to confine these radioactive materials. Whole image of radioactive material distribution is summarized in the fusion DEMO reactor site.

1. Background

As introduced in Part I, DT fusion neutrons with 14MeV will activate structural materials surrounding the plasma. Because a few kg level of tritium will be handled in the DT fusion reactor as a fuel, some level of tritium contamination of various equipments will be considered. From the safety point of view, to control/confine the above radioactive materials is the most important key issue in the fusion reactor. This part, summarizes a whole image of radioactive materials, regarding the maintenance and waste management.

2. Image of radioactive materials distribution

Figure 1 shows typical DEMO plant image and distribution of radioactive isotopes (RI) materials, such as tritium and neutron-induced one.

Activated materials by neutron mainly exist around vacuum vessel, hot cell, and waste storage area. Some of them become to radioactive solid waste finally. In general, mobile activated RIs, such as dust and corrosion products, should be handled more carefully, however, activated equipment itself should be cared also depending on the maintenance concept. The equipment, which requires periodical nuclear maintenance, will be blanket, diverter, diagnostics, tritium plants, hot cell, plasma heating, water-cooling, and air-conditioning (HVAC) systems. When the decommissioning will be carried out, the activated materials must be treated with a special attitude.

Potentially tritium contamination area will be widely distributed in the reactor site, though tritium will be handled safely using multiple confinement concept. Ventilated atmosphere in the above all area should be cared continuously by nuclear air conditioning systems with various detritiation systems. Even in ITER, total area of potentially tritium contamination is around 250,000 m^3 and the biggest one is a gallery of > 70,000 m^3. The tritium is removed by catalytic oxidation with dryer or wet scrubber, as tritiated water. In DEMO rector with water-cooling blanket, tritiated cooling-water should be processed to maintain an acceptable concentration of tritum with the above by water detritiation system using the improved CECE (Combined Electrolysis and Catalytic Exchange).

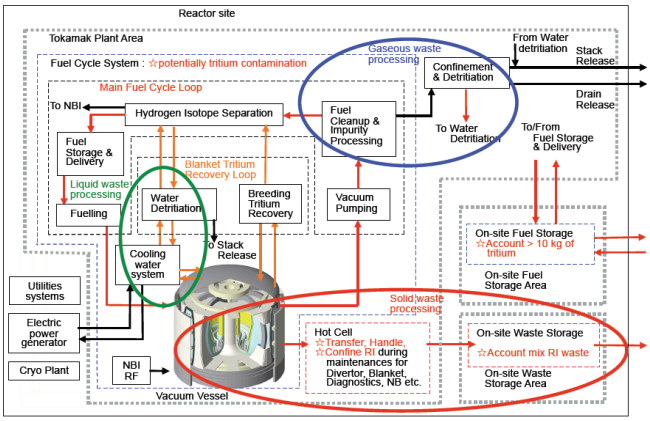

Fig. 1 Typical DEMO plant image and distribution of RI (tritium & activated materials) in the site

3. Accountancy of radioactive materials

In order to establish stable fusion power generation, one of key issues is how to manage the balance of tritium production and consumption. Accountancy of the fuel and management its uncertainty should be considered including those for the various mixed wastes.