

Technology Options for Free-Release Closure of Concrete Slabs

The free release requirements for building surfaces (including concrete) are contained in the Ashatabula site's license for radioactive material from the Ohio Department of Health. These are as follows:

- 1000 dpm alpha/100 cm², removable
- 1000 dpm beta-gamma/100 cm², removable
- 5000 alpha/100cm², averaged over 1 m²
- 5000 dpm beta-gamma/100 cm², averaged over 1 m²
- 15000 dpm alpha/100 cm², maximum over 100 cm²
- 15000 beta-gamma/100 cm², maximum over 100 cm²

Assuming that U238 is in secular equilibrium with its shorter-lived daughters, then the beta-gamma restrictions mentioned above will be more restrictive than the alpha restrictions, i.e., if 100 cm² is less than 5,000 dpm for beta-gamma, it will be also for alpha. This is an important fact relative to technology selection because measuring alpha *in situ* is much more difficult than measuring beta-gamma emissions.

There are several different types of sensor technologies that can be used with sufficient sensitivity for scanning surficial contamination on concrete at the levels described. These include organic scintillators and gas proportional counters. For example, NUREG-1507 indicates MDCs (dpm per 100 cm²) of 550 for a GM and 170 for a gas proportional counter for Sr-90, which would be expected to be approximately the same as that for U-238. In a mobile scan mode with a 4 second acquisition time, this would work out to be There are three primary vendors of equipment for this purpose:

Ludlum Model 239-1F Floor Monitor System

The Ludlum Model 239-1F Floor Monitor System (<http://www.ludlums.com/>) is a gas proportional counting system for beta-gamma emissions with a 582 cm² active counting window. When coupled with a Model 2350-1 data logger, this system is capable of generating and storing up to 1,000 measurements. Additional equipment would be required to provide for positional control. An RS-232 connection allows for downloading data to a laptop. Its purchase price is around \$4,000. It can be leased from GTS Instruments in Pittsburgh for approximately \$600 per month. The system requires a user-supplied gas source.

Bicron Model FLM3B

The Bicron Floor Monitor FLM3B (beta) (<http://www.bicron.com/>) is a scintillation-based system for beta-gamma emissions with a 582 cm² active counting window. When coupled with a Bicron data logger, this system is capable of generating and storing up to 1,000 measurements. Additional equipment would be required to provide position control. Its purchase price is around \$4,500. Unlike the Ludlum, there is no need for gas tanks for the system. However, the window of the system is potentially more difficult to maintain if damaged by debris on a concrete slab. While the Bicron Floor Monitor should

have detection limits adequate for Ashtabula's needs, they would not be as good as with a gas proportional system, and there are potential issues with non-uniform spatial efficiencies across its viewing window.

Shonka Research Surface Contamination Sensor

The Shonka Research Surface Contamination Monitor (SCM) (<http://www.shonka.com>) is a position-sensitive gas proportional system that is really an array of small-window gas proportional counters mounted on wheels for smooth surface assay work. The system has intrinsic position and data logging capabilities, and is capable of both providing individual-window specific results as well as results integrated across viewing windows, providing the opportunity for varying levels of spatial integration. The Shonka system has been successfully deployed with EM50 support at DOE facilities. It would be capable of completing the RF6 and RF6A pads with a day or two of scanning. The system is not for sale. Deployment costs would be on the order of \$10-20K for the Ashtabula site, with a significant portion of this being mobilization and demobilization costs.

For both the Ludlum and Bicron systems, the active window is larger than 100 cm². This means that to correctly scan for the 15,000 cpm constraint, one would need to use a lower value equivalent to the ratio of the 100 cm² criteria to the active window of the system as a trigger for additional investigation work with a hand-held unit with smaller window size.