ALARA Activities at DOE

This section on ALARA activities is a vehicle to document successes and to point all DOE sites to those programs whose managers have confronted radiation protection issues and used innovative techniques to solve problems common to most DOE sites. DOE program and site offices and contractors who are interested in benchmarks of success and continuous improvement in the context of Integrated Safety Management and quality are encouraged to provide input to be included in future reports.

4.1. ALARA Activities at the Argonne National Laboratory

4.1.1. Improving Operational Tests of Radiation Protection Instruments

An instrument operational test fixture for neutron detectors has been designed and fabricated at Argonne National Laboratory for performing pre-operational tests on portable neutron survey instruments (See Exhibit 4-1). This test fixture was developed after success with a test fixture for gamma-ray detectors.

For a number of years Argonne deployed a gamma operational test fixture containing a shielded ^{137}Cs source. The source can be rotated into position to provide a gamma field for performing operational tests of higher range portable radiation protection instruments such as those containing ion chambers which need a source stronger than the typical check sources. The shielding is sufficient with the source in its "stored" position to allow the gamma test fixture to be located in the Health Physics Offices in buildings where radiological work is performed. Recently this concept was extended to operational tests for neutron detecting instruments such as polyethylene-moderated ^{3}He proportional counters (Rem Balls).

The neutron test fixture consists of a 12-inch cube of high density polyethylene with 7.5% lithium/polyethylene as shielding material. Inside the cube is a 6.75" diameter drum containing a 200 mCi $^{241}AmBe$ neutron source. The drum is rotated to move the source from the "stored" position, centered in the cube, to the "exposed" position, with the source directly under the top of the cabinet, for testing the survey instruments (See Exhibit 4-2). The position of the source is controlled by an operating handle projecting through a metal cabinet which totally encloses the neutron test fixture. An indexing mechanism ensures correct source position and a keyed lock secures the source in the "stored" position and prevents operation by unauthorized persons (See Exhibit 4-3, cabinet cover removed).

Exhibit 4-1: Neutron rig

Exhibit 4-2:
Neutron rig - drum

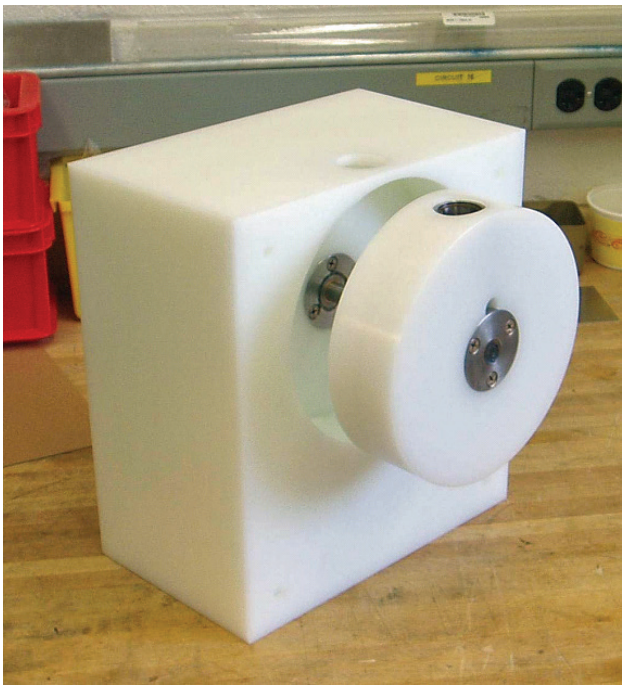
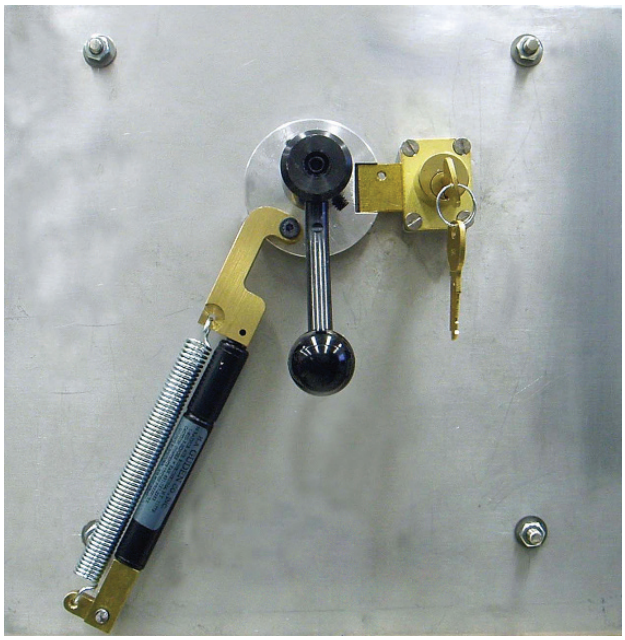


Exhibit 4-3:
Neutron rig index plate - locked



The test fixture makes it possible to check the performance of the neutron detector (Rem Ball) in a reproducible manner. There is a dimple in the top plate of the test fixture which indicates where to place the Rem Ball. The Rem Ball dose rate with the source exposed is 27 mrem per hour. With the source in the "stored" position the dose rate is 0.6 mrem per hour at 30 cm from the cabinet. Until the neutron test fixture became available, operational checks were made by taking the Rem Ball to a location where there was a source of neutrons and checking to see if the Rem Ball detected neutrons. This can be inconvenient and non-reproducible. For example, in the past the Rem Ball was used to check incoming shipments in Building 46-Shipping and Receiving and was taken to another building where there was a drum containing a shielded neutron source. To make the operational check, the health physics technician brought the Rem Ball into contact with the drum containing the source. No attempt was made to place it in the same strength neutron field each time. Thus, the calibration efficiency could have changed by more than 20%, the limit for remaining in service, without detection of the change.