# Deduction of the Optimal Operation Mode of Purifier System

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## 1. Introduction

Korea Atomic Energy Research Institute(KAERI) has a Pyro-processing Integrated Inactive Demonstration facility(PRIDE) for the development of pyro-technology. In essence, the PRIDE enable integrated pyro-systems testing at engineering scales using depleted uranium or surrogates for depleted nuclear fuels.

The PRIDE must maintain an inactive (argon) atmosphere due to the characteristics of processes that take place in it, such as electrochemical reduction, electrochemical refining, and electrochemical smelting. In concentrating impurities at the facility, oxygen and moisture must be lower than 100 ppm. This paper describes the optimal operation mode using the purifier system among the methods for managing the atmosphere of argon cell of the PRIDE facilities

## 2. Main

*2.1 Consist of Ar cell*

The PRIDE of the Korea Atomic Energy Research Institute maintains the atmosphere of the Ar cell with the largest scale (L40*W4.8*H6.4) in Korea at below 100 ppm. The argon cell of PRIDE consist of a argon cell, a purifier system, a circulation and discharged system as shown in Figure 1 below.

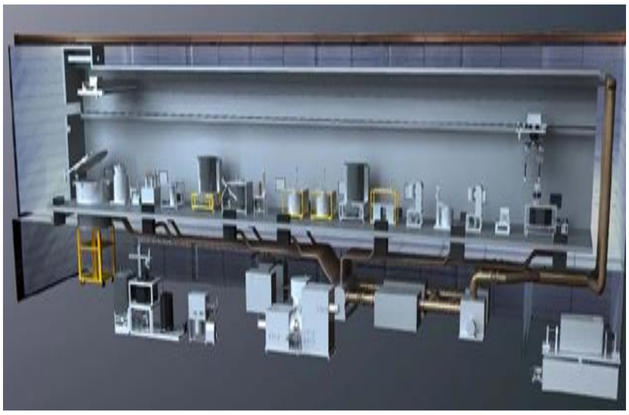

Fig. 3. Schematic of Ar cell.

*2.2 Optimal operation mode of the purifier system*

**2.2.1** The air intake rate of the argon cell shall not be less than 0.02%/day of the argon cell.

**2.2.2** The design basis concentration of the argon cell's oxygen and moisture is 50 ppm and kept lower than 100 ppm

**2.2.3** If the concentration of moisture and oxygen is more than 1000 ppm, reduce the concentration of the contamination to 200 ppm or less by purging through argon gas for the efficiency of the purifier, and then operate and manage it below 100 ppm

**2.2.4** If the argon cell is contaminated by more than 1000 ppm, it will take approximately two to three days to reduce the flow rate of 200CMH to less than 200 ppm. (24hours purging can shorten time)

**2.2.5** The argon compressor discharge pressure value is 5 to 6 kg/cm2 when two purifiers are operated simultaneously and 3 to 3.5 kg/cm2 when one purifier is operated.

## 3. Conclusion

*3.1 Design criteria for Argon cells.*

0.02V%/day = 0.02×0.01×1200 $m^3$= 0.24 $m^3$/day

*3.2 Argon cell leakage rate*

Using the leak Volume equation, calculate the argon cell leakage rate.

$$C_1 = 200{,}000ppm \quad , C_2 = 12ppm$$
$$V_1 = leakage\ volume,\ V_2 = Ar\ Cell\ Volume(1200m^3)$$

$$200{,}000ppm \times V_1 = 12ppm \times 1200m^3$$
$$V_1 = 0.072m^3/day$$

Argon cell leakage rate running 24 hours the moisture analyzer is satisfied, and oxygen, argon manages less than 100 ppm a cell's pollution.

*3.3 conclusion*

The secretive performance of Argon cells currently operated by the Korea Atomic Energy Research Institute is 30 percent higher than the design basis, and the standard procedure for managing the contamination of argon cells by obtaining the optimal operation mode of argon cell.

## REFERENCES


[1] ANL-7959 Hot Fuel Examination Facility/North Facility Safety Report, February 1975, Argonne National Laboratory pp.42-53.

[2] The EBR-II Fuel Cycle Story, Charles E. Stevenson, American Nuclear Society pp.16-25.