INFORMATION NOTE
BUBBLE DETECTORS
US NUCLEAR GENERATING SITE
NOVEMBER 2006

Neutron bubble detectors are used on a regular basis for neutron dosimetry at several nuclear generating sites. An example is a site located in the mid-Western, USA. The reactor is a pressurized water 503 MWe unit commissioned in 1974. It is typical of US nuclear generating facilities.

Approximately 400 people are employed on site and of these 40% or approximately 150, work at the reactor facility and are regularly badged for gamma exposure. Badging is done with a TLD supplied and read by an outside commercial service.

Neutron exposure is perceived to be only of concern to workers entering the containment building for repair and inspection. Typically this involves 12-24 people a minimum of once a month. A work shift may be from 1-8 hours in duration depending on the nature of the work. Neutron fields typically are 10-15 mrem/hr depending on location. Neutron fields vary dramatically depending on exact location due to gaps in the concrete bioshield that surrounds the reactor itself, causing "streaming paths". A typical dose per excursion into containment is 5-10 mrem. Workers wear standard drawstring "bag" suits. Ambient temperature in containment may vary from 25-35°C.

Historically neutron dose was estimated via albedo TLD but this method suffered from a lack of sensitivity (minimum detectable dose 10-20 mrem) and spiked testing revealed large errors both in accuracy and reproducibility. Area monitors are used in containment but these are not deemed satisfactory for reliable personal dosimetry since the neutron fields vary widely by location.

BTI BD-PND™ detectors are now used exclusively for the measurement of neutron dose. Dosimetry results have been accepted by the US Nuclear Regulatory Commission (NRC). Typically BD-PND detectors with a sensitivity of 1-2 b/mrem are issued by a Health Physicist to each worker who has occasion to enter containment. The HP logs workers identity, detector serial number and time in and out. At the end of the job, workers count the bubbles in the detector themselves, by eye.

The HP on station enters the dose information in the logbook, recompresses the detector, places it back into its aluminum storage tube and puts the assembly in a rack for future issue.

At this nuclear site the BTI BD-PNDs are favoured for dose measurements because its size and cost allow for individual dosimetry versus area monitoring. The minimum detectable dose is superior to TLD's, as are accuracy and repeatability. Detailed knowledge of the neutron energy is not required for useful dosimetry since the bubble detector response is flat with energy over a very wide range.

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