INTEGRATING INTERNATIONAL TECHNOLOGIES AND PRACTICES TO ADDRESS DOE NEEDS

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Introduction

AEA Technology (AEAT) has collaborated with the US Department of Energy, Office of Science and Technology for the past five years to transfer technologies and practices from the United Kingdom to the US DOE clean-up effort, through a series of projects. This partnership has resulted in several successful studies, demonstrations and deployments of innovative technologies and/or practices that offer benefits including schedule reduction, increased worker safety and/or cost savings. Projects have included personnel placements within DOE offices, participation on Integrated Contractor Teams (ICTs), demonstrations of innovative technologies or practices, creation of Options Studies for specific facilities or sites, and deployment of specialist equipment to meet challenging requirements across the complex. This paper summarizes projects completed during fiscal year 2000 for the Deactivation and Decommissioning Focus Area under the Industry Program of the Office of Science and Technology.

Objective

In collaboration with site representatives, AEAT works closely with the Focus Areas to identify problems around the complex that could benefit from demonstration or deployment of innovative technologies and/or practices. In addition, AEAT and representatives from Headquarters identify mutual areas of interest where the transfer of knowledge from the UK would be beneficial to US programs; for example, Long Term Stewardship, Project Risk Management, and D&D Planning Practices. AEA Technology has successfully completed or are near completion of a variety of projects in FY00, including:

1. Contribution to the Development of an Options Study to Decontaminate Exhaust Ducting in Building 324 at Hanford.
2. Inspection, Sampling, and Remediation Options for Tank 105 in the High Level Waste Vault in Building 324 at Hanford.
3. A Conceptual Design to Retrieve Raschig Rings and Sludge from Storage Tanks at Rocky Flats.
4. Demonstration and Deployment of a Passive Ventilation Device for D&D Activities at the Savannah River Site.
5. Demonstration and Deployment of Soft Media Decontamination Techniques for Various Applications at the Savannah River site.
6. Design, Fabrication and Deployment of a Soft Media Blasting System for Decontaminating Pipes.

Approach

Hanford

The Department of Energy has accelerated the Decommissioning and Dismantlement Schedule of the facilities in the 300 Area at the Hanford Reservation site in Richland, Washington. As part of the overall decommissioning plan at the site, it is planned to deactivate Building 324. The 324 Building is a hot cell facility that poses challenging problems to the Department including, highly contaminated ductwork and tanks. AEA Technology was assigned the tasks of identifying options for decontaminating the exhaust ducting and the inspection, visual imaging and sampling of a highly radioactive tank (T105) in the high level waste vault.

Using worldwide resources and experience, AEAT worked with DOE to prepare a report for the Hanford site detailing the options available for decontaminating the exhaust ducting. The options that were considered concentrated on meeting several objectives, including:

- Minimization of equipment costs
- Maximization of worker safety
- Optimization of characterization tasks
- Maximization of cleaning speeds
- Minimization of waste generation
- Minimization of cross contamination of surroundings

AEAT supported a comprehensive study to identify appropriate technologies for visual survey, radiological survey and decontamination of the ductwork. AEAT reviewed and evaluated US-based as well as UK and European-based technologies to identify the optimum technology for this application. The report discusses various options and technologies available for this application. The preferred option, which included manually inserting a camera with lighting and a TLD for an initial survey of the duct, followed by the use of a Remote Operated Vehicle with a brush for decontamination and closed circuit television (CCTV) for viewing was discussed in detail. On the basis of the study and subsequent report, the Focus Area and site have requested AEA Technology collaborate with DOE to conduct a demonstration of the preferred options in FY01.

In addition to the ductwork in Building 324, Facility managers and representatives from the D&D Focus Area requested AEA Technology support their efforts to identify technologies and processes capable of entering a highly radioactive tank (T105) in the high level waste vault to perform a variety of tasks, including:

- Inspection – view internals and the suspected heel
- Radiation monitoring – take readings from inside the tank
- Sampling – retrieval and analysis of samples of waste
- Decontamination – removal of the tank waste contents

The tank is located under a 6-foot cover block that doubles as a floor for the cask handling area. There is very limited access to the tank because all of the risers are welded

to the tank and there are no blank flanges. AEAT was responsible for devising a plan to access the tank to achieve the objectives listed above with minimal impact to the cask handling operations while minimizing the cost and maximizing the safety of the system.

Tank T-105

AEAT designed a simple, low cost mechanical arm that could be deployed through a 6-8" riser and would be capable of meeting the project's objectives. A prototype arm was demonstrated at AEA Technology's facility in North Carolina to representatives from Hanford, the D&D Focus Area, DOE Headquarters and the Savannah River Site. Tank T-105 was simulated by use of an 80% scale, open top tank. The 324 Building, Cask Handling floor level (i.e., top of the concrete cover block) was simulated by use of a 22-foot-high scaffolding platform centered above the tank. The arm was deployed from the platform to the center of the tank. The arm was equipped with a surveillance camera and remote TV monitor at the operational levels as well as a wire-plunger sampling device for retrieving simulated waste material in the tank bottom. All parties considered the demonstration a success and plans are underway to fabricate and functional test a complete system at the Hanford site in FY01 on an exact replica of the T-105 tank.

Rocky Flats Environmental Technology Site

The Rocky Flats Environmental Technology site has nine major plutonium processing buildings and 60 or more uranium and other radioactive waste storage buildings. All of the buildings are slotted for eventual demolition as stated in the Site Closure Plan. Four

of the buildings used directly in the plutonium production process house storage tanks with an inventory of sludge and Raschig rings, which are used to control criticality. The contents of the tanks (including the Raschig rings and sludge) will be removed as part of the deactivation activities taking place. The current method utilized to remove the Raschig rings requires building an enclosure around the tank, manually opening the tank, then removing the Raschig rings by shoveling or raking the rings into a separate container. These procedures expose workers to high levels of risk and result in high levels of airborne contamination.

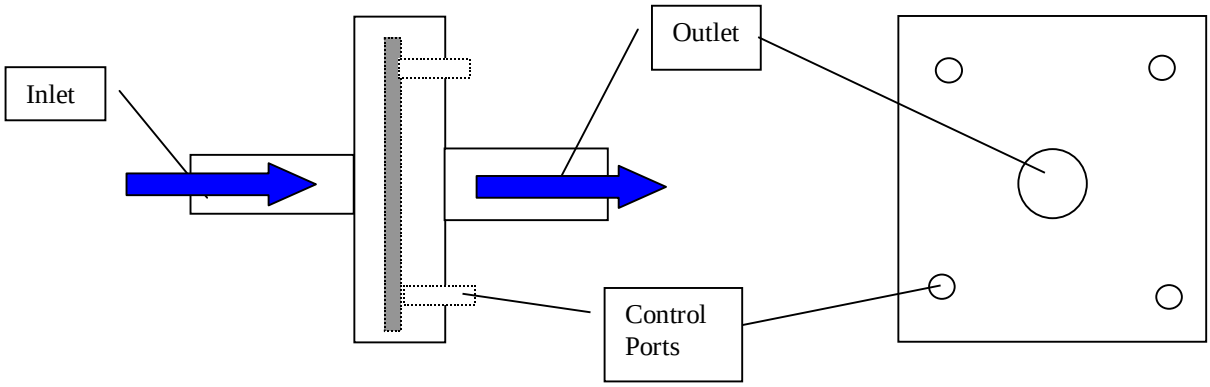
RFETS and D&D Focus Area personnel requested AEAT collaborate with them to create a conceptual design for a system to remove the raschig rings and sludge from the tanks during deactivation activities while managing criticality and minimizing worker exposure. AEAT has created a conceptual design, based on Power Fluidic ^{TM} technology, which has been proven to remove sludge and debris from storage tanks. The conceptual design will be finalized and then agreed with site and DDFA personnel. Upon approval, AEAT will complete the design, fabricate the system and demonstrate it to DOE representatives in a mock-up facility. Specific constraints and restrictions (i.e. tank access) of the system must be agreed prior to completion of the design.

Savannah River Site – (Ventilation Control)

The Facilities Decommissioning Division at the Savannah River site performs decontamination and decommissioning activities for various groups across the site. Often, these activities take place in temporary (soft-sided) containment structures called 'Decontamination Huts', which require some form of ventilation control to prevent the release of airborne contamination. Ventilation control has classically been conducted using a pressure sensor, controller, valve actuator and mechanical air-regulating valve to vary the flow of air and the depression in a system. Should the dynamics of the system under control vary, there is a finite time for the mechanical system to adjust while the signal from the pressure sensor travels to the controller as it opens or closes the mechanical valve to regulate the flow. This time delay is very system specific and depends on many factors associated with the age and use of the system, but is generally a fraction of a second. The system is always lagging behind what is happening in the unit under control, and, under varying conditions this can be detrimental to operations and/or hazardous to workers. For example, if the ventilation of a system is drastically changed due to a containment failure, a fraction of a second is more than enough time to contaminate the surrounding workers and environment.

To overcome this problem in the UK, AEA Technology developed a non-mechanical, part passive ventilation valve that responds instantaneously to the behavior of the system. This device, known as a Vortex Amplifier or VXA, has no moving parts and is maintenance free. It is able to react instantaneously to pressure variations in a system, and is therefore inherently more reliable and more efficient than "conventional" pressure equalizing systems. In response to the SRS requirement, AEAT designed, demonstrated and will deploy a VXA on a Decontamination Hut at SRS.

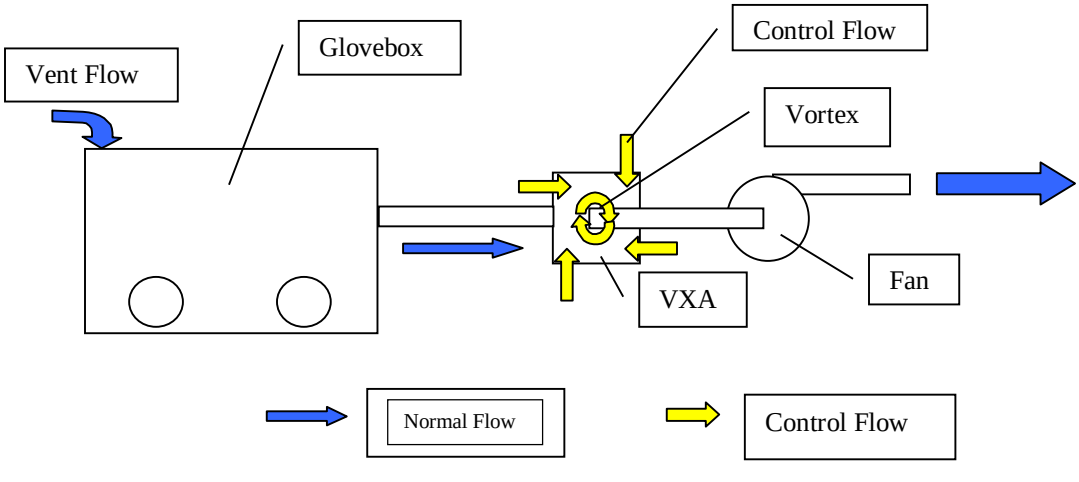
The vortex amplifier is a square box with an inlet on one side and an outlet on the other. In the center of the VXA is a flat square opening to which four control ports are attached.



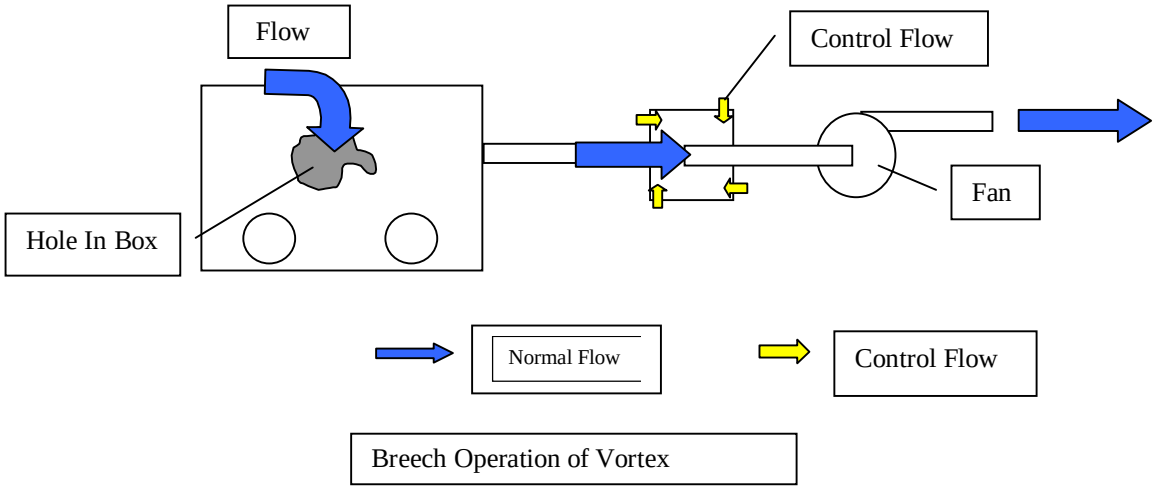
Side View **Front View**

The outlet side of the vortex amplifier is connected to the off gas train and fan. The inlet side is connected to the Decontamination Hut or system under control. When the fan is turned on, air is drawn from the glovebox through the VXA, over the square plate and out of the VXA into the off gas train. As the depression in the glovebox increases, air is drawn in through the four control ports to maintain a steady flow to the fan. The control ports are arranged in such a manner that as air is drawn through them, a vortex is set up on the side of the square plate nearest the outlet. This vortex sets up a pressure differential between the inlet and outlet of the VXA.

Under normal operating conditions, the vortex set up in the Vortex Amplifier produces a pressure drop across the device. In an accident condition, there is a sudden loss of primary containment, which causes a large volume of air to be sucked into the low pressure inside the glovebox. The air is sucked through the vent system and across the VXA. This large volume flow swamps the vortex in the VXA, and therefore instantaneously connects the fan to the Decontamination Hut. In this way a flow of air is maintained in through the Decontamination Hut, through the VXA, and out through the vent system.



Normal Operation Of Vortex Amplifier



The Vortex Amplifier has many applications around the DOE complex. After the system is successfully deployed at the Savannah River site, AEAT will work closely with DDFA and site representatives to identify other projects that would benefit from a VXA. Efforts are underway to agree a deployment opportunity at Rocky Flats.

Savannah River Site – (Decontamination Technology)

In addition to the VXA demonstration, SRS and DDFA personnel supported a demonstration of an innovative decontamination technology that offered the following benefits:

- A dry process which is virtually dust free,
- A lightweight and mobile system,
- Fast and reliable production rates,
- Easy to operate and low maintenance,
- Low secondary wastes.

The soft media (sponge) blast system successfully decontaminated lead bricks (without generating a mixed waste stream) and stainless steel riser plugs. The system is being developed further to decontaminate the inside diameter of pipework.

AEA Technology supplied a soft media blast system to the site and trained site operators on its operation and maintenance. The Decontamination Facility has added the soft media blast system to its inventory of decontamination tools. The new system provided the facility with a portable option for decontamination operations in the field.

After further development, the SRS will have two complete soft media blast systems. The first system will be used for decontaminating small pieces (i.e. hand tools, and lead bricks) in a containment structure. The second system will automatically decontaminate the inside diameter of pipework.

Future Activities

It is anticipated that AEA Technology and the US Department of Energy, Office of Science and Technology will continue their collaboration to bring innovative technologies and practices from the UK and European nuclear industries to the United States. This partnership has resulted in a number of successful projects over the past five years. Several more projects to bring innovative technologies or practices to the United States are in their planning stages, including, a demonstration of an alternative technology to incineration, Silver II ^{TM}, and a deployment of a tank mixing and retrieval system capable of retrieving the heel of waste in large storage tanks. As one of the leading authorities on nuclear waste management in the United Kingdom and Europe, AEA Technology is ideally suited to transfer the know-how and experience to the US DOE complex.