

ROCKY FLATS ENVIRONMENTAL TECHNOLOGY SITE 1998 ACCELERATED SITE TECHNOLOGY DEPLOYMENT PROGRAM

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ABSTRACT

The Rocky Flats Environmental Technology Site (RFETS) Accelerated Site Technology Deployment (ASTD) Program seeks to implement a suite of proven technologies that will provide a comprehensive process for accelerating baseline Decontamination and Decommissioning (D&D) activities while correspondingly reducing Site closure costs. The RFETS 1998 ASTD program is implementing the following technologies:

- Decommissioning In-Situ Plutonium Inventory Monitor (DISPIM™)
- Enhanced cutting tools.
- A mobile WIPP certified standard waste box assay system.

The DISPIM™ System is a passive neutron coincidence counter designed for *in-situ* assay of plutonium contaminated process equipment (i.e. gloveboxes and tanks) in-situ. Its main use will be to estimate plutonium holdup in process equipment. In FY98, BNFL Instruments was contracted to deploy the DISPIM™ System at the Rocky Flats Site. The objective of the deployment was to evaluate the effectiveness of the DISPIM™ System in assaying RFETS's plutonium contaminated gloveboxes and equipment in-situ. The DISPIM™ System was deployed in Buildings 771 (former plutonium processing building) and 788 (waste storage building) during September 1998. Overall the deployment was successful.

In the field of size reduction the RFETS ASTD Program will be implementing new and more efficient cutting tools. The Program is working with on-going D&D Projects to select and deploy high efficiency, lightweight tools capable of cutting various materials. The overall goal is to select tools that speed up size reduction and equipment strip out, and/or minimize the release of air borne contamination during cutting operations. Two tools have already been selected, a crimper/cutter that is capable of flattening and cutting up to 1½ " schedule 80 pipe and a newly designed ¼" sheet cutter. The crimper/cutter is scheduled to be deployed in mid February 1999 in Building 771 under the Tap and Drain Program.

Site waste projections for the 2006 and 2010 Site Closure Plans indicate that the generation rates of transuranic (TRU) and low level waste (LLW) will outstrip the Site's current non-destructive assay capabilities. To meet our closure plans RFETS is working with the Los Alamos National Laboratory (LANL) to design, WIPP certify and deploy at Rocky Flats a Mobile TRU Standard Waste Box (SWB) Counter that can be placed next to buildings undergoing D&D. A mobile design was selected since it will offer the greatest flexibility to the Site as more and more of the Site's buildings are

decommissioned. The expected delivery date for the mobile counter is February 2000. To date, the counter specification and the basic design have been completed. In addition, LANL has placed orders for a majority of the hardware and the trailer.

BACKGROUND

In the spring of 1997, EM-50 started the Technology Deployment Initiative (TDI) Program. The TDI Program was designed to provide funding to DOE Facilities to stimulate the implementation of demonstrated and proven technologies. Each DOE Facility was encouraged to submit TDI proposals to EM-50 for review. EM-50 competitively reviewed the proposals to identify which ones would be selected for development of Deployment Plans. The Deployment Plan would outline the strategy DOE Facilities would follow to successfully deploy and implement the technologies.

The Site submitted three TDI proposals to EM-50. A total of 89 proposals were submitted to EM-50, of which only 16 were selected. Only one of the Site's proposals was selected, "Enhanced In-Situ Decontamination and Size Reduction of Gloveboxes". In October 1997, EM-50 requested a Deployment Plan for the "Enhanced In-Situ Decontamination and Size Reduction of Gloveboxes" TDI proposal. The name of the TDI program was changed to the Accelerated Site Technology Deployment (ASTD) Program in the fall of 1997. In mid November 1997, the Site submitted its Deployment Plan. The Deployment Plan was approved in January 1998 with funding transferred to the site in February 1998.

INTRODUCTION

The initial ASTD Proposal and Deployment Plan outlined the deployment of five technologies within three technology areas. The identified technologies were selected for use based on proven operating history and enhanced performance capabilities over the current baseline. The three technology areas were radiological characterization, in-situ decontamination, and size reduction.

The economics of Decontamination and Decommissioning (D&D) at RFETS changed with the start of Building 779 D&D and the expected opening of the Waste Isolation Pilot Plant (WIPP). RFETS D&D Programs are focusing on minimizing costs to perform in-situ characterization, size reduction, and certification for waste disposal. Current project planning indicates that minimizing steps involved in the planning and execution of equipment strip out and disposal lowers overall D&D costs. This drove the Site management to rethink the deployment of the technologies outlined in the original ASTD Deployment Plan.

The initial ASTD proposal was modified to put more emphasis on initial and final waste characterization and more cost effective size reduction. A recently completed economic evaluation by K-H indicated that the economic drivers for decontaminating transuranic waste down to low level waste are marginal. Decontamination is now a very low priority and will be implemented on a case by case basis at RFETS. Therefore the two decontamination technologies were removed from the proposal.

In the area of size reduction the D&D Program strategy for Building 779 (former R&D building) is to lower the overall costs of size reduction by focusing on technologies that will allow the relaxation of requirements for personnel protective equipment. Current D&D planning has size reduction being performed in supplied air suits. A supplied air suit operation requires a larger support staff than an equivalent operation, which uses only Anti-C clothing and full-face respirators. A 50% reduction in size reduction costs can be realized by the relaxation of personnel protective equipment (PPE) requirements from supplied air suits down to Anti-C clothing and respirators. The Building 779 D&D Project managers showed that they can accomplish this to a reasonable extent by using fixatives to trap contamination in combination with mechanical cutting methods such as nibblers, reciprocating saws, and band saws for size reduction. Future deployments will focus on faster cutting tools and remote size reduction to further reduce labor exposure and costs.

The in-situ characterization of plutonium contaminated equipment is key to the downstream D&D planning in a building. The DISPIM™ System was selected in the original ASTD Deployment Plan for this task. It remained as a selected technology in the modified ASTD Deployment Plan.

To further minimize cost, current D&D projects are placing and plan to place most of the D&D TRU waste into standard waste boxes (SWBs). The standard waste box (SWB) can handle larger pieces which translates into less size reduction, lower labor costs, and significantly lowers waste certification costs since fewer containers need to be certified (7 drums are needed to hold the waste contained in 1 SWB). To illustrate, if the Building 779 D&D Program had to dispose of all of its plutonium contaminated equipment in 55-gallon drums, K-H estimated that the program would have to spend an additional \$4M in increased labor and PPE supplies. Building 779 represents less than 10% of the Site's glovebox D&D work.

For TRU waste disposal, the Site will be using drums and SWBs as the primary waste containers. Currently these are the only primary waste containers allowed by WIPP and DOT for use in the TRUPACT-II. The Site is currently working to WIPP certify two drum counters and is using three leased WIPP certified trailer mounted commercial drum counters. There are currently no certified non-destructive assay (NDA) systems in the DOE complex for SWBs. Criteria have been defined by WIPP for the NDA certification of drums, but not for SWBs.

The current Site passive/active crate counter (PACC) was placed into service in 1983. The counter was designed to provide gram values of Special Nuclear Material to meet the needs of the nuclear material control and accountability program. The current PACC cannot meet the stringent measurement requirements of WIPP. Because of this and the significant cost savings associated with disposing waste in SWB, the Site has placed a high priority toward the procurement and WIPP certification of a NDA system for SWBs. In addition, a mobile design was selected since it will offer the greatest flexibility to the Site as more and more of the Site's buildings are decommissioned. The RFETS ASTD

Program was modified to include the deployment of a WIPP certified mobile SWB counter.

The RFETS ASTD Program is working jointly with LANL to design, WIPP certify and deploy a mobile SWB counter at Rocky Flats. The counter is based on LANL's Super High Efficiency Neutron Counter (HENC) technology. Since WIPP does not currently have a certification program for assay of SWBs, LANL and RFETS are working jointly with WIPP and certification programs at other DOE sites to both define the criteria and certify the system.

A summary of the final technologies selected for the modified ASTD Deployment plan is as follows:

- DISPIM™ -- In-situ radiological characterization of contaminated equipment.
- Enhanced mechanical cutting tools.
- A mobile WIPP certified standard waste box assay system.

3-D IMAGING DECOMMISSIONING IN-SITU PLUTONIUM INVENTORY MONITOR (DISPIM™) SYSTEM

System Description

The DISPIM™ system is an *in-situ* glovebox and vessel assay and imaging tool. It was designed for the assaying of gloveboxes, process vessels, and equipment having a wide variety of shapes, sizes, and orientations. It was developed by BNFL Instruments and is being used at the BNFL plc, Sellafield site and at other European nuclear facilities. The DISPIM™ is a modular passive neutron coincidence counting system which is especially suitable for use at the Site as it will overcome the following specific challenges, some of which cannot be resolved by the baseline methods (gamma based assays) currently employed at RFETS.

Systems that contain plutonium embedded in heavy machinery will be accurately monitored due to the penetrating nature of spontaneous fission neutrons from plutonium. The high neutron background interference existing at RFETS is minimized by the coincidence counting technique.

High dose-rate gloveboxes, which require supplementary lead shielding, can be accurately measured without the requirement to remove this shielding. Both in-box machinery and lead shielding present an increasing problem for plutonium assay by gamma measurements as the most useful emissions are quickly absorbed by these materials. A potential therefore exists to significantly underestimate the residual plutonium content by any gamma-based assay. The effect of 'self shielding' is most problematic for gamma-based assay systems, especially when they are used to quantify the mass of plutonium metal concentrations.

The DISPIM™ system will primarily be a work planning and decision tool. The system along with the 3-dimensional imaging is capable of accurately locating plutonium concentration within gloveboxes and process vessels, thereby enabling operators to target appropriate locations within the glovebox for TRU and low level segregation during size reduction. The paybacks will be in timesavings, ALARA and reduced TRU waste volume.

The Imaging DISPIM™ system consists of 24 individual neutron counting modules arranged into six deployment assemblies (with four counting modules per assembly, Figure 1) and one Hyper Pure Germanium (HPGe) High Resolution Gamma Spectrometry (HRGS) detector mounted on its own deployment mechanism. The *in-situ* assay is carried out by deploying the counting assemblies around each glovebox (or process vessel) of interest and collecting and analyzing neutron and gamma counting data.



Figure 1
DISPIM™ Deployment Assembly

The deployment assemblies were designed to allow the DISPIM™ modules to be easily positioned in their optimum assay configuration by a single operator. The deployment mechanism is flexible enough for use in confined spaces.

Each DISPIM™ counting module is comprised of two ^3He neutron detectors mounted inside a rectangular polyethylene moderating block covered with a 0.5mm layer of cadmium. This assembly is clad in a brushed stainless steel case and sealed to prevent contamination ingress and to enable easy decontamination of external surfaces. The modules' dimensions are approximately 200 mm wide x 125 mm deep x 800 mm high

and weigh approximately 20 kgs. There is 10.2 cm of polyethylene shielding behind the ^3He neutron detectors. The polyethylene shielding is wrapped in stainless steel for fire protection.

Each DISPIM™ module has its own amplifier, which is enclosed within the outer casing of the module. This allows the connection between each counting assembly and the mobile DISPIM™ workstation to be made by a single cable.

The HPGe detector is rigidly mounted on a deployment mechanism, which allows it to be accurately positioned for analysis of individual activity hotspots. The deployment system allows vertical adjustment of the detector once it has been positioned at the glovebox. A lead collimator with various sizes of aperture is used to ensure that HRGS measurements are not affected by background radiation from other parts of the plant. The HPGe detector is also connected to the mobile DISPIM™ workstation.

The DISPIM™ system is controlled from a mobile DISPIM™ workstation, which may be sited remotely from the glovebox being measured. The workstation is fitted with wheels which allow it to be moved easily, but be stable when in use.

Detectors

The neutron detectors are ^3He gas filled proportional counters with a 50 cm active length. The selected detectors are known to have high reliability following extensive operational experience.

The HRGS detector has a 30-liter liquid nitrogen Dewar. A combined liquid nitrogen Filling port and level detection device is incorporated. This sensor indicates when the liquid nitrogen level is low and requires refilling. The HRGS detector is RFI (Radio Frequency Interference) screened and protected against microphonic pick-up, to ensure reliable operation in the plant environment.

Data Analysis

The output from each of the neutron counting modules is fed into separate total neutron counting channels and into a system neutron coincidence counting channel. Also the summed output from each group of four modules (comprising a neutron counting assembly), is fed into separate neutron coincidence counting channels. The neutron counting data is analyzed in terms of a distribution of discrete spontaneous fission activity values (or $^{240}\text{Pu}_{\text{eg}}$ mass values) and 3-dimensional position information (activity hotspot and location data).

The output from the HPGe HRGS detector is recorded in a multi-channel spectrum format and analyzed by the MGA (Multi Group Analyzer) plutonium isotopic analysis software for the relative abundance of each major plutonium isotope and ^{241}Am . This data may be recorded for each activity hotspot.

The neutron and HRGS measurement results are combined by the DISPIM™ system to determine total plutonium mass values for each activity hotspot and for the glovebox as a

whole. Uncertainty values for each activity and hotspot location will also be determined and reported.

System Operation

The system is operated as two discrete sub-systems: the Neutron Coincidence Counting system and the HRGS system. Results obtained from either/both of these sub-systems are saved on hard disk immediately after successful completion of the assay, along with a unique identification number or code supplied by the operator. Saved results from the two sub-systems for the same glovebox can be recalled and combined by the system software at any subsequent time to determine fissile content of the glovebox. The operator may also choose to perform simultaneous measurements of HRGS and Neutron Coincidence Counting on different gloveboxes. The operator is led through the operating procedures of both sub-systems by Windows NT based, menu driven software.

Performance

The Imaging DISPIM™ system with 24 modules is capable of the following performance:

Limit of detection:	1 gram Pu
Pu mass range:	1 gram Pu to 10 kilograms Pu
Combined (random and systematic) standard uncertainty on Pu content:	$\pm 29\%$ (1 standard deviation (sd) for 1 gram Pu) $\pm 10\%$ (1 sd for 10 grams Pu) $\pm 6\%$ (1 sd for 100 grams Pu)
Combined (random and systematic) standard uncertainty on source location:	± 10 cm (1 sd for 10 grams Pu) ± 6 cm (1 sd for 100 grams Pu)

1. These values are achievable with 24 modules positioned around a reference glovebox of dimensions 53.5 x 32.3 x 45.7 inches (L x W x H).
2. Good access of about a 1 meter is required around all four sides of the glovebox to achieve this performance. If less than four sides are available then reduced performance is anticipated. In the case of very poor access the imaging results will not be available however, the Pu mass results will still be available.
3. In all cases the values are for the measurements of a single mass of weapons grade PuO₂ at the geometric center of the box with neutron count time of 8 hours.
4. HRGS performance is strongly dependent on the matrices present and therefore HRGS uncertainty contributions are not included in the combined standard uncertainties quoted above.
5. The performance values above are applicable only in a low background environment. As the neutron background increases, the performance gradually degrades.
6. At high plutonium masses (> 100 grams) and concentrations, neutron multiplication effects may cause the DISPIM™ system to overestimate the plutonium mass content. This systematic error is not determined by the system, but when present always results in a safe overestimate of the Pu mass.

DISPIM™ Deployment at RFETS

In September 1998, the DISPIM™ was deployed in Buildings 788 and 771. The DISPIM™ System was used to assay three items; 1) a glovebox (J-40) formerly used in a plutonium foundry operation now stored in a carpenter crate in Building 788, 2) a plutonium/uranium aqueous processing glovebox (SR-14) in Building 771, and 3) a

raschig ring filled tank (705) in Building 771. Each item was selected to evaluate the strength and weaknesses of the DISPIM™ System.

Overall it took approximately four months from the initial submittal of the purchase requisition until the DISPIM™ System was delivered to Rocky Flats. The Security Plan and the Criticality Evaluation were the two longest lead items. BNFL Instrument's Subject Matter Expert for the DISPIM™ System was a United Kingdom citizen from their Sellafield facility. The use of a foreign national during the deployment required that a Security Plan be implemented. In addition the DISPIM™ System was deployed inside Building 771's Material Accountability Area. Overall the addressing of these and other security factors required approximately three months to complete.

The Criticality Evaluation for the deployment of the DISPIM™ System identified three criticality safety issues associated with the application of the DISPIM™ System within Buildings 788 and 771. These were:

- Assembling additional reflecting material outside a glovebox or around equipment and tanks to increase neutron multiplication (each DISPIM™ assembly has 10.2 cm of polyethylene shielding behind each module).
- Impact of the additional shielding material on criticality detector responses.
- Introduction of a californium 252 (^{252}Cf) source into a plutonium processing building.

The impact of the additional shielding material (10.2 cm of polyethylene) introduced by the DISPIM™ System needed to be considered for each separate application. Two cases were evaluated: 1) a criticality in the glovebox being measured, and 2) the DISPIM™ providing shielding between the criticality and the criticality accident alarm system detector (CAAS). The results from the evaluation indicated that if a criticality were to occur inside an item being counted by the DISPIM™ System, the effect would be a lower neutron flux as seen by the CAAS. However the neutron flux would still exceed the minimum required to set off the criticality detector by a factor of 10. In the second scenario, it is possible that a criticality could occur in any location of a Building. If the DISPIM™ System happened to be between the criticality and the criticality detector, then the flux might be reduced by 10%. This would not be a problem in a majority of the areas, but there are a few locations at the Site where the CAAS coverage is not adequate. In these areas, deployment of the DISPIM™ System would have to be reviewed by Criticality Engineering.

For the third scenario, the use of the ^{252}Cf source will have no impact on the criticality of sub-critical systems in the building. However, care should be exercised while moving the source near the criticality detector; it could activate the detector.

BNFL Instruments was required to present the following information at the completion of the contract:

- Total plutonium holdup
- Location of plutonium holdup and amount of plutonium present
- Isotopic composition of radioactive materials
- Lowest level of detection based on background radiation

They met this obligation in all areas except for isotopic composition. The DISPIM™ System delivered to the Site included a High Resolution Gamma Spectrometer (HRGS) for isotopic analysis. The HRGS electronics module's signal cable was damaged during shipment. The first replacement cable was too short and the second one arrived too late during the deployment to be tested. At their cost, BNFL Instruments later repaired/replaced the damaged equipment. The HRGS was tested in December on known standards and performed satisfactory.

As part of the deployment, the following data was collected:

- Ease of transport, setup and disassembly of system
- Readability of output data (Data Interpretation)
- Minimum spacing required to insert DISPIM modules between gloveboxes/tank
- Qualitative identification of instruments range of application
- Maximum background radiation and its effect on imaging
- Count times

The DISPIM™ System consists of six assemblies holding 24 He³ detector modules. The assemblies measure 0.9 m deep by 0.8 m wide by 1.7 m tall. The assemblies weigh between 230 to 270 kgs each. The computer and electronics are divided between two electronic cabinets. The cabinet containing the computer monitor, keyboard and printer is approximately 0.8 m square by 1.5 m tall. The main electronics cabinet, which contains the HRGS module, computer, and data acquisition system, is 0.8 m wide by 0.9 m deep by 1.8 m tall. The assembly that holds the germanium detector and 30 liter nitrogen Dewar is the same as the ones for the He³ detector modules. The germanium detector is attached to the Dewar. BNFL Instruments personnel recommended that the germanium detector and Dewar be shipped from building to building inside the supplied shipping box. All of the assemblies and electronic cabinets are on wheels that can be swiveled 360° degrees or locked in place. Two operators can easily roll the equipment from room to room through standard doors. A minimum two-ton flat bed truck is needed to transport the equipment. The equipment was not designed to be lifted by a fork truck.

The DISPIM™ System's output data is easy to read and understand. The System presents the data in two formats; Non-Imaging and Imaging. The plutonium results are first presented in Pu²⁴⁰ Mass for the whole item and then for each hotspot. The user has the option of inputting the isotopic data or using the data generated by the HRGS. Different isotopics can be input for the whole item and each individual hotspot. For this deployment we used aged weapons grade plutonium isotopics. In addition, the system

prints out a three dimension drawing of the assembly layout around the item being counted. The raw data output, however, is not suitable for direct release to the average user.

A minimum of ninety to ninety seven centimeters of clearance is needed around the glovebox to allow proper placement of the DISPIM™ assemblies. The ideal placement of the DISPIM™ assemblies is on all four sides of the glovebox, but imaging can still be performed in some cases when assemblies are on just two sides. The DISPIM™ System can be used with proper clearance on a majority of RFETS gloveboxes. The electronics cabinet can be easily placed up to three meters away from the last assembly. The cabinet holding the monitor, keyboard, and printer can be located up to 30 meters from the electronics cabinet. This allows the operators to control the equipment from a lower radiation area if required.

The effect of background radiation was noticed on the aqueous processing glovebox SR-14 and the carpenter crate containing glovebox J-40. In both cases the DISPIM™ System saw the special nuclear material that was near by, but it did not affect the overall assay of the item. For example, a filter housing containing gram quantities of plutonium on the north end of J-40 was spotted by the System while it was counting the south end. For glovebox SR-14 there were two drums containing greater than 200 grams of plutonium near the west end. This skewed the assay of the hotspot in SR-14, but the system accurately identified the location of the hotspot and the overall assay was within the range of the previous Safeguards Measurements assay.

The count times for the DISPIM™ System are user defined. The user can define count times as low as two hours to as high as sixteen hours. The count times are dependent on the amount of plutonium that is present. For example, if the user believes that there is significant plutonium holdup then a count time of two hours is sufficient. If the user suspects that the item has less than 10 grams of plutonium then an overnight count of four to eight hours may be necessary. During the deployment we were able to perform the first count on J-40 during the day and the second count that evening.

The *in-situ* characterization of plutonium contaminated equipment is a key task in building deactivation and downstream D&D. The deployment allowed RFETS personnel to evaluate how well the system would perform in our environment. The deployment was successful in many areas. The first being the identification of all of the requirements the DISPIM™ System would have to meet prior to full scale operation. This will dramatically reduce the time necessary to deploy the System in the other plutonium buildings. Secondly the DISPIM™ System provided a second method for determining plutonium holdup in gloveboxes, tanks, and process equipment. Overall the equipment is relatively easy to transport, set-up, and operate. The design is clean and has good fit and finish.

The DISPIM™ System will be able to provide support to RFETS in two areas:

- *In-situ* plutonium hold-up measurement on gloveboxes, tanks, and process equipment
- *In-situ* plutonium measurements of orphan, in-process and oversized waste crates

In conclusion, the DISPIM™ System met the contract defined expectations and was purchased for use at RFETS. The training and qualification of the operators in the Tank Surveillance Group will be completed by the end of January. After this the DISPIM™ System will be ready for use by RFETS personnel.

ENHANCED MECHANICAL CUTTING TOOLS

During the cleanup and closure of the Rocky Flats Environmental Technology Site, personnel will be required to size reduce almost a thousand gloveboxes, five hundred tanks, thousands of feet of contaminated exhaust ducts and miles of process piping. Each item must be adequately size reduced to allow disposal in either a 55-gallon drum, low level waste crate, or standard waste box. At this time the Site is using commercially available mechanical cutting tools such as reciprocating saws, band saws and electric power nibblers. The fastest of these tools is the nibbler, which can cut up 7 cm per minute in 0.47 cm thick stainless steel. These tools, however, were not designed for use on radioactively contaminated equipment or by operators wearing personal protective equipment (PPE). Therefore, the RFETS ASTD Program will be continually looking for more efficient, faster and better ergonomically designed cutting tools.

A large proportion of the plutonium contaminated equipment at RFETS will be size reduced in temporary size reduction facilities located in the buildings undergoing D&D. The average labor and PPE costs to operate these size reduction facilities ranges from \$3,000 to \$6,000 per shift depending on whether the operators are in anti-contamination clothing and full face respirators or in supplied air suits. Each supplied air suit costs an average of \$300 and is a single use garment. Six supplied air suits are generally used per shift. In addition supplied air operations require additional support personnel. Typically, it takes anywhere from two to four shifts to size reduce an RFETS glovebox. The glovebox walls range in thickness from 0.4 to 0.7 cm. The floors can vary from 0.7 to 2.5 cm in some cases. Any improvements in cutting speed, relaxation of PPE requirements, or methods to minimize size reduction can result in significant cost savings.

Crimper/Cutter

The crimper/cutter is a modified version of the “jaws of life.” The crimper/cutter tool is being purchased from AMKUS Rescue Systems. This hydraulically powered tool will be used to size reduce piping by first making a flat crimp in a section of the pipe (Figure 2) and then cutting through the flattened section. This crimping action effectively seals the ends of the pipe, thus minimizing the potential spread of contamination during the cutting operation.

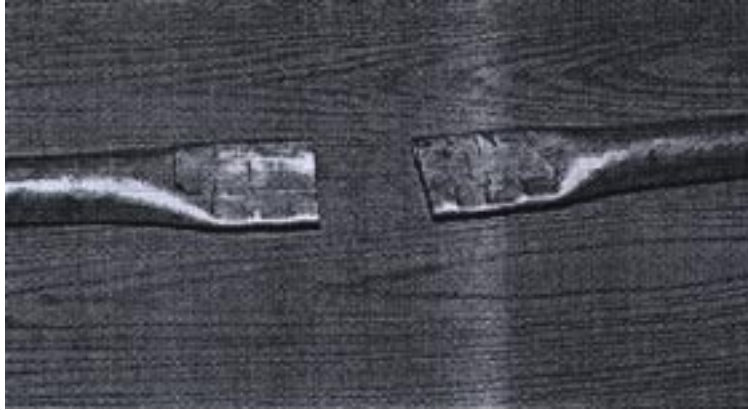


Figure 2
Crimped and Cut Pipe

The crimp and cut tool is slated to be deployed in the RFETS Building 771 Tap and Drain Program. The objective of the Tap and Drain Program is to drain the remaining liquid in the plutonium process lines in Building 771. It is estimated that there is a 1000 liters of plutonium bearing solutions still in the Building's process piping. The tap and drain operation consists of tapping into the low point section of a pipe run and draining the solution. While the scaffolding is in place the pipe will then be stripped out prior to moving to the next area.

To strip out the pipe, operators first install a glovebag or sleeve around the section that will be cut. To use a glovebag the operator first pressure tests it in a radioactively cold area to insure there are no holes, split seams or weak areas in the bag. If there are any problems the glovebag is either repaired or rejected. The next step is to install the glovebag around the pipe. Generally the operators support the glovebag by either strapping it to adjacent objects or constructing a support frame to prevent the glovebag from collapsing under a negative pressure. The pipe will be held under a negative pressure during the cutting operation. Prior to sealing the glovebag or sleeve around the pipe, any tools that will be used will be placed inside the glovebag or sleeve (i.e. reciprocating saw, tube/pipe cutter, tape, etc). Once everything is set up, the glovebag/sleeve is again inspected. As before, any holes, cuts, etc that are discovered are repaired. The cutting operation may then begin after this last inspection. The next step is to cut the pipe, separated the two resulting pieces, and then seal the cut ends with tape. The inside of the bag is cleaned by removing all of the tools and extraneous equipment and then decontaminated. The final step is removing the support structure and allowing the glovebag to collapse. The glovebag is bundled together in the center, taped, and cut. This last step is similar to the umbilical cut (or "bag-in or -out" of material and equipment) used routinely on gloveboxes. This entire operation takes between five and ten labor hours. The resulting waste pipe is disposed of into either a 55-gallon drum or a SWB. The 55-gallon drum is the preferred disposal container since the pipe will be loaded vertically with absorbent place at the bottom of the drum to immobilize any residual liquid that drains out of the pipe.

The crimper/cutter is expected to reduce the steps required to cut and removed drained process piping. The crimper/cutter should allow operations to eliminate the inspection, testing and installation of the glovebag/sleeve. The steps identified with using the crimper/cutter are:

- 1) Install a downdraft (or air mover) under the pipe section that will be cut
- 2) Crimp (flatten) approximately 25 cm of the pipe
- 3) Change out the crimper jaws with the cutting head
- 4) Cut the pipe
- 5) Seal the cut ends with tape
- 6) Perform radiological surveys of the area
- 7) Decontaminated the cutting head

Overall the use of the crimper/cutting tool is expected to save from one to three hours of labor per cut. This would result in significant cost savings considering that over 18 thousand feet of process piping is scheduled to be removed from Building 771 under the Tap and Drain Program. The crimper/cutter is scheduled to be delivered in January 1999, with deployment commencing in mid February 1999.

¼" Sheet Cutter

A ¼" sheet cutter is being considered as a possible replacement for conventional nibblers. The Building 779 D&D Program is purchasing this tool for testing. It is hydraulically powered and made by AMKUS Rescue Systems. The tool will be able to cut up to a 5 cm length of 0.6 cm thick plate in one stroke. The tool does not produce small sharp metal particles, as do the nibblers. It is designed so that the item being cut supports its weight, which should result in less operator fatigue. It is expected it to cut at a rate of about 10 cm per minute. Vibration is a problem with the current nibbler; it increases operator fatigue and can cause dry contaminated materials to loosen and become airborne. The sheet cutter is on order and should be delivered in the spring of 1999.

MOBILE WIPP CERTIFIED STANDARD WASTE BOX ASSAY SYSTEM

Waste projections for the 2006 and 2010 RFETS Closure Plans indicated that the generation rates of TRU and LLW would outstrip the Site's current non-destructive assay capabilities. Due to the favorable economics with using the largest waste containers (LLW crate and TRU SWB) available, the Site is striving to ensure that it has the NDA capability to keep up with current and future generation rates of these containers. Failure in this area could cause large container waste assay to become the critical path and delay the closure of the Site. The most conservative rates (2010 Closure Plan) indicate that the Site will need at least two counters (probably three during the peak waste generation years) capable of assaying crates and SWBs. The current counter is certified for both Safeguards and Nevada Test Site (LLW) measurements, however, RFETS NDA personnel do not believe it can meet the more stringent quality, accuracy and precision requirements for WIPP. Since WIPP has not yet developed a certification program for the assay of SWBs, there are no commercial crate/SWB counters available for lease as

there are for drums. Because of this and the favorable economics of using SWBs, the Site has placed a high priority on obtaining a SWB counter that is WIPP certifiable.

In the spring of 1998, RFETS NDA personnel developed a specification for a crate/SWB counter based on WIPP's current quality assurance objectives for drums. The specification included for the RFETS ASTD Program a requirement that the counter be mounted in a trailer. A trailer mounted counter was specified since it would offer the greatest flexibility to the Site as more and more of the Sites buildings are decommissioned. The specification also included the RFETS Safeguards & Accountability measurement requirements for precision and accuracy. For plutonium quantities greater than 10 grams the Safeguards & Accountability measurement requirements for accuracy are more stringent than WIPP's. The logic to base the specification on WIPP's drum program was that they were the only requirements available to follow. Ultimately the precision and accuracy requirements that will be developed for SWBs will not be any more stringent and most likely less stringent since the SWB is seven times larger in volume than the 55-gallon drum.

RFETS ASTD personnel reviewed the NDA equipment that was available from the commercial sector and the Los Alamos National Laboratory. It was discovered that LANL's NDA personnel had made some significant advances in the area of passive neutron coincidence counting. It was felt that Los Alamos's new Super-HENC technology provided a low risk approach to meeting RFETS's performance and schedule requirements for a SWB counter. This conclusion is based on the performance of the existing commercialized High Efficiency Neutron Counter (HENC) drum counter in the Performance Demonstration Program (PDP) and on the published results of matrix correction improvements for the Super-HENC physics package. The present HENC drum system has participated in and passed cycles 2, 3, and 4 of the PDP and was the best instrument (lowest error) in cycles 2 and 3.

In July 1998, K-H under the RFETS ASTD Program issued an Interoffice Work Order (IWO) to LANL to design, fabricated, WIPP certify, and deploy at RFETS a Mobile SWB Counter. The Counter shall be capable of meeting the WIPP and RFETS Safeguards and Accountability accuracy and precision requirements for the following waste forms: light metal waste, lead waste, dry combustibles, wet combustibles, plastic, and non-borated glass, containing 0.05-320 g. plutonium. The waste forms are expected to have a nominal density range of 0.040 g/cc to 1.20 g/cc and contain nominally 90% of the listed matrix with 10% impurity. Typically the waste will be heterogeneous with void space and will contain discrete items exceeding the nominal density range. Los Alamos expects the Super-HENC to have a 35 mg. of plutonium lower level of detection.

At this time LANL personnel have completed the design for the Mobile SWB Counter (Figure 3). The Counter will be mounted in a 12 to 15 meter long low boy trailer. The trailer will be industry standard height and width so that it can be easily moved from site to site. The trailer will have a draw bridge type dock mounted on the side to allow loading and unloading of the SWB into the counter. A load cell (scale) will be integrated

into the dock. The load cell will measure the weight of the SWB prior to assay. The counter chamber will have high efficiency ^3He detector tubes arranged in a fully encircling (4π) geometry. The system will not have Gamma isotopic measurement capability. The assay system shall be capable of a throughput of no less than 1 SWB per half-hour on the average (The assay time is from start of assay to finish of assay and does not include loading or unloading operations.).

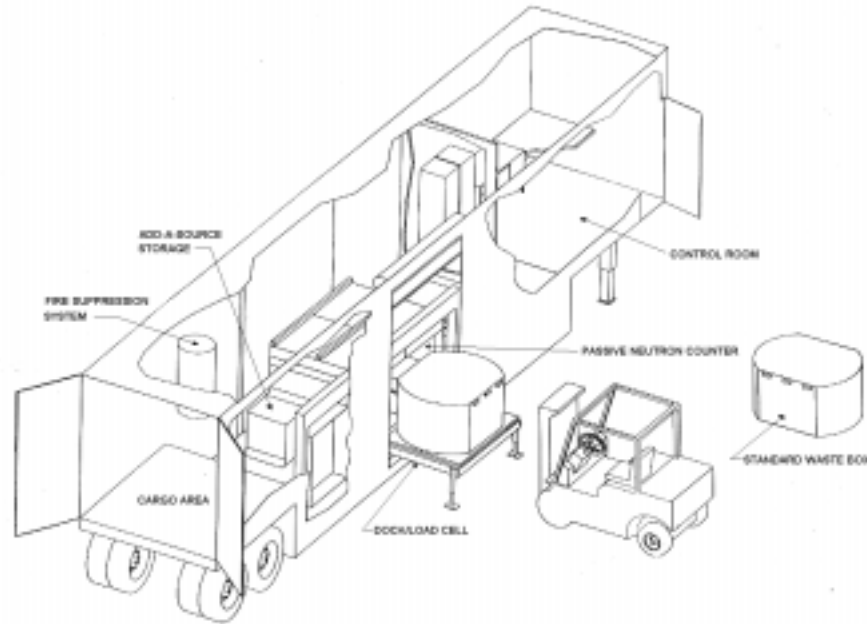


Figure 3
Mobile SWB Counter

The RFETS ASTD Program is supplying \$1.5 million with Site leverage funding of up to \$1.7 million. The Mobile SWB Counter is schedule to be delivered to RFETS in February 2000. Fabrication should be completed by September 1999 with WIPP certification at LANL completed by December 1999.

CONCLUSION

The EM-50 ASTD Program has provided RFETS with funding to implement demonstrated and proven technologies. The Site has selected technologies in the areas of in-situ radiological characterization, size reduction, and non-destructive assay. The RFETS 1998 ASTD program selected the following technologies:

- Decommissioning In-Situ Plutonium Inventory Monitor (DISPIM™)
- Enhanced cutting tools.
- A mobile WIPP certified standard waste box assay system.

The DISPIM™ System is a passive neutron coincidence counter designed to assay plutonium contaminated process equipment (i.e. gloveboxes and tanks) in-situ. The in-

situ characterization of plutonium contaminated equipment is a key task in building deactivation and downstream D&D. The DISPIM™ System was deployed in Buildings 788 and 771 during September 1998. The deployment allowed RFETS personnel to evaluate how well the system would perform in our environment. The deployment was successful. The System has been purchased and NDA operators are currently being trained and qualified to use the system in RFETS buildings undergoing D&D.

Schedule, costs, ALARA, and safety are driving the Site to select and deploy better size reduction tools. Two tools are on order, the crimper/cutter and the ¼ inch sheet cutter. Each has the potential to improve safety and lower D&D costs by speeding up size reduction of process equipment.

To ensure that waste assay does not delay closure, the Site is having Los Alamos design, fabricate, WIPP certify and deploy at Rocky Flats a Mobile TRU SWB Counter. The Counter will be a passive neutron coincidence counter based on LANL's new Super HENC technology. The Counter is being designed to meet WIPP's drum specifications. A mobile Counter was selected because it offers the Site the greatest flexibility in placement as more and more of the Site's buildings are decommissioned. The Counter is scheduled for delivery in February 2000.