INTRODUCTION

Concept of Zero Release at KAERI

- No discharge of radioactive liquid waste from KAERI to environment
- Natural Evaporation Facility
  - Pure water component (RWTF) Natural Evaporation Facility
  - Radioactivity component / Concentrate

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DIMENSION

24m(L), 12m(W), 15m(H)

Area of facility: 1,148 m²

Maximum evaporation capacity: 1.0 m³/hr

LIQUID EVAPORATION

Descriptive Facility

- System principle: Evaporation process by solar energy and air stream
- Facility structure: Concrete building - four floors and one underground
- Area of facility: 1,148 m²
- Maximum evaporation capacity: 1.0 m³/hr
- Considered facility
  - Evaporation equipment
  - Storage unit
  - Transfer unit
  - Ventilation unit
  - Radiation monitoring system

Evaporation Theory

\[ \frac{dE}{dt} = K \times (P_s - P_w) / H \]

- \( E \): Amount of evaporation (unit time, unit area)
- \( P_s \): Saturation vapor pressure of air
- \( P_w \): Vapor pressure of air
- \( K \): Constant (Air factor)
- \( H \): Atmosphere pressure

Effect of Humidity on Evaporation Rate

Relative Humidity: 40% - 80%
Liquid Waste Flux: 3.4 l/hr m² - 4.6 l/hr m²
Air Temperature: over 10°C
Air Velocity: 0.6 - 1.47 m/sec

Effect of Air Velocity on Evaporation Rate

Evaporation Process

- Consist of Process: Evaporator / Storage tank / Transfer unit / Cooling unit
  - Ventilation unit / Radiation monitoring system
- Equipment type: Semi-batch forced circulation
- Evaporation capacity: 1.0 m³/hr
- Decontamination factor: 100,000
- Heat source: Steam (105°C)

Consist of Equipment

- Evaporation Module: 1,302 EA, 1M * 5.4M
- Evaporation Material: Cloth Sheet
  - Synthetic Textile: cotton (35%), polyester (65%)
- Exhaust Fan: Axial Type, 1,600 m³/min, 10 ea
- Cartridge Water Filter: 50 micro, 50 ea
- Storage Tank: 860 m³ (23m * 3.7m * 3.4m * 3 ea)
- Radioactivity Measurement System

Experiment Result

Transition of Evaporation Rate for 24 Hours Operation results of the NEF for 10 years

Conclusions

- Evaporation Factor
  - Relative humidity
  - Air temperature, Air flow rate
  - Liquid temperature, Liquid flow rate
  - Possible Operation: May - October
- Relative Humidity: 40% - 80%
- Liquid Waste Flux: 3.4 l/hr m² - 4.6 l/hr m²
- Air Temperature: over 10°C
- Air Velocity: 0.6 - 1.47 m/sec
- Evaporation Rate: 0.4 - 1.0 m³/hr

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