Report of Pool Liner Repair

University of Massachusetts Lowell Research Reactor

Introduction

The University of Massachusetts-Lowell Research Reactor (UMLRR) has been serving the university and surrounding community since 1974. The UMLRR is non-power (non-electricity producing) steady-state reactor licensed to operate up to 1 MW of thermal power. It is one of a number of facilities within the University of Massachusetts-Lowell Radiation Laboratory, which also includes a 5.5 MV Van de Graff accelerator. The principal purpose of the UMLRR is to provide a multidisciplinary facility for use in nuclear-related education and research. Although the main focus of the facility is on intra-university research, use by those outside the university is fully welcomed.

Used by six UML departments and in 13 courses, the UMLRR supports existing degree programs in sciences, engineering, and other disciplines. Its use fosters interdisciplinary academic activity to support faculty and student research for UML and the entire UMASS system. The UMLRR also provides irradiation services benefiting government agencies and industry, and it supports outreach activities for pre-college students that encourage interest in science and engineering careers. The facility is regulated by the Nuclear Regulatory Commission and is currently licensed to 2015.

Various experimental facilities within the UMLRR produce thermal neutrons for radioactivation purposes and fast (fission spectrum) neutrons for radiation effects research. Capabilities include: neutron activation analysis (parts per billion sensitivity for most elements), full spectral or enhanced thermal or enhanced fast neutron irradiation facilities (for material effects studies), neutron transmission measurement (for material properties studies) · radiation detector response and calibration to neutron, gamma, and mixed radiation fields; neutron radiography (for materials imaging).

Pool Liner Repair

The UMLRR is housed in a reinforced high-density concrete open pool lined with ¼-inch aluminum plates. When it was constructed, the concrete side of the aluminum liner was coated with a coal tar paint (BITUMASTIC SUPER SERVICE Black). The pool is 30 feet deep and holds 75,000 (gallons) of demineralized water. In the late 1980's, leaks in the aluminum liner began to appear in one end of the pool where the reactor is normally positioned. An initial repair was made by moving the reactor to the opposite end of the pool, isolating and draining the leaking end of the pool, and then welding aluminum patches to the degraded areas. This solution worked for a limited number of years until new leaks appeared in the same end during the early 1990's. By 2001, the leaking had progressed to a level of several gallons per hour. The leaking water would accumulate mainly in the sub-basement of the reactor containment building, where it would be pumped to a waste sump for radiological analysis and eventual disposal.

In January 2001, the reactor end of the pool was isolated and drained to install a new experimental facility. Three beam tubes on one side of the reactor end were removed and the a new experimental facility for fast neutron irradiation research was installed at the location of the removed beam-tubes (Figures 1 and 2).

During the process of removing the three beam tubes and installing the fast neutron irradiator, a repair of the pool liner in the stall-pool section of the reactor pool was undertaken. The repair involved the use of a commercial-grade Kevlar enhanced epoxy coating (BioDur 561). The coating was applied by UMLRR staff to selected areas of the stall pool liner. These areas included weld seams along the pool floor, around the beam tube flanges, around the thermal column support footings, and on several areas of visually observed pitting (Figures 3 & 4). After re-filling the stall pool, no further evidence of leaking was observed. The sub-basement is checked monthly as part of a routine surveillance activity.

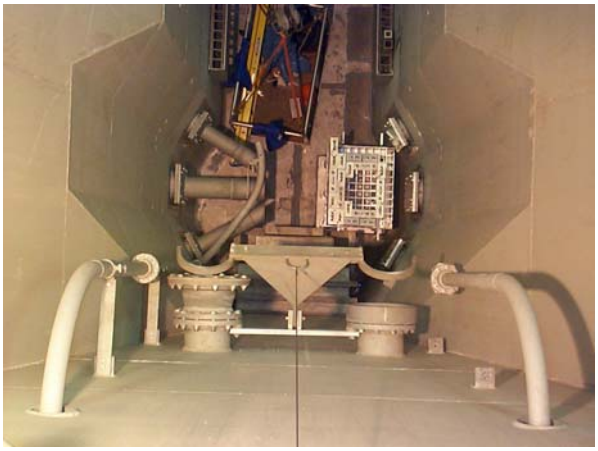

Figure 1 - Looking 30' down into the drained reactor end of the tank. The reactor has been moved to the isolated end beyond the top of the picture.

Figure 2 - Closer view showing beam tubes at left and new FNI facility at right. The reactor is normally stationed between the two when the tank is filled.

Fig. 3

Fig. 4

Figure 3 – Inside the tank facing the experimental facilities. Beam tubes are located at the upper right. Thermal column is center and the base for the new FNI facility is center-left. Note the location of previous patches (yellow arrows).

Figure 4- Close view of epoxy applied to weld seams and area around the thermal column right support strut.

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