

ATTACHMENT C1
WASTE CHARACTERIZATION TESTING METHODS

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Introduction

The Permittees will require generator/storage sites (**sites**) to use the following testing methods, as applicable, for characterization of transuranic mixed waste, which is managed, stored, or disposed at the WIPP facility. These methods include requirements for radiography or visual examination. Additionally, this Attachment provides quality control requirements.

C1-1 Radiography

Radiography has been developed by the Permittees specifically to aid in the examination and identification of containerized waste. The Permittees shall require that sites describe activities required to achieve the radiography objectives in site Quality Assurance Project Plans (**QAPjPs**) and standard operating procedures (**SOPs**). These SOPs should include instructions specific to the radiography system(s) used at the site. For example, to detect liquids, some systems require the container to be rotated back and forth while other systems require the container to be tilted.

A radiography system (e.g., real time radiography, digital radiography/computed tomography) normally consists of an X-ray-producing device, an imaging system, an enclosure for radiation protection, a waste container handling system, an audio/video recording system, and an operator control and data acquisition station. Although these six components are required, it is expected there will be some variation within a given component between sites. The radiography system shall have controls or an equivalent process which allow the operator to control image quality. On some radiography systems, it should be possible to vary the voltage, typically between 150 to 400 kilovolts, to provide an optimum degree of penetration through the waste. For example, high-density material should be examined with the X-ray device set on the maximum voltage. This ensures maximum penetration through the waste container. Low-density material should be examined at lower voltage settings to improve contrast and image definition. The imaging system typically utilizes either a fluorescent screen and a low-light television camera or x-ray detectors to generate the image.

To perform radiography, the waste container is scanned while the operator views the television screen. A video and audio recording is made of the waste container scan and is maintained as a non-permanent record. A radiography data form is also used to document the Waste Matrix Code to ensure that the waste container contains no ignitable, corrosive, or reactive waste by documenting the absence of liquids in excess of Treatment, Storage, and Disposal Facility Waste Acceptance Criteria (**TSDF-WAC**) limits or compressed gases and verify that the physical form of the waste is consistent with the waste stream description documented in the Acceptable Knowledge (**AK**) Summary. Containers whose contents prevent full examination of the remaining contents shall be subject to visual examination unless the site certifies that visual examination would provide no additional relevant information for that container based on the AK information for the waste stream. Such certification shall be documented in the generator/storage site's record.

1 For containers which contain classified shapes and undergo radiography, the radiography video
2 and audio recording will be considered classified. The radiography data forms will not contain
3 classified information.

4 The radiography system involves qualitative and semiquantitative evaluations of visual displays.
5 Operator training and experience are the most important considerations for ensuring quality
6 controls in regard to the operation of the radiography system and for interpretation and
7 disposition of radiography results. Only trained personnel shall be allowed to operate
8 radiography equipment.

9 Standardized training requirements for radiography operators shall be based upon existing
10 industry standard training requirements.

11 The Permittees shall require each site to develop a training program that provides radiography
12 operators with both formal and on-the-job (**OJT**) training. Radiography operators shall be
13 instructed in the specific waste generating practices, typical packaging configurations, and
14 associated waste material parameters expected to be found in each Waste Matrix Code at the
15 site. The OJT and apprenticeship shall be conducted by an experienced, qualified radiography
16 operator prior to qualification of the training candidate. The training programs will be site-specific
17 due to differences in equipment, waste configurations, and the level of waste characterization
18 efforts. For example, certain sites use digital radiography equipment, which is more sensitive
19 than real-time radiography equipment. In addition, the particular physical forms and packaging
20 configurations at each site will vary; therefore, radiography operators shall be trained on the
21 types of waste that are generated, stored, and/or characterized at that particular site.

22 Although the Permittees shall require each site to develop its own training program, all of the
23 radiography quality-control requirements specified in this WAP shall be incorporated into the
24 training programs and radiography operations. In this way data quality and comparability will not
25 be affected.

26 Radiography training programs will be the subject of the Audit and Surveillance Program (Permit
27 Attachment C6).

28 Training containers (including prohibited items and internal containers of various sizes) common
29 to the waste streams to be characterized and internal containers of various sizes shall be
30 scanned semiannually by each operator. The audio and video media shall then be reviewed by
31 a supervisor to ensure that operators' interpretations remain consistent and accurate. Imaging
32 system characteristics shall be verified on a routine basis.

33 Independent replicate scans and replicate observations of the video output of the radiography
34 process shall be performed under uniform conditions and procedures. Independent replicate
35 scans shall be performed on one waste container per day or once per testing batch, whichever
36 is less frequent, by a qualified radiography operator that was not involved in the original scan of
37 the waste container. Independent observations of one scan (not the replicate scan) shall also be
38 made once per day or once per testing batch, whichever is less frequent, by a qualified
39 radiography operator that was not involved in the original scan of the waste container. A testing
40 batch is a suite of waste containers undergoing radiography using the same testing equipment.
41 A testing batch can be up to 20 waste containers without regard to waste matrix.

1 Oversight functions include periodic audio/video media reviews of accepted waste containers
2 and shall be performed by qualified radiography operators that were not involved in the original
3 scans of the waste containers. The results of this independent verification shall be available to
4 the radiography operators who performed the original scans. The Permittees shall require the
5 site project manager to be responsible for monitoring the quality of the radiography data and
6 calling for corrective action, when necessary.

7 C1-2 Visual Examination

8 The waste container contents may be verified directly by visual examination (**VE**) of the waste
9 container contents. Visual examination may be performed by physically examining the contents
10 of waste containers to verify the Waste Matrix Code and to verify that the container is properly
11 included in the appropriate waste stream. Visual examination shall be conducted on a waste
12 container to identify and describe waste items, packaging materials, and waste material
13 parameters in the waste container. Visual examination activities shall be documented on
14 video/audio media, or by using a second operator to provide additional verification by reviewing
15 the contents of the waste container to ensure correct reporting. When VE is performed using a
16 second operator, each operator performing the VE shall observe for themselves the waste being
17 placed in the waste container or the contents within the examined waste container when waste
18 is not removed. The results of VE shall be documented on VE data forms, which are used to
19 document the Waste Matrix Code, ensure that the waste container contains no ignitable,
20 corrosive, or reactive waste by documenting the absence of liquids in excess of TSDF-WAC
21 limits or compressed gases, and to verify that the physical form of the waste is consistent with
22 the waste stream description documented in the AK Summary.

23 Visual examination recorded on video/audio media shall meet the following minimum
24 requirements:

- 25 • The video/audio media shall record the waste packaging event for the container such
26 that waste items placed into the container are recorded in sufficient detail and shall
27 contain an inventory of waste items in sufficient detail that another trained VE operator
28 can identify the associated waste material parameters
- 29 • The video/audio media shall capture the waste container identification number
- 30 • The personnel loading the waste container shall be identified on the video/audio media
31 or on packaging records traceable to the loading of the waste container
- 32 • The date of loading of the waste container will be recorded on the video/audio media
33 or on packaging records traceable to the loading of the waste container

34 Visual examination performed using two generator/storage site personnel shall meet the
35 following minimum requirements:

- 36 • At least two generator/storage site personnel who witnessed the packaging of the
37 waste shall approve the data forms or packaging records attesting to the contents of
38 the waste container

- 1 • The data forms or packaging records shall contain an inventory of waste items in
2 sufficient detail that another trained VE operator can identify the associated waste
3 material parameters
- 4 • The waste container identification number shall be recorded on the data forms or
5 packaging records

6 Visual examination video/audio media of containers which contain classified shapes shall be
7 considered classified information. Visual examination data forms or packaging records will not
8 contain classified information.

9 Waste container packaging records may be used to meet the VE data quality objectives (**DQOs**)
10 (Permit Attachment C, Section C-4a(1)). These records must meet the minimum requirements
11 listed above for either VE recorded on video/audio media or VE performed by two
12 generator/storage site personnel and shall be reviewed by operators trained and qualified to the
13 requirements listed below. The operators will prepare data forms based on the visual
14 examination records. Visual examination batch data reports will be prepared, reviewed, and
15 approved as described in Permit Attachment C, Section C-4, and Permit Attachment C3.

16 Standardized training for VE shall be developed. Visual examination operators shall be
17 instructed in the specific waste generating processes, typical packaging configurations, and
18 waste material parameters expected to be found in each Waste Matrix Code at the site. The
19 training shall be site specific to include the various waste configurations generated/stored at the
20 site. For example, the particular physical forms and packaging configurations at each site will
21 vary so operators shall be trained to examine the types of waste that are generated, stored,
22 and/or characterized at that particular site. Training will include the following regardless of
23 Summary Category Group:

- 24 • Identifying and describing the contents of a waste container by examining items in
25 waste containers of previously packaged waste
- 26 • Identifying when VE cannot be used to meet the DQOs

27 Visual examination personnel shall be requalified once every two years.

28 Each VE facility shall designate a VE expert. The VE expert shall be familiar with the waste
29 generating processes that have taken place at that site and also be familiar with the types of
30 waste being characterized at that site. The VE expert shall be responsible for the overall
31 direction and implementation of the VE at that facility. The Permittees shall require site QAPjPs
32 to specify the selection, qualification, and training requirements of the VE expert.