

<Reference>
February 14, 2014
Tokyo Electric Power Company

Counting Loss of Beta-Ray Measuring in Fukushima Daiichi Nuclear Power Station

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1. Details thus far

- On February 6, 2014, TEPCO issued a set of data, where a part of the measured value of Gross-β was below that of Sr-90.
- We found that ‘counting loss’, which arises by measurement, caused value of Gross-β to drop below that of Sr-90.
- We found that ‘counting loss’ caused an underestimate of measurement values. We investigated into the influence produced by this counting loss.
- As one of its backgrounds, we reported as follows:
On February 5, 2014, we reported that the improper measurement efficiency of Gas Flow Proportion Counter (LBC) caused the value of Sr-90 to exceed that of Gross-β, and also reported on several measures.
- Since the end of July, 2013, the fixation of Sr-90 has been suspended and its cause has been researched, for we found the measurement of Sr-90 was incorrect.
- Thus, since the end of July 2013, the fixation of the measurement of the sample ‘Groundwater observation hole (No.1-2)’(obtained on July 5, 2013) has been suspended.
*We completed the analysis on September 12, 2013.

2. Investigation

<Subject>

Liquid, dust, and soil samples produced in Fukushima Daiichi NPS after the earthquake

- The 'ordinary procedure for monitoring in atomic and radiation emergency situation' (IAEA-TECDOC1092) determines that the ratio of 'counting loss' with the counter (LBC) occupies 20%. Thus, we will extract samples whose measurement efficiency exceeded 800 cps, which is a figure that corresponds to the ratio.

※ Ge-Semiconductor spectrometer (for analyzing γ -nuclide), liquid scintillation measuring device (analyzing tritium), and β -ray nuclide analyzer (Pico- β : analyzing strontium), all which have correction function regarding 'counting loss' were excluded from investigation.

<Result>

- 167 (0.8%) out of 20,866 samples (which we measured Gross- β before) turned out to exceed 800 cps, which are suspicious of 'counting loss'.
- None of 671 samples of Sr-90 (which were measured with the counter (LBC)) turned out to be suspicious of 'counting loss'.

3. Action plan in future

- The values of the 167 samples which are suspected to be applicable to 'counting loss' and whose measurement efficiency exceed 800 cps will be corrected the value by excluding the influence by 'counting loss'. (Correction method is under consideration.)
- We will adopt double check system, in order to maintain and enhance the reliability of measurement by 1) having our measuring system assessed by international and domestic water analysis agencies, and 2) ordering those agencies to analyze water samples.

[Reference] What is 'counting loss'?

When radiation enters sensor, a period of time where the following radiation cannot be detected will arise → “Resolving time”

Phenomenon that radiation are not counted during “resolving time” → “Counting loss”

‘Higher’ radiation density = ‘More’ enumerated data → ‘Longer’ resolving time = ‘More’ counting loss

Counting loss

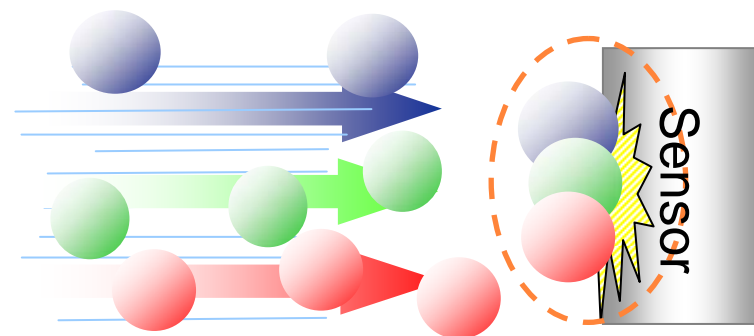
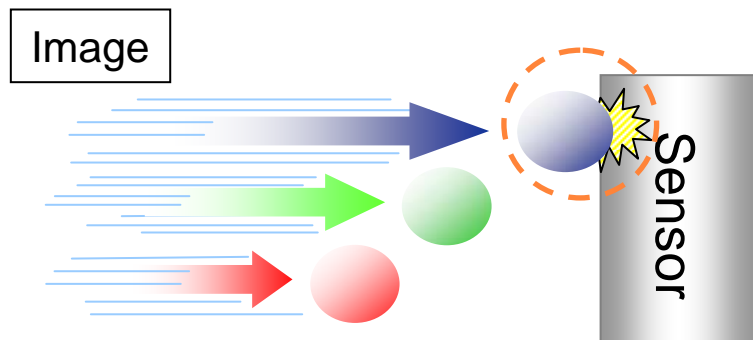
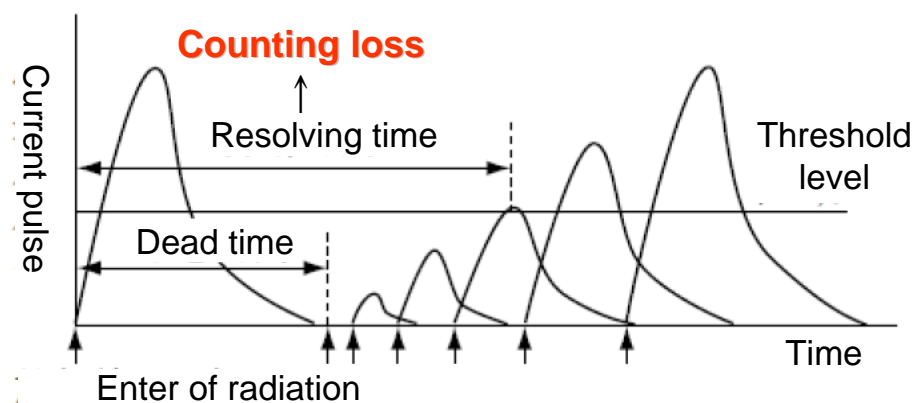
Phenomenon that radiation enters sensor, and ion pairs arise, but they are not counted.

Dead time

Time when radiation enters the sensor and ionization occurs, but the detector does not respond.

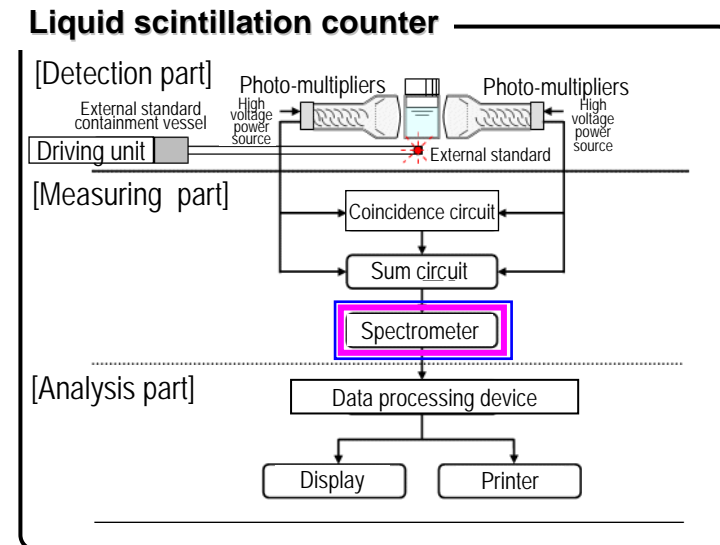
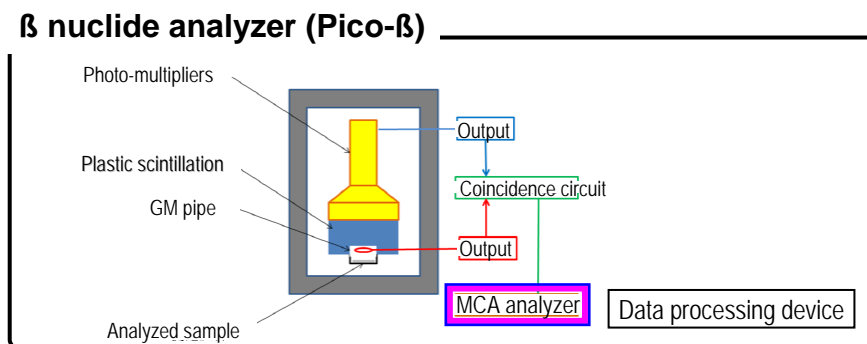
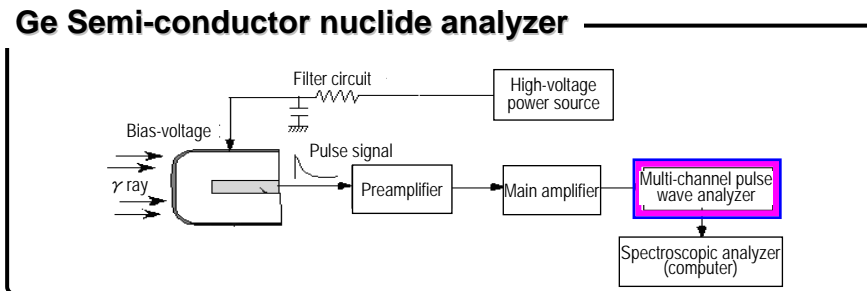
Resolving time

Time necessary for recognizing radiation as current signal and measuring



[Reference] Existing correction for 'counting loss'

- Time to analyze whether or not the detected radiation signal is significant via a correction circuit is significant is necessary.
- Once analysis is in process, correction circuit cannot process the following signals.
- Unprocessed signal leads to 'counting loss', resulting in decrease of measurement value.
- In order to avoid a decline in measurement value, we regard the time when the detector cannot process the latter radiation signal due to analyzing the former radiation signal as 'dead time'. We implement a circuit which subtract 'dead time' from the actual elapsed time.
- We subtract 'dead time' (time equivalent to the measurement value decreased by 'counting loss') from the elapsed time.



Counting loss correction circuit