

## Accidental exposure (217-237)

### 217      Bioassay for Neutron Dose Estimation of Three Victims in the JCO Criticality Accident by Measuring $\beta$ -ray emitters

#### 1. Bioassay as an emergency countermeasure

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This series of reports will deal with the results of bioassay performed to estimate the neutron doses for three victims in the JCO criticality accident. In this report, we present the circumstances of why and how to perform the bioassays as an emergency countermeasure. From the information in the draft paper provided by IAEA on the criticality accident in Sarov, we first tried to measure the induced  $^{32}\text{P}$  activity arising from the  $^{32}\text{S}(\text{n}, \text{p})^{32}\text{P}$  reaction in the hair samples of three victims using a liquid scintillation counter. The result indicated the presence of  $^{32}\text{P}$  activity in the hair. However, it was also elucidated that the activity was very low level and was contaminated with some other radio-nuclides. Therefore, it was suggested that the procedures such as chemical separation and  $\beta$ -ray spectrometry should be prepared for more precise measurement of the induced  $^{32}\text{P}$  activity.

### 218      Bioassay for Neutron Dose Estimation of Three Victims in JCO Criticality Accident by Measuring $\beta$ -ray Emitters

2. Determination of  $^{32}\text{P}$  concentration in hair of the victims and estimation of the fast neutron dose  
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$^{32}\text{P}$  is generated by the fast neutron of 2.5MeV and over in sulfur with (n, p) reaction. Since content of sulfur in hair is high as compared with the other human tissues, we tried to estimate fast neutron dose to the victims using concentrations of  $^{32}\text{P}$  and stable sulfur in their hair.  $^{32}\text{P}$  activity was measured by a low background  $\beta$ -ray spectrometer (Pico  $\beta$ ) mainly, and the results were verified by radio-chemical separation of phosphorus and counting with a gas-flow counter. Stable sulfur was determined by ICP-AES method after wet digestion with ultra-pure  $\text{HNO}_3$  and a microwave digester. Concentrations of  $^{32}\text{P}$  in the scalp hair were around 0.002dpm/g for two victims and undetectable for one victim. Pubic hair of one victim showed higher concentration than the scalp hair. Estimated neutron dose for each victim will be discussed in this paper.