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Dear Larry:

The Agency's letters dated March 19, April 17, and April 25, 1997 establish values for several parameters in the performance assessment ("PA") of the Waste Isolation Pilot Plant ("WIPP"). However, the letters (and the docket as a whole) do not contain any explanation or justification for the decisions reflected in the letters nor contain any of the information supplied to EPA by DOE in meetings and discussions about the parameter values. Neither do the letters respond to the numerous public comments that have been made concerning the parameters in question and the values that might be assigned to them in performance assessment. Many such comments have been made by the Environmental Evaluation Group ("EEG"), which has statutory responsibilities with respect to oversight of WIPP.

To address this situation, I request that the Agency ("EPA") state on the record of docket no. A-93-02, the compliance certification rulemaking, (a) that EPA's determinations as to the parameters in issue are withdrawn and (b) that comments made by members of the public will be fully considered by EPA with an open mind before the Agency takes a position on the matters in issue. Further, I request that EPA also state that it will not issue decisions as to parameter values except in the context of a published proposed rule, containing the reasoning supporting the Agency's proposed decisions as to the relevant parameters and addressing concerns expressed by the public.

Frank Marcinowski's letter dated May 21, 1997 to Don Hancock raises several serious concerns as to the parameter issues discussed herein. First, it says that since the compliance certification application was filed, EPA has engaged in "necessary discussions with DOE" and "has been in New Mexico on an almost continual basis," and it points out that the Administrative Procedure Act "does not place any restrictions on agency communications during informal rulemaking" and contends that the rulemaking has not, in any case, officially begun. This letter fails to appreciate that an agency conducting an informal rulemaking, even under EPA's bare-minimum interpretation of its statutory responsibilities, is required to withhold its final judgment

until it has given the opportunity for public comment, and is required to make public the rationale and technical basis for the rule it proposes to adopt. EPA's current practice violates both such requirements, since EPA is publicly announcing its decisions on values of parameters important to the compliance determination before stating the technical and theoretical basis for those values and obtaining public comment. To the contrary, EPA appears to have obtained important data from DOE in unannounced nonpublic meetings, decided parameter values based on the data and information presented in those meetings, and publicly taken a position on parameter values without allowing public participation in the process.

To restore the process intended by the APA, EPA should announce that the parameter values established by the April 17 and 25 letters are withdrawn. EPA should also make public the data an information conveyed to EPA in the exchanges with DOE. At present these exchanges are scarcely documented in the record. Further, should EPA determine that it must establish parameter values at this time, prior to the proposed rulemaking, EPA must issue a proposal stating the parameter values selected by EPA, must set forth the rationale and data supporting such values, and must allow public comment on the proposed values. Further, in determining parameter values EPA must address both the concerns raised to date and those expressed in future comments about the values of the parameters in issue.

The parameter values established by the Agency may cause the compliance determination to be based on an erroneous estimate of the safety of the repository and may seriously understate the likelihood and extent of future releases of radioactivity. This letter discusses the parameters which are the subject of the Agency's April 17 and 25 letters and points out considerations which the Agency appears to have disregarded. The discussion uses the section designations of the Compliance Certification Application ("CCA"):

6.4.3.2: Repository fluid flow: The letters state that the permeability values for the experimental region and the panel closures (EXP_AREA/PRMAX_LOG and PAN_SEAL/PRMX_LOG) are no longer in question.

The panel closure value is discussed in MASS Att. 7-1. This document in turn refers to small-scale tests of Salado mass concrete. However, those tests do not examine materials of the dimensions and configuration of the panel closures. Further, there are assumptions of 5% and 10% porosity, which are not supported by data. These assumptions and other assumptions about dimensions and closure of the DRZ underlie the Agency's conclusions as to the magnitude of flow through the panel closure, and hence its rate of degradation. The Conceptual Models Peer Review panel initial report found that the PA values for permeability of waste regions and panel seals underestimate permeability for early periods (PEER at 3-21). The panel rejected the use of the constant value (at 3-22) and said that the "ability of these seals to successfully isolate waste panels must be considered uncertain" (at 3-23). The supplementary report stated that the seal permeability could be assumed to be maintained by forces of closure, but no data so showing were referred to (Dec. 1996 report at 14). The value remains unsupported.

The value for permeability of the experimental area was judged by the peer review group to be "conservatively high" (PEER at 3-21) and adequate, but the group's later report stated that the value of permeability for the waste region (a different region) was acceptable on the assumption that there would be few intrusions in early years because of the assumed effectiveness of active and passive institutional controls (Dec. 1996 report at 12). I understand that DOE will soon submit PA demonstrations which omit the supposed effects of PICs. In such circumstances, the PA values for permeability of both the waste and the experimental regions must be considered invalid and would need to be supported by new data. Such concerns have not been addressed by EPA in finding that the parameter values are "no longer in question."

6.4.3.3: Gas generation: EPA has, without explanation, directed use of an inundated corrosion rate twice as fast as the value selected in the CCA. The CCA value is based on long-term tests, thus disregarding rates observed in shorter-term tests, assumes a pH of about 10, and has a minimum rate of 0, on the assumption that salt crystallization may possibly prevent corrosion. See MASS Att. 8-2, at 4-5. None of these assumptions is well-founded; in particular, the probabilities assigned lack support, and the overall result is to bias the corrosion rate on the low side. EPA's designated values retain the minimum of 0 in a uniform distribution. Doubling the other CCA values is not explained.

The CCA range fails to account for the recent work reported in Telander and Westerman (1997)(SAND96-2538). This report states, inter alia, that increasing pressure significantly increases the anoxic corrosion rate (see ES-2, 6-37). The corrosion rate is correlated to repository pressure, and PA should account for the two variables in that manner. In the absence of correlation, the corrosion rate range and distribution should be increased significantly to include the highly-probable circumstance of high repository pressure.

Further, Telander and Westerman (1997) reports that decreasing pH will significantly enhance corrosion rates. At pH 3 the average rate was 7900 μm/yr. (ES-2; 6-33). Although it is assumed that MgO will tend to control pH, there must be some uncertainty in the matter, and there will be individual areas where MgO is not effective. Thus, some consideration of low pH must be included in the gas generation rate.

Also, direct contact with salt and backfill enhances the rate (Telander and Westermann (1997) at ES-2, 6-41), and such will often or usually be the case. Thus, this should also be accounted for in the rate. The backfill-immersed specimens showed a corrosion rate of 4.58 μm/yr. in the bottom-most tier, which may be regarded as reflective of the repository after closure. It should be noted that the backfill in the experiments contained 30% bentonite and 70% salt.

The 1997 report also states that aluminum corrosion is a significant factor, approximately equal to the corrosion rate for steel (ES-3). The rate of Al corrosion increased dramatically in the presence of CO_2 and in the presence of iron, which must be regarded as ever-present. See 6-53

through 6-68). Telander and Westerman also reported that corrosion of steel in the presence of aluminum is sharply accelerated (ES-3; 6-71 through 6-72).

Based on the ongoing Telander and Westerman studies, in 1993 Larry Brush wrote that the demonstrated corrosion rate of 1mm/yr. should be increased by a factor of 50 to account for the possibility of low pH (Brush to Tierney, June 18, 1993, at E-10, -11). He also determined to increase the maximum rate by a factor of four to account for high N_2 partial pressure (id. E-12). There was a further increase by a factor of 1.23 based on temperature (id. E-13). The resulting maximum gas generation rate was 200mm/yr (id. E-23). Brush's "best estimate" was 1mm/yr. (id.). Likewise, Brush previously adopted anaerobic microbial degradation rates of 0.1 moles/kg./yr. (inundated) and 0.01 moles/kg./yr. (humid)(Brush to Tierney, June 18, 1993, at E-17). Such rates for processes which generate gas would appear to be considerably higher than the values which EPA has said are no longer in question.

Such observations do not appear to have been taken into account by DOE in preparing the CCA. Moreover, DOE seems to have proceeded on the premise that the observed data shall be used to fix the upper limit of a uniform distribution of corrosion rates (see MASS att.8-2 at 5, 6)—a practice which would systematically understate the corrosion rate. There is no indication that EPA has considered these factors in determining projected gas generation rates. EPA should discuss these results in making public its decision.

6.4.3.5: Dissolved actinide source term: EEG has pointed out that, for plutonium, the assumption of oxidation states of Pu(III) or Pu(IV), with 50% probability assigned to each, will lead to a significant understatement of releases. See Lee, W. W.-L., the Waste Isolation Pilot Plant Compliance Certification Application: Under-estimated Dissolved Actinide Source Term (1997). In contrast to the values used in the CCA, experimental data showed that if the repository brine is assumed to have a pH of 8 to 10 and reducing conditions, Pu(VI) is the stable state. Reed et al., Stability of Pu(VI), Np(VI), and U(VI) in Simulated WIPP Brine, 1996, CCA add'l refs. no. 539. Thus, it would be appropriate to use solubility values for Pu in Salado brine of 9.0000E-5 M and in Castile brine of 8.0000E-5 M. However, EPA's letters to DOE appear to have adopted DOE's approach of assuming oxidation states III and IV and directs use of solubility values of 1.3000E-08 M (Castile; III), 1.2000E-07 (Salado, III), 4.1000E-08 M (Castile, IV), and 1.3000E-08 (Salado, IV). Clearly, the amounts shown as released will be much understated. The following values are specified in EPA's April 25, 1997 letter (comparisons are shown with CCA values):

3402: SOLMOD3/SOLCIM: CCA: 6.5200E-08; EPA: 1.3000E-08
3406: SOLMOD3/SOLSIM: CCA: 5.8200E-07; EPA: 1.2000E-07
3403 SOLMOD4/SOLCIM: CCA: 6.0000E-09; EPA: 4.1000E-08
3407: SOLMOD4/SOLSIM: CCA: 4.4000E-06; EPA: 1.3000E-08
3404: SOLMOD5/SOLCIM: CCA: 2.2000E-06; EPA: 4.8000E-07
3408: SOLMOD5/SOLSIM: CCA: 2.3000E-06; EPA: 2.4000E-07
3405: SOLMOD6/SOLCIM: CCA: 8.8000E-06; EPA: 4.6000E-03

3409: SOLMOD6/SOLSIM: CCA: 8.7000E-06; EPA: 3.7000E-05

Some of the values selected by EPA vary by two orders of magnitude from the values in the

6.4.3.6: Source term for colloidal actinides: EPA has accepted, after initial questions, the CCA values for proportionality constants for moles of actinide (Pu and Am) sorbed on microbial colloids (PU/PROPMIC and AM/PROPMIC) and for moles of actinide in oxidation state III sorbed on humic colloids in Castile brine and in Salado brine (PHUMOX3/PHUMOX and PHUMOX3/PHUMSIM). The nature of the questions raised by EPA and their resolution cannot be determined from the materials. EPA should explain its questions and state the basis for its selection of the CCA values.

Further, the letters dated March 19 and April 25, 1997 both refer to a parameter no. 3429 as PHUMOX3/PHUMOX. In fact, parameter no. 3429 is PHUMOX3/PHUMCIM. EPA should state the correct reference.

6.4.5.2: Salado interbeds: EPA has stated its concerns as to the fracture model for the anhydrite interbeds and has also questioned several parameters related to this model. Then, in its letter dated April 25, 1997, EPA stated that several parameters are no longer in question:

S_ANH-AB/POROSITY
S_MB138/POROSITY
S_MB139/POROSITY
S_MB139/DPHIMAX
S_MB139/PF_DELTA
S_MB139/PI_DELTA
S_MB139/KMAXLOG
S_ANH_AB/DPHIMAX

(nos. 528, 567, 588, 2177, 2180, 586, 2178, and 2158) Such acceptance implies that the model itself is also accepted by EPA. EPA's action calls for explanation. The size of releases depends significantly upon the model chosen; the "porosity" model used in PA tends to show significantly lower permeabilities (and lower fluid-migration distances) for the same porosity than an alternative model, the "aperture" model. See Beauheim et al., Integrated Modeling and Experimental Programs to Predict Brine and Gas Flow at the Waste Isolation Pilot Plant, SAND94-0599C (see discussion of pressure-dependent permeability). Sandia has stated that a new fracture model, and specifically the aperture model, should be developed. See Freeze, et al., Coupled Multiphase Flow and Closure Analysis of Repository Response to Waste-Generated Gas at the Waste isolation Pilot Plant (WIPP), SAND93-1586, at 6-25. Why this has not been deemed necessary is unexplained. See, in this connection, the comments submitted by Walter Gerstle, dated December 3, 1996 and docketed as item II-H-01.

6.4.5.3: DRZ: The March 19, 1997 letter identified the DRZ permeability value as "lacking supporting evidence" (enc. 2). In the April 17, 1997 letter EPA specified log uniform, rather than constant, values for this parameter (enc. 2). EPA does not explain the origin of the permeability range and distribution stated. What is the basis for these values?

6.4.6.2.1: Transport of dissolved actinides in the Culebra: EPA has directed use of log uniform distributions with specified values for five matrix partition coefficients, which define the extent of retardation in the Culebra:

U+6/MKD_U
U+4/MKD_U
PU+3/MKD_PU
PU+4/MKD_PU
AM+3/MKD_AM

(nos. 3475, 3479, 3480, 3481, 3482). The maximum and minimum values are as stated in the CCA. This Agency position calls for explanation. For one thing, EEG has reviewed DOE's proposed K_d values and has pointed out (a) the inappropriateness of using data from batch tests with high CO_2 levels in light of plans to use MgO backfill, (b) the inapplicability of data based on dolomite taken from outside the WIPP site, (c) applicability of column test data using the longest possible test period, and (d) the need to consider organic ligands. See EEG comments, Feb. 7, 1997. Since that time, EEG has thoroughly reviewed DOE's K_d values and has shown in detail, in its letter dated May 23, 1997, that the DOE K_d values are not based in valid experimental data. Notably, there are column test data only for U(VI) and Np(V), and there are no powdered rock data for Pu(III), Pu(IV), Pu(VI), U(IV), and Np(IV). DOE's choice of distributions is also unsupported. EPA 's own determinations contained in its letter dated April 25, 1997 is to all appearances made without considering any of the serious problems raised in EEG's review. EPA should explain to what extent it has scrutinized the DOE claims and how it has arrived at the distributions it has selected.

6.4.7.1: Releases during drilling: This category includes the modeling of cuttings, cavings, and spallings releases. These models are insufficiently described in the CCA, despite their importance. Thus, it is difficult to identify clearly the reasoning that may underlie EPA's actions involving the cuttings, cavings, and spallings models.

Concerning the cavings model, DOE includes a table of parameter values in Appendix CUTTINGS (p. 49), and the parameters are different from those in the tables in Appendix PAR. Table PAR-11 shows that DOE uses 7.8000E+00 rad/s as the drill string angular velocity parameter BOREHOLE/DOMEGA), but EPA has directed DOE to use the range of values for the parameter from Appendix CUTTINGS. EPA has, however, directed use of a cumulative distribution, rather than DOE's constructed distribution. EPA has not revealed its thinking. For example, one unanswered question is whether it makes more sense to vary also the drill bit diameter if the velocity parameter is to be varied.

Another cavings parameter is waste shear strength (BOREHOLE/TAUFAIL). In Appendix CUTTINGS (at 49) DOE selects the range 0.05 to 10 Pa with a constructed distribution, and in Appendix PAR DOE selects the same range, but a uniform distribution, and the medians of the two distributions are plainly different. EPA has stated that it does not accept DOE's chosen value but that the value chosen by EPA will depend on the outcome of an expert elicitation on waste particle size. I question whether, in the absence of valid data on which to base a parameter value, a panel of experts can provide a valid figure.

EPA has stated that the waste material absolute roughness (WAS_AREA/ABSROUGH), stated to have a value of 2.500E-02 with a "uniform" distribution, is "no longer in question." The parameter is discussed at Appx. CUTTINGS, p. 49. However, it appears that the value supported by that reference is a variable parameter. EPA should explain why it has selected a single value and what data support that choice.

In connection with the spallings model, EPA has stated that it cannot accept the value for the particle diameter (BLOWOUT/PARTDIA) chosen by DOE but has no acceptable value of its own. EPA states that the matter must be resolved by an expert elicitation. But, as stated, the fact that insufficient data exist to support a parameter value does not mean that a valid value can be developed by an expert panel. In addition, it is a major unproved assumption of the CCA spallings model that to derive a single particle-size value for each iteration by sampling from a range properly represents, or conservatively bounds, releases. EPA needs to explain why it believes that this is so.

EPA has directed the use of a waste permeability value (BLOWOUT/APORO) of 2.4000E-13 m^2 in place of 1.7000E-13 m^2 specified in the CCA. EPA seems to have been guided by the discussion in the Engineered Systems Data Qualification Peer Review report, pointing out that data indicate a value of 2.4000E-13 m^2 (Appx. PEER5 at 5-16 through 5-19). However, problems with the waste permeability value do not end there. EEG has pointed out that DOE's use of a single permeability value ignores permeability uncertainty (EEG comments, Feb. 7, 1997). With lower permeability, the phenomena of gas erosion and stuck pipe would need to be considered (id.). EPA, despite these concerns, has specified a single value for the highly uncertain parameter of waste permeability. Further explanation is required.

Similarly, EPA's action in accepting DOE's value for waste compressibility (WAS_AREA/COMP_RCK) of zero should be explained and justified as conservative, if it is so.

EPA has also directed a new value for the gravity effectiveness factor in the spallings model (BLOWOUT/FGE), specifying a uniform distribution from 1 to 18.1, in lieu of the point value of 18.1 used in the CCA. It is clear that the value for the gravity effectiveness factor was arbitrarily arrived at (See Lee, W. W.-L., The Waste Isolation Pilot Plant Compliance Certification Application: Problems with the Direct Solids Release Calculations (1997), at 2.)

How EPA determined that a range might be used to generate more accurate or conservative results is not explained.

6.4.7.1.1: Direct brine release during drilling: EEG has shown that waste permeability is very important to the direct brine release scenario (EEG comments, March 14, 1997). Higher permeability increases direct brine releases in direct proportion. Again, EPA must explain its position on the waste permeability parameter.

EPA has determined that values for three parameters in the BRAGFLO direct brine release model are "no longer in question," namely: BLOWOUT/MAXFLOW, BLOWOUT/MINFLOW, AND BLOWOUT/GASMIN. The derivation of these values is not clear, and the reason for EPA's acceptance of them is also unclear.

As to BLOWOUT/GASMIN, the CCA states that the value is "arbitrarily set" (MASS Att. 16-2, at 10). There is no basis to accept an arbitrary value. As to MAXFLOW, the CCA says only that a certain well was brought under control within 11 days (950400 seconds), but why that example should set the maximum time is unexplained (id. 11). As to MINFLOW, the value of three days is said to reflect the time to drill through the Castile and cement casing (id. 10), but the cited reference provides no support for such value.

EPA has also specified a value for waste cementation strength in BRAGFLO_DBR at a log uniform distribution ranging from the minimum for TAUFAIL to a maximum of 4.8000E+06 Pa, substituting for the value in the CCA, which is a constant 6895 Pa. The origin of the value range selected by EPA is completely unexplained. Cementation strength of waste is certainly a sensitive parameter in direct releases and must be well justified. EPA's value may be even less conservative than DOE's unsupported value.

6.4.7.2: Long-term releases following drilling: EPA has determined values for three parameters related to the performance of borehole plugs. It has been contended by EEG that borehole plug lifetimes should be a sampled parameter (EEG comments, March 14, 1997), since a short borehole plug lifetime (specifically, a short period of low permeability) is non-conservative with regard to spallings and direct brine releases. It has also been pointed out that it would be appropriate in the WIPP area to assume that full-length borehole plugs are used, which provide an essentially permanent plug (NM Atty. Gen. Comments, March 14, 1997). Nevertheless, EPA has fixed plug parameters without explanation and without responding to such comments. The values relate to the parameters BH_OPEN/PRMX_LOG, CONC_PLG/POROSITY, BH_SAND/PRMX_LOG, and CONC_PLG/PRMX_LOG. As to the first two, DOE's values are said to be "no longer in question." As to the permeability of borehole sand and of concrete plugs, EPA has specified a log uniform distribution for the first (in place of a uniform distribution) and a uniform distribution for the latter (in place of a constant value). No explanation of the source of the new values is stated.

6.4.8: Castile brine reservoir: EPA has examined and specified parameter values for eight parameters concerning the Castile brine reservoir:

CASTILER/VOLUME
CASTILER/COMP_ROCK
CASTILER/POROSITY
CASTILER/PRESSURE
CASTILER/GRIDFLOW
GLOBAL/PBRINE
BLOWOUT/THICK_CAS
BLOWOUT/RE_CAST

The CCA parameters governing the flow from a brine reservoir have departed from available data, and the CCA values have been seriously questioned by EEG. In comments dated March 14, 1997 EEG has shown that the values used for volume, rock compressibility, and porosity depart from the WIPP-12 data (the only reasonable analog) and understate reservoir brine production. EPA has nevertheless accepted the CCA values for reservoir volume (CASTILER/VOLUME), effective porosity (CASTILER/POROSITY), and far-field pore pressure (CASTILER/PRESSURE) and specified a new value for compressibility (CASTILER/COMP_RCK). The compressibility value seems to have emerged from the peer review process, although the scientific basis and quality control support for materials presented to the peer reviewers is entirely absent from the record. Any data and materials relied upon by EPA must be put in the public record. Further, EPA's determinations leave unanswered EEG's logical presentation in support of values leading to a productivity ratio (volume times rock compressibility divided by porosity) of 4.000E-2 m^3/Pa, representing the characteristics of the WIPP-12 brine encounter. The values specified by EPA dictate a productivity ratio considerably smaller than the ratio arising from EEG's presentation based on WIPP-12 data. EPA has not explained how it reached such conclusions.

Nor has EPA explained how it determined that the index for selecting brine pocket volume (CASTILER/GRIDFLOW) should be "no longer in question." The distribution of 1 to 32 is admittedly based on no data and does not correspond to reality. EEG has shown that it is far more realistic to use WIPP-12 reservoir parameters to describe this critical characteristic (EEG comments, March 14, 1997).

EPA has also stated that two parameters governing the behavior of the Castile brine reservoir in case of direct brine releases, BLOWOUT/THICK_CAS and BLOWOUT/RE_CAST, are "no longer in question." No explanation has been offered.

EPA has also, inexplicably, specified that the probability of encountering pressurized brine should be changed from 8% to a uniform distribution from 1% to 60%. Such a decision on what could be a very important parameter of the CCA should be soundly based in data or in conservative interpretation of data. EPA's decision is neither. There are no data supporting a

range for this parameter which includes values as low as 1%. To the contrary, the data support a value of 100%, since the smallest possible interpretation of the WIPP-12 reservoir is a reservoir approximately 3 km in diameter underlying the WIPP site. Together with the TDEM data from magnetic surveys, the existing data show a high probability of a brine reservoir at any location underlying the repository. See EEG presentation, March 14, 1997.

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EPA has prejudged several critical parameters critical to the certification rulemaking and has done so without considering and responding to well-founded public comments, most especially comments from knowledgeable scientists. EPA's actions will result in the understatement of the risks of the facility. EPA has an obligation to restore the process required by the APA, to withdraw its parameter determinations, to state publicly that it will consider public comments on these parameters with an open mind and to show that it has done so, by reconsidering all comments on the parameters in question and fully explaining its decisions as to those parameters. Please explain what schedule the Agency will follow in reinstating the public process.

Very truly yours,

Lindsay

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