Field Services, Nuclear Services

Simultaneous Inspection and Cleaning of Reactor Vessels and other Cavities

Debris Uptake Suction Tool (DUST)

Background

The DUST helps protect the plant from costly fuel damages while simultaneously reducing time in-vessel during cleanliness inspections.

Foreign material in nuclear power plants can cause fuel failures. The foreign material is carried by the coolant through the core at high speed, potentially damaging the fuel cladding; this can lead to expensive fuel failures and significant increased doses in the primary system.

Description

The DUST tool´s function is the location and removal of foreign material under water. Currently there are three different versions available within the DUST family. The three versions are developed for different purposes and have been used successfully in the field since 2011.

A see-through debris trap with micro-filters efficiently and securely captures the debris and allows the operator to visually verify the retention of the foreign material with the inspection cameras. Depending on the version, the entire suction nozzle and/or debris trap is removable while under water, should a hot spot need to be retrieved.

The foreign material that can be captured, using the DUST, varies from small bolts, washers, shavings, plastic tie wraps, pieces of cloth, etc. The suction force can be adjusted by the operator in a fully variable fashion, allowing for high precision during retrieval of debris. The ability to collect and retrieve foreign material allows the utility to analyze and identify the source and take action to prevent material from entering the system in the future.

Experience

As demonstrated at a customer's power plant, DUST (version 1, see technical description) has been used during final inspections at outages since 2014. DUST has successfully removed over 50 pieces of foreign debris ranging from 1.5 mm to 28 mm long metallic objects. The foreign material was identified and immediately captured when discovered. The DUST has saved in excess of 30 minutes per removed object on the critical path (as much as 5.5 hours of total savings during one outage) and prevented numerus potential fuel failures.

Benefits

- Saves time on critical path
- Easy to use and implement
- Foreign material is safely removed in a single-step operation
- Mitigates fuel failures
- Mitigates damage of reactor components
- The integrated see-through debris trap enables visual verification of debris retention
- The entire suction nozzle and/or debris trap can be removed under water remotely

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DUST 1

DUST 1 is used with Ahlberg Cameras inspection/surveillance systems, either with existing plant cameras, or a suitable camera is included in the delivery, and no external cable or power supply is required.

Area of use

- Pump deck in BWR (reach behind obstacles like main circulation pumps, feed water sparger and insert pipes)
- Any pool or cavity
- Small RPV nozzles and orifices with customized suction nozzles

Technical Data

Compatible cameras	Ahlberg: N47, N30, MegaRad, other on request
Equipment weight (with N47)	6 kg (approx.) in air
Length x Width x Depth	570 x 432 x 110 mm
Filter mesh sizes	0.1 – 1 mm
Maximum ambient temperature	45° C
High radiation tolerance	Yes

DUST 2

DUST 2 has an integrated camera and lighting in front of the suction nozzle, with pan and tilt function enabling a high degree of flexibility and access.

Area of use

- Control rod drive housing BWR/PWR
- Any pool or cavity
- Small orifices, difficult to access otherwise

Technical Data

Equipment weight	4 kg (approx.) in air
Length x Diameter	430 x 82 mm
Pan range	360° +25°
Nozzle and camera tilt range	0°–75°
Filter mesh sizes	0.1 – 1 mm
Maximum ambient temperature	45° C
High radiation tolerance	Yes

DUST 3

DUST 3 can be used with any camera system. Any suitable camera can easily be deployed as the DUST 3 is mounted on a handling pole.

Area of use

- Lower support plate in PWRs during visual inspections
- Pump deck in BWR (reach behind obstacles like main circulation pumps, feedwater sparger and insert pipes)
- Any pool or cavity
- Small RPV nozzles and orifices with customized suction nozzles

Technical Data

Compatible cameras	Any pole mounted camera
Equipment weight	3 kg in air
Length x Width x Depth	550 x 280 x 60 mm
Filter mesh sizes	0.1 – 1 mm
Max. ambient temperature	45° C
High radiation tolerance	Yes

WesDyne is the nondestructive inspection branch of Westinghouse and a leading supplier of mechanized nondestructive examination (NDE) products for all inspection needs worldwide providing turnkey and one-off-type solutions with a focus on the nuclear market. WesDyne's expertise spans all aspects of remote and mechanized inspections, from problem analysis and solutions generation to development and manufacturing to field deployment of personnel and equipment. Inspection capabilities cover all key NDE areas such as ultrasonic, visual, eddy current, magnetic particle, dye penetrant and X-ray.

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