Design of the PRIDE Facility

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1. Introduction

From 2007, KAERI is developing a **PyR**oprocess **I**ntegrated inactive **DE**monstration facility (the **PRIDE** facility). In this facility a full pyroprocess flow described in the figure 1 can be tested and its integrated performance will be verified. The maximum annual treatment capacity of this facility will be a 10 ton-HM. The process will use a natural uranium feed material or a natural uranium mixed with some surrogate material for a simulation of a spent fuel. KAERI has also another plan to construct a demonstration facility which can treat a real spent fuel by pyroprocessing. This facility is called by ESPF, Engineering Scale Pyroprocess Facility. The ESPF will have the same treatment capability of spent fuel with the PRIDE facility. The only difference between the PRIDE and the ESPF is a radiation shielding capability. From the PRIDE facility designing works and demonstration with a simulated spent fuel after construction, it will be able to obtain the basic facility requirements, remote operability, interrelation properties between process equipments for designing of the ESPF. As shown in the figure 1, the flow sheet of the PRIDE processes is composed of five main processes, such as a decladding & voloxidation, an electro-reduction, an electro-refining, an electro-winning, and a salt waste treatment. The final products from the PRIDE facility are a simulated TRU metal and U metal ingot.

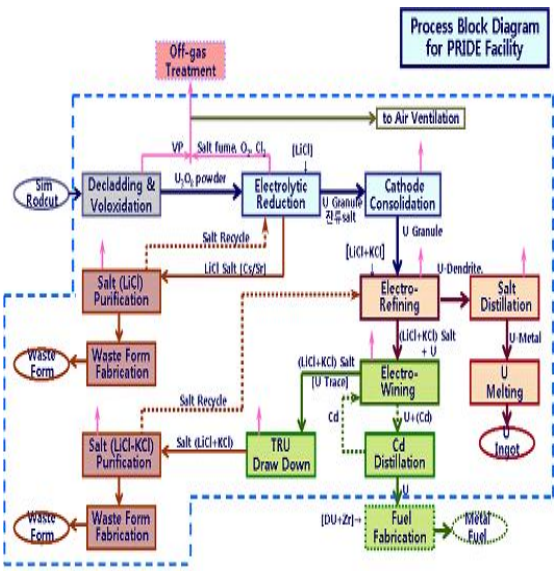

Fig. 1. Flow Sheet of the PRIDE Facility.

2. Design of the PRIDE Facility

For demonstration of an integrated inactive pyroprocess technology, two mock-up cells in which a simulated spent fuel can be treated safely under a high temperature salt medium are needed. For installation of the PRIDE cells a uranium conversion facility at KAERI site was chosen for an external building. This facility was built in the early 1980 and now is under decontamination step. Figure 2 shows the uranium conversion facility located at the KAERI site.

Fig. 2. Uranium Conversion Facility at KAERI.

The uranium conversion facility is a three story building and its external dimension is 43.2 x 20 x 12 m.

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3. The PRIDE Facility Layouts

The uranium conversion facility in which the PRIDE cell structures will be installed is a three story building. The layouts for each story are shown in the figure 3, 4 and 5. These layouts also show the installation schemes of the PRIDE cells and auxiliary facilities. In the 1st floor, Ar supply, purification and exhaust systems and a Large Transfer Lock System will be installed. The main cells, such as Air Cell and Ar Cell, will be installed in the 2nd floor and the Air ventilation and stack systems in the 3rd floor. The yellow color zones in the figures indicate a radiation surveillance area for radiation safety control. Figure 6 shows the PRIDE system layout. In the Air Cell, a decladding & voloxidation and a powder mixing equipments will be installed. In the Ar Cell, an electro-reductioner, an electro-refinner, an electro-winner, a waste salt treatment, and some auxiliary equipments will be

installed. The cell internal dimension is 40 mL x 4.75 mW x 6.3 mH.

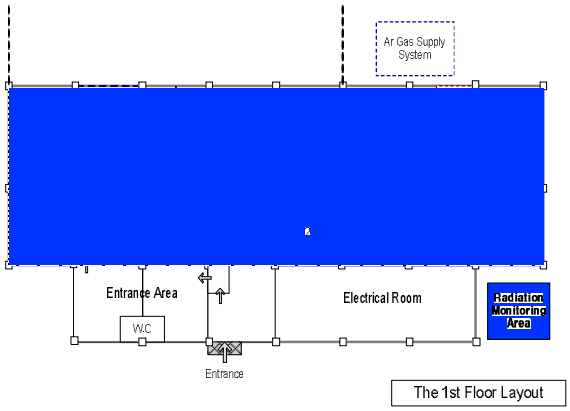

Fig. 3. The 1st Floor Layout.

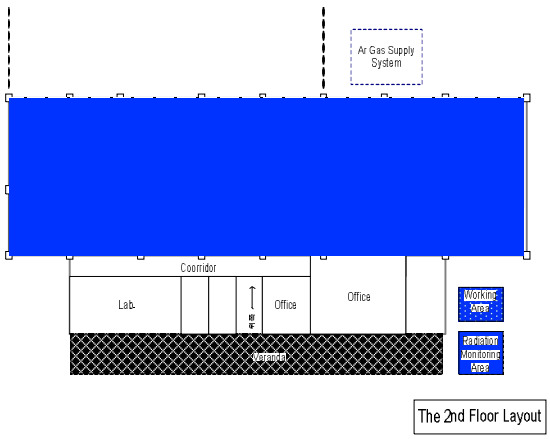

Fig. 4. The 2nd Floor Layout.

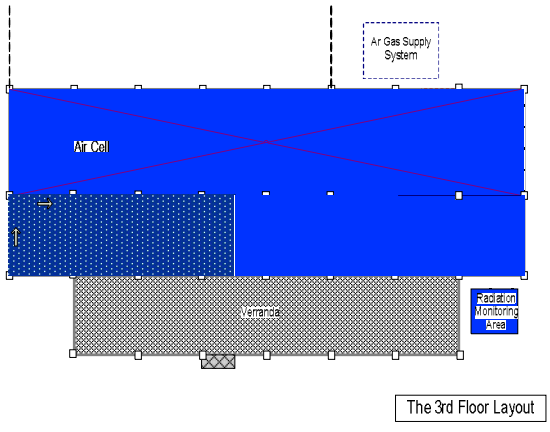

Fig. 5. The 3rd Floor Layout.

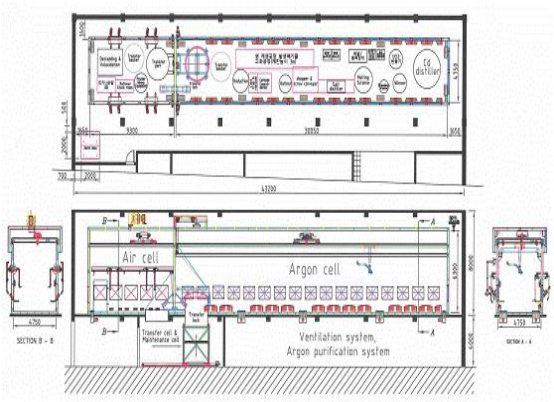

Fig. 6. System Layout of the PRIDE Facility.