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JUN 27 2002

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TRANSMITTAL OF REPORT ADDRESSING IGNEOUS ACTIVITY (IA) KEY TECHNICAL ISSUE (KTI) AGREEMENT ITEMS 2.02 AND 2.09

Reference: Ltr, Brocoum to Reamer, dtd July 19, 2001

This letter transmits one hard copy each of the reports entitled, *Particle Size Sensitivity* (enclosure 1), and *Wind Speed Data Appropriate for the Height of the Eruptive Columns Being Modeled* (enclosure 2), which provide the information to satisfy the two subject agreement items:

> IA 2.02 - "Document results of sensitivity studies for particle size, consistent with (1) above." [IA 2.01]
> "DOE agreed and will document the waste particle size sensitivity study in a calculation document. This will be available to the NRC in FY 2002."
>
> IA 2.09 - "Use the appropriate wind speeds for the various heights of eruption columns being modeled."
> "DOE agreed and will evaluate the wind speed data appropriate for the height of the eruptive columns being modeled. This will be documented in a calculation document. This will be available to the NRC in FY 2002."

Enclosure 1 documents the waste particle size sensitivity study and is based on information contained in the Supplemental Science and Performance Assessment (SSPA) Volume 1, Section 14.3.3.4 and Volume 2, Section 3.3.1.2.2. The SSPA was transmitted to the U.S. Nuclear Regulatory Commission (NRC) by the referenced letter.

Enclosure 2 evaluates the use of wind speed data from altitudes that could be reached by an ash column associated with a violent strombolian eruption. The report is based on information contained in the SSPA Report, Volume 1, Section 14.3.3.5 and Volume 2, Section 3.3.1.2.1.

Although the agreement items state that the information would be documented in a calculation document, the information has been included in the enclosed report as discussed at the April 15-16, 2002 NRC/U.S. Department of Energy (DOE) Technical Exchange and Management Meeting on KTIs. This does not impact the nature and extent of the information to be provided to the NRC in accordance with the agreements, and DOE considers IA 2.02 and IA 2.09 fulfulled.

This letter contains no new regulatory commitments. If you have any questions about this report or the associated references, please contact Timothy C. Gunter at (702) 794-1343 or Eric T. Smistad at (702) 794-5073.

Joseph D. Ziegler,
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OL&RC:TCG-1269

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1. *Particle Size Sensitivity*
2. *Wind Speed Data Appropriate for the Height of the Eruptive Columns Being Modeled*

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PARTICLE SIZE SENSITIVITY

June 2002

Preparation:

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Approval:

for

Jerry A. McNeish, TSPA Department Manager, PA — Date 6-19-02

Reviewed by:

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CONTENTS

Page

ACRONYMS AND ABBREVIATIONS iv

1. BACKGROUND 1
   1.1 NRC INITIAL COMMENTS 1
   1.2 DOE INITIAL COMMENTS 1
   1.3 STATEMENT OF DIFFERENCES 2
   1.4 DEFINITION OF TECHNICAL TERMS 2

2. APPLICABLE NUCLEAR SAFETY STANDARDS/REQUIREMENTS/GUIDANCE 2
   2.1 APPLICABLE REQUIREMENTS 2
   2.2 KTI AGREEMENT 2
   2.3 STATUS OF AGREEMENT(S) 2

3. BASIS FOR REGULATORY COMPLIANCE STATEMENT 3
   3.1 BACKGROUND 3
   3.2 SAFETY/TECHNICAL BASIS FOR THE COMPLIANCE DEMONSTRATION 4

4. REFERENCES 5
   4.1 DOCUMENTS CITED 5
   4.2 CODES, STANDARDS, REGULATIONS, AND PROCEDURES 6

FIGURES

Page

1. Sensitivity of Probability-Weighted Mean Annual Dose from Volcanic Eruption to Waste Particle Diameter 4

ACRONYMS AND ABBREVIATIONS

DOE	U.S. Department of Energy
FY	Fiscal Year
KTI	Key Technical Issue
LA	License Application
NRC	U.S. Nuclear Regulatory Commission
SR	Site Recommendation
SSPA	Supplemental Science and Performance Assessment
TSPA	Total System Performance Assessment

Particle Size Sensitivity

This report describes the basis to resolve and close an agreement item IA 2.02 associated with the consequences subissue of the igneous activity Key Technical Issue (KTI). The item in question is the U.S. Department of Energy (DOE)-U.S. Nuclear Regulatory Commission (NRC) agreement that DOE document the waste particle size sensitivity study (Crump, 2001 [DIRS 156332]).

The Analysis/Model Report, Igneous Consequences Modeling for Total System Performance Assessment for the Site Recommendation (ANL-WIS-MD-000017), identifies waste particle size as one of the input parameters for the ASHPLUME code (CRWMS M&O 2000 [DIRS 151560], Table 2). The ASHPLUME code is used to evaluate the disruptive event scenario that depicts a hypothetical volcanic eruption that intersects a repository at Yucca Mountain (CRWMS M&O 2000 [DIRS 151560], Section 4.1).

1. BACKGROUND

DOE originally agreed to document a waste particle size sensitivity study in the Total System Performance Assessment (TSPA) for the Site Recommendation (SR), Revision 1 (Reamer and Williams 2000 [DIRS 154597]). Plans to develop Revision 1 were cancelled, and the agreement was revised during the NRC/DOE Technical Exchange and Management Meeting on Igneous Activity, June 21-22, 2001 (Crump 2001 [DIRS 156332]). Under the revised agreement, DOE would provide the information in a calculation document, which was to be available to the NRC in June 2002.

1.1 NRC INITIAL COMMENTS

The NRC was concerned about the potential effect on dose of uncertainties associated with the distribution of waste particle size used in the ASHPLUME code. The concern was generally that use of inappropriate waste particle sizes could bias the incorporation ratio parameter, such that amount of waste incorporation modeled in ASHPLUME would be inappropriately reduced.

1.2 DOE INITIAL COMMENTS

DOE agreed to document a waste particle size sensitivity study in TSPA-SR Revision 1, but when plans to develop the revision were cancelled, the location and schedule for the documentation changed. DOE provided information about waste particle size sensitivity in the Supplemental Science and Performance Assessment (SSPA) Volume 1 (BSC 2001 [DIRS 154657], Section 14.3.3.4), and Volume 2 (BSC 2001 [DIRS 154659], Section 3.3.1.2.2). DOE considers that the information in these analysis/model reports is adequate to resolve and close the agreement item.

1.3 DEFINITION OF TECHNICAL TERMS

ASHPLUME v1.4LV is the computer code, selected from several such codes, that the project has decided to use to simulate potential volcanic events at a repository at Yucca Mountain. The other codes are identified, and the basis for selection of the ASHPLUME code is described in the igneous consequences analysis and model report (CRWMS M&O 2000 [DIRS 151560], Sections 6.1 and 6.4, respectively).

2. APPLICABLE NUCLEAR SAFETY STANDARDS/REQUIREMENTS/GUIDANCE

2.1 APPLICABLE REQUIREMENTS

The Yucca Mountain disposal regulations include a requirement to provide the technical basis for models used in the performance assessment (10 CFR63.114(g)). Particle size is an input parameter for the ASHPLUME code. However, the KTI agreement item, described below, is the only stipulation specifically applicable to documenting a waste particle size sensitivity study.

2.2 KTI AGREEMENT

The following KTI agreement IA 2.02 is based on the Summary Highlights of the NRC/DOE Technical Exchange and Management Meeting on Igneous Activity that occurred on August 29-31, 2000 (Reamer and Williams 2000 [DIRS 154597]) as modified in the Summary Highlights of the NRC/DOE Technical Exchange and Management Meeting on Igneous Activity that occurred on June 21-22, 2001 (Crump 2001 [DIRS 156332]).

Document the results of sensitivity studies for particle size, consistent with (1) [i.e., IA 2.01] above (Eruptive AC-1).

DOE agreed and will document the waste particle size sensitivity study in a calculation document. This will be available to the NRC in Fiscal Year (FY) 2002.

2.3 STATUS OF AGREEMENT(S)

DOE considers that the agreement item related to documenting the dose sensitivity to waste particle size has been fulfilled because the requested information has been provided to the NRC. DOE provided information about waste particle size distribution used in ASHPLUME in the SSPA Volume 1 (BSC 2001 [DIRS 154657], Section 14.3.3.4), and described the sensitivity of dose to uncertainties in waste particle size in the SSPA Volume 2 (BSC 2001 [DIRS 154659], Section 3.3.1.2.2). DOE considers that the information in these reports is adequate to resolve and close the agreement item.

An ASHPLUME model report is being developed to support TSPA-LA. Purposes for the report include describing the ASHPLUME model, providing documentation of the validation of the model, and describing the inputs that are provided to TSPA-LA. In addition, planned activities include work to justify existing parameter distributions or update those parameters and integrate ASHPLUME with GoldSim. These activities and the documentation in the ASHPLUME model

report are intended to ensure that appropriate parameters, such as the particle size distribution, are used in ASHPLUME and integrated into TSPA-LA.

3. BASIS FOR REGULATORY COMPLIANCE STATEMENT

The information in the following two sections, addressing the agreement item about waste particle size sensitivity, is excerpted from SSPA Volume 1 (BSC 2001 [DIRS 154657], Section 14.3.3.4) and Volume 2 (BSC 2001 [DIRS 154659], Section 3.3.1.2.2).

3.1 BACKGROUND

As described in the SSPA Volume 1 (BSC 2001 [DIRS 154657], Section 14.3.3.4), DOE completed analyses to evaluate the effects on dose of uncertainties in waste particle size. The parameter is associated with the volcanic eruption scenario (CRWMS M&O 2000 [DIRS 151560], Section 6.1 and Table 4).

The ASHPLUME code (V1.4LV-dll) calculates the areal density of both volcanic ash and spent nuclear fuel in grams per square centimeter on the surface of the earth as functions of location relative to the volcanic vent. For each execution of ASHPLUME, the code makes two internal passes: one for calculation of ash deposition, and one for calculation of fuel deposition. The same mathematical model is used for both calculations. In the pass for the fuel deposition calculation, the code simply modifies the ash particle density to account for the incorporation of a fuel particle and determines what fraction of the combined particle mass consists of fuel. An incorporation ratio is used to calculate a fuel fraction, or the ratio of fuel mass to ash mass. A detailed description of the mathematical model for the ash and fuel deposition calculation is available in Jarzemba et al. (1997; [DIRS 100987]), and a more detailed description of the treatment of the combined ash/waste particle density is provided in SSPA Volume 1 (BSC 2001 [DIRS 154657], Section 14.3.3.6).

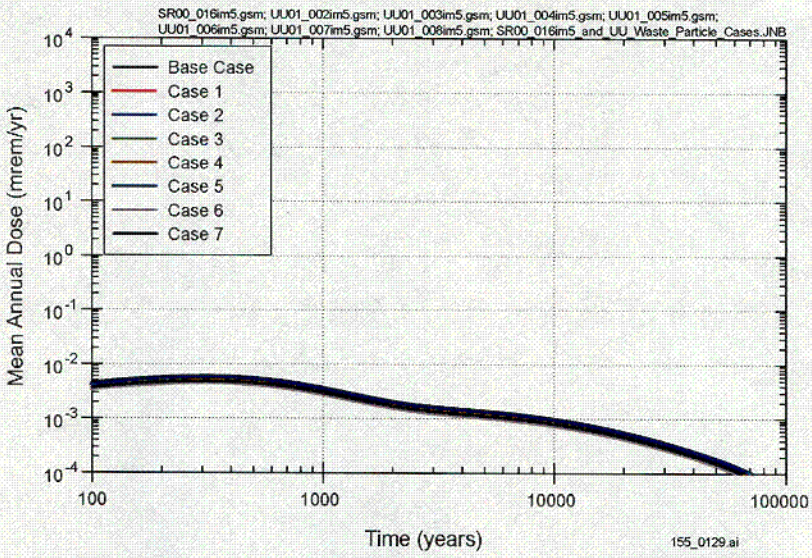
Within the ASHPLUME code, waste particles are treated as varying in size, with the variation in particle size following a log-triangular distribution (Jarzemba et al. 1997; [DIRS 100987], Section 2.2). The particle size distribution is defined by specifying the minimum, mode, and maximum diameter of the fuel particle size distribution. These three parameters are important in determining the ground-level waste density calculated by ASHPLUME because, along with the incorporation ratio, they are used to determine the total mass of fuel that is actually entrained in the ash column and transported downwind. In addition, because of the effect of waste particle mass in altering the density of ash particles, the waste particle size distribution also affects the dispersion calculation within ASHPLUME.

In Igneous Consequence Modeling for the TSPA-SR (ANL-WIS-MD-000017; CRWMS M&O 2000 [DIRS 151560], Section 6.1.2.1.12), the minimum, mode, and maximum diameter for waste fuel particle size were specified as 0.0001, 0.002, and 0.05 cm, respectively. In *Miscellaneous Waste-Form FEPs* (CRWMS M&O 2001 [DIRS 153938], Attachment 1), it was noted that waste forms may have different particle diameters in the eruptive environment, depending both on the initial type of the waste (commercial spent nuclear fuel or high-level radioactive glass waste) and the degree and type of alteration of the waste. This uncertainty in waste particle size distribution was examined by conducting a series of sensitivity runs with the

TSPA model using different values for the minimum, mode, and maximum waste particle sizes that define the log-triangular distribution. For the sensitivity analysis, the minimum waste particle size was reduced by a factor of one-half and the maximum waste particle size was increased by a factor of two. The mode value for the log-triangular distribution was varied between 0.0002 and 0.02 cm, or a range of one-tenth to ten times the base case mode value.

3.2 SAFETY/TECHNICAL BASIS FOR THE COMPLIANCE DEMONSTRATION

As describe above, a set of alternative waste particle size distributions was examined in a TSPA sensitivity analysis. The log-triangular distribution for waste particle diameter that is used in ASHPLUME V1.4LV-dll was modified to consider cases in which the maximum and minimum values were increased and decreased by factors of 2, and the modal value was increased and decreased by a factor of 10. The alternative distributions were chosen to allow testing the sensitivity of performance to the form of the distribution within a range of reasonable maximum and minimum values. Figure 3.3.1.2-2 in SSPA Volume 2 (BSC 2001 [DIRS 154659]) shows probability-weighted mean annual doses from the eruptive case only, calculated for the seven waste particle size distributions described (SSPA Volume 1; BSC 2001 [DIRS 154657] Table 14.3.3.4-1) and the TSPA-SR base-case distribution (CRWMS M&O 2000 [DIRS 153246], Section 3.10.2.2.2). This figure has been included in this report as Figure 1. The other input parameters in each case were identical to those used in TSPA-SR (CRWMS M&O 2000 [DIRS 153246], Sections 3.10.2 through 3.10.4). Calculated annual doses vary by a factor of approximately 1.3 or less, and performance is relatively insensitive to uncertainty in waste particle diameter within the range considered in the analysis.



Source: TSPA-SR (CRWMS M&O 2000 [DIRS 153246], Sections 3.10.2.2 through 3.10.2.4).

NOTE: All models and input parameters, except the alternative waste particle diameter distributions, are identical to those used in the TSPA-SR.

Figure 1. Sensitivity of Probability-Weighted Mean Annual Dose from Volcanic Eruption to Waste Particle Diameter. (Same as Figure 3.3.1.2.2 in SSPA Vol. 2)

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Waste particle diameter was varied over a range of values (BSC 2001 [DIRS 154657], Section 14.3.3.4) sufficient to address uncertainties in the distribution. The sensitivity analysis showed that performance is relatively insensitive to uncertainty in waste particle size within the range considered in the analysis (BSC 2001 [DIRS 154659], Section 3.3.1.2.2). DOE considers that the sensitivity of performance to uncertainties in waste particle size distribution is well understood and was sufficiently documented in SSPA Volume 2 (BSC 2001 [DIRS 154659], Section 3.3.1.2.2). DOE considers that the information in the SSPA volumes is adequate to resolve and close the agreement item.

4. REFERENCES

4.1 DOCUMENTS CITED

BSC (Bechtel SAIC Company) 2001. *FY01 Supplemental Science and Performance Analyses, Volume 1: Scientific Bases and Analyses.* TDR-MGR-MD-000007 REV 00. Las Vegas, Nevada: Bechtel SAIC Company. ACC: MOL.20010712.0062. DIRS 154657

BSC (Bechtel SAIC Company) 2001. *FY01 Supplemental Science and Performance Analyses, Volume 2: Performance Analyses.* TDR-MGR-PA-000001 REV 00. Las Vegas, Nevada: Bechtel SAIC Company. ACC: MOL.20010724.0110. DIRS 154659

Crump, T. 2001. "Igneous Activity TE Meeting Summary." E-mail from T. Crump to J. McNeish, June 25, 2001, with attachment. ACC: MOL.20010723.0094; MOL.20010723.0095. DIRS 156332

CRWMS M&O 2000. *Igneous Consequence Modeling for the TSPA-SR.* ANL-WIS-MD-000017 REV 00 ICN 01. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.20001204.0022. DIRS 151560

CRWMS M&O 2000. *Total System Performance Assessment for the Site Recommendation.* TDR-WIS-PA-000001 REV 00 ICN 01. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.20001220.0045. DIRS 153246

CRWMS M&O 2001. *Miscellaneous Waste-Form FEPs.* ANL-WIS-MD-000009 REV 00 ICN 01. Las Vegas, Nevada: CRWMS M&O. ACC: MOL.20010216.0006. DIRS 153938

Jarzemba, M.S.; LaPlante, P.A.; and Poor, K.J. 1997. *ASHPLUME Version 1.0—A Code for Contaminated Ash Dispersal and Deposition, Technical Description and User's Guide.* CNWRA 97-004, Rev. 1. San Antonio, Texas: Center for Nuclear Waste Regulatory Analyses. ACC: MOL.20010727.0162. DIRS 100987

Reamer, C.W. and Williams, D.R. 2000. Summary Highlights of NRC/DOE Technical Exchange and Management Meeting on Igneous Activity. Meeting held August 29-31, 2000, Las Vegas, Nevada, with attachments. [Washington, D.C.]: U.S. Nuclear Regulatory Commission. ACC: MOL.20001101.0106; MOL.20001101.0107; MOL.20001101.0108; MOL.20001101.0105; MOL.20001101.0109; MOL.20001101.0110; MOL.20001101.0111; MOL.20001101.0112; MOL.20001101.0113; MOL.20001101.0114; MOL.20001101.0115;

MOL.20001101.0116; MOL.20001101.0117; MOL.20001101.0118; MOL.20001101.0119; MOL.20001101.0120; MOL.20001101.0121; MOL.20001101.0122; MOL.20001101.0123; MOL.20001101.0124; MOL.20001101.0125; MOL.20001101.0126; MOL.20001101.0127; MOL.20001101.0128. DIRS 154597

4.2 CODES, STANDARDS, REGULATIONS, AND PROCEDURES

10 CFR 63. Energy: Disposal of High-level Radioactive Wastes in a Geologic Repository at Yucca Mountain, Nevada. Readily available.

WIND SPEED DATA APPROPRIATE FOR THE HEIGHT OF THE ERUPTIVE COLUMNS BEING MODELED

June 2002

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Enclosure: Wind Speed Data

Enclosure 2

CONTENTS

Page

ACRONYMS AND ABBREVIATIONS iv

1. BACKGROUND 1
   1.1 NRC INITIAL COMMENTS 1
   1.2 DOE INITIAL COMMENTS 1
   1.3 STATEMENT OF DIFFERENCES 1
   1.4 DEFINITION OF TECHNICAL TERMS 2

2. APPLICABLE NUCLEAR SAFETY STANDARDS/REQUIREMENTS/GUIDANCE 2
   2.1 APPLICABLE REQUIREMENTS 2
   2.2 KTI AGREEMENT 2
   2.3 STATUS OF AGREEMENT(S) 3

3. BASIS FOR REGULATORY COMPLIANCE STATEMENT 3
   3.1 BACKGROUND 3
   3.2 SAFETY / TECHNICAL BASIS FOR THE COMPLIANCE STATEMENT 4

4. REFERENCES 5
   4.1 DOCUMENTS CITED 5
   4.2 CODES, STANDARDS, REGULATIONS, AND PROCEDURES 6

FIGURES

Page

1. Sensitivity of Probability-Weighted Mean Annual Dose from Volcanic Eruption to the Use of an Alternative Set of Wind Speed Data..... 5

ACRONYMS AND ABBREVIATIONS

DOE	U.S. Department of Energy
FY	Fiscal Year
KTI	Key Technical Issue
LA	License Application
NRC	U.S. Nuclear Regulatory Commission
SR	Site Recommendation
SSPA	Supplemental Science and Performance Assessment
TSPA	Total System Performance Assessment

Wind Speed Data Appropriate for the Height of the Eruptive Columns Being Modeled

This Licensing Letter Report describes the basis to resolve and close an agreement item (IA 2.09) associated with the consequences subissue of the igneous activity Key Technical Issue (KTI). The item in question is the U.S. Department of Energy (DOE)-U.S. Nuclear Regulatory Commission (NRC) agreement that DOE evaluate the wind speed data appropriate for the height of the eruptive (ash) columns being modeled (Crump 2001 [DIRS 156332]).

The mathematical model (implemented within ASHPLUME v1.4LV) uses the wind speed as an input parameter (CRWMS M&O 2000 [DIRS 151560], Table 2).

1. BACKGROUND

DOE originally agreed to evaluate the wind speed data appropriate for the height of the eruptive columns being modeled in the Total System Performance Assessment (TSPA)-Site Recommendation (SR), Revision 1 (Reamer and Williams 2000 [DIRS 154597]). Plans to develop Revision 1 were cancelled, and the agreement was revised during the NRC/DOE Technical Exchange and Management Meeting on Igneous Activity, June 21-22, 2001 (Crump 2001 [DIRS 156332]). Under the revised agreement, DOE agreed to provide the information in a calculation document that would be available to the NRC in Fiscal Year (FY) 2002.

1.1 NRC INITIAL COMMENTS

The NRC is concerned that use of air speed data described in the igneous consequences analysis/model report (CRWMS M&O 2000 [DIRS 151560], Table 2) might not be representative of wind speeds throughout the altitudes attained by ash columns from violent strombolian eruptions.

1.2 DOE INITIAL COMMENTS

For the TSPA-SR, DOE used wind speed data from altitudes between about 1.5 and 5 km above mean sea level (CRWMS M&O 2000 [DIRS 153246], Section 3.10.2.2.3).

In response to comments from the NRC and agreement IA 2.09, DOE has used wind speed data from elevations that ash columns from violent strombolian eruptions would be expected to attain. The analyses were documented in the Supplemental Science and Performance Assessment (SSPA), volumes 1 (BSC 2001 [DIRS 154657], section 14.3.3.5) and volume 2 (BSC 2001 [DIRS 154659], Section 3.3.1.2.1). The data was from the Desert Rock airstrip (NOAA n.d. [DIRS 154435]) and was collected between 1978 and 1995.

1.3 STATEMENT OF DIFFERENCES

The NRC questioned the basis for the wind speed data used in the TSPA-SR by noting that eruption columns associated with violent strombolian eruptions could reach altitudes higher than

5 km. By using the higher altitude wind speed data, the differences between the NRC and DOE analyses, related to height of the eruption column, have been addressed.

After the September 5, 2001 DOE-NRC technical exchange, the NRC expressed a concern about use of average values for wind speed rather than a stratified distribution of wind speeds. The NRC concern is that DOE's method might result in underestimating dose because of not accounting for the effect of thermal buoyancy keeping some particles aloft for a longer period of time. While it is true that the DOE analysis assumes that wind speed does not vary with height, the wind speed used in the DOE analysis is not an averaged wind speed. In the DOE analysis, wind speed is treated as a stochastic variable, which is modeled as a distribution of wind speeds. The distribution of wind speeds has been derived from data collected from various heights, times, and wind directions. The data represent the entire range of wind speed expected to occur at all altitudes during a hypothetical future volcanic eruption at Yucca Mountain. The TSPA model samples from the distribution of wind speeds for the TSPA analysis. For each realization of the model, the analysis uses the discrete value for wind speed obtained during that realization. The model does not use an average value for wind speed. Because the highest wind speeds in the distribution of wind speeds are sampled for some TSPA model realizations, longer settling times due to thermal buoyancy for some particles are accounted for in the average dose calculations, and the DOE method should not underestimate dose.

1.4 DEFINITION OF TECHNICAL TERMS

ASHPLUME v1.4LV is the computer code, selected from several such codes, that the project has decided to use to simulate potential volcanic events at a repository at Yucca Mountain.

Strombolian is a type of volcanic eruption named for occurrences on the island of Stromboli (Italy, north of Sicily) and featuring eruptions characterized by jetting of clots or fountains of fluid, basaltic lava from a central crater.

2. APPLICABLE NUCLEAR SAFETY STANDARDS/REQUIREMENTS/GUIDANCE

2.1 APPLICABLE REQUIREMENTS

The Yucca Mountain disposal regulations include a requirement to provide the technical basis for models used in the performance assessment (10 CFR63.114(g)). Wind speed is a required input for the ASHPLUME code. While no specific requirement to address wind speed has been identified, the KTI agreement item, described below, is the only stipulation applicable to the evaluation of wind speed data appropriate for the height of the eruptive (ash) columns being modeled.

2.2 KTI AGREEMENT

The following KTI agreement, IA 2.09, is based on the Summary Highlights of the NRC/DOE Technical Exchange and Management Meeting on Igneous Activity that occurred on August 29-31, 2000 (Reamer and Williams 2000 [DIRS 154597]) as modified in the Summary Highlights of the NRC/DOE Technical Exchange and Management Meeting on Igneous Activity that occurred on June 21-22, 2001 (Crump 2001 [DIRS 156332]).

Use the appropriate wind speeds for the various heights of eruption columns being modeled. (Eruptive AC-5)

DOE agreed and will evaluate the wind speed data appropriate for the height of the eruptive columns being modeled. This will be documented in a calculation document. This will be available to the NRC in FY 2002. (MOL.20010723.0098)

2.3 STATUS OF AGREEMENT(S)

DOE documented the technical basis for using the wind speed data for higher altitudes in the SSPA, Volume 1 (BSC 2001 [DIRS 154657], section 14.3.3.5), and the TSPA sensitivity to the new information was described in Volume 2 (BSC 2001 [DIRS 154659], Section 3.3.1.2.1). However, during a DOE-NRC Technical Exchange on Igneous Activity, April 15-16, 2002, the NRC indicated concerns about the use of average wind speed data, which would not include consideration of thermal bouyancy, and thus underestimate transport (Gunter 2002). Section 3.2 provides the technical basis for DOE's treatment of wind speeds as documented in SSPA Volume 1 and Volume 2. DOE considers that the documentation provided in the SSPA Volume 1 (BSC 2001 [DIRS 154657], section 14.3.3.5), and the TSPA sensitivity to the new information that was described in Volume 2 (BSC 2001 [DIRS 154659], Section 3.3.1.2.1) are sufficient to address the agreement. In addition, DOE acknowledges the appropriateness of the Desert Rock data and intends to use that data in calculations supporting TSPA-License Application (LA).

An ASHPLUME model report is being developed to support TSPA-LA. Purposes for the report include describing the ASHPLUME model, providing documentation of the validation of the model, and describing the inputs that are provided to TSPA-LA. This report is scheduled for completion by the end of December 2002. In addition, planned activities include work to justify existing parameter distributions or update those parameters and integrate ASHPLUME with GoldSim. These activities and the documentation in the ASHPLUME model report are intended to ensure that appropriate parameters, such as the wind speeds appropriate for the heights of eruption columns being modeled, are used in ASHPLUME and integrated into TSPA-LA.

Based on the information in the SSPA volumes 1 and 2 and planned work to document the use of appropriate wind speeds in a new ASHPLUME model report and integrate the windspeed data into TSPA-LA, DOE considers the agreement fulfilled.

3. BASIS FOR REGULATORY COMPLIANCE STATEMENT

DOE has completed the analyses needed to fulfill the agreement item, but the documentation was provided in the SSPA Volume 1 and Volume 2 rather than in a calculation document.

3.1 BACKGROUND

Wind speed is a required input for the ASHPLUME code, and for the TSPA-SR analyses, DOE used a distribution for wind speed data that was developed in the igneous consequences analysis/model report (CRWMS M&O 2000 [DIRS 151560], Section 6.1.2.2.1). That

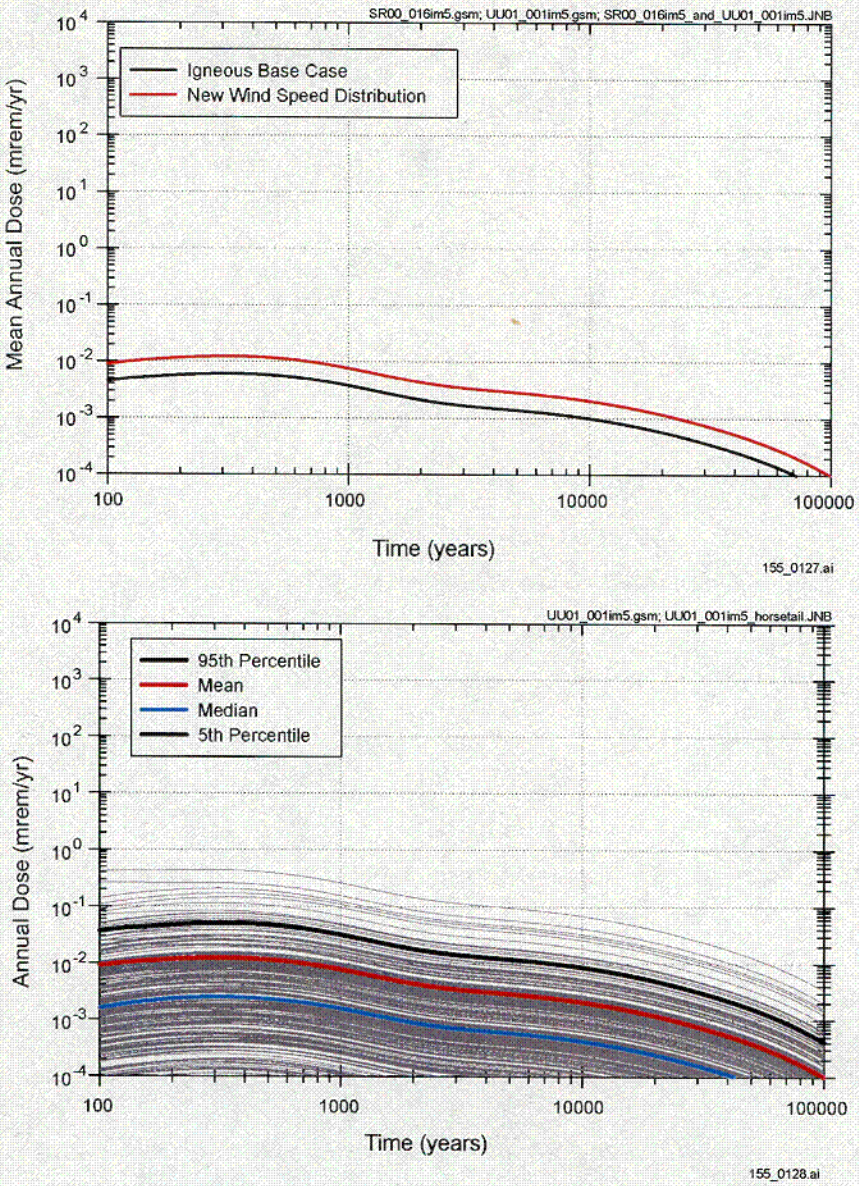
distribution was based on site data collected at altitudes from about 1.5 to 5 km above mean sea level. As described in the SSPA Volume 1 (BSC 2001 [DIRS 154657], section 14.3.3.5), it is possible for violent strombolian eruptions of the type possible in the Yucca Mountain Region to produce ash plumes that reach altitudes greater than 5 km. DOE therefore reexamined the distribution of wind speed and included wind speed information from higher altitudes than those used in the TSPA-SR.

3.2 SAFETY / TECHNICAL BASIS FOR THE COMPLIANCE STATEMENT

The technical basis for using the higher altitude wind speed data is described in the SSPA Volume 1 (BSC 2001 [DIRS 154657], section 14.3.3.5) and has been excerpted for this discussion. For the analysis documented in SSPA Volume 2 (BSC 2001 [DIRS 154659], Section 3.3.1.2.1), wind speed data taken from the Desert Rock airstrip (NOAA n.d. [DIRS 154435]) between 1978 and 1995 were used to develop the new wind speed distribution using the same method described in the igneous consequences analysis/model report (CRWMS M&O 2000 [DIRS 151560], Section 6.1.2.2.1). Desert Rock 300 millibar wind speed data (taken from an average height of 9434 m from all wind directions) were combined to create the new distribution. The wind speed cumulative distribution function includes wind speeds up to 5683 cm/s, which is approximately 2.4 times faster than the maximum wind speed given in the igneous consequences analysis/model report (CRWMS M&O 2000 [DIRS 151560], Section 6.1.2.2.1). The median value for the new distribution was 1,033 cm/s, or approximately 1.6 times faster than that used in the igneous consequences analysis/model report (CRWMS M&O 2000 [DIRS 151560], Section 6.1.2.2.1). The wind was assumed to blow to the south toward the critical group (reasonably maximally exposed individual).

Because the Desert Rock data includes data from higher altitudes, the wind speeds are somewhat higher than those used in TSPA-SR. The median value of the new data set was about 1033 cm/sec compared to the median value of about 650 cm/sec for the data used in TSPA-SR (BSC 2001 [DIRS 154659], Section 3.3.1.2.1). Because the higher altitudes included in the Desert Rock airstrip data are consistent with the upper range of column heights proposed as possible for eruptions at Yucca Mountain, the Desert Rock data were used in the supplemental TSPA analyses for the SSPA.

The analysis, documented in the SSPA Volume 2 (BSC 2001 [DIRS 154659], Section 3.3.1.2.1), showed that use of the Desert Rock data increases the probability-weighted mean annual doses by a factor of approximately 2 compared to the TSPA-SR values. The results of the analysis are shown in SSPA Volume 2 (BSC 2001 [DIRS 154659] Figure 3.3.1.2-1, which has been included below as Figure 1. As described in Section 2.3 of this report, DOE intends to use the Desert Rock data in analyses supporting TSPA-LA. This use will ensure that the licensing case includes wind speed data representing altitudes that could be reached by violent strombolian eruptions, which could be associated with disruption of the repository by igneous activity.



Source: TSPA-SR (CRWMS M&O 2000 [DIRS 153246], Section 3.10.2.2 through 3.10.2.4)

NOTE: All models and input parameters, except the alternative wind speed data, are identical to those used in the TSPA-SR. In (b), the 5th percentile curve plots below the lowest value shown on the y-axis.

Figure 1. Sensitivity of Probability-Weighted Mean Annual Dose from Volcanic Eruption to the Use of an Alternative Set of Wind Speed Data

4. REFERENCES

4.1 DOCUMENTS CITED

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4.2 CODES, STANDARDS, REGULATIONS, AND PROCEDURES

10 CFR 63. Energy: Disposal of High-level Radioactive Wastes in a Geologic Repository at Yucca Mountain, Nevada. Readily available.