*Transactions of the Korean Nuclear Society Autumn Meeting*
*Gyeongju, Korea, October 24-25, 2013*

# Measurement of Gamma Spectrum at domestic Nuclear Power Plant with CZT Semiconductor Detector

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## 1. Introduction

Monitoring sources terms at Nuclear Power Plant(NPP) is important to aggressive ALARA activities and evaluation of exposure of workers. EDF (Electricite de France)[1]-[7] and AEP (American Electric Power)[8] conduct monitoring source terms using by CZT semiconductor detector. CZT is different from HPGe in that it does not need any cooling system at room temperature, it has good energy resolution and it can be made portable type easily. For these reason CZT is used in various fields commercially to measure gamma ray and therefore KHNP(Korea Hydro & Nuclear Power Co., LTD) RHRI(Radiation Health Research Institute) has been measuring gamma spectrum at domestic NPP last spring. We had have presented the first result through the last Transactions of the Korean Nuclear Society Spring Meeting[9] for old S/G(Steam Generator). In this study we monitored gamma spectrum for young S/G to see difference of the detected nuclides between old and young S/G.

## 2. Methods and Results

### *2.1 Methods*

EDF showed major nuclide is different from old and young S/G for dose rate[7]. We did measure gamma spectrum to check what kinds of nuclides are detected at a young NPP with CZT semiconductor detector and analyzed the spectrum. The measurement points are S/G Inlet Manway and S/G Cold Leg(See figure 1). Measurement conditions are as follows table 1. The used CZT semiconductor detector is GBS SDP310 and Multi-Channel Analyzer is MCA-166. It was conducted after water chemistry process. The temperature of Reactor Cooling System(RCS) was room temperature and RCS level was normal which means S/G was empty but cold leg was not.

**Table 1 Measurement conditions**

| | Measurement Points | |
|---|---|---|
| | S/G Inlet Manway | S/G Cold Leg |
| Time(Sec) | 5,500 | 20,000 |
| CPS | 6,000 | 360 |
| Dose Rate | 2.5mSv/h | 0.35mSv/h |

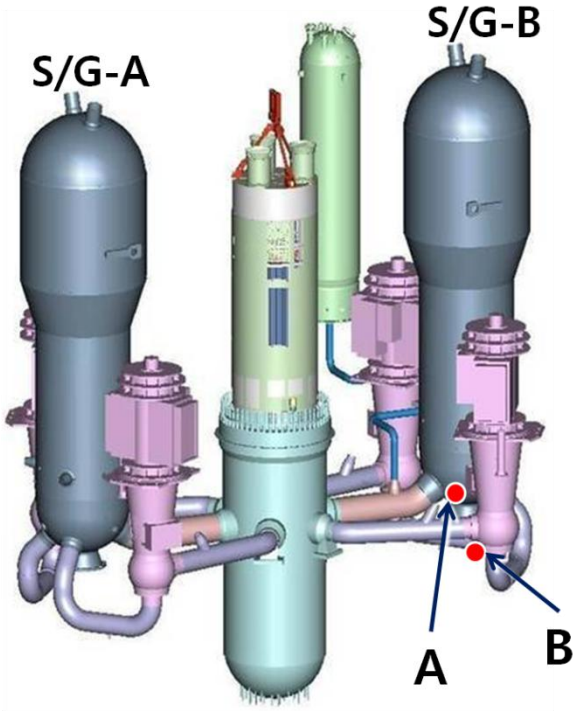


**Figure 1 Measurement points, A: S/G Inlet Manway, B: S/G Cold Leg**

### *2.2 Results*

The measured spectrum shape is same as the last one[9] without measurement points(See figure 2). Detected nuclides are Cr-51, Mn-54, Co-58, Fe-59, Co-60, Nb-95 and Sb-124(See figure 3). The major nuclide is Co-58 also. The main issue is Fe-59. It did not detected last experiment but we could see in this measurement. Cs-137 and Zr-95 did not appear in here. Cr-51 signal was very vague in last measurement because of background but it is more clear than the last one(See table 2).

Table 2 Comparison of detected nuclides

| Nuclide | Old S/G | Young S/G |
|---|---|---|
| Cr-51 | △ | ○ |
| Mn-54 | ○ | ○ |
| Co-58 | ○ | ○ |
| Fe-59 | X | ○ |
| Co-60 | ○ | ○ |
| Nb-95 | ○ | ○ |
| Zr-95 | ○ | X |
| Sb-124 | ○ | ○ |
| Cs-137 | △ | X |

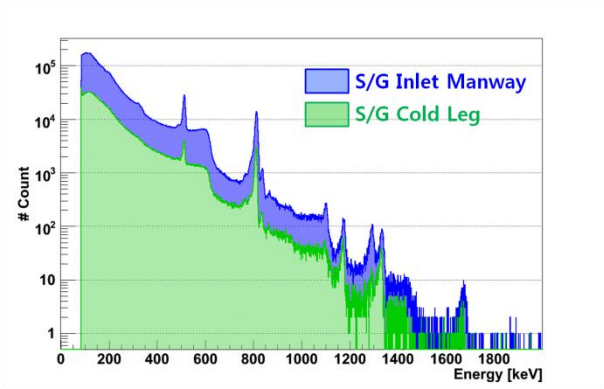


**Figure 2 Measured gamma spectra, S/G Inlet Manway(Blue), S/G Cold Leg(Green)**

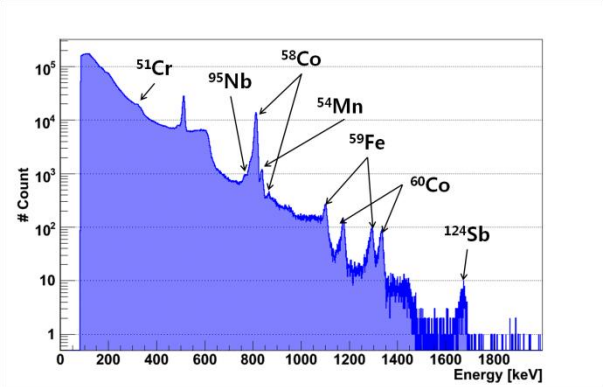


**Figure 3 Result of nuclide analysis, S/G Inlet Manway**

There is difference between old and young S/G in that not only the major nuclides but also the kinds of detected nuclide by EDF[7]. Co-58 is the major one for young S/G and Co-60 is the major one for old S/G. In this study we could not compare them because we are under developing the analysis program to find quantity of activity and dose rate.

## 3. Conclusions

The detected source terms were the same for all measurement points. There is not comparison of quantity among the nuclides. The program which analyzes gamma spectrum to calculate activity and dose rate is under developing. We expect it will be done by end of this year. In this study we could see the difference of detected nuclides between old and new S/G for the first time whereas last measurement has significant meaning in that the measurement was taken for the first time all over country

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