Section 2

Best Practices

Test

High Energy Radiography

The Non-destructive Evaluation Laboratory at Mason & Hanger - Pantex has designed a state-of-the-art facility encompassing excellent capabilities in high energy radiography. Several systems are utilized for the evaluation of thick sections of very dense materials such as uranium and tungsten alloys. Future capabilities will enable Pantex to become world-class in non-destructive evaluation of nuclear test items.

There are five linear accelerators in separate operating bays, from 2 MeV to 9 MeV, each with real-time capability. External collimation with laser beam alignment is common to three of these systems. Variable alignment of the beam on stationary objects is obtainable by flexible positioning of an x-ray head with five-axis movement. Precise alignment of the beam greatly enhances resolution of a selective part while minimizing object distortion and reducing radiation scatter (Figure 2-1). Remote operation of the positioning table aids in accurate evaluation of test items.

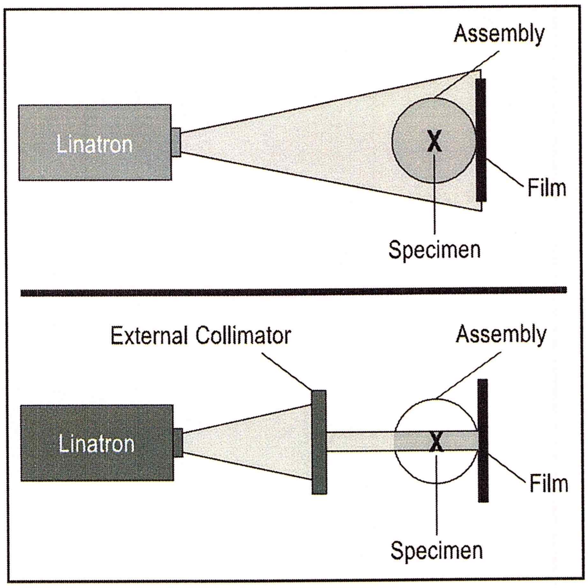

Figure 2-1. Beam Collimation

Pantex has satisfied all local and federal regulations in radiation safety while increasing the safety of its employees by implementing the Rad-Safe System. A closed circuit TV system for remote viewing of test bays combined with remote monitoring of gamma radiation at various locations in and around exclusion areas greatly reduce the possibility of radiation exposure to personnel. The Rad-Safe System has microprocessor-controlled functions for current sensing on warning devices. If failure occurs, the machine becomes inoperable. Personnel verify the Rad-Safe System prior to every shift by simulation of system failures.

Both personnel qualification and quality control requirements exceed industry standards. Density measurements of inspected items are maintained at a density reading of 2.4, with a tolerance of +.4. Training requirements in radiation-specific areas are in excess of 460 hours, given on a biannual basis.

In pursuit of its goal of world-class recognition, Pantex recently added a 9 MeV Computer Tomography System. Upon approval from regulating agencies, Pantex will have an unparalleled high-resolution capability for nuclear test items.

Laser Sampling

Mason & Hanger - Pantex uses an exceptionally sophisticated laser sampling technique to certify the correct gas fill for pits (spheres of plutonium hermetically sealed in metallic shells that comprise the cores of nuclear weapons) manufactured off site. It is also used to characterize the aging effects in the pits to determine any radiolytic decomposition. It is critical to collect enough volume to be analyzed, yet small enough so as not to deviate the existing fill from specifications. This must also be done without degrading the hermetic integrity of the component and without exposing personnel to any radioactive contamination.

In use since 1983, the technique uses a highly-focused and collimated infrared laser beam. Laser pulses are transmitted through an optical window to drill a 0.1 mm diameter hole in the stainless steel pit tube with a wall thickness of 0.7 mm A small (10cc) gas sample is collected and sent to the Gas Analysis Laboratory for examination. Drilling of the pit tube by the laser is accomplished in a completely enclosed cabinet to protect the operator from exposure to any radiation or laser hazards. By using enclosures and tooling designed and built in-house, gas samples are extracted through a sealed manifold system under vacuum conditions. The tube is then resealed by welding the drilled hole closed using the same laser (Figure 2-2). Each component is leak-checked prior to and after the laser sampling. A simulation coupon is processed

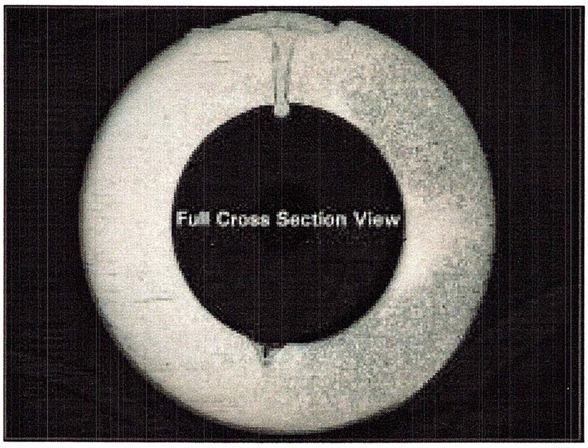

Figure 2-2. Tube Weld

using the laser before and after each day's operation. These dummy tubes are manufactured to component material specifications and are sectioned and photomicrographed by the Metallurgy Laboratory to monitor the laser weld performance. All welds undergo a microfocus radiography to measure the fill depth and quality of the weld.

Laser sampling has proven to be an effective method for analyzing high hazard contents housed within high-value sealed containers. This application has provided minimal exposure to personnel, and is planned for expansion to include evaluation of other containers and components for various chemical analysis. It may also be used to support the disposal of highly hazardous military chemicals.

Mass Spectrometry

Mason & Hanger - Pantex has successfully integrated a research instrument into a production facility environment. By using a mass spectrometer, Pantex can accomplish analysis in nearly half the optimum turnaround time. Pantex provides outstanding precision customer response with its capability to analyze 10 samples per day with excellent quality control. Extensive training and stringent quality requirements are critical components to Pantex's rapid response time.

Training for technicians includes qualification on all different spectrometer types at the plant. Technicians must pass both a thorough written test and an extensive operational evaluation for each type of mass spectrometer, and technicians are requalified every two years with an operational evaluation on each type. This training ensures readiness in the production process and expedites the analysis.

Each machine is calibrated daily with a pure gas standard of nitrogen and weekly with pure gas standards of CO_2, argon, CO, and O_2. The machines receive calibration bi-weekly and monthly for other gases and special calibrations are run only as needed. For quality control, a certified primary quality control premix is analyzed prior to sample analysis. These premixes are similar to samples being analyzed to reduce uncertainties, and are also analyzed after the completion of sample analysis to ensure accuracies.

Pantex's ability to accomplish research precision and quality analysis in a production facility environment places it among the best in mass spectrometry analysis. This is accomplished through its rigorous quality assurance program and exhaustive qualification of technicians.

Production

Cycle Time Reduction

Mason & Hanger - Pantex's Seven-Step Process Improvement Method redefines cycle time reduction by devising a method that structures the process for analysis. By defining the process boundaries and scrutinizing the different internal processes to reduce their duration, the Seven-Step process has been proven to be effective in reducing the overall cycle time. This simple method is applicable to a variety of processes from business and administrative practices to manufacturing-related areas.

The first step, **defining process boundaries**, includes determining what constitutes the beginning, end, inputs, and outputs of the process. Through initial familiarization of the process, measurement metrics can then be determined. This step is followed by **observing the process**. Every process step is recorded and the flow is detailed to include intermediate steps. Process steps are also categorized for ease of observation (Figure 2-3). At this point, **process metrics are collected**. Each step of the process is timed, including transition from one subprocess to another subprocess. **Collected data is then analyzed**, and the cost of individual steps as well as the total process cost are then determined. It is then easy to **identify improvement**

#	STEP DESCRIPTION	FLOW	TIME (MIN)	RESOURCES	NOTES
1	Component A Assembled	○	15	1	
2	Transferred on Conveyor	⇨	5		
3	Component A Attached To B	○	20	1	
4	Transferred on Conveyor	⇨	5		
5	Waiting for Quality Inspection	D	300		
6	Assembled Components Inspected	□	10	1	

Figure 2-3. Process Analysis Worksheet