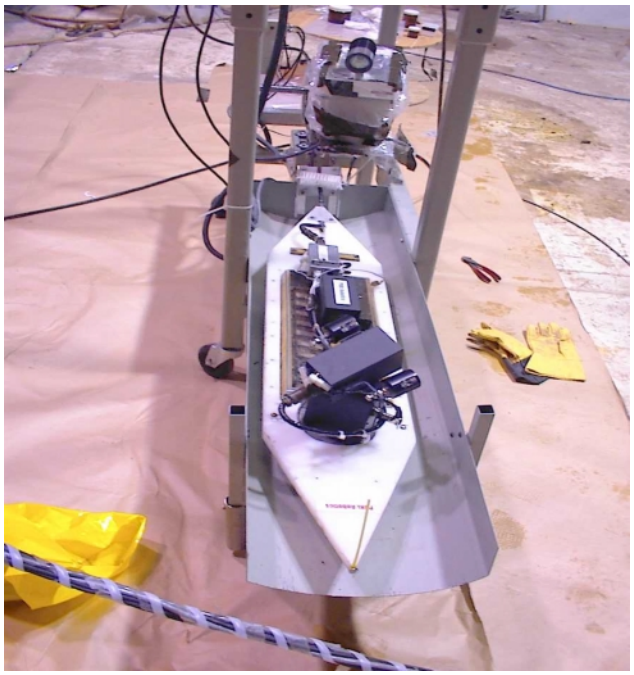
Technology Deployment Fact Sheet
Drain Line Characterization Robot



SUMMARY

The Drain Line Characterization Robot is a tracked robotic vehicle with onboard video and radiation monitoring instrumentation. The robot was deployed to safely and economically inspect, characterize, and collect samples from 800 ft of subterranean piping in the Hanford Site's 221-U Facility. The remote capabilities of the Drain Line Characterization Robot greatly reduced actual and potential radiological dose to operations personnel. No practicable alternate methods to obtain similar characterization data have been identified.

The *Sampling and Analysis Plan for 221-U Facility*, DOE/RL-97-68 (herein after referred to as the [SAP]), defines the objectives for examination of the 221-U Facility drain line. In accordance with the SAP, necessary characterization data included the following:

- Visual record for assessment of the structural integrity of the pipe and where liquid may be draining from
- Scale or sludge samples and a radiological survey of the pipe to correlate with the isotopic distribution obtained from the scale/sludge sample.

The robot successfully completed all of these objectives.

The Drain Line Characterization Robot was designed and constructed by Pacific Northwest National Laboratory. Deployment of the Drain Line Characterization Robot was accomplished through the support of the Deactivation and Decommissioning Focus Area, which is managed by the National Energy Technology Laboratory. This work was conducted as part of the 221-U Facility characterization in support of the Canyon Disposition Initiative Project. Characterization information is being obtained to support a Record of Decision for the 221-U Facility. The Record of Decision will establish regulatory and technical precedence for future disposition of the other chemical processing facilities (also known as canyons).

INNOVATIVE TECHNOLOGY DESCRIPTION

Robot Description

The tracked robotic vehicle is constructed with sharply tapering ends (front and rear) to aid in navigating obstructions. Vehicle power, control, and data are carried over a cable bundle (tether) that is pulled by the vehicle. An adjustable iris/focus pan-tilt-zoom camera and two variable intensity headlights are mounted at the vehicle's mid-plane. The vehicle is equipped with a MGP DMC 100 gross gamma sensor. Data are transmitted to the control station and are superimposed on the video image from the primary camera.

A secondary camera and microphone with digitized radio frequency (RF) output are also provided. The secondary camera and RF instruments are not necessary for operation of the Drain Line Characterization Robot but were deployed for evaluation purposes.

The vehicle is operated via a control station that was staged in the 221-U Facility operating gallery. Data presented for operation and recording at the control station include video images from the primary on-vehicle camera, an overview camera on the deployment platform, and video/sound from the RF instruments.

Deployment System Description

The deployment system involves two major elements: a deployment platform (which is lowered via overhead crane to the drain line outfalls) and a separate cable management system (which was located on the canyon deck). The deployment platform is designed to be manipulated and lowered by the facility overhead bridge crane into cell 10 to the level of the drain line outfalls. The cable management system is used to deploy and retrieve the tether that must travel as far as 600 ft down the drain line.

BASELINE DESCRIPTION

A specific baseline method for data collection equivalent to that obtained by the Drain Line Characterization Robot has not been identified. A plausible scenario for collecting acceptable data would involve sequential opening of multiple process cells. The cell contents would be rearranged and/or removed to provide access to the existing drain line connection from each process cell to the 24-in. drain line.

Video, radiological, and sample collection equipment would then be lowered into the drain line. This method would result in localized characterization data of the drain line, consisting of approximately 35 discrete points at about 22-ft increments.

These efforts would also include developing detailed special-purpose work procedures, increased coverage by radiological and safety personnel, and significant engineering evaluation necessary for manipulation of process cell contents. The labor required for such an effort, combined with design, development and deployment of characterization equipment, would be cost prohibitive.

DEPLOYMENT DESCRIPTION

The Drain Line Characterization Robot was deployed to examine the 24-in. process cell common drain line in August 2000. The drain line was accessed from the two outfall points into cell 10.

The Drain Line Characterization Robot deployment platform and cable management system were deployed from the 221-U Facility canyon deck. Vehicle controls, camera controls, video monitors, and data recording equipment were located in the 221-U Facility operating gallery. All camera and system controls were remotely operated from the operating gallery.

Entries into the canyon deck and operating gallery areas were made in a routine manner and within normal radiological monitoring and survey requirements.

DETAILS OF BENEFITS

Use of the Drain Line Characterization Robot for characterization of the 221-U Facility process cells common drain eliminated the need for personnel to make multiple entries onto the canyon deck. Regularly assigned facility personnel are capable of performing remote below-deck examinations. Risks to workers are reduced through the use of the Drain Line Characterization Robot. Potential risks include the following:

- Exposure to unknown or unsafe air space in the equipment under examination
- Contact with unknown materials/contents
- Exposure to potentially pressurized piping or equipment
- Fall hazards associated with working from scaffolding
- Heat stress concerns from greater levels of physical exertion
- Radiological exposure dose to personnel due to closer proximity and extended contact with the equipment subject to examination.

A single deployment of the Drain Line Characterization Robot enabled a more complete survey of the drain line while eliminating the costs of multiple personnel entries into the facility.

CONTACTS

Kim Koegler, BHI (509) 372-9294
Carl Strode, BHI (509) 372-9133
Sharon Bailey, PNNL (509) 375-2243
John Sands, DOE-RL (509) 372-2282
John Long, DOE-RL (509) 372-3068
John Duda, NETL (304) 285-4217