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June 27, 2002

Steve Zappe
New Mexico Environment Department
2905 Rodeo Park Drive, Building 1
Santa Fe, NM 87505

RE: WIPP Drum Age Criteria (DAC) Draft Permit Modification

Dear Steve,

Southwest Research and Information Center (SRIC) requests that NMED deny the permit modification because it is unnecessary and not adequately supported technically. Regulations under the New Mexico Hazardous Waste Act (20 NMAC 4.1.900, incorporating 40 CFR 270.42(c)(6)) provide that NMED may deny a Class 3 modification. SRIC requests that NMED revise its position and deny the modification.

If NMED does not deny the modification, SRIC requests a public hearing on the matter. However, SRIC further requests that any public hearing be postponed from the currently announced date of August 26 for several reasons:

1. As the following comments indicate, there is a need for further information to be provided before the hearing. Such information cannot be provided sufficiently in advance to allow adequate time for review before July 29, when notices of intent for technical testimony are due. Thus, the date for submission of notices of intent must be delayed, and consequently, the hearing date must also be postponed.

2. During the next two months extensive preparations for the hearing would be required. However, during the same time, the permittees are planning to submit numerous Class 1, 2, and 3 permit modifications, which SRIC and other interested persons will need to comment on, thereby imposing a huge, and unnecessary burden on SRIC and other members of the public. The large number of modifications and the volume of material related to the requests cannot be adequately analyzed while preparing for the hearing. The problem is created by the permittees, and they should choose their priorities. If it is the DAC, then the other modifications should be delayed until after the hearing process on the DAC is completed. If the permittees' priorities are other modifications, they should agree to a delay in the hearing on the DAC.

3. As NMED is well aware, SRIC has long maintained that for reasons of public health and safety, interrelationships of various proposed modifications, and efficient use of resources that public hearings on Class 3 modifications be consolidated so that there are not separate hearings on various modifications every few months. Given that there are other pending Class 3 modifications -- the Centralized Confirmation Facility (CCF) and the Remote-Handled Waste modification -- any public hearing on the DAC should be delayed and consolidated with the hearings on those other modifications. The CCF modification, especially, is directly related to the DAC since at least some of the activities, such a radiography included in the DAC modification, could be conducted at WIPP if the proposed CCF is allowed.

The permit modification is unnecessary.

The New Mexico Hazardous Waste Act regulations (20 NMAC 4.1.900, incorporating 40 CFR 270.42(c)(1)(iii)) require that the request "[e]xplains why the modification is needed." The request does not do so, and thus, the modification request should be denied, and it should be deemed to be unnecessary.

Since November 13, 2000, when the permittees first proposed changing the DAC as a Class 1 modification, the major reason for the modification was to facilitate waste characterization at that the Idaho National Engineering and Environmental Laboratory in order to meet a deadline of shipping 3,100 cubic meters of waste to WIPP by December 31, 2002. Since a final decision on the modification cannot be made in time to assist in that effort, that INEEL situation certainly cannot provide the need for the modification.

SRIC strongly raised this issue of need in our letter to Greg Lewis of December 12, 2000, which contributed to NMED reversing its decision to grant a temporary authorization for the DAC. The most detailed discussion of the need, of which SRIC is aware, is the letter of December 28, 2000 from Dr. Inés Triay to Greg Lewis that focused on the then supposed problems caused by not having the DAC revisions. Given the fact that the need for this modification has been at issue for more than 18 months, it is unacceptable that a detailed basis for the need has not been provided and that the only stated rationale is 18 months old and was inadequate at that time and is irrelevant to the existing situation.

The permit modification is not adequately supported technically

1. The underlying technical basis for the modification is not presented in the permittees' request or in the draft modification.

A. Modeling. The modeling done to support the various scenarios is different and to some extent inconsistent between the two studies -- Lockheed Idaho Technologies Company, 1995 and BWXT, 2000. In NMED General Comments of March 26, 2001 on the DAC modification submitted on December 7, 2000 there were numerous discrepancies identified between the two studies. Differences included the term used for calculating VOC accumulation in the rigid liner, equations to define the rate of change of the VOC concentration in each layer of confinement, VOC diffusivity in air, filters and filter diffusivities used, variation of liner types and sizes, consideration of hydrogen generation, and VOC multipliers. These discrepancies have not been adequately explained by the permittees. And they are not addressed at all in the draft permit modification. Thus, SRIC believes that there is not an adequate technical basis for any of the proposed changes to the DAC.

Neither of the two studies included the range of almost two dozen types of filters allowed by the WIPP Waste Acceptance Criteria. Further, SRIC is unaware of any data on the actual performance of each of those types of filters.

The permittees must provide additional information on the modeling, including all studies done to verify the modeling results, including sensitivity and uncertainty analyses, in both the 1995 and 2000 studies, and any subsequent memoranda, studies, or analyses done of the modeling. Such information must be produced well in advance (at least 30 days) of the time for any notice of intent to present technical testimony. If that information is voluminous, as it should be, additional time will be needed to analyze the information.

NMED must present all of its analysis of modeling results and provide witness(es) at the public hearing to discuss its modeling analysis.

B. Survey of generator/storage sites. In its modification request (p. A-6), the permittees refer to a survey of generator/storage sites, but they did not include the results of the survey nor provide it as a reference document. SRIC and other commentors have previously requested the survey, and, to provide adequate time for review, it must be provided at least 30 days in advance of the time for any notice of intent to present technical testimony.

C. Data. The permittees have not provided the data on actual results of sampling. SRIC pointed out the lack of this data in its July 6, 2001 comments (page 3), but such results have not been provided. In addition, the permittees must present data on the actual effectiveness of drum venting and filters, including information about failure of filters, filter diffusivity values, the amounts of VOCs "lost" from various sized filter vents and using various "air tight" sampling techniques. Data on hydrogen gas generation in drums should be provided. Such data should been provided for all container sizes and types, including pipe overpacks. Such results must be provided at least 30 days in advance of the time for any notice of intent to present technical testimony.

The permittees have not provided data on all actual vent hole sizes and types and sizes of liners. There are more sizes of filters than specified and more types and sizes of liners than those specified in the modification. The permittees should provide a comprehensive list of sizes and types of filters and vents and a demonstration that the modeling done is actually bounding for the entire range of filters, vents, and liners. Such data should be provided at least 30 days in advance of the time for any notice of intent to present technical testimony.

The modeling, information from generator/storage sites, and actual data provide the essential basis for the DAC modification. Without that information, SRIC contends that there is no adequate technical basis for any changes in the DAC, let alone the dramatically reduced requirements included in the request and draft permit modification.

In addition, the permittees have made no showing that the existing DAC have produced erroneous results or that those procedures have endangered public health and the environment. Further, they have not shown that the proposed DAC are more protective of human health and the environment than the existing DAC. On the contrary, the proposed DAC appear to be less protective of public health and the environment than the existing requirements.

2. Additional data are needed.

SRIC does not believe that the three scenarios for packaging configuration groups necessarily encompass all such configurations. For example, liner bags and inner bags can be of different types and sizes, containers can be of different sizes than those used. Yet, the draft modification does not provide for a conservative DAC in such situations. Data should be provided that demonstrate that the proposed DAC are conservative for all other packaging configurations. Such data should be provided and to provide adequate time for review, they must be provided at least 30 days in advance of the time for any notice of intent to present technical testimony.

In the absence of such actual data, the modification should be denied or the modification changed to provide that in any other packaging configurations, the existing DAC must be used -- a minimum of 142 days for debris waste (Summary Category S5000) and a minimum of 225 days for homogeneous solids and soil/gravel (Summary Category S3000/S4000).

The permit modification does not include necessary requirements.

Permit Attachment B, Page 12 of 57, provides that Acceptable Knowledge (AK) will be used to establish drum age criteria scenarios and packaging configurations. While SRIC agrees that accurate data is needed on each drum in order to establish such scenarios and packaging configurations, there have been problems at sites in meeting existing AK requirements. Thus, rather than improving waste characterization, SRIC believes that the DAC will not produce better headspace gas sampling results and it is likely to reduce the effectiveness of AK, since it will put further burdens on AK documentation, which is demonstrably suspect. The problems that exist in accurately determining the scenarios and packaging configurations are additional reasons to deny the DAC and maintain the existing, simple DAC requirements. If the new DAC scenarios and packaging configurations are to be used, SRIC believes that they must be determined through radiography and visual examination, not through AK.

Thus, SRIC believes the provision in Attachment B, Page 12 of 57, line 25, must be changed to state that radiography and/or visual examination shall be used "in addition to" (rather than "in conjunction with") AK. SRIC does not believe that AK can accurately determine scenarios and packaging configurations, so they have to be determined by actual examination of each drum. If the modification is approved, a similar change should be made throughout the permit.

Permit Attachment B1, Page 3 of 55, provides that the sampling device form an airtight seal when sampling the rigid drum liner under Scenario 1. The modification should provide (or refer to another area of the permit) for what happens to a drum when the airtight seal is not achieved. SRIC believes that if adequate sampling is not done, the drum must be prohibited since it has not meet all permit requirements.

Permit Attachment B1, Page 3 of 55, provides that if additional packaging configurations are identified, additional modification requests may be submitted. SRIC asks that this provision be deleted. Permittees may submit permit modifications, consistent with Hazardous Waste Act regulations, so such a statement need not be included in the permit. SRIC further believes that the range of packaging configurations should be known and reported as the basis for this modification. Thus, if NMED or the permittees believe that there are other packaging configurations, they should have been included in this modification request, rather than requiring NMED and the public to go through another DAC process (in addition to the three previous ones). Moreover, if there are other packaging configurations, they should comply with the existing DAC requirements.

Attachment B1, Page 8 of 55, B1-1a(6)(i), specifies several times the sampling procedures regarding a 90-mil rigid poly liner. SRIC is unaware of a requirement that each drum have a 90-mil rigid poly liner, and we are also unaware of any data from DOE that specifies that every drum that could come to WIPP has a 90-mil rigid poly liner. On the contrary, SRIC believes that there may be drums that have other than 90-mil rigid poly liners, and if so, the modification does not address those containers. The modification must be revised to either prohibit drums without a 90-mil rigid poly liner or requirements for other liner types must be developed. Of course, specifying requirements for drums with other types of liners should be supported by modeling and data from the permittees to support any proposed DAC. As already discussed above, the permittees should be required to provide this data before the hearing process proceeds.

<u>The permit modification contains various typographical errors</u>

Among the errors are the following:

1. In Attachment B, page 12, line 7, "three" should have been changed to "four."
2. In Attachment B4, page 1, line 19, "three should have been changed to "four."
3. In Attachment B6, there are blank requirements -- specifically numbers 49, 54, and 57 are assigned, but the fields are then blank.

Thank you for your careful consideration of these comments.

Don Hancock

<u>NOTE</u>: Citizens for Alternatives to Radioactive Dumping (CARD) endorses and signs on to these comments.

Deborah Reade, Research Director

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June 27, 2002

Mr. Steve Zappe
NMED Hazardous Waste Bureau
2905 Rodeo Park Drive East
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Santa Fe, NM 87505-6303

Dear Mr. Zappe:

The EEG comments on the May 13, 2002 Notice of Intent to Approve a Class 3 Modification to the HWFP on WIPP are attached. We have concluded: (1) the mathematical model used to calculate DAC values is adequate but that Permittees should provide more information for the public record on parameter values used and graphs of the approach to equilibrium for the DAC conditions; and (2) the HWFP should more explicitly prescribe the procedure for assuring that the vent hole diameter values used for each drum are conservative.

Sincerely,

Matthew K. Silva
Director

MKS:js
Attachment

cc: Inés Triay, DOE/CBFO
Dave Streng, DOE/CBFO
Scott Monroe, US EPA

EEG Comments on New Mexico Environment Department's May 13, 2002 Notice of Intent to Approve a Class 3 Modification to the Hazardous Waste Facility Permit For The Waste Isolation Pilot Plant (DAC)

Summary and Conclusions

The Environmental Evaluation Group (EEG) used a conceptual model of an idealistic waste package to visualize volatile organic compounds (VOC) transport and to build a mathematical model to describe it. This approach was used to qualitatively understand the mathematical model used by the Department of Energy (DOE) to calculate the Drum Age Criteria (DAC) values and to determine the sensitivity of certain input parameters. Details of this evaluation are given below. The evaluation led to the following conclusions:

(1) The model presented by Connolly et al. (1998) appears to represent the theoretical kinetics of gas movement well and the output time concentration curves (used to calculate DAC values) seem reasonable;

(2) Our conceptual model confirmed the sensitivity of the diameter of the hole in the rigid liner lid and the number of plastic bags containing the waste to the calculated DAC values. The VOC permeability coefficient, which is different for each chemical compound, also appears to be a sensitive parameter.

(3) EEG found it difficult to determine which parameter values were used to calculate the different DAC values. It is recommended that the Permitees tabulate, in a central document, the values used for each parameter in every DAC scenario and include this in the public record. This would make it more straightforward for others to understand and duplicate the DAC values. It would also be useful to graphically represent the approach to equilibrium (as done in Figures 2 and 3 in EEG's evaluation).

The importance of the rigid liner vent hole diameter is recognized in the Draft Permit (and confirmed by the EEG evaluation). We have a concern that this value cannot be accurately determined by radiography. The ability to distinguish between the 0.3 inch and 0.375 inch diameter vent holes is especially important since this results in a maximum difference of 37 days in the DAC. It is also possible that the diameter of the holes (as drilled or punched) deviates from the discrete hole sizes used for the DAC values. In many cases accurate diameter values may be obtainable by Acceptable Knowledge. The Draft Hazardous Waste Facility Permit (HWFP) does not specifically address the acceptable procedure for determining the vent hole diameter value. The EEG recommends that the acceptable procedure (including AK, radiography, visual examination, and/or use of conservative values) be clearly specified in the HWFP.

Comments on Individual Draft Permit Sections

Evaluation of DAC Mathematical Model

Introduction

Each container shipped for disposal at the WIPP must be sampled for VOCs, but VOCs migrate from the waste to the sampling site inside the containers at rates that depend on a number of factors. Therefore, the DAC is a prescriptive waiting period to ensure that enough time has elapsed between packaging the waste and sampling for VOCs so that the measured VOCs adequately characterize the total VOC concentration in the containers. DACs are calculated from chemical vapor transport theory and equations.

The current Hazardous Waste Facility Permit (HWFP) requires DACs of 142 and 225 days depending on the type of waste/packaging. The DOE and Westinghouse TRU Solutions LLC (WTS), the permittees, have proposed new DACs as short as 4 days based on new calculations of VOC migration in various waste packaging configurations. The permittees have cited three reports by Connolly et. al. (1998), Liekhus et. al. (1999), and Liekhus et. al. (2000) that describe the original calculations of the 142 day and 225 day DACs and the changes proposed for new DACs.

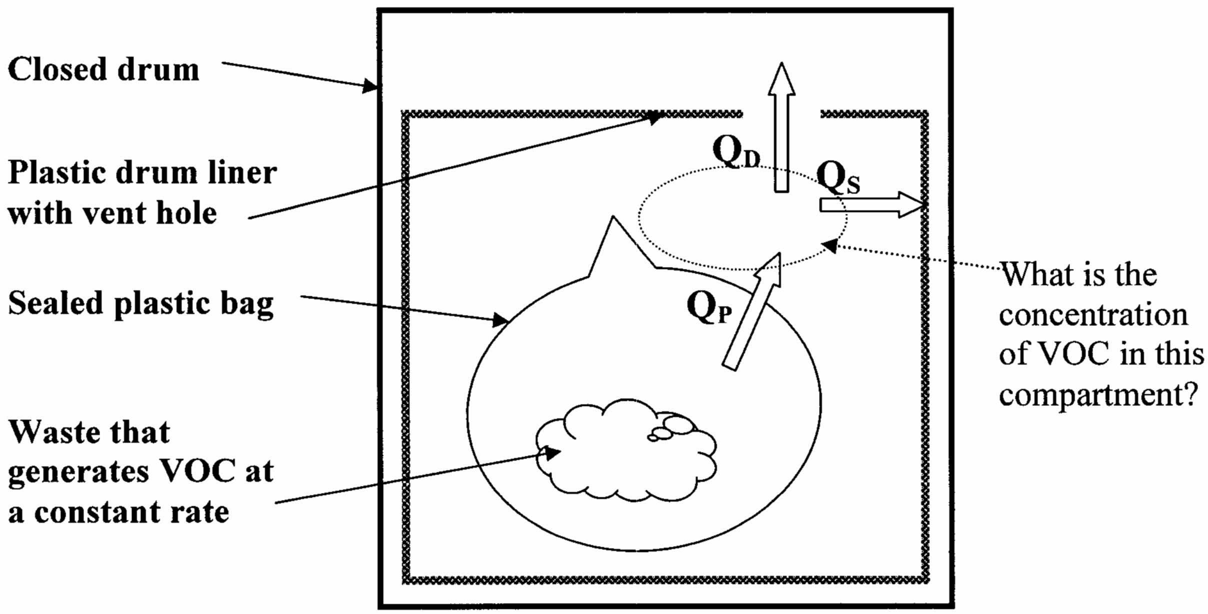
This paper describes an effort to qualitatively (vs. quantitatively) understand the mathematical model used to calculate the DACs and to form a conclusion as to whether the newly calculated DACs may be adequate to ensure that VOC sample results reflect the total VOC quantity in the containers and ultimately, if the new DACs provide the same level of safety as the current DACs. Comments will also be offered concerning the adequate documentation of mathematical input parameters, output presentations, and confirmation of the facts of the waste/packaging before selecting a DAC.

Method

A conceptual model of an idealistic waste package was used to visualize VOC transport and to build a simple mathematical model to describe it. Figure 1 is a diagram of a closed waste drum with a plastic drum liner (and vent hole) containing waste in a single, sealed plastic bag. The permittees have proposed both more and less complex scenarios and have calculated DACs for them. All the equations used in this analysis were from the original study on calculating DACs (Connolly 1998) because the permittees stated that the subsequent new DACs were based on these equations. Using a simple arrangement for this evaluation helps in the understanding of the model behavior more than in the actual results produced.

The VOC accumulation in the drum liner compartment was modeled for simplicity. VOCs enter this compartment by permeation through the plastic bag at rate Q_P and leave the compartment by diffusion through the vent hole, rate Q_D, and absorbing into the plastic liner at rate Q_S. The original study conservatively (and appropriately) assumes that the waste continues to generate VOCs at a constant rate.

Figure 1. Shown is a diagram of a conceptual waste container. The compartment of interest for this analysis is the void within the drum liner. Also shown are the VOC transport vectors.



The change in the VOC concentration, or overall rate at which VOCs enter the compartment (Q, in the units of moles per second, mol s^{-1}) is simply the sum of the individual rates:

$$Q = Q_P - Q_D - Q_S$$

where Q_D and Q_S are negative because VOCs are leaving the compartment. The concentration (C, in units of moles per cubic centimeter, mol cm^{-3}) in the compartment at some time (t) may be expressed as:

$$C = \frac{Q \cdot t}{V}$$

where V (cm^3) is the volume of the compartment of interest. However, the rates are time dependent, that is, the rates change with time. It is important, therefore, to find when the rate of change of the concentration is zero (at steady-state) because the VOC concentration will be the same anywhere in the system, i.e., it will be the same at the sampling location as it is next to the waste. To find the change in concentration with a change in time, one must differentiate the concentration equation, or:

$$dC = \frac{Q}{V}dt \xrightarrow{or} \frac{dC}{dt} = \frac{Q}{V}$$

Usually in a complex, dynamic system of material flow between compartments, several differential equations will be solved simultaneously. For this paper, the single differential equation was solved numerically using a fourth-order Runge-Kutta method (Kirchner 2002) to generate time series graphs of the concentration (Figure 2).

The primary purpose of this exercise was to observe how the concentration varies with changes in the parameters that describe the waste or waste packaging. For example, the thickness of the plastic bag surrounding the waste is represented by the "X_P" term in the permeation rate (Q_P) equation. Changing individual parameters to observe the model output is known as a sensitivity analysis, i.e., which parameter causes the greatest change in the results or to which parameters is the model most sensitive. This was accomplished using a software program designed to estimate the uncertainties in model output given the uncertainty in parameters (Kirchner 2002). For each test, all the parameters were held constant except for one that was allowed to vary over a specified range. The results of the sensitivity analysis are shown in Figures 2 and 3.

The equations for these rates and the parameters are described in Connolly et. al (1998) and are repeated below for completeness and comment. A full dimensional analysis was also performed to ensure that the units of each parameter were valid for the DAC model.

The rate of VOC **permeation** through the plastic bag, Q_P, is described as:

$$Q_P = \frac{\phi \rho A_P P}{X_P} y_P$$

where

- ϕ ("psi") gas concentration constant at standard temperature and pressure (STP) = 4.46 x 10^{-5} (mol cm^{-3})
- ρ ("rho") VOC permeability coefficient which is different for each chemical compound, allowed to vary between 1 x 10^{-8} and 10 x 10^{-8} (cm^3 cm cm^{-2} s^{-1} cm-Hg^{-1}) for this experiment, although Connolly et. al. (1998) reported permeability values between 0.15 x 10^{-8} – 23 x 10^{-8} (cm^3 cm cm^{-2} s^{-1} cm-Hg^{-1}).
- A_P permeable surface area of plastic bag, 6,000 cm^2 was chosen as a nominal value
- P gas pressure inside container, constrained to be at STP throughout the container (76.0 cm-Hg) in this model

Figure 2. Crude Sensitivity Analysis on DAC Model

Parameters having little effect on model output.

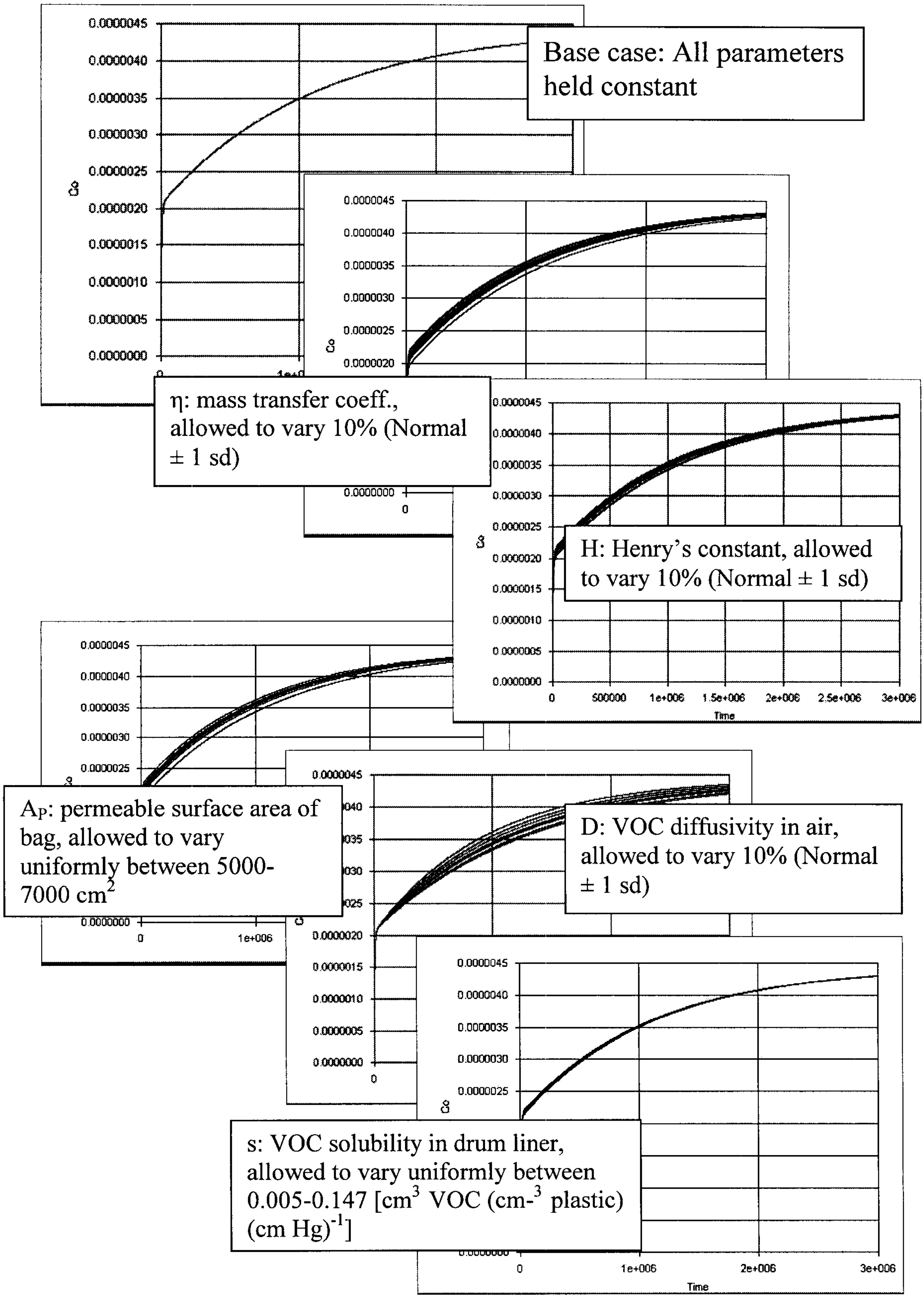
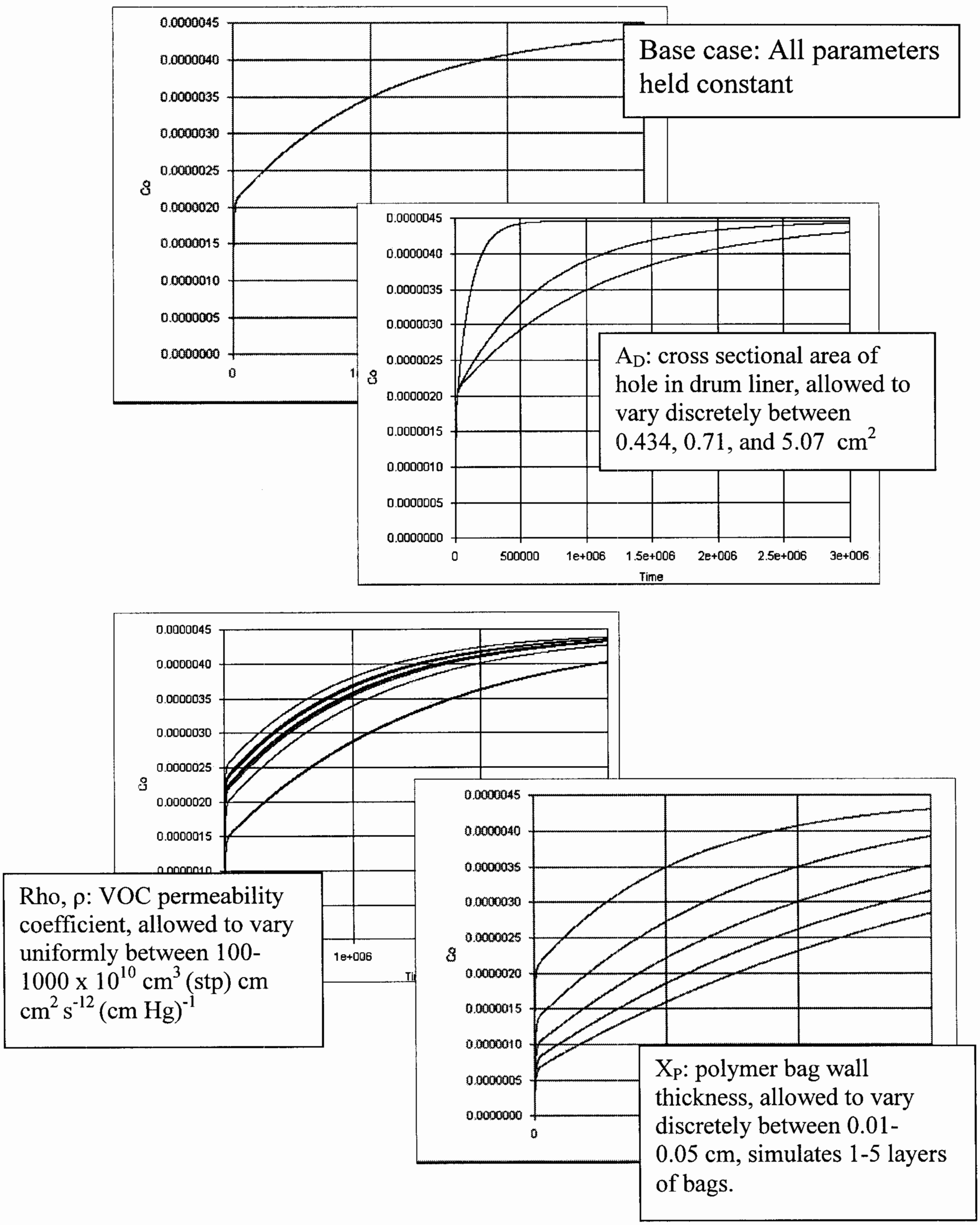


Figure 3. Crude Sensitivity Analysis on DAC Model – continued

Parameters having significant effect on model output.



X_P thickness of plastic bag in cm, 0.01 cm was chosen as the nominal value in this test. Note, Connolly et. al. (1998) varied this value to simulate the number of layers of plastic bags that a VOC would have to permeate to get to the head space of a drum

y_P VOC mole fraction difference across plastic bag. The mole fraction difference, y_P, is essentially the difference in concentrations, or quantities of VOCs, on either side of the plastic bag. If C_i and C_o are the VOC concentrations inside and outside the bag, respectively, another way to write y_P is:

$$y_P = \frac{C_i}{\phi} - \frac{C_o}{\phi} = \frac{1}{\phi}(C_i - C_o)$$

and the permeability equation reduces to:

$$Q_P = \frac{\rho A_P P}{X_P}(C_i - C_o)$$

Please note that Co is the concentration or compartment of interest in this current work. The rate of **diffusion** through the hole in the drum liner lid is expressed by Q_D (mol s^{-1}):

$$Q_D = \frac{CDA_D}{X_D} y_D$$

where

C concentration of gas (mol cm^{-3}). Connolly et. al. (1998) did not describe this concentration well. It was assumed to be equal to ϕ for the current test.

D coefficient describing the VOC diffusivity in air, a nominal value of 0.152 cm^2 s^{-1} was used

A_D cross sectional area of the hole in the drum liner lid (cm^2), set at 0.434, 0.7, and 5.07 cm^2, corresponding to 0.3, 0.375, and 1.0 inch diameter holes respectively

X_D diffusional path length across drum liner lid, set at a nominal value of 1.2 cm

y_D VOC mole fraction difference across drum liner lid. Using the same technique as the permeation equation, the diffusion equation may be reduced to:

$$Q_D = \frac{DA_D}{X_D}(C_o - C_D)$$

where C_D is the VOC concentration in the drum head space. The final rate equation is to describe how fast VOCs absorb into the plastic drum liner material, or the **solubility** rate, Q_s (mol s^{-1}) of the VOCs:

$$Q_s = \eta \phi V_p P[s_\infty - s]$$

where

- η mass transfer coefficient (s^{-1}). Connolly et. al. (1998) derived this coefficient experimentally, but did not list a table of the researched values. A nominal value of 2.4 x 10^{-7} s^{-1} was selected for this test from the given FORTRAN code examples.
- ϕ ("psi") gas concentration constant at standard temperature and pressure (STP) = 4.46 x 10^{-5} (mol cm^{-3})
- V_p volume of plastic in the drum liner, taken to be the product of the given drum liner surface area (15,500 cm^2) and it's given thickness (0.229 cm), or constant at 3,550 cm^3
- P gas pressure inside container, constrained to be at STP throughout the container (76.0 cm-Hg) in this model
- s average VOC solubility in drum liner plastic with the units [cm^3 (VOC at STP] [cm^{-3} polymer] [cm-Hg]$^{-1}$. The nominal value of 0.01 [cm^3 (VOC at STP] [cm^{-3} polymer] [cm-Hg]$^{-1}$was derived from the equilibrium concentration values listed by Connolly et. al. (1998) in Appendix D. Note that the values in the appendix had to be transformed (by dividing by P) because the units listed were not what was required by the equation.
- s_∞ VOC equilibrium solubility in drum liner plastic with the units [cm^3 (VOC at STP] [cm^{-3} polymer] [cm-Hg]$^{-1}$. This value was estimated by:

$$s_\infty = \frac{y_v}{H}$$

where y_v is the volume average VOC mole fraction in the gas near the plastic drum liner and H is the VOC Henry's constant for the liner. The value of 0.027 [cm-^{3} (VOC at STP] [cm^3 polymer] [cm-Hg] was used in this trial because it was used as an example value in the FORTRAN code. Even with some concern about Henry's constant for toluene and cyclohexane, values for this constant were not listed in Connolly et. al. (1998). It is important to note that y_v is a mole fraction and not a mole fraction difference as used in the previous equations. If it were rewritten as C_o/ϕ (the fraction of VOC in the entire gas inside the liner), then the **solubility** equation may be written:

$$Q_s = \eta\phi V_p P\left[\frac{\left(\frac{C_o}{\phi}\right)}{H} - s\right]$$

The final differential equation used in this evaluation of the DAC model is:

$$\frac{dC}{dt} = \frac{Q}{V} = \frac{Q_P}{V_o} - \frac{Q_D - Q_s}{V_D}$$

where V_0 is the void volume inside the drum liner and V_D is the void volume in the drum headspace, fixed at 40,000 cm^3 and 28,000 cm^3 respectively (Connolly 1998).

The differential equation was solved using uncertainty software (Kirchner 2002) and the concentration results were plotted (Figs. 2 and 3). Then selected parameters were given a range of values over which they may vary and the model was re-run ten times using the range of values. Each result was plotted with the others to compare the effect of varying the parameter.

Discussion

It should be strenuously noted that the modeling exercise conducted for this paper was not intended to recreate any particular value of a DAC. It was done to ascertain, in a general way, how the mathematical model used to derive DACs would behave when certain input parameters were changed as proposed by the permittees. The model presented by Connolly et. al. (1998) appears to represent the theoretical kinetics of gas movement well. That is, given nominal values of input parameters, the output time/concentration curves seem reasonable, at least on a visual, qualitative basis.

It appears clear, based on Figure 3, that the diameter of the hole in the drum liner lid (A_D) and the thickness (or number) of plastic bags containing the waste (X_P) have a pronounced impact on how fast the VOC will reach equilibrium concentration. This confirms the permittees' claims that package configurations where these values are optimized will result in shorter DACs. One may conclude, also from Figure 3, that the permeability coefficient (ρ or rho) might significantly affect the DACs as well. This suggests that the time to reach equilibrium concentration throughout the drum is VOC dependent and not strictly packaging dependent as suggested by Liekhus et. al. (2000).

The sensitivity of the DAC to these three parameters requires that the measurements or other methods used to determine the values of the parameters be checked very carefully. On the other hand, using the most conservative known values may be necessary. Acceptable Knowledge programs will be crucial to ensuring that the correct DAC has been selected.

The abbreviated modeling exercise described in this paper did not fully investigate all the DAC claims by the permittees. The exercise also did not examine the possible effects of correlating parameters, i.e., varying two or more parameters at the same time. It does, however, demonstrate a modeling method that may be used to display the results of concentration calculations graphically so that any reader may see that equilibrium in the system is being reached near the DAC time. The old adage is still valid that a graphic is worth a thousand words. It would be to the permittees' advantage to graphically represent each DAC scenario so that the public would understand that there were solutions to the differential equations that resulted in DACs.

One of the most difficult tasks of this simple modeling exercise was the extraction and compilation of correct parameter values. These values were found scattered between appendices and documents and may have had different units in each. One example of this was the permeability coefficient (ρ). One can only imagine how easy it would be to confuse parameter values in a more complex scenario using more differential equations and more variables. It is strongly recommended that the permittees tabulate, in a central document, the values used for each parameter in every DAC scenario. Such a document of clearly described parameter values would be important for the public record.

References

Connolly, M.J., Djordjevic, S.M., Liekhus, K.J., Loehr, D.A., Spangler, L.R.. Position for determining gas phase volatile organic compound concentrations in transuranic waste containers. Idaho National Engineering and Environmental Laboratory, Transuranic Waste Programs, Lockheed Martin Idaho Technologies Company, Idaho Falls, Idaho 83415. INEEL-95/0109, Rev. 2. June 1998.

Kirchner, T.B.. Uncertainty Calculator, Windows 95/98/NT version [software]. ModelWright Software, 1307 S. Country Club Circle, Carlsbad, NM 88220. 2002.

Liekhus, K.J., Djordjevic, S.M., Devarakonda, M., Connolly, M.J.. Determination of transuranic waste container drum age criteria and prediction factors based on packaging configurations. Idaho National Engineering and Environmental Laboratory, Bechtel BWXT Idaho, LLC, Idaho Falls, Idaho 83415. INEEL/EXT-99-01010. November 1999.

Liekhus, K.J., Djordjevic, S.M., Devarakonda, M., Connolly, M.J.. Determination of drum age criteria and prediction factors based on packaging configurations. Idaho National Engineering and Environmental Laboratory, Bechtel BWXT Idaho, LLC, Idaho Falls, Idaho 83415. INEEL/EXT-2000-01207. 2000.

Comments on Attachment B

1. Section B-4a(1) is altered to add to the data quality objectives (DQOs) for radiography as follows (p. B-18, lines 14-15, and p. B-19, lines 1-7):

> To satisfy the RCRA regulatory compliance requirements, the following DQOs are established by this WAP: ...
>
> - Radiography
>
> – To verify the TRU mixed waste streams by Waste Matrix Code for purposes of physical waste form identification and determination of sampling and analytical requirements, to identify prohibited items, to determine waste packaging configurations, to determine presence and diameter of rigid polyliner vents, and to confirm the waste stream delineation by acceptable knowledge.

The radiography equipment currently in use for WIPP waste characterization approaches the limits of the technology when used to determine waste packaging configurations and the presence of rigid poly liner vents. To determine the diameter of the polyliner opening is normally far beyond the ability of any waste characterization site's currently certified radiography program.

Radiography units typically scan from the side of the container, with the container moving vertically past the scanning device. The vents in lids are often identified only by a slight protrusion in the liner lid, or by viewing a plug or piece of liner material on the top of the waste. Radiography units currently in use usually do not image the actual vent opening; some units can tilt the container a few degrees, which may help to establish evidence of the opening, but the units were not designed to provide the vertical view of drums that would be essential to accurately measuring the diameter of liner lid openings.

Since there are problems with relying solely on radiography to accurately determine vent hole diameter, EEG recommends that an acceptable procedure including AK, radiography, visual examination, and/or use of conservative values, be clearly specified in the HWFP.

Attachment B1

1. Section B1-1(a)(1) is altered to indicate that pipe component packaging in Standard Waste Boxes (SWBs) is acceptable (p. B1-1, lines 25-29):

> If a specific packaging configuration cannot be determined based on the data collected during characterization and confirmation, a conservative default Packaging Configuration Group of 3 for drums and 6 for Standard

> Waste Boxes (SWBs) must be assigned, provided the drums and SWBs do not contain pipe component packaging.

Similar statements can be found elsewhere in the draft (see, for example, Section B1-1a(2), p. B1-2, lines 16-20). The HWFP currently contains no allowance for overpacking of pipe components in SWBs, nor is there criteria in the HWFP that prescribe such important parameters as the number of pipe components that can be placed in SWBs, how they are to be arranged, and the packaging materials that would be placed in the SWB to support the pipe components. Other regulatory documents (i.e., the TRUPACT-II TRAMPAC) also do not contain specifications for pipe components placed in SWBs.

The EEG believes that the HWFP should not refer to the use of SWBs for pipe components until the methods and materials to be used have been properly assessed and documented.

2. Section B1-1(a)(6) is altered to indicate that

> A representative sample cannot be collected from the drum headspace until the 90-mil rigid polyliner has been vented to the drum.

The thickness of drum liners is usually 90-millimeters; however, inclusion of the specification implies that only 90-mil liners must be vented, and any non-90-mil liners would not be covered by the requirement. The term "rigid poly liner" would seem to be a sufficiently specific terminology for the requirement.

Some containers have a fiberboard liner, sometimes in addition to the rigid poly liner. The proposed DACs do not consider these liners. Other containers use a lead liner for radiation emissions control. Pipe components can contain a neutron-absorbing matrix (S100 POCs; see Section 2.1.3 of Revision 19 of the TRUPACT-II Authorized Methods for Payload Control), which are polyester/polyethylene materials that could alter VOC steady-state attainment similarly to that of poly liners. Other pipe components (S200 POCs; Section 2.1.4) contain polyurethane inserts. The possible impact of these liners and packaging materials was not discussed either in the DAC modification request or in this draft HWFP. Since these materials will likely affect both the diffusion rate, by limiting diffusion openings, by limiting VOC solubility, and by providing additional soluble materials, specific DACs for these containers would also seem to need to be included in the HWFP.

3. Section B1-3b(2), On-the-Job Training for radiography operations, includes a requirement for "Identification of Rigid Polyliner Vents and Determination of Vent Diameters"(p. B1-24, line 22), and states (p. B1-24, lines 27-29, and p. B1-25, lines 5-8 and lines 21-24):

> A radiography test drum shall include items common to the waste streams to be generated/stored at the generator/storage site, and shall also include

> common waste packaging configurations and rigid liner vent hole diameters. ...These items shall be successfully identified by the operator as part of the qualification process. In addition, the operator shall successfully determine and/or verify the sampling scenario, packaging configuration, and rigid liner vent hole presence/absence and diameter in order to document the criteria for selecting the appropriate DAC from Tables B1-5 through B1-10...Unsatisfactory performance is defined as the misidentification of a prohibited item, failure to identify a packaging configuration, or failure to correctly identify the presence and diameter of a vent hole in a training drum or a score of less than 80% on the comprehensive exam.

Given the importance of the vent opening to the DAC, this text should be altered to indicate that multiple test drum liner lids should be available, each with a different rigid liner vent hole diameter so as to represent the various hole diameters that may be on actual drums examined by the operator being tested, and the operator should be required to correctly identify the diameter of each of these vent openings during the testing.

As noted previously, most, if not all, radiography equipment currently in use cannot distinguish rigid liner vent hole diameters. Thus, including the requirement either as currently stated or with the EEG's proposed addition would seem to penalize the operator for a technological problem beyond the control of radiography operators.

<u>Attachment B1 Tables and Figures</u>

1. Table B1-5, Scenario 1.B1, and Scenario 1.B2, are as follows (p. B1-37):

   B1. Unvented drums with unvented rigid poly liners are sampled through the rigid liner at time of venting

   B2. Vented drums with unvented rigid poly liners are sampled through the rigid liner at time of venting

   The practice in the past has been to ensure that drum liners are vented to the drum headspace, and take samples from the drum headspace. Scenario 1.B2 was apparently developed under the assumption that rigid poly liner lids which lack a visible opening are unvented. There is no surety that rigid poly liners are unvented–the liner lid may, or may not, be sealed to the liner itself (some liner lids were glued to the liner, but even these may not be sealed). To be conservative these containers should not be considered as "unvented" containers, and processed under Scenario 3 requirements if the DAC is longer.

2. Figure B1-1, Headspace Gas Drum Age Criteria Sampling Scenario Selection Process, does not appear to represent the logical flow necessary to determine DACs. No flow chart was provided in the initial Permittee's modification submission. The flow chart

does not indicate all the decisions that would need to be made; one block in the flow chart is formatted as an "action" block (rectangle) even though it has two outputs. The block should be rewritten as a "decision" block (diamond shaped).

As an example of a logical flow failure, a "Yes" answer to the first block ("Containers packaged in vented condition?") would logically lead to the decision block ("Containers sampled at time of venting?") provided in the Figure, but a "Yes" answer there should lead to the decision, "Was Scenario 1 DAC satisfied before sampling?". This, in turn, when answered "Yes" answer should lead to an action block of, "Process sample according to WAC". The current figure attempts to combine these last two steps. The problem is that a "No" answer to the last in the decision tree proposed in this comment would require new sampling of the container–whereas the draft flow chart states an oxymoron, "Satisfy DAC Scenario 1 before sampling". The sampling has already occurred, according to previous flow chart steps, and the flow chart should clearly indicate that a new sample must be taken. It would also appear that other decisions should be made before sampling that should be reflected on the flow chart.

<u>Attachments B3 and B4</u>

1. Section B3-4 adds the following quality assurance objective for radiography precision (p. B3-25, lines 22-25):

> The quantitative determination of the vent hole diameter is verified through confirmatory visual examination and through replicate scan measurements. Because of the criticality of the vent diameter in establishing DAC equilibrium times, the precision limit for a measurement is 0% RPD as defined in Section B3-1.

Section B3-4 is titled "Radiography"; the reference to "confirmatory visual examination" in the added portion would therefore seem inappropriate. A comparable addition under a section for visual examination would seem to be necessary (the draft does not currently contain one).

The "replicate scan measurements" apparently refer to radiography determinations. As noted in previous comments, radiography measurements of vent hole diameters is at best a highly questionable endeavor. While the EEG agrees that the vent diameter is critical to the DAC, a 0% RPD by radiography would be achieved only on a random statistical basis, or by prior agreement as to what the measurement would be found to be. Even if radiography operators needed only to choose one of the four diameter sizes listed in the DAC tables, the visual image provided by most radiography equipment is such that the results would not usually be acceptable under this criterion.

As noted in the EEG's general comments the process for measuring the vent hole diameter would appear to be critical enough to the DAC determination that the HWFP should specify how the measurement is to be taken.

2. Section B4-1 states in part (p. B4-1 lines 18-25):

> Acceptable knowledge is used in TRU mixed waste characterization activities in three ways:
>
> - To delineate TRU mixed waste streams
> - To establish drum age criteria scenarios and waste packaging configurations
> - To assess if TRU mixed heterogeneous debris wastes exhibit a toxicity characteristic (20.4.1.200 NMAC, incorporating 40 CFR §261.24)
> - To assess if TRU mixed wastes are listed (20.4.1.200 NMAC, incorporating 40 CFR §261.31)

Note that there are four items listed, not three; the initial statement should be corrected.