Radioactive Radon Effect of Spent Fuel Storage Pool Kr-85 Monitor

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1. Introduction

In the Post Irradiation Examination Facility (PIEF) spent fuel storage pool site of KAERI, there are three Kr-85 monitors used to detect Kr-85 gas in real time. If a certain spent fuel is cut and floats above the pool surface when operating the facility, the Kr-85 monitors can detect a Kr-85 gas spurt from the damaged spent fuel. The detector of the Kr-85 monitor is a proportional counter tube in a sandwich geometry, and can detect radioactive noble gas. Noble gas flows into the input port not adsorbed into the pre-filter but counts in the count chamber. The measured values are calculated by applying the count efficiency of Kr-85. At the same time, Rn-222, which is also a noble gas count in the counter chamber as well, and the measured values can be shown.

Radioactive radon nuclides, which are always in the work field, can cause confusion regarding whether these values are caused by Kr-85 or Rn-222. As a result, the workers in that field cannot estimate whether the work field is in a safe condition or not. For this reason, it is essential to conduct a refinement and separation of the radioactive gases, such Rn-222.

This study was about whether the measured value from the spent fuel pool site of the PIEF, KAERI Kr-85 monitor is actually caused by Kr-85 or Rn-222. Furthermore, the behavior of radioactive radon nuclides has been monitored in the pool site. The observation was conducted by comparing the continuous radon monitor installed in the workplace near the pool side with a Kr-85 monitor that is continuously monitoring the pool surface.
allows measuring the radon concentration in the workplace.

2. Measurement

2.1 Measurement instruments

1) Kr-85 Monitor
(Model: FHT 57 E-S, Thermo, Germany)

- Proportional counter tube in a sandwich geometry
- Monitoring radioactive noble gases in air
- Noble gas flows into the input port,
  is not adsorbed in the pre-filter but counts in the count chamber.
- The measured values are calculated by applying
  a count efficiency of Kr-85.

[FHT 57 E-S]

2) Continuous Radon Monitor
(Model: RAD7, Durridge, US)

- Silicon detector
- I lpm through the connected pipe with a moisture remover
- Short and long term continuous measurements
- Mobility and simplicity

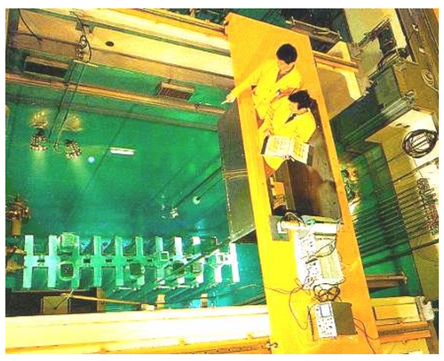
[RAD7]

2.2 Measuring point

- Facility: Post Irradiation Examination Facility(PIEF) spent fuel storage pool site of KAERI
- Structure: consists of concrete materials (plenty of radioactive radon nuclides can be released)
- Kr-85 gas spurt from the damaged spent fuel

2.3 Measuring method

- A continuous radon monitor has been installed near the pool side
  (near the sample port of the Kr-85 monitor)
- The continuous radon monitor(RAD7) was measured for 3 days with 30 minute intervals(Bq/m^3)
- The Kr-85 monitor(FHT 57 E-S) detects the net count per second(cps)



[Spent Fuel Storage Pool Site]

HVAC Operating 8 h
(Normal Working)

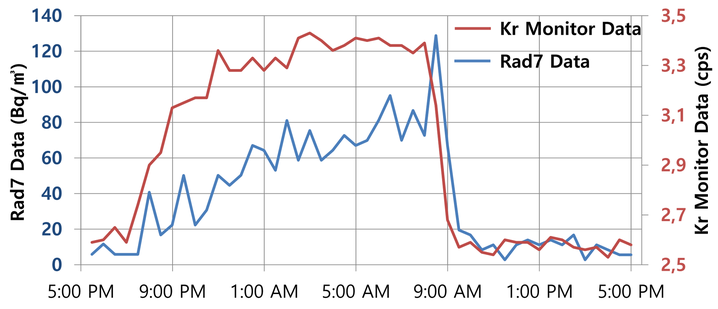
HVAC Stopping 16 h

Kr-85 Monitor
&
RAD7
Continuous
Monitoring
24 h

3. Data Analysis

3.1 Comparing trend of measured data & Comparing measured data in time dependent

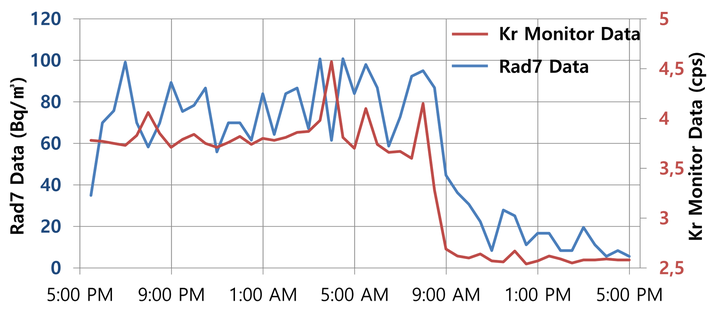
1 8/9~8/10



Time (hr)	RAD7 (Bq/㎥)		Kr monitor (cps)	
	Avg.	Max.	Avg.	Max.
17~21	27.59	47.42	2.99	3.18
21~01	52.74	72.73	3.31	3.52
01~05	82.51	120.38	3.44	3.55
05~09	84.94	106.29	3.49	3.80
09~13	21.64	44.75	2.61	2.66
13~17	15.34	27.90	2.59	2.63

HVAC operating time

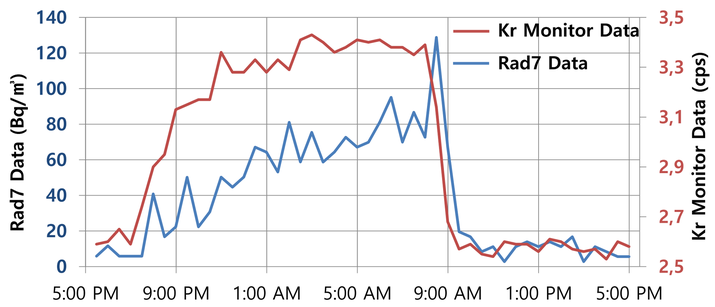
2 8/13~8/14



Time (hr)	RAD7 (Bq/㎥)		Kr monitor (cps)	
	Avg.	Max.	Avg.	Max.
17~21	70.88	99.13	3.81	4.06
21~01	72.69	86.63	3.78	3.84
01~05	81.10	100.79	3.92	4.57
05~09	79.37	97.99	3.61	4.15
09~13	22.32	36.27	2.60	2.67
13~17	10.46	19.53	2.58	2.62

HVAC operating time

3 8/17~8/18



Time (hr)	RAD7 (Bq/㎥)		Kr monitor (cps)	
	Avg.	Max.	Avg.	Max.
17~21	14.35	40.78	2.77	3.13
21~01	47.47	67.07	3.25	3.36
01~05	66.39	81.04	3.38	3.43
05~09	83.91	128.78	3.27	3.41
09~13	11.86	19.53	2.57	2.60
13~17	9.42	16.74	2.58	2.61

HVAC operating time

4. Conclusion

- During suspension of the working area, the data trends of the Kr-85 monitor and RAD 7 were about equal.
- It can be estimated that Rn-222 in the space somewhat contributed to the measured data of the Kr-85 monitor.
- From the viewpoint of radiation monitoring, it is essential to consider the Rn-222 effect during the Kr-85 monitoring in the spent fuel storage pool site.
- The trend was not exactly equal, and there were some differences as time passed. The reason for this was the different location of the sampling port of the Kr-85 monitor, and RAD7 made some differences.

5. Reference

[1] D.K. Keum et al. Development of Atmospheric Kr-85 Analysis Technology, KAERI/RR-2468(2004)
[2] Y. Igarashi, M. Aoyama, K. Nemoto, K. Hirose, T. Miyao, K. Fushimi, M. Suzuki, S. Yasui, Y. Asai, I. Aoki, K. Fujii, S. Yamamoto, H. Sartorius and W. Weiss, ^{85}Kr measurement system for continuous monitoring at the Meteorological Research Institute, Japan, J. of Environmental Monitoring, 3, 688-696(2001)
[3] National Council on Radiation Protection and Measurements, Measurement of Radon and Radon Daughters in Air(1988)