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

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ABSTRACT

In the Post Irradiation Examination Facility (PIEF) spent fuel storage pool site of KAERI, there are three Kr-85 monitors in order to detect Kr-85 in real time. When if certain spent fuel cut and float above the pool surface while operating the facility, the Kr-85 Monitors can detect Kr-85 spurt from the damaged spent fuel.

The Detector of Kr-85 Monitor is proportional counter tube in sandwich geometry, and can detect radioactive noble gas. Noble gas flow into the input port not adsorbed to the pre-filter but counts in the count chamber. Measured values calculated by applying the count efficiency of Kr-85. At the same time Rn-222 which is also a Noble gas counts 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 whether these values are caused by Kr-85 or Rn-222. As a result the workers in that filed cannot estimate whether the work field is in safe condition or not. For that reason, it is essential that conduct refinement and separation of radioactive gases, like Rn-222.

In this study, to estimate whether the measured value from the spent fuel pool site of PIEF, KAERI Kr-85 monitor is actually caused by Kr-85. Furthermore, behavior of radioactive radon nuclides had been monitored in the pool site. The observation was conducted comparing continuous radon monitor (RAD7) installed in the workplace near the pool side and a Kr-85 monitor (FHT 57 E-S) which is continuously monitoring the pool surface.

During suspension of working in the area, the data trend of Kr-85 monitor and RAD 7 was about equal. As a result, it can be figured out that the measured data of Kr-85 monitor was from Rn-222 which is always in the area. Merely, the trend was not exactly equal, and there was some difference as time goes by. The reason was figured out that the difference of sampling port of Kr-85 monitor and RAD7 made some differences.

1. Introduction

In the Post Irradiation Examination Facility (PIEF) spent fuel storage pool site of KAERI, there are three Kr-85 monitors in order to detect Kr-85 gas in real time. When if certain spent fuel cut and float above the pool surface while operating the facility, the Kr-85 monitors can detect Kr-85 gas spurt from the damaged spent fuel.

The detector of Kr-85 monitor is proportional counter tubes in sandwich geometry, and can detect radioactive noble gas. Noble gas flow into the input port not adsorbed to the pre-filter but counts in the count chamber. Measured values calculated by applying the count efficiency of Kr-85. At the same time, Rn-222 which is also a Noble gas counts 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 whether these values are caused by Kr-85 or Rn-222. As a result, the workers in that filed cannot estimate whether the work field is in safe condition or not. For that reason, it is essential that conduct refinement and separation of radioactive gases, like Rn-222. [1]

In this study, to estimate whether the measured value from the spent fuel pool site of PIEF, KAERI Kr-85 monitor is actually caused by Kr-85. Furthermore, behavior of radioactive

radon nuclides had been monitored in the pool site. The observation was conducted comparing continuous radon monitor installed in the workplace near the pool side and a Kr-85 monitor which is continuously monitoring the pool surface.

2. Measurement instruments and measuring points

In this study, observation had been conducted in the spent fuel pool site of PIEF, KAERI where the facility is consist of concrete materials. For that environment, it is likely to release plenty of radioactive radon nuclides.

The Kr-85 monitors (Model: FHT 57 E-S, Thermo, Germany) which is in the pool site, has been installed in 2014, are monitoring radioactive noble gas of air especially Kr-85 above the pool surface.

A continuous radon monitor (Model: RAD7, Durridge, US) has been used to monitor the radioactive radon nuclides. RAD7 detects radioactive radon nuclides with a silicon detector which is installed in the instrument. RAD 7 inhales l linter per minute air through the connected pipe with moisture remover. It is possible that both short time and longtime continuous measurements. Furthermore, mobility and simplicity of this instrument is apt to measuring radon concentration it the workplaces.

3. Measuring methods.

A continuous radon monitor (RAD7) has been installed near the pool side which is near the sample ort of Kr-85 monitor (FHT 57 E-S). The RAD7 measured for 3 days with 30 minute intervals.

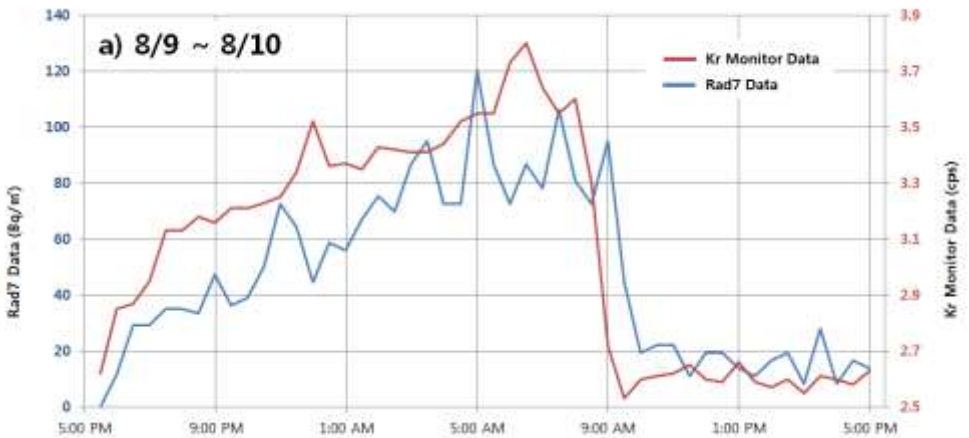
Kr-85 monitor (FHT 57 E-S) detects net count per second (cps) and the data has been averaged in 30 minutes. As a result, comparison has been taken with the RAD7 data in Bq/m^3 and Kr-85 monitor in cps.

4. Comparing trend of measured data

Figure 1 shows the measured data of noble gas radioactivity detected with Kr-85 Monitor and RAD7 in time dependent.

Though it is not exactly fits the data of Kr-85 monitor and RAD7 in time dependent, when ventilation system (HVAC) of PIEF operates, he trend graphs are remain low.

When the observation executed, there was no working or relocation of spent fuels in the pool site. For that reasons, there was no radioactive noble gases except Rn-222. So that radon nuclides are the same family group as krypton nuclides, these nuclides can be considered having similar behavior. As a result, the measured data of Kr-85 monitor was from Rn-222 by analogy.



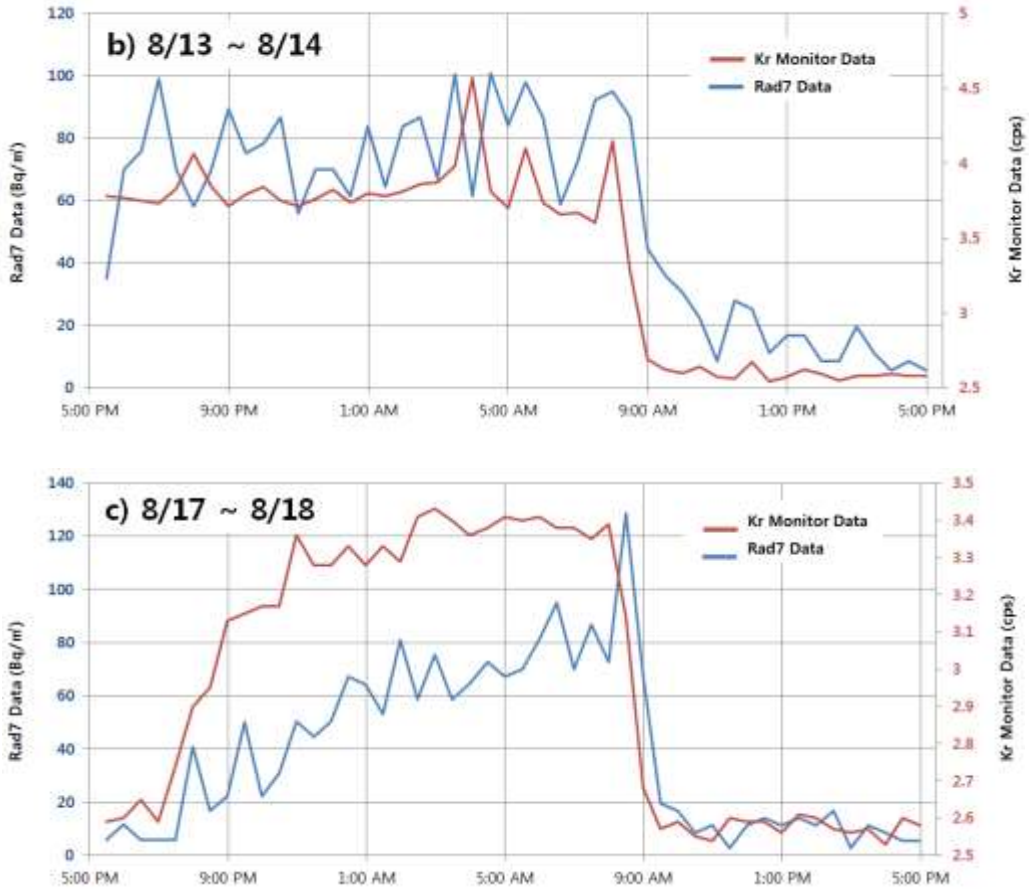


Fig 1. Hourly variations of Kr monitor (FHT 57 E-S) data and radon (RAD7) concentrations in the spent fuel storage pool site.

5. Comparing measured data in time dependent

Table 1. Represents 4 hour averaged data and maximum data of Kr-85 monitor and RAD7 for 3 days.

When HVAC system operation discontinued (From 09 AM to 17 PM), the measured data of both Kr-85 monitor and RAD7 started to increase. The reason is some of Rn-222 eliminated while HVAC operating cannot be eliminated and accumulates in the spent fuel pool site. The next day, when HVAC operated again, radioactive radon concentration dropped dramatically.

Table 1. Measurement result of Kr-85 monitor (FHT 57 E-S) and radon (RAD7).

Date	Time (hr)	Kr Monitor(cps)		RAD7(Bq/㎥)	
		Average	Maximum	Average	Maximum
8/9~8/10	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
8/13~8/14	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
8/17~8/18	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

6. Conclusion

In this study, to estimate the measured data of Kr-85 monitor (FHT 57 E-S) which is operating in the spent fuel storage pool site, installed continuous radon monitor (RAD7) and compared the data from both instruments.

During suspension of working in the area, the data trend of Kr-85 monitor and RAD 7 was about equal. As a result, it can be figured out that the measured data of Kr-85 monitor was from Rn-222 which is always in the area.

Merely, the trend was not exactly equal, and there was some difference as time goes by. The reason was the difference of sampling port of Kr-85 monitor and RAD7 made some differences.

7. References

[1] D.K. Keum et al. Development of Atmospheric Kr-85 Analysis Technology, KAERI/RR-2468(2004)

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