

ATTACHMENT C1
WASTE CHARACTERIZATION TESTING METHODS

Waste Isolation Pilot Plant
Hazardous Waste Permit
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1 **ATTACHMENT C1**

2 **WASTE CHARACTERIZATION TESTING METHODS**

3 Introduction

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

8 C1-1 Radiography

9 Radiography has been developed by the Permittees specifically to aid in the examination and
10 identification of containerized waste. The Permittees shall require that sites describe all
11 activities required to achieve the radiography objectives in site QAPjPs and SOPs. These SOPs
12 should include instructions specific to the radiography system(s) used at the site. For example,
13 to detect liquids, some systems require the container to be rotated back and forth while other
14 systems require the container to be tilted.

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

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

39 For containers which contain classified shapes and undergo radiography, the radiography video
40 and audio recording will be considered classified. The radiography data forms will not contain
41 classified information.

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

6 Standardized training requirements for radiography operators shall be based upon existing
7 industry standard training requirements.

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

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

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

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

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

39 Oversight functions include periodic audio/video media reviews of accepted waste containers
40 and shall be performed by qualified radiography operators that were not involved in the original
41 scans of the waste containers. The results of this independent verification shall be available to
42 the radiography operators who performed the original scans. The Permittees shall require the

1 site project manager to be responsible for monitoring the quality of the radiography data and
2 calling for corrective action, when necessary.

3 C1-2 Visual Examination

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

19 Visual examination recorded on video/audio media shall meet the following minimum
20 requirements:

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

30 Visual examination performed using two generator site personnel shall meet the following
31 minimum requirements:

- 32 • At least two generator site personnel who witnessed the packaging of the waste shall
33 approve the data forms or packaging records attesting to the contents of the waste
34 container.
- 35 • The data forms or packaging records shall contain an inventory of waste items in
36 sufficient detail that another trained VE operator can identify the associated waste
37 material parameters.
- 38 • The waste container identification number shall be recorded on the data forms or
39 packaging records.

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

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

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

- 19 • Identifying and describing the contents of a waste container by examining all items in
20 waste containers of previously packaged waste
- 21 • Identifying when VE cannot be used to meet the DQOs

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

23 Each VE facility shall designate a VE expert. The VE expert shall be familiar with the waste
24 generating processes that have taken place at that site and also be familiar with all of the types
25 of waste being characterized at that site. The VE expert shall be responsible for the overall
26 direction and implementation of the VE at that facility. The Permittees shall require site QAPjPs
27 to specify the selection, qualification, and training requirements of the VE expert.