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NONDESTRUCTIVE EXAMINATION DEVELOPMENT AND DEMONSTRATION PLAN

1.0 INTRODUCTION

Nondestructive examination (NDE) of waste matrices using penetrating radiation is by nature very subjective. Two candidate systems of examination have been identified for use in WRAP 1 (see reference 1).

2.0 SCOPE

The scope of this plan is to quantify the subjectiveness and the efficiency of both fluoroscopic examination and digital radiography using offsite vendors and a certified Level II or III radiographer, the eventual system operators of the equipment, to interpret the images of various simulated drummed waste/matrices.

2.1 OBJECTIVES

The objectives of this demonstration (test) are:

- Provide drums of surrogate waste to be examined in the Hanford "TRUSAF" fluoroscopic examination facility and then send these same drums to contracted potential suppliers of NDE equipment. These drums will represent the approximate density and complexity of waste matrices which might be encountered in WRAP 1.
- Provide a realistic comparison of the advantages and/or disadvantages of using fluoroscopic examination of various imaging types and digital radiography with either differential energy adsorption and/or backscatter imaging enhancement.
- Particular emphasis is to be placed on image acquisition time, image clarity, feature definition, accuracy and ease of operator interpretation and system/operator ability to identify and differentiate free liquids in drums, free residual liquids in large (1 liter) and small containers (aerosol cans), apparent attempts to mask (camouflage) materials such as free liquids and powders.
- Provide some indication as to the physical state of various sized powders and granular material.

2.2 DELIVERABLES

The deliverable for this plan will be a report documenting the results of the tests performed which may include videotapes, hard-copy prints,

photographs and computer discs. It is anticipated that this report will provide test data to support decisions on NDE equipment concept selection for WRAP Module 1.

3.0 DESCRIPTION

3.1 PHYSICAL DESCRIPTION

The purpose of the surrogate waste test drums will be to evaluate the advantages and disadvantages of various imaging technologies, as compared to the current "TRUSAF" real time, fluoroscopic system. The Westinghouse Hanford Company (WHC) NDE Service Organization and Engineering Testing will assemble the test drums in such a manner that will provide the opportunity to rigorously test the imaging system. Three 55-gallon drums of surrogate waste will be prepared. The containers may be either DOT 17C (16 gage) or 17H (18 gage). One "overpack" container will be acquired. After the final drum contents are determined, a detailed inventory of the drum and detailed sketches will be prepared as shown in Attachment 1. Examination checksheets will be prepared, similar to those described in Attachment 2. The NDE Service Organization will evaluate and compare the testing results to the existing TRUSAF system capabilities and submit a report to Solid Waste Systems Engineering listing the advantages and disadvantages of the various imaging systems as they compare to "TRUSAF" type examination.

4.0 ORGANIZATION

Solid Waste Systems Engineering (23110) will have overall cognizant responsibility, will prepare the general test plan and assemble the data and prepare the final report with direct input from the NDE Service Organization.

Engineering Testing (25310) and NDE Service Organization (25350) will prepare and assemble the three test drums and prepare the appropriate drums for shipment to vendors as needed. Engineering testing will also receive the drums from vendors for reassembly as needed, including preparation of the offsite property control forms. Engineering testing will also review the inventory contents to assure that hazardous materials are not used to assemble the surrogate waste matrices which complicate ultimate disposal when testing is completed.

The NDE Service Organization will review the material content list for the drums in such a manner as to evaluate the advantages and disadvantages of fluoroscopic examination and digital x-ray examination. This content list is included as Attachment 1. The NDE Service Organization will prepare a report outlining advantages, disadvantages, and capabilities of the different imaging techniques.

Engineer Application Quality Assurance (38920) will be responsible for approving the test plan and review the final test report upon release.

Engineering/Environment Services Procurement (43520) will be responsible for contacting potential equipment suppliers, and for placement of the vendor contracts.

5.0 COST AND SCHEDULE

See attached cost and schedule.

6.0 QUALITY ASSURANCE

The impact level of these tests is 4.

7.0 REFERENCES

1. WHC-SD-W026-004, "Evaluation of Alternatives for Nondestructive Assay and Examination of Drummed and Boxed Waste in WRAP 1," July 1991.
2. WHC-SD-WM-TP-108, DRAFT, "Real Time Radiography System Qualification Test Plan."
3. WHC-SD-WM-TI-212, Rev 1, "Real Time Radiography Inspection Criteria," September 1988.

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APPENDIX

TEST DRUM PREPARATION

Initially, all liquid and powder samples shall be placed in a 1 ounce polypropylene container. Other containers may be used to test any special condition provided it is documented in Figure 1 and the appropriate table.

There shall be a minimum of three powder samples: one empty bottle; one bottle half-full of 10 micron size powder; and one bottle half-full of 200 micron size powder. Any additional samples may be added provided it is documented in Table 3. Place the samples near the center of the drum in any configuration convenient for viewing. Document the final drum configuration in Figure 1.

There shall be a minimum of five liquid samples: one bottle completely full; one bottle half full of liquid; one bottle one-quarter full; one bottle of absorbed liquids; and one bottle with free liquid above the absorbent material. Any additional samples may be added provided it is documented. Place the samples near the center of the drum in any configuration convenient for viewing. Document the final drum configuration in Figure 1.

Place a plastic bag with liquid inside, between the plastic drum liner and the drum wall. Document the final drum configuration in Figure 1 and list results in Table 2.

There shall be a minimum of 4 aerosol spray cans: one empty; one half-full; one completely full; and one that has been properly vented. There shall be a minimum of one full fire extinguisher. Any additional samples may be added provided it is documented in Table 3. Place the samples in the drum in any configuration convenient for viewing (placement location is not important). Document the final drum configuration in Figure 1.

There shall be a plastic bag containing spent rifle cartridges. Place the samples in the drum in any configuration convenient for viewing (placement location is not important). Document the final drum configuration in Figure 1.

Miscellaneous items such as a HEPA filter; small pump with liquid inside; gloveboxes, both lead lined and standard types; sharp or pointed objects (scissors and knives); and a used 1 gallon paint can shall be placed within a drum and examined by the RTR. Any other appropriate samples may be added at the discretion of the RTR operator.

Included in this Appendix are the following:

- Figure 1. Actual Test Drum Sample Configuration
- Table 1. Powder Samples
- Table 2. Liquid Samples
- Table 3. Pressurized Samples
- Table 4. Explosives and Miscellaneous Items

Figure 1. Actual Test Drum Sample Configuration.

Drum # _____

Side View

Aerial View

NDE Level II Radiographer

Date

Reviewed by: NDE Level III Radiographer

Date

Table 1. Powder Samples		
Powder Samples	Examination Results	Y/N Initial
Empty bottle 1 ounce polypropylene	Is the empty container visible? Comments:	
10 micron sample 1/2 full	Is the sample visible? Comments:	
200 micron sample 1/2 full	Is the sample visible? Is there a difference in density between the powder samples? Comments:	
List Additional Samples:		
Additional Comments:		
NDE Level II Radiographer:		
Reviewed by: NDE Level III Radiographer:		

Table 2. Liquid Samples		
Samples	Examination Results	Y/N Initial
Bottle completely full of liquid	<p>Is there a discernable difference between an empty bottle and one completely full of liquid (see empty bottle in the powder sample)?</p> <p>Is a wave action present when the drum is rotated?</p> <p>Comments:</p>	
Bottle 1/2 full of liquid	<p>Is there a discernable difference between an empty bottle and one half full of liquid (see empty bottle in the powder samples)?</p> <p>Is a wave action present when the drum is rotated?</p> <p>Comments:</p>	
Bottle 1/4 full of liquid	<p>Is the liquid visible? Is a wave action present when the drum is rotated?</p> <p>Comments:</p>	
Bottle of absorbed liquid	<p>Is the absorbed liquid visible? Is there a discernable density difference between free liquid and absorbed liquid?</p> <p>Comments:</p>	
Bottle of free liquid above the absorbent material	<p>Is there a discernable difference between this bottle and the bottle of absorbed liquid?</p> <p>Is a wave action present when the drum is rotated?</p> <p>Comments:</p>	
Free Liquid between the drum liner and wall	<p>Is the liquid between the drum liner and wall discernable?</p> <p>Is a wave action present when the drum is rotated?</p> <p>Comments:</p>	
List Additional Samples:		
Additional Comments:		
NDE Level II Radiographer:		
Reviewed by: NDE Level III Radiographer:		

Table 3. Pressurized Samples		
Pressurized Samples	Examination Results	Y/N Initial
Empty aerosol spray can	Is the image identifiable as an aerosol spray can? Comments:	
One-half full aerosol spray can	Is there a discernable difference between an empty spray can and one 1/2 full? Is there a wave action present when the drum is rotated? Comments:	
Completely full aerosol spray can	Is there a discernable difference between an empty spray can, a half full one, and one that is completely full? Is there a wave action present when the drum is rotated? Comments:	
Properly vented aerosol spray can	Is there a discernable difference between an empty spray can and another that has been properly vented? Comments:	
Fire extinguisher (full)	Are the chemicals inside the fire extinguisher discernable? Comments:	
List Additional Samples:		
Additional Comments:		
NDE Level II Radiographer:		
Reviewed by: NDE Level III Radiographer:		

Table 4. Explosives and Miscellaneous Items		
Samples	Examination Results	Y/N Initial
Spent rifle cartridges	Are cartridges discernable? Comments:	
HEPA filter	Is filter frame discernable? Is filter element discernable? Comments:	
Small pump with free liquid inside	Is the pump identifiable? Is the free liquid visible? Is a wave action present when drum is rotated? Comments:	
Glovebox gloves	Is the image identifiable as gloves?	
One lead lined glove One non-lead lined glove	Is there a density difference between the two types of gloves? Comments:	
Sharp or pointed objects (scissors, knives)	Are the scissors and utility knives identifiable? Comments:	
Used paint can	Is the paint can identifiable? Comments:	
List Additional Samples:		
Additional Comments:		
NDE Level II Radiographer:		
Reviewed by: NDE Level III Radiographer:		