Remote Monitoring System of HVAC in Post Irradiation Examination Facility

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1. Introduction

The post irradiated examination facility(PIEF) is the first hot cell facility in Korea completed at the end of 1985. It has been performing experiments on commercial spent nuclear fuel for about 40 years. Each room in the facility is classified into four zones according to radioactive materials and has been safely manages. In particular, the HVAC(Heating, Ventilating, and Air Conditioning, HVAC)system is designed to maintain negative pressure inside facility so that the air inside the facility does not leak to the outside and flows only from a zone with low pollution to a zone with high pollution. In this paper, we want to describe about installation of the wireless monitoring system for the effective maintenance of HVAC system.

2. Methods and Results

2.1 The Maintenance Method of HVAC System

The HVAC system is a device that maintains indoor air in a pleasant state through cooling, heating, filtering, etc. In particular, in facilities handling radioactive material, it is more important because it prevents the leakage of radioactive materials to the outside. In general, it is known that air conditioning system account for 50-65% of energy consumption and maintenance costs[1]. Therefore, cost and failure can be reduced through effective maintenance, and the life of the system equipment can be extended.

The traditional maintenance method is to inspect equipment and replace parts at regular intervals. There is a possibility that the replacement time may be delayed or accelerated because the actual state of the equipment is not considered. Recently, a PHM (Prognostics & Health Management) has been introduced to solve these problems[2]. If an abnormality occurs in the HVAC system, there may be a change in measured data such as vibration and temperature. Therefore, failure can be predicted from measured data in real-time or periodically. To this end, we want to predict failure by installing a wireless sensor to the HVAC system in PIEF.

2.2 The HVAC System in PIEF

Fig. 1 shows HAVC system in PIEF. When outside air enter the facility, fresh air is supplied to laboratories and offices by passing through a pre-filter and a medium filter. The used air pass through a HEPA filter to remove contaminants before being exhausted to the outside. In particular, ducts are separated for each zone, and the inside and outside air is strictly managed.
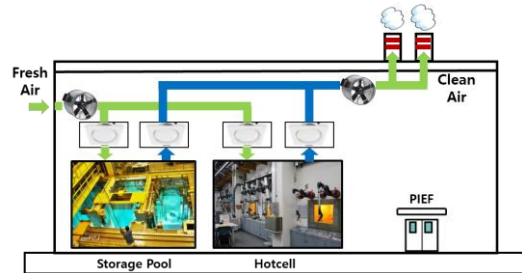

Fig. 1. HVAC system in PIEF.

2.3 The Installation of Wireless Sensor

To monitor the health of the exhaust fan, a sensor that can measure 3-axis acceleration and temperature is attached to the bearing housing as shown in Fig. 2. Using the measured data, especially acceleration, the health of the fan is going to be predicted by FFT analysis. The measured values could be saved on a smartphone or computer via bluetooth connection.
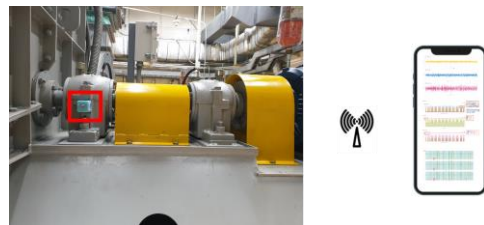

Fig. 2. Installed sensor and application.

3. Conclusions

In this paper, the construction of a wireless monitoring system for efficient maintenance of the HVAC system in PIEF is described. In the future, we will check the possibility of predicting the failure of the exhaust fan by analyzing the measured data.

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