



ENVIRONMENTAL EVALUATION GROUP

ENTERED

AN EQUAL OPPORTUNITY / AFFIRMATIVE ACTION EMPLOYER

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Mr. Steve Zappe
New Mexico Environment Department
Hazardous Waste Bureau
P.O. Box 26110
Santa Fe, NM 87502

Dear Mr. Zappe:

Attached are EEG's comments on DOE's proposed Class 2 modification for use of Digital Radiography/Computed Tomography (DR/CT) in lieu of visual examination (VE).

Sincerely,

Matthew K. Silva
Director

MKS:JKC:pf
Enclosure

cc: Inés Triay, CBFO
Mary Kruger, EPA



010403



EEG Comments on Proposed Class 2 Modification
(Digital Radiography/Computed Tomography)

SUMMARY-COMMENTS

The Radiography and visual examination (VE) requirements in the HWFP are important for both RCRA considerations and for long-term disposal. EEG is supportive of the effort to replace VE if the necessary information can be obtained by other means. EEG believes that Digital Radiography/Computed Tomography (DR/CT) is a powerful tool that should be able to replace the use of VE to confirm the results of radiography. However, the proposed modification does not provide any data with real waste drums to show that DR/CT and VE will give comparable results. These comments are made on the understanding that the modification applies to the use of only DR/CT in place of both RTR radiography and VE (not RTR plus DR/CT). This understanding is not ever stated explicitly in the modification.

Our summary comments mention the one issue considered to be most important. The detailed comments discuss possible problems with replacing VE and provide detailed comments on the proposed modification that need to be considered.

The Key Issue

The relevant quote in the proposed modification that describe the issue of greatest concern to EEG in this Modification is: "This proposed modification allows independent interpretation of DR/CT scans as an alternative to visual examination (VE) as a QC check for radiography." Thus, the proposed modification would eliminate the need for visual examinations.

The elimination of VE would have significant advantages in saving cost and reducing incidental external radiation exposure, and reducing the possibility of radiological contamination from accidents. It is appropriate to try to use advanced technology to minimize or eliminate VE if waste characterization needs can be met otherwise. The most important needs are to confirm the waste matrix code and to determine the waste material parameter weights. We have observed the capabilities of DR/CT in brief demonstrations at conferences and in some written material. The references on the Internet addresses provided in Attachment B were not very helpful. Nevertheless, it appears to be a powerful tool that is capable of performing the tasks proposed in this modification.

One omission in this proposal is a comparison of results between VE and DR/CT with real waste drums. The assumption is made that verification with VE of test drums proves there will be a good correlation with waste drums. This is in contrast to the present requirements for RTR where the independent replicate scan and independent observation and the use of test drums in training is not assumed to provide confirmation of radiography. Reference is made on pages A-9, 10 to an August 1998 DR/CT Technology inter agency evaluation. But no report is referenced or data provided.

Recommendation

Each waste generating site should be required to show that DR/CT gives results similar to those obtained from VE for each Summary Category Group. This could be done during the audit certification process where an initial batch of data that has been characterized by both VE and DR/CT is compared. This could be required in the B6 checklists, perhaps in the item labeled 59A (page A-42) of the proposed modification. A satisfactory comparison of data on one batch should be sufficient for each Summary Category Group at each site.

Detailed Comments

The comments that follow are based on an interpretation of the proposed modification that digital radiography and computed tomography (DR/CT) would be used as a visual examination (VE) technique only when DR/CT was used for radiography. This interpretation can be supported by text from the proposed modification but remains questionable, as the modification request does not use clear language to explain where, and when, the DR/CT scans would be used to replace the hands-on visual examination technique.

The EEG did not review the proposed modifications to the Hazardous Waste Facility Permit (HWFP) Attachment B6 checklists, as these should only mirror proposed alterations of other portions of the WAP text.

Possible Disadvantages of DR/CT as a VE Technique

Use of DR/CT as a VE technique has many obvious advantages, some of which are pointed out in the introduction to the Permittee's proposed modification. A major advantage not stated in the proposal is that VE by DR/CT would significantly reduce the resources needed, resources that could potentially be used to enhance other portions of the waste characterization process. The following comments attempt to point out some of the disadvantages in using DR/CT as a VE technique--they are not meant to necessarily dissuade the NMED from approving the modification, but to ensure that the NMED is aware of potential problems in the use of DR/CT in lieu of VE

1. The HWFP already includes digital radiography as a radiography technique, describing it as follows in Section B1-3b (which discusses radiography training):

For example, certain sites use digital radiography equipment, which is more sensitive than real-time radiography equipment.

Computed tomography is an integral part of the digital radiography described above. Until a full scan of an entire container has been accumulated digitally and a three-dimensional image has been developed by computed tomography of the digital data, there is no image for a radiographer to look at. Thus, this proposed modification is essentially

allowing visual examination by what was considered to be a radiographic technique in the original HWFP. The proposed modification would allow a check only of the interpretation of the image, rather than the completely independent visual examination method currently utilized, which provides not only an independent interpretation but also a different, theoretically more reliable methodology to be used. As stated in the HWFP (Section B1-3b(3)):

The visual examination program has been developed by the Permittees to provide an acceptable level of confidence in radiography.

It seems clear that acceptance of this modification has the potential to greatly diminish the visual examination check of radiography, and hence the confidence in radiographic determinations.

2. The HWFP requires (Section B1-3b(3)) that Waste Matrix Codes and waste material parameter weights be verified by visual examination. DR/CT should be able to verify Waste Matrix Codes, but material parameter weights are another matter.

The radiographic determination of material parameter weights is from an operator's estimate of the volume of each material in a container, which is translated to a weight value through use of a look-up table. Currently the VE provides a quality control check of this process by comparing the actual weights of the materials with the estimates from radiography. Under this proposed modification the same estimating techniques and conversion tables would be used for both the initial determination and the quality control check. While DR/CT will likely provide a superior image from which to estimate the volume of each material, the process will still be one in which operator's subjective estimates of the matrix will still govern the accuracy of the reported material parameter weights.

HWFP Section B1-3b(3) does allow visual examination to estimate weights, but only under the following conditions:

Visual examination experts who are experienced and trained shall assess the need to open individual bags or packages of waste. If individual bags/packages are not opened, estimated weights shall be recorded. Estimated weights shall be established through the use of historically derived waste weight tables and an estimation of the waste volumes. It may not be possible to see through inner bags because of discoloration, dust, or because inner containers are sealed. In these instances, documented acceptable knowledge may be used to identify the matrix parameter category and estimated waste material parameter weights. If acceptable knowledge is insufficient for individual bags/packages, actual weights of

waste items, residual materials, packaging materials, or waste material parameters shall be recorded.

Even when inner bags are not opened the visual examination expert can still handle the bag, and thereby obtain a tactile sense of the volume and types of the contents that provide what can only be a better evaluation of the various masses than can be provided by a translated visual image alone. While the use of DR/CT would eliminate the inability to see through inner bags, it would also seem to eliminate any useful check of the accuracy on material parameter weights.

The EEG notes that there is no specific RCRA requirement for establishing material parameter weights; the closest may be the 40 CFR 264.13 requirement to obtain a detailed physical analysis of a *representative sample* of hazardous waste before it can be stored, treated, or disposed of. Material parameter weights were intended to be used primarily used to meet the requirements of 40 CFR 194.24, and measurement of cellulose, plastic, rubber, and ferrous materials is necessary to conform with 40 CFR 194.8(b)(1)(ii).

3. The data quality characteristic of precision for radiography will also be negatively affected in using DR/CT as a VE technique. The establishment of precision requirements for radiography and VE is as follows (HWFP Section B3-4):

The qualitative determinations, such as verifying the waste matrix code, made during radiography do not lend themselves to statistical evaluation of precision because of the qualitative nature of the inspection. However, comparison of data derived from radiography and visual examination on the same waste containers at the Rocky Flats Environmental Technology Site and the Idaho National Engineering Laboratory indicates that radiography operators can provide estimated inventories and weights of waste items in a waste container. As a measure of precision, the Permittees shall require each Site Project QA Officer to calculate and report the RPD between the estimated waste material parameter weights as determined by radiography and these same parameters as determined by visual examination.

The EEG has some reservations about use of this process to establish precision, which would be more appropriately developed from comparison of two independent radiography interpretations (“precision” is a measure of consistency, not accuracy). However, as noted in the previous item, the check of the estimated material parameter weights using DR/CT would seem to be much less reliable than VE. Establishment of precision using the current HWFP process would also be seem to be weakened by use of DR/CT as a VE technique, though the EEG believes the proposed DR/CT process would more closely approach the standard interpretation of the term “precision”.

The proposed modification contains no data that would seem to be comparable to the RFETS and INEEL data cited in the HWFP to show that DR/CT estimates of inventories and weights could be considered as accurate a yardstick as a VE technique.

4. DR/CT will not be able to perform other activities that are a part of the currently accepted VE process. For example, it would be highly unlikely that a small container clearly labeled "Picric Acid", containing crystals of the dried acid, would be distinguishable by DR/CT, but the hazard would be immediately obvious to a well-trained visual examination team under the current processes. While this is an obvious extreme case--there will be few waste streams for which presence of picric acid will be a possibility--determination of hazardous constituents, such as the absence or presence of PCBs in electronic equipment can depend on reading of labels.

Proposed Modification Introductory Material

5. The "Measures 1 and 2" portion of the "Basis" section of the introductory material indicates that no additional training would be required for use of DR/CT as a VE technique (p. A-2). The EEG believes that visual examination experts using DR/CT should also be a fully qualified DR/CT operator, and that language should be added to the HWFP to ensure that they meet qualifications for both positions.
6. The EEG agrees that an independent replicate scan of containers is neither necessary nor useful when DR/CT is performed, as stated in the "Measures 3 and 5" portion of the "Basis section of the introductory material (p. A-2), and the "Use of Independent Interpretation of DR/CT Scans" portion of the "Discussion section (pp. A-5 and A-6). The EEG believes the NMED should approve of this concept whether or not DR/CT as a VE technique is accepted or rejected.
7. The "Measure 4" portion of the "Basis" section of the introductory material indicates that DR/CT would be used "in lieu of using VE" (p. A-3). The EEG believes that DR/CT should be considered as an alternative method of VE when DR/CT is the radiographic technic, rather than an apparently mandatory replacement of it. This would allow waste characterization facilities to use the current VE technique if it appeared to be a more appropriate method.
8. The "Use of Independent Interpretation of DR/CT Scans" portion of the "Discussion Section of the introductory material states:

Therefore, when the DR/CT technology is used the independent replicate scan and an independent observation requirements are equivalent and are met using independent review and interpretation of the digital record from at least two randomly selected containers per batch or two per day, whichever is less frequent.

The current HWFP requirements for radiography are for one independent scan, and one independent review, per batch or day whichever is less frequent (see Attachment B1-3b(2)), and this proposed modification provides no indication as to why the number will be doubled for DR/CT.

40 CFR 270.42(b)(iii) requires that a submitted Class 2 modification explain why a modification is needed. This is also a modification to radiography requirements, rather than to the visual examination requirements that are the announced subject of this proposed modification. The NMED should elicit an explanation as to why the Permittees believe the radiography review requirements should be doubled for DR/CT before approving this concept throughout the proposed modification.

9. The "Direct Comparison of Independent Review of DR/CT Scan and VE in Meeting the Permit Requirements for Radiography QC" section of the "Discussion" in the introductory material (pp. A-6 and A-7) states (p. A-8):

Implementation of the Performance Evaluation Program at the generator/storage sites is the responsibility of the Site Project Manager (SPM). All necessary changes to the generator/storage site's Quality Assurance Project Plan (QAPjP) to implement the Performance Evaluation Program will be the responsibility of the SPM.

The EEG does not believe that the NMED has the authority to require waste generator/storage sites to implement this proposed program--The HWFP only establishes requirements for the WIPP site, not the generator/storage sites. The NMED should ensure that any provisions added to the HWFP are enforceable.

10. The "Process for Implementing the Requested Modification" portion of the "Discussion" section in the introductory material (p. A-8) indicates that the "2 containers per batch or 2 containers per day, whichever is less frequent" for which independent interpretation would be required would also be used to determine the miscertification rate. Thus, the independent reviewer for DR/CT should also be a visual examination expert; if the proposed modification is accepted the NMED should ensure that language is added to the HWFP to require this training.
11. A footnote in the proposed modification request states, concerning the miscertification sampling rate determined by VE/radiography comparisons, that (p. A-8):

To put this sampling rate into perspective, one need only consider the Rocky Flats Environmental Technology Site (RFETS), Hanford and Idaho National Engineering and Environmental Laboratory (INEEL) all of whom have identified no miscertifications since the inception of their program

under the WIPP Permit. These sites have a zero percent (0%) miscertification rate.

This “zero percent (0%) miscertification rate” may be dependent on several factors that were not anticipated in the HWFP. For example, a CBFO audit at one of these sites recently discovered that a fluorescent light ballast, a well-established archetype of a prohibited item that may contain PCBs, was not properly recorded by either radiography or visual examination of the container. The site determined that this was not a miscertification, based on the following argument (CBFO Corrective Action Report 01-019, 02/23/01 revision, p. 3, Block 16 continuation, “Investigative Actions” section; “RTR” is an acronym for “real time radiography”):

The WIPP-WAC, section B2-1, states miscertified drums are those that radiography indicates meet the WIPP-WAP and TRAMPAC, but visual examination indicates do not meet these criteria. For drum D72774, the ballasts recorded on the RTR report were identifiable on the VE videotape. The VE personnel did not verify the presence of a “No PCB” label but based on the results of this investigation the ballasts in D72744 do not contain PCBs therefore D72774 do not contain PCBs therefore D7274 is not considered a miscertified drum. None of the eighty S5000 visually examined to confirm RTR last year were miscertified.

While the investigation described in the same section does include evidence that the ballast may not have contained PCBs, it certainly is not the conclusive evidence as stated here. In any case, the point should be that radiography failed to properly document an indicator of a prohibited item, and this failure was discovered later. The radiography clearly *miscertified* the container as meeting Waste Analysis Plan requirements, when it may not have. If miscertification statistics are accumulated based on logic such as is used here, then miscertification rates may never exceed 0%.

12. The “DR/CT Technology Evaluation” portion of the “Discussion” section in the introductory material (pp. A-9 and A-10) points out the general technological characteristics of DR/CT which make it an advantageous system to use. However, there are no technical specifications supplied which establish baseline requirements for the system. Since there will be no effective check of the equipment efficiency, the NMED should consider establishing minimal technical specifications for the equipment. While the equipment currently proposed for use may be sufficient, the WIPP is a long-term project, and later versions of the equipment may not always be of the same quality.
13. Item 5 of the “Benefits From Using An Independent Interpretation of DR/CT Data Instead of VE” portion of the “Discussion” section in the introductory material states (p. A-14):

A search of the ORPS to determine the number of incidents and exposures which resulted from glovebox operations or visual examinations showed that, over the last several years, several exposures occurred as a direct result of torn gloves, equipment failure, or similar uncontrollable events. During the same time frame, the number of incidents and exposures which resulted from radiographic examination was zero (0).

The ORPS reports should be traceably cited. ORPS reports show that many--not just "several"--glovebox exposures have been recorded in the last few years. LANL's TA-55 facility alone has produced 16 ORPS reports that include the words "glovebox" and "exposure" since 1998. However, as yet there is no evidence of ORPS-reported incidents related to WIPP visual examination requirements. There are also radiation dangers from use of radiography equipment, and the ORPS reports do include at least one incident related to radiography (a 1998 report titled "Unauthorized Access into a Radiography Area", Report Number SR--WSRC-TRIT-1998-0007).

Comments on the Proposed Modification's Revised Permit Text

Comments on proposed text modifications will follow the alphanumeric itemization scheme used in the proposed modifications (a.1, a.2, b.1, b.2, etc). If multiple comments are used for the same item, a numeric addition will be added to distinguish between them (a.1-1, a.1-2, etc).

- a.1 "Module II" text (actually, Module II.C.1.c text) is modified to change the language relating to statistical selection of the number of samples to be taken. The term "QC of radiography" is used to replace the term "visual examination". While this alteration introduces a needed change if "QC of radiography" is introduced, it also eliminates any Module II requirement for establishing the number of samples necessary for the currently used visual examination.

Similar wording replacements are made throughout the proposed text modifications; for example, modification B.2 makes the same change to wording in Attachment B-3c, a similar alteration appears in the last paragraph of modification b.3, modification d.4 alters Table B2-1 by using the same replacement. Some of these eliminate requirements, others just eliminate references to other sections of the HWFP. The NMED should ensure that none of the text alterations eliminate requirements for the current visual examination process before approving the modification request.

The writers and reviewers of this modification were apparently under the impression that the only use of visual examination is as "QC of radiography", and were unaware that among other uses, visual examination can be performed instead of radiography (see the opening statement of HWFP Attachment B1-3b(3), Visual Examination).

The EEG suggested in a previous comment that DR/CT should be viewed as an alternative form of visual examination allowed when DR/CT is used to perform radiography. Under this suggestion no modification of Module II.C.1.c, or any of the similar alterations, would be needed. The NMED may wish to have the Permittees rewrite the proposed modification from the viewpoint of using DR/CT as an alternative form of visual examination.

- c.2. HWFP Attachment B1-3a is altered to create the following sentence (p. A-19; modified text in italics):

An audio/videotape or equivalently non-alterable media *or a digital record* is made of the waste container scan and is maintained as a non-permanent record.

The intent of the HWFP was apparently that the record would be “non-alterable”, and digital images can be altered without leaving any evidence of the alteration. The NMED should review the need for “non-alterable” VE records before approving this modification request. It should be noted that radiography by DR/CT is already allowed by the HWFP, and would apparently allow the same “alterable” record.

- c.3. HWFP Attachment B1-3b(2) is altered to add language referring to “independent reviews of DR/CT scans”. The added language appears to be unnecessary--the HWFP already addresses radiography independent reviews, and DR/CT was already an accepted radiography technique. As noted in a previous comment, no justification for the doubling of the number of required independent reviews added here has been provided. The NMED should consider the need for these additions before approving of this portion of the proposed modification.
- c.4-1. HWFP Attachment B1-3b(3) is altered to add both DR/CT and “Performance Evaluation Program” as QC checks on radiography. The Performance Evaluation Program, as described in the added HWFP Attachment B1-3b(3)(iii), is not an activity that will provide nearly the same level of confidence in radiography as does VE or the proposed use of DR/CT as a VE technique. These latter two techniques review drums of actual waste; the Performance Evaluation Program utilizes mock-up drums. While the Performance Evaluation Program could potentially add a useful check on DR/CT process, it should not be considered the equivalent of a VE technique. The NMED should edit this portion of the proposed modification before approving of it.

The proposed Performance Evaluation Program is analogous to the PDP programs for headspace gas sampling and analysis, solids sampling, and NDA, except that it will be a generator site program rather than a Permittee one. As noted in a comment above, the NMED may not have the authority to regulate the program.

c.4-2. HWFP Attachment B1-3b(3)(i) eliminates the statement (p. A-21):

The visual examination program has been developed by the Permittees to provide an acceptable level of confidence in radiography.

The statement is still valid, and is not a part of the intent of this proposed modification, which is to address using DR/CT as a visual examination technique when DR/CT is used for radiography. This alteration is unnecessary, and should not be approved.

c.4-3. The proposed modification's added B1-3b(3)(ii), Review of Digital Radiograph Scans, changes the requirements for independent review of DR/CT scans from those in the current HWFP (p. A-21; doubles the number of required reviews). The expressed purpose of the proposed modification is to add DR/CT as a visual examination technique when DR/CT is used for radiography, not to change independent reviews of radiography. Changes to HWFP requirements for radiography independent reviews should be a separate modification. The functions of independent review of radiography and visual examination are not the same, and should remain separate for DR/CT used as a VE technique.

Other proposed additions to the HWFP also change the independent review rate. For example, proposed modification d.3 includes similar adding of text to Attachment B2-1 multiple times to double the rate of independent reviews. The need for, and use of, these alterations should be evaluated by the NMED before approving of this proposed modification.

The added B1-3b(3)(ii) section does not address using DR/CT as visual examination at all. The NMED should consider whether or not this section is related to the ostensible purpose of the proposed modification before approving it.

c.4-4. The proposed modification's added B1-3b(3)(ii), Review of Digital Radiograph Scans, contains a paragraph (the third one) that begins as a statement of training issues, veers into an incomprehensible discussion of data summary reports and batch data reports, and then returns to training issues (pp. A-21 and A-22). The NMED should ascertain from the Permittees what the paragraph was supposed to address and edit the paragraph before approving of this portion of the proposed modification.

c.4-5. The proposed modification's added B1-3b(3)(ii), Review of Digital Radiograph Scans, contains a paragraph (fourth one) which appears to be a sort of internal argument, rather than a statement of requirements (p. A-22). The argument does not conclude with a statement of requirements. The NMED should attempt to ascertain whether or not inclusion of the paragraph would add any useful content to the HWFP. If it does, the paragraph should be edited to make that content explicit before this portion of the proposed modification is approved.

- c.4-6. The proposed modification's added B1-3b(3)(iii), Performance Evaluation Program, while potentially a useful addition to the HWFP, may not be enforceable, as noted in a previous comment. It should also be noted that the proposed evaluation does not provide for a check on radiography determination of material parameter weights, a requirement in the present HWFP for visual examination that will be much diminished when DR/CT is used as a radiography technique. The NMED should consider whether or not the Performance Evaluation Program should include methodology for checking DR/CT estimates of material parameter weights before approving of this portion of the modification.
- c.5. Text is added to Attachment B1-3b(5) to indicate that HWFP Figure B1-6 is to be applied when VE is used "...as the QC of radiography" (p. A-23). Visual examination can also be used in lieu of radiography, and Figure B1-6 should apply for that use, also. The NMED should ensure that the text is edited to indicate the full use of Figure B1-6 before approving this portion of the modification.
- e.1. Text is added to Attachment B3-1 to indicate that radiography can be either analog or digital (p. A-27). The addition is unnecessary, as the HWFP already allows digital radiography techniques to be used. The NMED should consider whether these additions are necessary or useful before approving this portion of the proposed modification.
- e.2. Text is deleted from the current HWFP Attachment B3-4 which establishes the rationale for using radiography to establish estimated inventories and weights of items in waste containers (p. A-27). While the statement may not be necessary in the HWFP, its removal is not an announced part of this proposed modification, nor is it related to the purpose of the proposed modification. The NMED should ascertain the need for the deletion of this portion of the HWFP before approving this portion of the proposed modification.
- e.8. Text is added to Attachment B3-12b(1) to state that a Characterization Information Summary can include a "radiography and/or VE summary to document prohibited items are not present and to confirm AK" (p. A-29; added text italicized). The addition changes the intent of the permit in ways that are not a part of this proposed modification, and should not be approved as a part of this modification request. DR/CT properly performed as a VE technique could be used, but radiography should not be considered as a substitute for VE. This portion of the modification should be rewritten before being approved by the NMED.
- f.1. Text is added to Attachment B4-1 to state that (p. A-33; added text is italicized):

Sampling and analysis includes radiography *and/or* visual examination, headspace gas, and homogeneous waste sampling and analysis.

Radiography and visual examination are two separate functions, and while VE can replace radiography, radiography should not be considered a replacement of visual examination. This portion of the proposed modification should not be approved by the NMED.