

WHITE PAPER ON RADIATION WATER MONITOR

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Jefferson National Laboratory is a high tech laboratory located on a beautiful campus in suburban Virginia. Their research is centered on their high-energy electron accelerator. Energies generated are as high as 6 GeV continuous with currents up to 200 micro Amps. Where does the high-energy accelerator beam go after smashing atoms in the experimental sample? It impacts into a tank of purified water called the Beam Dump. This creates a problem when it transmutes the hydrogen in the water into radioactive tritium. Tritium (H^3) is created in beam dumps, target gases and magnet cooling water.



Most of these disposal options were quite expensive and potentially problematic. The options were to solidify waste in 55 gallon barrels and ship to a burial site; drain all systems into tanker for disposal by contract; do nothing and let the concentrations build up; or we could generate a controlled waste stream to a sanitary sewer at low cost. The last option was chosen as the most cost effective and with the best control over pollution risk. The waste stream restrictions were 5 Curies per year, 100 million pico Curies/liter. Please note that 20,000 pCi/l is the clean drinking water standard.

How was this problem solved? Bob May and Daniel Dotson of the Jefferson Labs called upon Technical Associates to develop an online monitoring system to monitor the waste stream. The monitoring system, Model SSS-33-5FT, was tailored to Jlab's specifications and all detection specs were met. In addition to tritium detection this system has gamma detection of $1.0 \text{ E-}5$ to $1.0 \text{ E-}01$ uCi/ml for Be-7 decay photons .435 to .55 MeV with good background gamma rejection. Comparison checks were made with the Packard Tri Carb Model 2500 TR accuracy 1 hr run $1.0\text{E-}6$ uCi/ml $\pm 2\%$.



The SSS-33-5FT proved its sensitivity and accuracy. The gamma checks were performed with Canberra Genie PC 2H .50% IG. As with all new technology the SSS-33-5FT evolved with Technical Associates expertise and heavy use at Jefferson Laboratory. An additional flow meter was added to the tritium discharge side. Failsafe external logic relays were developed for monitoring the monitor. A UPS was added to the computer to allow for a soft shutdown during a power outage. "It was a refreshing experience to develop new instrumentation with Technical Associates, an instrument company dedicated to working with industry to design and develop innovative instruments."—Dan Dotson of Jefferson National Laboratory.

