

Under-core Plate Foreign Object Search and Retrieval

Background

A critical aspect of refueling is to protect the fuel from possible damage as a result of foreign material in the reactor coolant system. Video inspections are performed on and beneath the lower core plate prior to reloading fuel assemblies into the core. Top-of-the-core plate search and retrieval activities can be easily performed using conventional equipment such as underwater cameras for visual inspections and air-operated vise grips or underwater vacuums for retrieving objects. However, under-core plate inspections are difficult to perform with conventional equipment because the area is only accessible through small holes in the core plate.

To improve the inspection accuracy and retrieval ability in the under-core plate region, Westinghouse now offers the under-core plate foreign object search and retrieval (FOSAR) system that consists of the following:

- Articulated retrieval tool (ART)
- Diakont® D-40 radiation-tolerant camera
- Tri Nuclear Corp.® Model UFV-260-gpm vacuum system (supplied by utility)

Developed in partnership with ROS Inc., the under-core plate FOSAR system can search and retrieve materials beneath the lower core plate. The under-core plate FOSAR system has an 18-inch articulated vacuum end effector that increases the ability to retrieve objects located under the core plate.

Description

The system incorporates a small high-resolution, radiation-tolerant camera. This D40 camera sends video to either the standard DVD-based recording station, or an updated recording station that features network-enabled viewing, recording or playback and can back up to a USB drive. The camera is deployed independently of the ART. The ART is the heart of the system and embodies a flexible, motorized, articulated vacuum tip affixed to the end of a straight rigid pole. The straight section and the articulated end effector measures 11 feet in length. The rigid top section includes the vacuum hose adapter and the motors used to precisely manipulate the articulated section via a system of internal cables. A single 60-foot, multi-pin underwater cable connects the in-water system with the surface electronics.

A Tri Nuclear underwater vacuum/filtration system typically supplied by the utility completes the ART system. As the vacuums from Tri Nuclear have developed, ART has adapted and can now be used with a UFV-260 or the more powerful UFV-600. Also included in the ART system is a set of air-operated grips. Depending on the extent of loose parts below the core plate, more than one retrieval method may be needed. The combination of tools creates a method of removing objects too large for the ART's inner diameter.

Deliverables

With the exception of the vacuum pump and associated filters and suction hose, Westinghouse provides all articulated retrieval tooling, radiation-tolerant camera equipment and procedures to deploy, use and recover the under-core plate FOSAR system.

Benefits

The benefits gained from using the enhanced FOSAR system include the following:

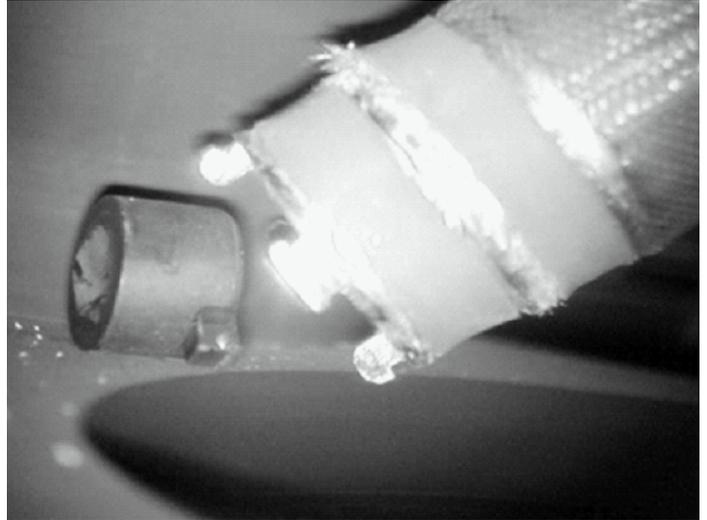
- Reduced personnel radiation exposure
- Shorter, less costly outages
- Fewer preventable fuel defects



Articulated retrieval tool (ART)

Experience

Many plants worldwide, including in the United States, Spain, and South Africa, have effectively reduced preventable fuel defects by using this system.



ART in use to retrieve foreign material