

# Comparative Study on Electrothermal Radioactive Waste Dryer & Non-Electronic Power Source Radioactive Waste Dryer Utilizing Air Circulation of Ventilation / Exhaust System in NPP

Kwang-sik Seo, Hyo-cheol Kim, Dong-hyun Park, Sang-tae Lee, Soon-hwan Yang, and Sang-uk Lim  
Hana Nuclear Power Engineering Co., Ltd, 84, Hanam-daero, Hanam-si, Gyeonggi-do, Republic of Korea  
shmhg@hanarad.com

## 1. Introduction

Most of dry radioactive waste created in the radiation management areas of domestic NUCLEAR POWER PLANT contain moisture. The waste containing moisture uses a radioactive waste dryer equipped with a suction fan in the heating device for drum disposal (free water content in drum : high integrity container less than 1%, other containers less than 0.5%). This dryer has low efficiency of use due to the fact that it is not only vulnerable to fire hazards, but also has lots of limitations of use. Therefore, it was necessary to develop a NEPS (Non-Electric Power Source) and an air-circulating dryer without fire hazard and electricity. This study compare the fire hazards and continuous operating conditions with the previous electrothermal waste dryer. Therefore, we have been studied to optimize drying efficiency and manpower utilization to draw a optimal operating technic of high quality drumming work.

## 2. Body

### 2.1 A comparison of the operating characteristics in electrothermal dryer and NEPS dryers

#### 2.1.1 Operating characteristics of Electrothermal dryer.

The electrothermal dryer which is operated by electricity has a high possibility of fire hazard due to malfunction of the temperature sensor and safety device, dust deposited on the coil of the heater, and overheating during operation due to the flammable materials. so, the electrothermal dryer needs to be approved by the MCR (Main Control Room) and the HP (Health Physics) Room before and after operation. In addition, the drying operation time is limited to 6 hours per day, and also it is necessary to observe 1 hour preheating before the use and 1 hour cooling after the use. Also, it cause

increase of personal exposure dose because operator has to be located at drying facility during the operation.

2.1.2 *Operation characteristics of NEPS dryer.* The purpose of NEPS dryer which is developed by characteristics of Nuclear power plant's operation is to reduce an unnecessary radiation exposure and to prevent fire. The NEPS dryer utilize the ventilation/exhaust suction system, and it is different from the electrothermal dryer that obtains dry heat source from a source of electric power. The NEPS dryer utilize a suction system (1,200CFM) which induced air flow from the lower part to the upper part. And it can be operated without any limitation. These characteristics make it possible to use the dryer continuously for 24 hours regardless of the residence of the operator. Therefore this structure improve the dry ability of any solid waste and reduce possibility of unnecessary radiation exposure.

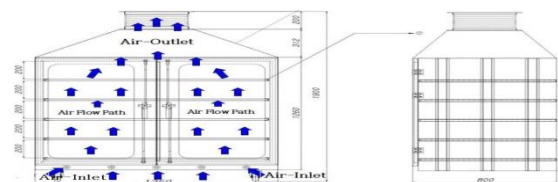


Fig. 1. NEPS dryer structure drawing.

### 2.2 A comparison of the with performance test in electrothermal dryer and NEPS dryers

2.2.1 *Testing method.* Step1: Measure the weight of dried papers (4 kg) and cottons (8 kg). Step2: Make two samples of each kind of papers (11 kg) and cottons (13 kg) dehydrated by adding enough moisture. Step3: Add one sample of each kind of papers and cottons which the moisture is sufficiently added to the electrothermal dryer and the NEPS dryer, and dry them. Step4: The drying time is measured by separating by natural drying, electrothermal dryer drying, and NEPS dryer drying until the weight is the same as measured at the initial drying state. Step5: The experimental results

are derived by comparing the drying time of each dryer based on the weight of the sample before drying (step 1) and the weight of the sample after drying.

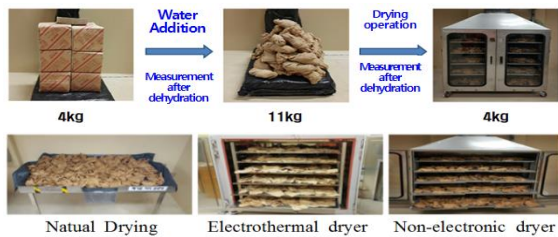


Fig. 2. Paper's sampling and measuring weight for each step.

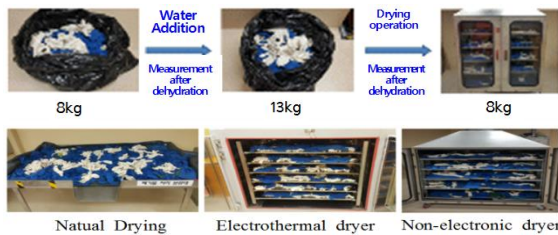


Fig. 3. Cotton's sampling and measuring weight for each step.

**2.2.2 Operation restriction requirement.** Limit the operating time (8 hours / day) due to the fire hazard of the electrothermal dryer and make sure that the operator is operated with the resident. The operation is 1 hour of preheating, 6 hours of drying, 1 hour of cooling, and the actual drying operation is 6 hours. Operators may contact the MCR before operation and obtain approval for operation. However, since the NEPS dryer does not have a fire hazard, it is possible to operate for 24 consecutive hours without the need of a operator. As a result, it was possible to improve drying ability and reduce manpower.

### 2.2.3 Test Result

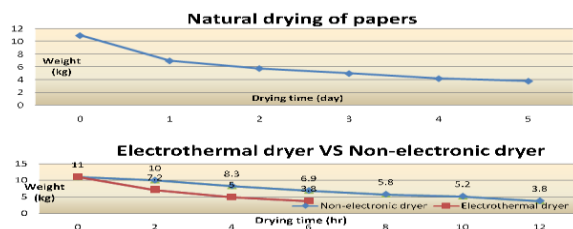


Fig. 4. Comparison graph of paper's drying time.

Table 1. Test result of papers

Division	Drying possible time/day	Ref1) Drying finished time	Drying finished days
Papers	Electrothermal dryer	Ref2) 6 hour/day	1.0 day
	Non-electric dryer	24 hour/day	0.5 day

Ref1) This is drying completed time about 11kg of moisture-containing papers regard to operating restriction requirement  
Ref2) Consider the preheating 1 hour before the operation and cooling 1 hour after the shutdown for 8 hours (working time)

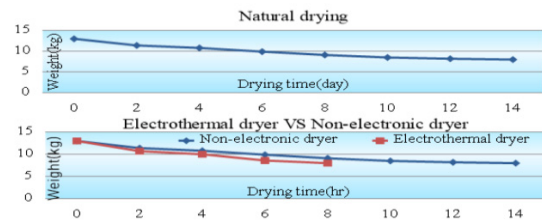


Fig. 5. Comparison graph of cotton's drying time.

Table 2. Test result of cottons

Division	Drying possible time/day	Ref1) Drying finished time	Drying finished days
Cottons	Electrothermal dryer	Ref2) 6 hour/day	1.3 day
	Non-electric dryer	24 hour/day	0.6 day

Ref1) Drying amount per 13kg of moisture-containing cottons taking into account the restricted driving condition.  
Ref2) The operator considers the preheat time and the cooling time after shutdown of the dryer for 8 hours.

**2.2.4 A comparison of the operation efficiency in electrothermal dryer and NEPS dryers.** Although the electrothermal dryer dried the moisture-containing waste about 2 times faster than the NEPS dryer, the drying time was limited to 6 hours during 8 hours/day. Unlike the electrothermal dryer, the NEPS dryer was able to operate without fire hazard for 24 hours continuously. Calculating the number of drying completed dates, It was confirmed that which was dried by NEPS dryer had a 2 times higher efficiency of the paper type and a 2.2 times higher efficiency of the cotton type.

## 3. Conclusion

The NEPS dryer is facility not using the power supply and using the negative pressure of ventilation or exhaust system, there is no anxiety of overheating during the operation. There was no fire hazard unlike the electrothermal dryer, and continuous and safe operation was possible even the inflammables are mixed without the need for the operator resident. It reduced the unnecessary radiation exposure dose and maximized the utilization of the human resources by converting the previous operator to other tasks. So, the work quality was improved ultimately. This study figured out that the operation time (1day) of NEPS dryer increased 4 times more and drying ability improved 2 times more than electrothermal dryer.

## REFERENCES

- [1] Guideline for the delivery of low-level.
- [2] radioactive waste (2014-64).
- [3] Criteria for the acceptance of low-level radioactive waste (disposal facility safety analysis report).