Sandia National Laboratories Waste Isolation Pilot Plant

Calculation of MgO Safety Factors for the WIPP Compliance Recertification Application and for Evaluating Assumptions of Waste Homogeneity in WIPP PA

BOE 1.3.5.4.3

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WIPP: 1.3.5. 4.3: PA10A-L: 530218 on Only

TABLE OF CONTENTS

1 ABBREVIATIONS, ACRONYMS, ETC.	
2 REVISION HISTORY	
3 BACKGROUND	
4 CALCULATIONS	
5 RESULTS	
6 REFERENCES	
APPENDIX A: MgOsafetyfactorEPAleigh.XLS	14
APPENDIX B: MgOsafetyfactorSNLleigh.XLS	
APPENDIX C: MgOsafetyfactorEPAleigh8panel.XLS	
APPENDIX D: MgOsafetyfactorSNLleigh8panel.XLS	
APPENDIX E: EPA13.5CPRpanelXupdate.XLS	18
APPENDIX F: SNL13.5CPRpanelXupdate.XLS	
APPENDIX G: EPA54CPRpanelX.XLS	20
APPENDIX H: SNL54CPRpanelX.XLS	
APPENDIX I: MgOsafetyfactorSNLPAcalcs.XLS	

1 ABBREVIATIONS, ACRONYMS, ETC.

Table 1 defines the abbreviations, acronyms, etc., used in this report.

Abbreviation, Acronym, Etc.	Definition
AMWTP	Advanced Mixed Waste Treatment Project
BRAGFLO	Brine and Gas Flow, a WIPP PA code
brucite	$Mg(OH)_2$
С	carbon
CCA	(WIPP) Compliance Certification Application
СН	contact-handled (transuranic waste)
CPR	cellulosics, plastics, and rubbers
CO_2	carbon dioxide
CRA	(WIPP) Compliance Recertification Application
DOE	(U.S.) Department of Energy
EPA	(U.S.) Environmental Protection Agency
ERDA-6	Energy Research and Development Administration (WIPP Well) 6,
	a synthetic brine representative of fluids in Castile brine reservoirs
g	gram(s)
gal	gallon(s)
GWB	Generic Weep Brine, a synthetic brine representative of
	intergranular Salado brines
H, H^{+}	hydrogen, hydrogen ion
hydromagnesite	$Mg_4(CO_3)_3(OH)_2 \cdot 3H_2O$ or $Mg_5(CO_3)_4(OH)_2 \cdot 4H_2O$
IN-BN-510	the AMWTP supercompacted waste stream
INEEL	Idaho National Engineering and Environmental Laboratory
kg	kilogram(s)
lb	pound(s)
m^3	cubic meter(s)
MgO	magnesium oxide, used to refer to the WIPP engineered barrier,
	which includes periclase as the primary constituent and
_	~5-10 wt % impurities
mol	mole(s)
N	nitrogen
NO_3	nitrate ion, nitrate

Abbreviation, Acronym, or Initialism	Definition
О	oxygen
PA	performance assessment
periclase	pure, crystalline MgO, the primary constituent of the WIPP engineered barrier
RH	remote-handled (transuranic waste)
S	sulfur
SNL	Sandia National Laboratories
SO ₄ ²	sulfate ion, sulfate
SWB(s)	standard waste box(es)
TDOP(s)	ten-drum overpack(s)
TRU	transuranic
WIPP	(U.S. DOE) Waste Isolation Pilot Plant

2 REVISION HISTORY

This analysis report has three objectives: (1) correction of the MgO safety factors for contact-handled (CH) and remote-handled (RH) transuranic (TRU) waste emplaced homogeneously in all 10 panels of the Waste Isolation Pilot Plant (WIPP); (2) correction of the safety factors calculated previously for supercompacted waste (waste stream IN-BN-510) from the Advanced Mixed Waste Treatment Project (AMWTP) at the Idaho National Engineering and Environmental Laboratory (INEEL) in a single panel for the analysis by Hansen et al. (2003), and the first calculation of additional single-panel safety factors for that analysis; (3) the first calculation of a safety factor for IN-BN-510 emplaced homogeneously in eight panels of the repository. In this report, the MgO safety factor is defined as the total quantity of MgO to be emplaced in a panel or the repository divided by the quantity of CO₂ that would be produced by complete microbial degradation of cellulosics, plastics, and rubbers (CPR) in the waste or waste containers in a panel or the repository.

Correction of the MgO safety factors for a homogeneous, 10-panel repository is necessary because Lott (2003) corrected Crawford's (2003) estimates of the quantities of CPR in the CH- and RH-TRU waste and waste containers to be emplaced in the WIPP; and because Leigh and Sparks-Roybal (2003) corrected the estimates by Leigh and Crawford (2003) of the quantities of NO₃ and SO₄² to be emplaced in the WIPP. The safety factors for a homogeneous, 10-panel repository reported herein replace those of



Snider (2003), which were based on the Crawford's (2003a) estimates of CPR and on Leigh and Crawford's estimates of NO₃ and SO₄² in the inventory.

Meanwhile, Leigh (2003a, b) estimated the quantities organic ligands in a hypothetical "Panel X" for the analysis by Hansen et al. (2003). The objective of this analyses are to assess the impact of emplacing 100-gal drums of IN-BN-510 on the validity of using assumptions of waste homogeneity in WIPP PA. Leigh (2003a, b) defined two cases for this analysis: (1) a realistic case, in which the portion of the total volume of the CH TRU waste in Panel X occupied by IN-BN-510 is equal to the portion of the total volume of the CH waste in Panel 1 occupied by the largest waste stream in Panel 1, incinerator ash and process residue (waste stream RF 118.01) from the Rocky Flats Environmental Technology Site (RFETS); (2) a conservative case, in which the portion of CH waste containers in Panel X from INEEL is equal to the portion of the containers in Panel 1 from RFETS, the site that shipped the most containers to Panel 1. For both the realistic and the conservative cases, Leigh (2003a, b) assumed that the ratio of each type of CH waste container with INEEL waste in Panel X to the total quantity of INEEL CH waste containers in Panel X is equal to the ratio of the total quantity of that type of CH waste container to be shipped from INEEL to the total quantity of all the CH waste containers to be shipped from INEEL. Finally, Leigh (2003b) assumed that the total volume of CH waste in Panel X is equal to 1.685×10^5 m³ $\times 0.1044 = 17,590$ m³, in which 1.685×10^5 m³ is the total volume of CH waste to be emplaced in the WIPP and 0.1044 is the portion of the total WIPP inventory in a seven-room, PA panel (Lappin et al., 1989, Table 4-7).

Leigh (2003a, 2003b) used the assumptions described above to calculate the following for a realistic and a conservative Panel X: (1) the quantities of INEEL waste containers with IN-BN-510 and with uncompacted waste, and the quantity of containers with waste from all of the other sites; (2) the quantities of CPR and of NO_3 and SO_4^2 in each type of container; (3) the total quantities of CPR and of NO_3 and SO_4^2 in Panel X.

This report includes calculation of MgO safety factors for a homogeneous, 10-panel repository; a realistic Panel X, a conservative Panel X (Leigh, 2003a; 2003b), and other loadings of IN-BN-510 for the analysis by Hansen et al. (2003); and for IN-BN-510 emplaced homogeneously in eight panels.

This work was carried out under the task entitled "Chemical Conditions in the Repository" in Table 2 of Hansen et al. (2003). This report supercedes Snider (2003).

3 BACKGROUND

CPR are present in the contact handled (CH) and remote-handled (RH) TRU waste that is being or will be emplaced in the WIPP. If significant microbial activity occurs in the repository, microorganisms would degrade CPR by the following,

sequential reactions (Brush, 1990; Brush 1995; Wang and Brush, 1996; Francis et al., 1997):

$$C_6H_{10}O_5 + 4.8H^+ + 4.8NO_3^- \rightarrow 7.4H_2O + 6CO_2 + 2.4N_2;$$
 (1)

$$C_6H_{10}O_5 + 6H^+ + 3SO_4^{2-} \rightarrow 5H_2O + 6CO_2 + 3H_2S;$$
 (2)

$$C_6H_{10}O_5 + H_2O \rightarrow 3CH_4 + 3CO_2.$$
 (3)

Microbial degradation of CPR according to Reaction 1 (denitrification) and Reaction 2 (SO₄²⁻ reduction) would produce 1.00 mol of CO₂ per mol of organic C consumed; Reaction 3 (methanogenesis) would produce 0.500 mol of CO₂ per mol of organic C. For the CCA, Wang and Brush (1996) calculated that Reaction 3 would account for over 95% of the (possible) microbial gas generation in the WIPP. They concluded that methanogenesis would be much more important than denitrification and SO₄²⁻ reduction because the quantity of CPR greatly exceeded those of NO₃⁻ and SO₄²⁻ at the time of the CCA (U.S. DOE, 1996a). Based on a total quantity of 77,640 metric tons of MgO to be emplaced in the repository in supersacks and minisacks (U.S. DOE, 1996b, Chapter 3) and an effective CO₂ yield consistent with the quantities of CPR, NO₃⁻, and SO₄²⁻ estimated by U.S. DOE (1996a), the MgO safety factor was 3.73 at the time of the CCA (Brush et al., 2002). The U.S. Environmental Protection Agency (EPA), however, calculated an MgO safety factor of 1.95 at the time of the CCA by assuming that microbial degradation of 1.00 mol of organic C would yield 1.00 mol of CO₂ (Brush et al., 2002).

In July 2000, the DOE proposed the elimination of the MgO minisacks to reduce the risk of injury associated with manual emplacement of the minisacks, and to further reduce worker exposure to radiation. The EPA approved this change in January 2001 (Marcinowski, 2001). Elimination of the minisacks has resulted in a 15% reduction in the total mass of MgO to be emplaced in the repository (from 77,640 to about 67,123 metric tons), and has reduced the safety factor from 3.73 to 3.23 assuming the proportions of CPR degraded by Reactions 1, 2, and 3 calculated by Brush and Wang (1996), or from 1.95 to 1.67 assuming that microbial degradation of 1.00 mol of organic C would yield 1.00 mol of CO₂ (Brush et al. 2002).

Since then, the DOE has not requested any further reductions in the MgO to be emplaced in the WIPP.

4 CALCULATIONS

All calculations were done using the Microsoft EXCEL 2000 spreadsheet program running Windows 2000. **EXCEL** files are entitled The "MgOsafetyfactorEPAleigh.XLS," "MgOsafetyfactorEPAleigh8panel.XLS," MgOsafetyfactorSNLleigh.XLS," "MgOsafetyfactorSNLleigh8panel.XLS," EPA13.5CPRpanelX.XLS," "SNL13.5CPRpanel.XLS," "EPA54CPRpanelX.XLS,"

"SNL54panelX.XLS," and "MgOsafetyfactorSNLPAcalcs.XLS." All of the files with "SNL" in the title assume that methanogenesis, which yields 0.50 mol of CO₂ per mol of C degraded (see Reaction 3 in Section 3, Introduction), is the dominant microbial respiratory pathway. The first four files listed above are used to calculate the MgO safety factor for a homogeneous repository with either 10 panels or 8 panels. The safety factor is calculated for a homogeneous 10-panel repository because this is the basis for "baseline" PA calculations such as those used for the CCA and the CRA; it is also calculated for a homogeneous, 8-panel repository because emplacement of waste in Panel 1 has been completed and because it is unlikely that any AMWTP waste will be shipped to WIPP prior to filling Panel 2. The next four files calculate safety factors for the realistic and the conservative Panel X defined by Leigh (2003a, 2003b) (see Section 2, Revision History, above). The final file calculates safety factors for Panel X with a range of AMWTP waste that varies from 0 to 100%.

The EXCEL files MgOsafetyfactorEPAleigh.XLS (Appendix A) MgOsafetyfactorSNLleigh.XLS (Appendix B) each contain four sheets. The sheet tabs in each file are labeled "MgO Dissolved in Brine," "CH CPR," "RH CPR," and "Safety The files MgOsafetyfactorEPAleigh8panel.XLS (Appendix C) and MgOsafetyfactorSNLleigh8panel.XLS (Appendix D) each contain five sheets. The tabs are labeled "MgO Dissolved in Brine," "CPR Calcs," "CH CPR," "RH CPR," and The files EPA13.5CPRpanelX.XLS (Appendix SNL13.5CPR panelX.XLS (Appendix F), EPA54CPR panelX.XLS (Appendix G), SNL54panelX.XLS (Appendix H) each contain five sheets: "MgO Dissolved in Brine," "PA Supersack Ratio," "CH CPR," "RH CPR," and "Safety Factor." The final file, MgOsafetyfactorSNLPAcalcs (Appendix I), contains eight sheets. The sheet tabs are labeled "MgO Dissolved in Brine," "Conservative Case," "CH CPR," "INEEL CPR," "RH CPR," "Safety Factors," "PA Request (EPA)," and "PA Request (DOE)." Detailed descriptions of each of the four sheets present in all nine of these files (MgO Dissolved in Brine, CH CPR, RH CPR, and Safety Factor) are contained in Snider (2003). This report contains brief descriptions of each of these sheets. The first sheet in all of the files calculates the number of moles of MgO that would dissolve in GWB and ERDA-6. This is critical to the calculations because in the event of a borehole intrusion, MgO would be lost by dissolution and transport up the borehole, thus reducing the amount available to consume CO2. Therefore, additional moles of MgO must be added to the final calculated amount in order to account for this possibility. To begin with, the initial and final concentrations of MgO were determined in both GWB and ERDA-6 from EQ3NR calculations performed by Yongliang Xiong. (These input and output files are contained in Snider, 2003.)

The second sheet in files MgOsafetyfactorEPAleigh.XLS and MgOsafetyfactorSNLleigh.XLS and the third sheet in all of the other files determines the number of moles of CO₂ that could be produced from complete microbial degradation of the CPR in CH TRU waste. Lott (2003) provided the average densities of CPR per drum of CH waste. In the file with SNL in the title, the second half of this sheet calculates the effects of including the total amounts of NO₃ and SO₄² in the corrected, updated inventory (Leigh and Sparks-Roybal, 2003). The relative amounts of CPR, NO₃, and

 SO_4^{2-} in the inventory determine the proportions of CPR degraded by denitrification, SO_4^{2-} reduction, and methanogenesis; see Reactions 1, 2, and 3 in Section 3, Introduction. To determine the percentages of the total moles of CO_2 produced by Reactions 1, 2, and 3, the total moles of NO_3^- and SO_4^{2-} are divided by the total moles of CO_2 produced from the CPR multiplied by the stoichiometric ratio of C to NO_3^- or SO_4^{2-} , which is finally multiplied by 100. The moles left over are produced by methanogenesis. The final moles of CO_2 that could be produced from the CPR is equal to ((the molar % of cellulosics degraded by sulfate reduction) + (the molar % of cellulosics degraded by methanogenesis/2)) x total moles of organic carbon (C).

The second sheet in files MgOsafetyfactorEPAleigh8panel.XLS and MgOsafetyfactorSNLleigh8panel.XLS, is entitled "CPR Calcs." This sheet takes the total CPR in kilograms for a 10-panel repository and determines the mass of CPR that will fill an 8-panel repository, assuming that Panels 1 and 2 are sealed by the time WIPP starts to emplace AMWTP waste. All INEEL waste will be distributed evenly throughout the eight remaining panels. Row 13 is the mass of CPR in INEEL waste determined by adding the 100-gal drums of supercompacted AMWTP waste + the ten-drum overpacks (TDOPs) of uncompacted AMWTP waste + the standard waste boxes (SWBs) of uncompacted AMWTP waste. Row 16 displays the mass of non-INEEL waste from all other DOE sites that will be distributed in an eight panel repository by subtracting the two seven-room panels in which waste emplacement has been completed (Panels 1 and 2) from the inventory. These numbers were calculated by taking the mass of CPR from Row 10 (55-gal drums from INEEL and all other sites) × CPR (row 10) × the proportion of the total WIPP inventory in tow seven-room panels (2 × 0.1044). Row 18 is the total mass of CPR that will be distributed amongst the eight panels.

The second half of the sheet, only present in MgOsafetyfactorSNLleigh.XLS, repeats the same arithmetic steps just described for the CPR throughout eight panels for the masses of NO₃ and SO₄².

The second sheet, PA Supersack Ratio, in files EPA13.5CPRpanelX.XLS, SNL13.5CPRpanelX.XLS, EPA54CPRpanelX.XLS, and SNL54CPRpanelX.XLS determines the ratio of the number of MgO supersacks in a seven-room panel as defined for PA calculations to the number of MgO supersacks expected in a seven-room panel based on the total amount of MgO approved by the EPA when it allowed the DOE to eliminate MgO minisacks (Marcinowski, 2001). A seven-room panel as defined for PA contains 0.1044 × the total CH and RH TRU waste inventory (Lappin et al., 1989, Table 4-7). This implies that there are $0.1044 \times 169{,}000 \text{ m}^3 = 17{,}591 \text{ m}^3 \text{ of CH}$ waste in a seven-room, PA panel (Leigh 2003b). This in turn implies that there are $17,591 \text{ m}^3 \div 0.208 \text{ m}^3/55 \text{ gal drum} = 84,574 55\text{-gal drums of CH waste in a seven-room}$ PA panel; that there are 12,081 seven-packs of 55-gal drums in a seven-room, PA panel; and that there are 4027 MgO supersacks in a seven-room, PA panel. (One MgO supersack is emplaced atop each stack of three seven-packs of 55-gal drums, each stack of three three-packs of 100-gal drums, each stack of three SWBs, or each TDOP.) Because each MgO supersack contains 4200 lb or 1905 kg of MgO (WTS, 2002), there are 7671 metric tons of MgO in a seven-room, PA panel. On the other hand, a total of 66,000 metric tons of MgO in the WIPP implies that there are 0.1044 × 67,132.8 = 7008.7 metric tons of MgO or 3679 MgO supersacks in a seven-room panel based on the mass of MgO approved by the EPA (Marcinowski, 2001). Therefore, a factor of 1.095 (Row 16 in the sheet entitled "Safety Factor") was obtained from the ratio of 4027 MgO supersacks in a seven-room, PA panel to 3679 MgO supersacks in a seven-room panel based on Marcinowski (2001). This factor of 1.095 is used to scale up the mass of MgO based on Marcinowski (2001) (Row 15 in Safety Factor) for the calculations involving the realistic and the conservative Panel X defined by Leigh (2003a, 2003b).

The third sheet in the files MgOsafetyfactorEPAleigh.XLS and MgOsafetyfactorSNLleigh.XLS, and the fourth sheet in all of the other files (except MgOsafetyfactorSNLPAcalcs.XLS), lists the CPR inventory for RH waste and the total moles of CO₂ that could be produced from possible microbial degradation of this CPR.

The final sheet in all of the files (except file MgOsafetyfactorSNLPAcalcs.XLS) shows how the safety factors were determined. A different safety factor was determined for each file based on the previously stated assumptions of CO₂ yields and the definition of Panel X (realistic or conservative). The safety factors were determined by adding the total possible moles of CO₂ that could be produced by complete degradation of CPR to the total moles of MgO dissolved in the ERDA-6 brine. The final result is divided into the total moles of MgO in Panel X or the WIPP.

The final file, MgOsafetyfactorSNLPAcalcs.XLS, fulfills a request by the PA personnel for information to be used in the computer code Brine and Gas Flow (BRAGFLO). This file contains sheets that carry out calculations that have not been described previously. However, the file does contain the four sheets that are present in all the previously mentioned EXCEL files.

The second sheet in the file, labeled Conservative Case, contains two parts. The top half of the sheet contains the total mass of CPR in Panel X, the mass of CPR per container type, and the total mass of CPR present in Panel X for each container. The total 55-gal mass represents all the CH waste from all the waste generation and storage sites, excluding INEEL. The three other waste containers (100-gal, SWBs and TDOPs) added together give the total mass of waste in Panel X from INEEL. To the right of the CPR table are additional columns containing such information as the emplaced waste volume, the percentage of each type of container, and the percentage by volume that each type of waste occupies in Panel X. The number of containers and container volumes are from Leigh (2003a, 2003b). The numbers of containers are multiplied by the mass of CPR per container to get the total mass of CPR in Panel X. The waste volume was determined by taking the number of containers and multiplying by individual container volumes. The lower half of the spreadsheet lists the masses of NO₃⁻ and SO₄²⁻ in Panel X, as total, per container, and total for the containers in the repository. Again, the total masses in 55-gal drums represent all the NO₃⁻ and SO₄²⁻ present in the CH waste

excluding INEEL. The masses in 100-gal drums, SWBs, and TDOPS were added together to obtain the total masses of NO₃⁻ and SO₄²- present in INEEL waste.

The fourth sheet, INEEL CPR, is calculated in the same fashion as the third (CH CPR) and fifth (RH CPR) sheets, which have been previously described. The masses of CPR used in the fourth sheet come from masses calculated from the sheet Conservative Case.

The sixth and seventh sheets, PA Request (EPA) and PA Request (DOE) contain a table of data to be used in BRAGFLO. The table is based on 1.00 m³ of waste starting from the conservative case where 54% of containers in panel X contain INEEL supercompacted and nondebris waste. As the non-INEEL waste is removed from 1.00 m³ the INEEL waste is emplaced in the resulting void volume. The safety factor is obtained for each waste:INEEL waste ratio. The table is presented in the following manner:

- 1. Columns A and C are volumetric proportions of both CH waste from all sites except INEEL and waste from INEEL. Each row adds up to 1.00 m³.
- 2. Columns B and D are scaled percent of the volume for each waste group starting from the conservative case.
- 3. Columns E and F are the number of moles of non-INEEL CH waste or INEEL waste present in each volume. The initial moles of CPR in non-INEEL CH waste, starting from the conservative case, was obtained from the sheet CH CPR (E37), whereas the initial moles of INEEL waste were obtained from sheet INEEL CPR (E40). The moles in both cases were scaled up or down accordingly.
- 4. For sheet PA Request (DOE), columns G through K and columns L through P are calculations that determine the percent degradation from the three possible pathways, denitrification, SO_4^{2-} reduction, and methanogenesis, and are scaled accordingly for the changes in volume for each waste type. Column G is the original moles of CO₂ produced for non-INEEL waste before correction for denitrification, SO_4^{2-} reduction, and methanogenesis. The original moles are found in sheet CH CPR, Column I, Row 9. The moles are multiplied by Column B (the scaled vol %). Column H, fraction % of denitrification is computed by: (moles of nitrate/original moles of CO₂ produced from CPR) x the stoichiometeric ratio (6/4.8) x 100. Column I, fraction % of sulfate reduction is calculated as above, except the stoichiometeric ratio is 2. The fraction % or methanogenesis (column J) subtracts the total of column H and I from 100. Column K calculates the total moles of CO₂ produced from CH waste accounting for denitrification, sulfate reduction and methanogenesis by: (fraction % denitrification/100) + (fraction % SO₄² reduction/100) + (fraction % methanogensis/100/2) x column G. Methanogenesis is divided by 2 because 1.00 mole of C produces 0.50 mole CO2. Columns L through P are calculated in the same way except the moles of CO₂ are from INEEL waste only.
- 5. Column Q from sheet PA Request (DOE) and column G from sheet PA Request (EPA) displays how many moles of MgO will be emplaced in one panel of the repository (the current design-basis quantitiy of MgO).
- 6. Column R from PA Request (DOE) and column H from PA Request (EPA) is the total moles of CO₂ that will be produced from all the CPR in Panel X. The column is an addition of columns K and P and the amount of dissolved MgO that could be lost up a borehole and the amount of CO₂ produced from RH waste.

7. The safety factors are listed in Column S in the PA Request (DOE) sheet and Column I in the PA Request (EPA) sheet.

5 RESULTS

The corrected, updated quantities of CPR, NO₃⁻, and SO₄²⁻ used in these current calculations are listed in Table 1 below.

Table 1. Densities and Masses of CPR, Nitrate, and Sulfate.

-	Cellulosics	Plastics	Rubbers	Plastic liner	Nitrates	Sulfates	Waste Volume
			Homog	eneous			
CH RH	<u>kg/m³</u> 5.80E+01 4.50E+00	<u>kg/m³</u> 1.40 E +01 4.90E+00	kg/m ³ 4.20E+01 3.10E+00	kg/m³ 1.60E+01 1.40E+00	<u>kg</u> 2.50E+06 0.00E+00	<u>kg</u> 4.21E+05 0.00E+00	<u>m³</u> 1.69E+05 7.08E+03
			Pan	el X			
Realistic Conservative RH	kg 9.34E+05 1.56E+06 4.50E+00	kg 6.38E+05 1.08E+06 4.90E+00	kg 2.23E+05 4.02E+05 3.10E+00	kg 2.86E+05 2.32E+05 1.40E+00	<u>kg</u> 2.31E+05 1.56E+06 0.00E+00	kg 1.20E+04 1.08E+06 0.00E+00	<u>m³</u> 1.76E+04 1.76E+04 7.39E+02

The MgO safety factors and other results obtained from these calculations are described briefly below. In the following discussion, "DOE safety factor" refers to an MgO safety factor calculated using the quantity of CO_2 that would be produced by complete microbial degradation of CPR in a panel or the repository by dentirification, SO_4^{2-} reduction, and methanogenesis (see Reactions 1, 2, and 3 in Section 3, Background) in proportion to the molar quantities of NO_3^- , SO_4^{2-} , and $CPR + (NO_3^- + SO_4^{2-})$, respectively in a panel or the repository; and "EPA safety factor" refers to a safety factor calculated by assuming a quantity of CO_2 that would be produced by complete degradation of the CPR by denitrification and/or SO_4^{2-} reduction.

For a homogeneous, 10-panel repository, 4.72% of the total mass of CPR would be degraded by denitrification, 0.82% by $SO_2^{2^2}$ reduction, and 94.46% by methanogenesis; and the DOE safety factor is 2.45. The EPA safety factor is 1.30.

For a realistic Panel X, 4.48% of the total mass of CPR would be degraded by denitrification, 0.66% by SO_2^{2} reduction, and 94.86% by methanogenesis; and the DOE safety factor is 2.66. The EPA safety factor is 1.39. These safety factors are higher than those calculated for a homogeneous, 10-panel repository (see above) because the amount of MgO assumed to be emplaced in Panel X in this report, 7670 metric tons, is 10.9%

higher than the amount consistent with a 10-panel repository that contains 74,000 short tons of MgO, the amount cited by the EPA when it approved the removal of MgO minisacks (Marcinowski, 20001, MgO Mini-sack Review, Table 1).

For a conservative Panel X, 3.00% of the total mass of CPR would be degraded by denitrification, 0.16% by SO_2^{2-} reduction, and 96.84% by methanogenesis; and the DOE safety factor is 2.02. The EPA safety factor is 1.05.

For an eight-panel, homogeneous repository, 4.87% of the total mass of CPR would be degraded by denitrification, 0.90% by $SO_2^{2^2}$ reduction, and 94.23% by methanogenesis; and the DOE safety factor is 2.14. The EPA safety factor is 1.14.

6 REFERENCES

- Brush, L.H. 1990. Test Plan for Laboratory and Modeling Studies of Repository and Radionuclide Chemistry for the Waste isolation Pilot Plant. SAND90-0266. Albuquerque, NM: Sandia National Laboratories.
- Brush, L.H. 1995. "Systems Prioritization Method Iteration 2 Baseline Position Paper: Gas Generation in the Waste Isolation Pilot Plant." Unpublished report, March 17, 1995. Albuquerque, NM: Sandia National Laboratories.
- Brush, L.H., A.C. Snider, C.R. Bryan, and Y. Wang. 2002. "The Use of MgO as an Engineered Barrier in the WIPP," Sixth International Workshop on Design and Construction of Final Repositories: Backfilling in Radioactive Waste Disposal, Brussels, 11-13 March 2002. Brussels, Belgium: Belgian Agency for Radioactive Waste and Enriched Fissile Materials (ONDRAF/NIRAS).
- Crawford, B.A. 2003. "Waste Material Parameters Deliverable in Support of WIPP CRA." Unpublished letter to C.D. Leigh, April 2, 2003. Carlsbad, NM: Los Alamos National Laboratory. ERMS 527270.
- Francis, A.J., J.B. Gillow, and M.R. Giles. 1997. *Microbial Gas Generation under Expected Waste Isolation Pilot Plant Repository Conditions*. SAND96-2582. Albuquerque, NM: Sandia National Laboratories.
- Gross, M.B. 2002. "Assessments of Impacts on Long-Term Performance from Supercompacted Wastes Produced by the Advanced Mixed Waste Treatment Project." Unpublished report, December 6, 2002. Carlsbad, NM: U.S. Department of Energy Carlsbad Field Office.
- Hansen, C.W., L.H. Brush, F.D. Hansen, G.R. Kirkes, and J.S. Stein. 2003. "Analysis Plan for Evaluating Assumptions of Waste Homogeneity in WIPP Performance Assessment." Unpublished analysis plan, AP-107, Rev. 1. Carlsbad, NM: Sandia National Laboratories. ERMS 531067.

- Lappin, A.R., R.L. Hunter, D.R. Garber, and P.B. Davies, eds. 1989. Systems Analysis, Long-Term Radionuclide Transport, and Dose Assessments, Waste Isolation Pilot Plant (WIPP), Southeastern New Mexico; March 1989. SAND89-0462. Albuquerque, NM: Sandia National Laboratories.
- Leigh, C.D. 2003a. "Estimate of Cellulosics, Plastics, and Rubbers in a Single Panel in the WIPP Repository in Support of AP-107, Supercedes ERMS #530959."
 Unpublished analysis report, September 4, 2003. Carlsbad, NM: Sandia National Laboratories. ERMS 531324.
- Leigh, C.D. 2003b. "Estimate of Oxyanion Masses in a Single Panel in the WIPP Repository in Support of AP-107, supercedes ERMS #530988." Unpublished analysis report, September 4, 2003. Carlsbad, NM: Sandia National Laboratories. ERMS 531332.
- Leigh, C.D., and B.A. Crawford. 2003. "Final Estimate of Oxyanion Mass in TRU Waste for Disposal in WIPP for the Compliance Recertification Application. Supercedes ERMS #529604 and ERMS #529592." Unpublished analysis report, June 13, 2003. Carlsbad, NM: Sandia National Laboratories. ERMS 529856.
- Leigh, C.D., and L. Sparks-Roybal. 2003. "Final Estimate of Oxyanion Mass in TRU Waste for Disposal in WIPP for the Compliance Recertification Application, Supercedes ERMS 529856," Rev. 1. Unpublished analysis report, August 22, 2003. Carlsbad, NM: Sandia National Laboratories. ERMS 530984.
- Lott, S. 2003. "Response to the Request for Waste Material and Container Material Densities from TWBID Revision 2.1, Version3.12, Data Version D.4.08." Unpublished letter to C.D. Leigh, August 15, 2003. Carlsbad, NM: Los Alamos National Laboratory. ERMS 530767.
- Marcinowski, F. 2001. Untitled letter with attachments from F. Marcinowski to I.R. Triay approving the DOE's proposal to eliminate MgO minisacks from the WIPP, January 11, 2001. Washington, DC: U.S. Environmental Protection Agency Radiation Protection Division. ERMS 519362.
- Peterson, A.C. 1996. "Mass of MgO That Could Be Added as Backfill in the WIPP and the Mass of MgO Required to Saturate the Brine and React with the CO₂ Generated by Microbial Processes". Albuquerque, NM: Sandia National Laboratories. ERMS 236214.
- Snider, A.C. 2002. "MgO Studies: Experimental Work Conducted at SNL/Carlsbad. Efficacy of Premier Chemicals MgO as an Engineered Barrier," "Sandia National Laboratories Technical Baseline Reports, WBS 1.3.5.3, Compliance Monitoring;

- WBS 1.3.5.4, Repository Investigations, Milestone RI110, January 31, 2002." Carlsbad, NM: Sandia National Laboratories. ERMS 520467. 3.1-1 to 3.1-18.
- Snider, A.C. 2003. "Calculation of the Quantities of MgO Required for Consumption of CO₂ for the WIPP Compliance Recertification Application." Unpublished analysis report, July 3, 2003. Carlsbad, NM: Sandia National Laboratories. ERMS 530220.
- U.S. DOE. 1996a. Transuranic Waste Baseline Inventory Report, Rev. 3. DOE/CAO-95-1121. Carlsbad, NM: U.S. Department of Energy Carlsbad Area Office.
- U.S. DOE. 1996b. Title 40 CFR Part 191 Compliance Certification Application for the Waste isolation Pilot Plant, Vol. 1-21. Carlsbad, NM: U.S. Department of Energy Carlsbad Area Office.
- Wang, Y. and L.H. Brush. 1996. "Estimates of Gas-Generation Parameters for the Long-Term WIPP Performance Assessment." Unpublished memorandum to M.S. Tierney, January 26, 1996. Albuquerque, NM: Sandia National Laboratories. ERMS 231943.
- WTS. 2002 "Specification for Prepackaged MgO Backfill." Unpublished specification, D-0101, Rev. 4. Carlsbad, NM: Westinghouse Electric Corp. TRU Solutions.

APPENDIX A: MgOsafetyfactorEPAleigh.XLS

MgO Dissolved in brink

	A	В	С	D	E	F	G	Н
1_		,						
2								
3_								
5	GWB	Moles of MaC	dissolved in brine					
6	I GWD	Moles of MgC	dissolved in brine	; 5 	<u> </u>	 		-
 7		Initial and final	conce by	EQ3	done by	Yongliang Xiong		
8	Concentration of Mg in brine	mila and ma	COLICG DY		done by	Torigilarig Xiorig		
9	Concentration of the art State				Molality to mo	larity ratio factor		1.146
10		Initial Conc	Final Conc in equil	Final Conc	1			1
11		Mol/L	with MgO, mol/Kg	mol/L				
12	Mg	1.000	7.8996E-01	6.89E-01				
13								
14		GWB ends up	with less Mg++ in so	olution and will be	e neglected for f	urther calcs	45.	
15		<u></u>						
16					Molality to mo	larity ratio factor		1.137
	ERDA-6	Calculated by	EQ3		ļ	1		
18						ra Pari Nilinano con a recentinga		
19		Initial Conc	Final Conc in equil	Final Conc	_ Volume	Moles of MgO		·
20		Mol/L	with MgO, mol/Kg	mol/L	m3 *	dissolved		
	INAC	0.019	1 OOAAE-O1					
21	Mg	0.010	1.0044E-01	8.83E-02	1.46E+05	1.01 E#07		
22	IVIS	0.010	1.004412-01	6.63E-02	1.40=+03			
22	living .	0.010	1.0044101	6.83E-02	1.46E+05			
22 23 24	living .	0.010	1.00442-01	0.03E-U2	1.40E+03			
22 23 24 25	l vig	0.010	1.00442-01	6.63E-U2	1.40E+03			
22 23 24 25 26		0.010	1.00442-01	6.63E-U2	1.40E+U3			
22 23 24 25		0.010	1.0044L-01	6.63E-U2	1.40E+U3			

CH CPR

	Α	В	С	D	Е	F	G	Н	1	J	K
1	Letter 2003, Waste	Material Pa	arameter Disp	osal Invento	ry	Average d	rum of CH wa	aste			
2											· [
3		Formula	Avg Density	Cellulosic	volume	weight	Total moles	Total moles			
4		Wt (g/mol)	(Kg/m3)	equivalent	m3	kg	of C	of CO2			
5	Cellulosics	162	58	_ 58		l				_	
6	Rubber	162	14	14							
7	Plastics	162	42	71.4							
8	Container plastic	162	16	_27.2							
9	Total Cellulosics			170.6	1.7E+05	2.9E+07	1.1E+09	1.1E409			
10						<u> </u>					
11		. <u> </u>						<u></u>			
12			<u> </u>								
	Wang and Brush (1 <u>996)</u>						Ì	·		
14						! 					
	P kg of plastics and	d R kilogram	s of rubbers a	re equivale	nt to the Q	kilograms o	f cellulosics, b	ased on carbon	equivalence	<u>e:</u>	Q=1.7P+R
16								!			
	162 g/mol was use	d for all cell	ulosics								
18	······································	31. 10.00 (48 b. 48 c.)									
_	Assume 1 mole of	C = 1 mole	o CO2	<u> </u>						- ·	
20						ļ					
_	PA parameter data										
22	Total volume of Ch	waste	1.69E+05								

RH CPR

	Α	В	С	D	Ε	F	G	Н	1	J	K
1	Letter 2003, Waste Ma	aterial Parame	ter Disposal Ir	ventory		Average drum of CH waste					
2							i				
3		Formula	Avg Density	Cellulosic	volume	weight	Total moles	Total moles			
4		Wt (g/mol)	(Kg/m3)	equvialent	m3	kg	of C	of CO2			
5	Cellulosics	162	4.5	4.5		<u> </u>					
6	Rubber	162	3.1	3.1							
7	Plastics	162	4.9	8.33							
8	Plastic liners	162	1.4	2.38							
9	Total Cellulosics			18.31	7.1E+03	1.3E+05	4.8E+06	4.8E+06			
10											
11											
	Wang and Brush (1990	<u>6)</u>									
13		<u> </u>									
-	P kg of plastics and R	kilograms of ru	ubbers are equ	uivalent to th	ne Q kilogran	ns of cellulo:	sics, based or	carbon equiv	alence:		Q=1.7P+R
15			<u> </u>								
	162 g/mol was used for	r all cellulosics	3								<u> </u>
17	- 10 CTESTER PROFESS (175 1) 10	Who was a second of the control of t			· <u>···</u> ··						
	Assume 1 mole of C =	1 mole fo CO	2			<u>.</u>					
19		<u> </u>				·					
-	PA parameter data bas										
21	Total volume of RH wa	aste	7.08E+03								<u>l</u>

Safety Factor

	A	В	С	D	Е	F	G	Н	<u></u>	J
1			-							
2	Total MgO required for	r dissolving in b	rine and re	acting with	CO2 gener	ated by mici	robial activit	у.		
3							!			
4										
5			Volume							
6		Moles	m3							:
7	Mg dissolved	1.01E+07								<u> </u>
8	Max CO2 generated	1.07E+09							: 	
	Max CO2 (RH)	4.80E+06	00000000000000000000000000000000000000							
10	Total MgO required	1.08E+09								
11						·	·	i		<u> </u>
12								/IgO is from	Marcinows	ski, 2001
13	Total MgO currently be	eing emplaced i	n WIPP				short tons			
14		<u> </u>				 	conversion			·
15	, , , , , , , , , , , , , , , , , , , ,	2001 MgO mi	nisack elim	nation repo	rt.	6.71E+04	metric tons			
16										
17										
18		Tons	kg	g	moles	85% react				
19		6.71E+04	67132800	6.71E+10	1.67E+09	1.41E+09		· · · · · · · · · · · · · · · · · · ·		<u></u>
20										
21						<u> </u>		,		
22										
23		Safety Factor	r with new	inventory (data assun	ning one m	ole of C pro	oduces one	mole CO	2
24			18118811881184	44-944-944-944-94-00°	~					<u> </u>
25		Safety Factor		1.30E+00						

APPENDIX B: MgOsafetyfactorSNLleigh.XLS

Mgo Dissolved in Brine

	Α	В	C	D	E	F	G	Н	I
1									
2									
<u>3</u>	·		 	<u> </u>		 			<u> </u>
	GWB	Moles of Mai	dissolved in brine	<u></u>		· · · · · · · · · · · · · · · · · · ·			-
6		moles of mg	dissorted in Brille						
7		Initial and fina	Lones by	EQ3	done by	Yongliang Xiong	1		
8	Concentration of Mg in brine	The state of the s			400.0)	Toriginality Paloting	<u> </u>		
9						<u> </u>	 		
10		Initial Conc	Final Conc in equil	Final Conc	·				
11		Mol/L	with MgO, mol/Kg	mol/L		Molality to mola	rity ratio facto	r	1.146
12	Mg	1.000	7.8996E-01	0.6893194			·		-
13									
14		GWB ends up	with less Mg++ in se	olution and wi	ll be negled	cted for further ca	lles		
15							[
16				\ <u>\</u>			<u> </u>		· · · · · · · · · · · · · · · · · · ·
	Castile	Calculated by	EQ3			Molality to mola	rity ratio facto	<u> </u>	1.137
18						"S. 1951" Physiological action (1951)	ļ		
19		Initial Conc	Final Conc in equil		Volume	Moles of MgO			
20		Mol/L	with MgO, mol/Kg	mol/L	_m3†	dissolved			
21	Mg	0.019	1.0044E-01	8.8338E-02	1.46E+05	1.01E+07	ļ		
22	<u> </u>	ļ							
23				:					
23 24 25		<u> </u>				 			
25		 							
26 27									
28									<u> </u>
	* Max brine flow up the bore he		DB7 S9 Boshada (F	ൂ അവരം പ	e' in RRAC	SFLO			· · · · · · · · · · · · · · · · · · ·

CH CPR

	Α	В	C	D	E	F	G	H	<u> </u>	J	К
1	Letter 2003, Waste	Material Pa	arameter Disp	osal Invento	ory	Average d	rum of CH wa	aste		-	<u> </u>
2					<u> </u>						
3		Formula	Avg Density	Cellulosic	volume	weight	Total moles	Total moles			
4		Wt (g/mol)	(Kg/m3)	equivalent	m3	kg	of C	of CO2			
5	Cellulosics	162	58	58						<u> </u>	
6	Rubber	162	14	14				T			
7	Plastics	162	42	71.4							
8	Container plastic	162	16	27.2							
9	Total Cellulosics			170.6	1.7E+05	2.9E+07	1.1E+09	1.1E+09			
10											
[11]						į				-·	
12	Wang and Brush (1996)			!		_				
13					<u> </u>	1					
	P kg of plastics an	d R kilogram	ns of rubbers	are equivale	nt to the Q I	kilograms of	cellulosics, ba	ased on carbo	n equivale	nce:	Q=1.7P+R
15								i			
	162 g/mol was use	ed for all cell	ulosics	! 					<u> </u>		
17				<u></u>		<u> </u>					
	PA parameter data				! :						
19	Total volume of Ch	l waste		1.69E+05							
20											
21											
22				L	<u></u>		<u></u>				
	Moles of Nitrate a	ind Sulfate	Initially Pres	ent in the W	/aste		I Estimate of (
24						for Disposa	al in WIPP for t	he Compliand	e Recertifi	cation".	
25	· · · · · · · · · · · · · · · · · · ·	kg*	g	<u>fw</u>	<u>moles</u>	, 					
26	Nitrate (NO3)	2.50E+06	2.50E+09	62.01	4.03E+07						!
27	Sulfate (SO4)	4.21E+05	4.21E+08	96.06	4.38E+06						
28											
29			<u> </u>		<u>:</u>	fraction %					
	Molar fraction of co	ell <u>ulosics bic</u>	odegraded via	<u>denitriticatio</u>	<u>n</u>	4.72	·	i -	-		
31	B4-12	- 11: 1 1 : 1 :		- 16-1	<u></u>						
	Molar fraction of co	eliulosics bio	odegraded via	sultate redu	ICTION	0.82	<u> </u>				
33	Note that the second se	. 111					L				
	Molar fraction of ce	ellulosics tro	m metnanoge	enisis T		94,46				}	
35 36				<u> </u>							
	T-1-1 000 :	Alam F			moles					 	
3/	Total CO2 produc	ction for the	repository	<u> </u>	5.63E+08	<u> </u>				<u> </u>	

RH CPR

\sqcap	Α	В	С	D	E	F	G	H		J	K
1	Letter 2003, Waste M	laterial Para	ameter Dispo	sal Inventor	У	Average d	Irum of RH v	vaste			
2											
3		Formula	Avg Density	Cellulosic	volume	weight	Total moles	Total moles			
4		Wt (g/mol)	(Kg/m3)	equvialent	m3	kg	of C	of CO2			
5	Cellulosics	162	4.5	4.5							
6	Rubber	162	3.1	3.1		ļ					
7	Plastics	162	4.9	8.33							
8	Plastic liners	162	1.4	2.38	· · · · · · · · · · · · · · · · · · ·						
9	Total Cellulosics		-	18.31	7.1E+03	1.3E+05	4.8E+06	2.4E+06			
10											
11	Wang and Brush (199	<u>96)</u>					ļ				
12		L <u></u>		<u>:</u>			L				
13	P kg of plastics and F	R kilograms	of rubbers a	re equivalen	t to the Q k	ilograms of	cellulosics, b	ased on carb	on equivale	ence:	Q=1.7P+R
14											
	162 g/mol was used t	or all cellul	osics								
16	 										
	PA parameter data ba										
18	Total volume of RH w	/aste	7.08E+03								

SAFETY FACTOR

A	В	С	D	E	F	G	Н		J	K
1			·						 	
2 Total MgO required for	dissolving in b	rine and re	acting with	CO2 generat	ed by m	icrobial activi	ty.			
3										
4		Volume								
5	Moles	m3								
6 Mg dissolved	1.01E+07									
7 Max CO2 generated	5.63E+08									
8 Max CO2 (RH)	2.40E+06									
9 Total MgO required	5.76E+08	1.45E+04		· ii						
10							ric Tons of N	IgO is from	n Marcinows	ki, 2001
11						····	short tons		 	
12						9.07E-01	conversion	factor		
13 Total MgO currently be	ing emplaced	n WIPP				6.71E+04	metric tons			
14	!									
15 Tons	Kg	g	moles	85% react			<u> </u>			
16 6.71E+04	67132800	6.71E+10	1.67E+09	1.41E+09						
17	<u>i </u>									
18									·	
19										
20 Safety Factor with ne	w inventory d	ata assumi	ng one mo	le of C prod	uces or	ne mole CO2				·
21		and the state of t					·			
22 Safety Factor		2.45E+00					i			

APPENDIX C: MgOsafetyfactorEPAleigh8panel.XLS

MgO Dissolved in Bring

	A	В	С	D	E	F_	G	Н
1			,					
2						<u> </u>		
3				-				
4	CWP	Malas at U = 0						
5	GWB	moles of MgC	dissolved in brine	?S				-
7		Initial and final	aanaa hu	EQ3	done by	Vanaliana Viene		
8	Concentration of Mg in brine	illinai ariu illiai	concs by	⊑Q3	done by	Yongliang Xiong		
9	Concentration of Mg in brine				Malality to ma	plarity ratio factor		1.146
10		Initial Conc	Final Conc in equil	Final Conc	iviolatity to file	namy rano ractor		1.140
11		Mol/L	with MgO, mol/Kg	mol/L				
	Mg	1.000	7.8996E-01	6.89E-01	-		· ·	!
13	<u></u>		7.00002 01	0.002 01				· ·
14		GWB ends up	with less Mg++ in so	l Diution and will be	nealected for t	further cales		
15]						1
16		1			Molality to mo	larity ratio factor		1.137
17	ERDA-6	Calculated by	EQ3					-
18								
19		Initial Conc	Final Conc in equil	Final Conc	Volume	Moles of MgO	-	
20		Mol/L	with MgO, mol/Kg	mol/L	im3 *	dissolved		
	Mg	0.019	1.0044E-01	8.83E-02	1.46E+05	1.01E+07		
22								
23								
24					: 			
25					<u>i</u>	,		
26 27								
						<u> </u>		<u> </u>
28						1999 THE PERSON OF THE SECOND CONTRACTOR OF TH		
29	* Max brine flow up the bore I	noie at the uppe	PILLHZ 53 scenario	(ET @ 1000+ yrs) in Bragtlow			

CPR Calcs

A	В	С	D	E	F	G	Н
1						, , , , , , , , , , , , , , , , , , , 	
2 From Leigh 2003 "Estimate of Cellulosi	cs, Plastic, a	and Rubber in	a Singel Pane	el in the WIPF	Repository in S	upport of A	P-107"
3							
4							
5	Vol (m3)	Cell (kg)	Plastic (kg)	Rubber (kg)	Plastic liner (kg)		
6 Whole repository	1.69E+05	9.77E+06	7.08E+06	2.36E+06	2.70E+06		
7 100 gal supercompacted INEEL	1.99E+04	6.02E+06	4.07E+06	1.59E+06	0.00E+00		
8 TDOPS non-debris INEEL	3.42E+04	9.18E+04	1.21E+05	3.14E+02	6.53E+05		
9 SWBs from INEEL	6.75E+03		2.40E+04	6.83E+01	1.08E+05		
10 55-gal from INEEL and all sites	1.08E+05	3.64E+06	2.87E+06	7.70E+05	1.94E+06		
11							
12							
13 1) INEEL; all distributed over 8 panels	1.34E+05	6.13E+06	4.22E+06	1.59E+06	7.61E+05		
14							
15 55-gal from INEEI and all sites		3.64E+06					
16 2) non-INEEL; for 8 panel	1.34E+05	2.88E+06	2.27E+06	6.09E+05	1.53E+06		ļ
17 [***************************************		***************************************	A A STATE OF THE S		ļ
18 Total for an eight panel repository	1.34E+05	9.01E+06	6.49E+06	2.20E+06	2.30E+06		

CH CPR

	Α	В	С	D	Е	F	G	Н.	$\overline{1}$	J	TK
1	Letter 2003, Waste	e Material Pa	arameter Disp	osal Invento	ry	Average d	rum of CH wa	aste		-	
2						T -					
3		Formula	Avg Density	Cellulosic	volume	weight	equivalent	Total moles	Total moles		
4		Wt (g/mol)	(Kg/m3)	equivalent	m3	kg	kg	of C	of CO2		
5	Cellulosics	162	6.72E+01	67.2		9.01E+06					
6	Rubber	162	1.64E+01	16.4		2.20E+06					
7	Plastics	162	4.84E+01	82.3		6.49E+06					
8	Container plastic	162	1.71E+01	29.1		2.30E+06					
9	Total Cellulosics			195	1.3E+05	2.00E+07	2.6E+07	9.7E+08	9.7E+08		
10					.					_	
11	<u> </u>	1]					
12											
	Wang and Brush (<u>1996)</u>						!			:
14						<u> </u>		<u> </u>			
	P kg of plastics an	d R kilogram	is of rubbers a	are equivaler	nt to the Q	kilograms of	cellulosics, ba	ased on carbon	equivalence:		Q=1.7P+R
16		۱ <u>.</u>	<u> </u>	l		ļ			<u> </u>		<u> </u>
17	162 g/mol was use	ed for all cell	ulosics						<u> </u>		
18	BEGIN TO THE SERVICE OF THE SERVICE	j Nadisarahari 7.		<u> </u>		 					
	Assume 1 mole of	C = 1 mole	o CO2								
20	DA	<u></u>									!
-	PA parameter data	-	1.005.05	ļ -				:			<u> </u>
22	Total volume of Cl	i waste	1.69E+05							_	

RA CPR

	Α	В	С	D	E	F	G	Н		J	K
1	Letter 2003, Waste M	aterial Parame	ter Disposal Ir	ventory		Average dr	rum of RH wa	ste			į į
2				i			· · · · · · · · · · · · · · · · · · ·				
3		Formula	Avg Density	Cellulosic	volume	weight	Total moles	Total moles			
4		Wt (g/mol)	(Kg/m3)	equvialent	m3	kg	of C	of CO2			
5	Cellulosics	162	4.5	4.5							
6	Rubber	162	3.1	3.1							
7	Plastics	162	4.9	8.33							
8	Plastic liners	162	1.4	2.38							
9	Total Cellulosics			18.31	7.1E+03	1.3E+05	4.8E+06	4.8E+06			
10				'							
11											
12	Wang and Brush (199	<u>6)</u>									
13		:	<u> </u>								
	P kg of plastics and R	kilograms of r	ubbers are eq	uivalent to th	ne Q kilograr	ns of cellulo	sics, based or	carbon equiv	alence:		Q=1.7P+R
15											
16	162 g/mol was used for	or all cellulosic	S								
17	ELECTRICATE CONTRACTOR SAME CONTRACTOR SAME	March Company of the Company	i i i i i i i i i i i i i i i i i i i								
	Assume 1 mole of C =	1 mole fo CO	2								
19						-				***	
	PA parameter data ba										
21	Total volume of RH wa	aste	7.08E+03								

Safety Factor

	A	В	С	D	E	F	G	Н	ļ	J	K
1											
2	Total MgO required for	r dissolving in b	orine and re	acting with	CO2 gener	ated by mic	robial activi	ly.			
3											
4										actor for a 8	
5			Volume					actor is the	ratio of the	volume of 8 p	anels
6		Moles	m3	<u> </u>	to the volu	me of 10 pa	nels.				
7	Mg dissolved	8.00E+06			Volume of	8 panels		1.34E+05			
	Max CO2 generated	9.68E+08			Volume of	10 panels		1.69E+05			
	Max CO2 (RH)	3.80E+06		<u> </u>	Ratio			7.93E-01			
10	Total MgO required	9.80E+08	odanie zastali								
11		!			Row 8 has			d for 8 pane	ls. See she	et CH CPR.	Note
12					volume is	1.34E+05					
13	Total MgO currently be	eing emplaced	in WIPP							<u> </u>	
14				<u></u>							
15		2001 MgO mi	inisack elim	ination repo	ort.				MgO is from	Marcinowski	, 2001
16		<u></u>					7.40E+04	short tons			
17											
18						·		conversion			<u></u>
19		Tons	kg	g	moles	85% react		metric tons		-	
20		53115.4714	53115471	5.31E+10	1.32E+09	1.12E+09					
21											
22											
23											
24		Safety Facto	r with new	inventory	data assur	ning one m	ole of C pr	oduces one	mole CO2		
25			the fit is a space to the	***************************************							
26		Safety Factor		1.14E+00							

APPENDIX D: MgOsafetyfactorSNLleigh8panel.XLS

M30 Dissolved in Brins

	Α	В	С	D	Ē	F	G	Н	l I
1									
2		_							
3							<u> </u>		
4	OWD	M-1	 	<u></u>					
5 6	GWB	Moles of MgC	dissolved in brine	25					
7		Initial and final	Loopon bu	EQ3	done by	Vanaliana Viana			
	Concentration of Mg in brine	Initial and final	cones by	EU3	done by	Yongliang Xiong	<u> </u>		
9	Concentration of Mg in brine	-	····						
10		Initial Conc	Final Conc in equil	Final Conc					
11		Mol/L	with MgO, mol/Kg	mol/L		Molality to molar	ity ratio factor		1.146
	Mg	1.000	7.8996E-01	0.6893194		iviolality to molal	ity ratio lactor		1,146
13	ivig	1.000	7.0990E-01	0.0093194					
14		_ _CMP ondo un	i 				l		
				Alution and wi	II ha naala		^^		
		Gvvb ends up	with less Mg++ in s	olution and wi	II be negle	cted for further ca	lcs:		
15		GVVB ends up	with less Mg++ in s	olution and wi	II be negle	cted for further ca	ICS:-		
15 16	Castila			olution and wi	III be negled		i		1 127
15 16 17	Castile	Calculated by		olution and wi	II be negled	Molality to molar	i		1.137
15 16 17 18	Castile	Calculated by	EQ3			Molality to molar	i		1.137
15 16 17 18	Castile	Calculated by	EQ3 Final Conc in equil	Final Conc	Volume	Molality to molar	i		1.137
15 16 17 18 19 20		Calculated by Initial Conc Mol/L	EQ3 Final Conc in equil with MgO, mol/Kg	Final Conc mol/L	Volume m3 *	Molality to molar Moles of MgO dissolved	i		1.137
15 16 17 18 19 20 21		Calculated by	EQ3 Final Conc in equil	Final Conc	Volume	Molality to molar Moles of MgO dissolved	i		1.137
15 16 17 18 19 20 21 22		Calculated by Initial Conc Mol/L	EQ3 Final Conc in equil with MgO, mol/Kg	Final Conc mol/L	Volume m3 *	Molality to molar Moles of MgO dissolved	i		1.137
15 16 17 18 19 20 21 22 23		Calculated by Initial Conc Mol/L	EQ3 Final Conc in equil with MgO, mol/Kg	Final Conc mol/L	Volume m3 *	Molality to molar Moles of MgO dissolved	i		1.137
15 16 17 18 19 20 21 22 23 24		Calculated by Initial Conc Mol/L	EQ3 Final Conc in equil with MgO, mol/Kg	Final Conc mol/L	Volume m3 *	Molality to molar Moles of MgO dissolved	i		1.137
15 16 17 18 19 20 21 22 23 24 25		Calculated by Initial Conc Mol/L	EQ3 Final Conc in equil with MgO, mol/Kg	Final Conc mol/L	Volume m3 *	Molality to molar Moles of MgO dissolved	i		1.137
15 16 17 18 19 20 21 22 23 24 25		Calculated by Initial Conc Mol/L	EQ3 Final Conc in equil with MgO, mol/Kg	Final Conc mol/L.	Volume m3 *	Molality to molar Moles of MgO dissolved	i		1.137
15 16 17 18 19 20 21 22 23 24		Calculated by Initial Conc Mol/L	EQ3 Final Conc in equil with MgO, mol/Kg	Final Conc mol/L.	Volume m3 *	Molality to molar Moles of MgO dissolved	i		1.137

CPR Calcs

Γ	A	В	C	D	Ε	F	G	Н
1								
2	From Leigh 2003 "Estimate of Cellulosia	cs, Plastic, a	and Rubber in	a Singel Pane	el in the WIPF	Repository in S	Support of A	P-107"
3								
4		;		i				
5		Vol (m3)	Cell (kg)	Plastic (kg)	Rubber (kg)	Plastic liner (kg)		ĺ
6	Whole repository	1.69E+05						
7	100 gal supercompacted INEEL	1.99E+04	6.02E+06	4.07E+06	1.59E+06	0.00E+00	 .	1
8	TDOPS non-debris INEEL	3.42E+04	9.18E+04	1.21E+05	3.14E+02	6.53E+05		
9	SWBs from INEEL	6.75E+03	1.85E+04	2.40E+04	6.83E+01	1.08E+05		
10	55-gal from INEEL and all sites	1.08E+05	3.64E+06	2.87E+06	7.70E+05	1.94E+06		
11		:						
12			· · · · · · · · · · · · · · · · · · ·					ļ
13	1) INEEL; all distributed over 8 panels	1.34E+05	6.13E+06	4.22E+06	1.59E+06	7.61E+05		
14								
15	55-gal from INEEI and all sites		3.64E+06	2.87E+06	7.70E+05	1.94E+06		
16	2) non-INEEL; for 8 panel	1.34E+05	2.88E+06	2.27E+06	6.09E+05	1.53E+06		,
17								
18	Total for an eight panel repository	1.34E+05	9.01E+06	6.49E+06	2.20E+06	2.30E+06		
19	Министине вымерания выполняющего выполняющего выполняющего выполняющего выполняющего выполняющего выполняющего	- John William Ballatin in mark in micro 2 ikusa	, , , , , , , , , , , , , , , , , , ,	MANAGE SEEST	onen en			
20							··	
21								
22	From Leigh 2003 "Estimate of Oxyanion	Masses in	a Single Pane	el in the WIPP	Repository in	Support of AP-	107"	
23						-		
24		Vol	Nitrates (kg)	Sulfate (kg)				
25	Whole repository		2.50E+06	4.21E+05				
	100 gal supercompacted INEEL		0	0				
	TDOPS non-debris INEEL		6.51E+05	8.70E+03				
28	SWBs from INEEL		1.29E+05	2.16E+03				
29	55-gal from INEEL and all sites		1.72E+06	4.10E+05		-		
30								
31	1) INEEL; all distributed over 8 panels		7.80E+05	1.09E+04				
	volume							
33								
	2) non-INEEL; for 8 panel		1.56E+06	4.08E+05				
35								
36	Total for an eight panel repository		2.34E+06	4. 19E+ 05				

CH CPR

	Α -	В	С	D	T E	F		П	1 1		Τκ
	Letter 2003, Waste						rum of CH wa		-		
2	Letter 2000, Waste	- Waterial I	arameter Dist	Joseffic	<u>,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,,</u>	Average u	uni oi oii wa	1916			
3		Formula	Avg Density	Cellulosic	volume	weight	Equivalent	Total moles	Total moles		
4		Wt (g/mol)	(Kg/m3)	equivalent	m3	kg	wt	of C	of CO2		
5	Cellulosics	162	6.72E+01	6.7E+01	1110	9.01E+06		0.0	0.002		
6	Rubber	162	1.64E+01	1.6E+01		2.20E+06					
7	Plastics	162	4.84E+01	8.2E+01		6.49E+06					
8	Container plastic	162	1.71E+01	2.9E+01		2.30E+06			-		
9	Total Cellulosics	102	1.7 (6101	195	1.3E+05	2.00E+07	2.6E+07	9.7E+08	9.7E+08		
10	Total Celidiosics			193	1.3L+03	2.00L+07	2.0LT07	3.7 L+00			
11									ļ <u>!</u>		
	Wang and Brush (1996)				i					
13	vialig and brasil (10001									
	P kg of plastics an	d B kilogram	es of rubbers	are equivale	nt to the O k	ilograms of	cellulosics ha	sed on carbo	on equivalen	co.	Q=1.7P+R
15	rig or placettoo art	a () talogram	io or rabboro	Oquitaio	lik to ino q.	inegramie of	Condicion, De	acca on carbo	i oquitaion	· · · · · · · · · · · · · · · · · · ·	Q=1.71 111
	162 g/mol was use	ed for all cell	ulosics								
17	to girilo trae dec								··		
18	PA parameter data	base								(-	
	Total volume of Ch		n 8 panel rec	ository	1.34E+05				 		
20				T		:					
21											
22											
23	Moles of Nitrate a	ind Sulfate	Initially Pres	ent in the W	aste	*from "Final	Estimate of (Oxvanion Ma	ss in TRU W	aste	
24				:			I in WIPP for t				
25		kg*	а	fw	moles						
26	Nitrate (NO3)	2.34E+06	2.34E+09	62.01	3.77E+07						
27	Sulfate (SO4)	4.19E+05	4.19E+08	96.06	4.36E+06						
28											
29						fraction %					
30	Molar fraction of ce	ellulosics bio	degraded via	denitrification	ภา	4.87					
31											
32	Molar fraction of ce	ellulosics bio	degraded via	sulfate redu	ction	0.90					
33									T		
34	Molar fraction of ce	ellulosics fro	m methanoge	enisis		94.23					
35		· · · · · · · · · · · · · · · · · · ·						:			
36					moles						
37	Total CO2 produc	tion for the	repository		5.12E+08						

RH CPR

	Α	В	C	D	E	F	G	Н	1	J	K
1	Letter 2003, Waste N	<u>faterial Para</u>	ameter Dispo	sal Inventor	Υ	Average d	rum of RH v	vaste			
2											
3		Formula	Avg Density	Cellulosic	volume	weight	Total moles	Total moles			
4		Wt (g/mol)	(Kg/m3)	equvialent	m3	kg	of C	of CO2			
5	Cellulosics	162	4.5	4.5							
6	Rubber	162	3.1	3.1							
7	Plastics	162	4.9	8.33			1				
8	Plastic liners	162	1.4	2.38						_	
9	Total Cellulosics			18.31	7.1E+03	1.3E+05	4.8E+06	2.4E+06			
10											
11	Wang and Brush (199	96)									
12							L				
13	P kg of plastics and F	Rkilograms	of rubbers a	re equivalen	t to the Q k	ilograms of	cellulosics, b	ased on carbo	on equivalend	ce:	Q=1.7P+R
14		<u> </u>					!				
15	162 g/mol was used	for all cellulo	osics	<u> </u>			<u> </u>				
16			·			<u></u>		<u>-</u>			
	PA parameter data b										
18	Total volume of RH w	/aste	7.08E+03							19.1	

Safety Factor

	Α	В	С	D	E	F	G	Н		J	K
1		l								ļ <u></u> -	
2	Total MgO required for	r dissolving in t	rine and rea	acting with	CO2 genera	ated by mic	crobial activit	ty.			
3			V-1		D	D 0	The state of the s			L.,	
4		NACTOR .	Volume					y a volume c			
5		Moles	m3					actor is the ra	atio of the	volume of 8	paneis
6	Mg dissolved	8.00E+06			to the volur		anels	!			
7	Max CO2 generated	5.12E+08	!		Volume of			1.34E+05			
8	Mas CO2 (RH)	1.90E+06			Volume of	10 panels	İ	1.69E+05			
9	Total MgO required	5.22E+08	1.31E+04		Ratio			7.93E-01			
10										_	
11					Row 7 has	already be	en corrected	for 8 panels	. See she	et CH CPR	. Note
12					volume is	1.34E+05	5				
13											
14											
15											
16	Total MgO currently be	ing emplaced	n WIPP	TAMES .							
17	· · · · · · · · · · · · · · · · · · ·		:		!		Total Metri	c Tons of Mg	O is from	, Marcinowsk	i. 2001
18	Tons	Kg	g	moles	85% react			short tons			<u>• </u>
19	53115.47136	53115471.4	5.31E+10	1.32E+09	1.12E+09		9.07E-01	conversion f	actor		
20		:			, 7 11 11 11 11 11 11 11 11 11 11 11 11 1		6.71E+04	metric tons			
21											
22							 				
23	Safety Factor with ne	w inventory d	ata assumi	ng one mo	ole of C pro	duces one	e mole CO2				
24	,				•						
	Safety Factor		2.14E+00							-	

APPENDIX E: EPA13.5CPRpanelXupdate.XLS

Mgo Dissolved in Bring

		ТВ	С	D	E	F	G	Н	1
1		 		L		<u>'</u>	<u> </u>		<u> </u>
2				 		<u>!</u>			
3				<u>.</u>		 		_	
4		 							
5	GWB	Moles of MaC	dissolved in brine) S					
6						†		_	
7		Initial and fina	concs by	EQ3	done by	Yongliang Xiong			
8	Concentration of Mg in brine					<u> </u>			
9	 			Ī		T			
10		Initial Conc	Final Conc in equil	Final Conc	-				
11		Mol/L	with MgO, mol/Kg	mol/L		Molality to molari	ty ratio factor		1.146
12	Mg	1.000	7.8996E-01	0.6893194					
13									
14		GWB ends up	with less Mg++ in se	olution and wi	ill be negle	cted for further calc	cs		
15				<u> </u>					
16									
	Castile	Calculated by	EQ3			Molality to molari	ty ratio factor		1.137
18				!					
19		Initial Conc	Final Conc in equil		Volume	Moles of MgO			
20		Mol/L	with MgO, mol/Kg	mol/L	m3 *	dissolved			
	Mg	0.019	1.0044E-01	8.8338E-02	1.46E+05	1.01E+07			
22					_				
23									
24		<u> </u>							
25						:	i		
26 27		 							
28									
28 29									
29	* Max brine flow up the bore h	nie ar me abbet	DHZ 53 SCENARO (E	ii 🕹 TUUU+ y	is) in Rhyr				

PA Supersack Ratio

	A	В	-	D	Е	F	G	Н
1								
2		PER PANEL						
3	Case 1	PA						operational
4		12082	se	ven packs				10908
5		3	se	ven packs	per availab	le space		
6		4027.333	Su	persacks		ļ		3636
7		16914800	M	ass of MgO	(lb) per pa	nel		
8		7672425	M	ass of MgO	(kg) per pa	anel		
9								
10	Case 2	operational						
11		67132800				ntly schedule	d to be er	nplaced
12		0.1044		atio factor fo				
13		7008664				aced in one p	anel	
14		3678.919	su	persacks o	f MgO in or	ne PA panel		
15			!					
16	Ratio	1.094706	i					
	# supersacks							
18						:		
19		supersack		4200	lb			
20		number in one pa	anel	1905	kg	<u> </u>		
21								
22					·			
23								
24								
25		Safety Factor cor	rrespond	ls to one su	persack pe	r stack.		

CH CPR

	Α	В	С	D	Е	F	G	Н	1		K
1		Average di	um of CH wa	ste for pane	I X assum	ng 13.5% c	of the volume is	AMWTP sup	percompact	ed.	
2	Cellulosic numbers	given by C	. Léigh	Peals noa	Se Se						
3		Formula	Avg Density	Cellulosic	volume	weight	weight (kg)	Total moles	Total moles		
4		Wt (g/mol)	(Kg/m3)	equivalent	_m3	kg	cell equivalent	of C	of CO2		
5	Cellulosics	162	6.1E+01	6.06E+01		1.07E+06					
6	Rubber	162	1.5E+01	1.48E+01		2.62E+05					
7	Plastics	162	4.4E+01	7.43E+01		7.71E+05					
8	Container plastic	162	1.6E+01	2.64E+01		2.74E+05					
9	Total Cellulosics			176.18287	1.8E+04	2.4E+06	3.11E+06	1.15E+08	1.15E#08		
10											
11									-		
	Wang and Brush (<u>1996)</u>									
13											
	P kg of plastics and	d R kilogram	s of rubbers a	are equivalen	t to the Q k	lograms of	cellulosics, base	d on carbon	equivalence:		Q=1.7P+R
15							·	*****			
-	162 g/mol was use	d for all cell	ulosics								
17											
	PA parameter data					•					
	Total volume of Ch			1.69E+05							
	Ratio factor for one	· · · · · · · · · · · · · · · · · · ·		0.1044							
21	Total volume of Ch	l waste for C	ONE panel	1.76E+04							

PH CPR

	Α	В	C	D	E	F	G	H		J	K
1	Letter 2003, Waste M	laterial Para	ameter Dispo	sal Inventor	Υ	Average d	rum of RH w	aste for on	e panel		
2	L										
3		Formula	Avg Density	Cellulosic	volume	weight	weight for	Total moles	Total moles		
4		Wt (g/mol)	(Kg/m3)	equvialent	m3	kg	one panel	of C	of CO2		
5	Cellulosics	162	6.1	6.1	,				İ		
6	Rubber	162	3.6	3.6		·					
[7]	Plastics	162	7	11.9							
8	Total Cellulosics			2.25504	7.4E+02	1.7E+03	174.01573	6.4E+03	6.45E+03		
9]					
10		!									
11	Wang and Brush (199	<u>96)</u>	i								
12											
13	P kg of plastics and F	R kilograms	of rubbers a	e equivalen	t to the Q k	lograms of	cellulosics, b	ased on carl	bon equivale	ence:	Q=1.7P+R
14		<u>L</u>									
15	162 g/mol was used f	or all cellulo	osics			<u> </u>	<u> </u>				
16				1		· 					
-	PA parameter data ba		<u> </u>								
18	Total volume of RH w	aste	7.08E+03	<u> </u>	.,-						

Safety Factor

A	В	С	D	E	F	G	H		J	K
1										
2 Total MgO required for	r dissolving in b	rine and re	acting with	CO2 genera	ted by micr	robial activi	ty.			
3										
4		Volume								
5	Moles	m3								
6 Mg dissolved	1.06E+06									
7 Max CO2 generated	1.15E+08									
8 Max CO2 (RH)	6.45E+03									
9 Total MgO required	1.16E+08	2.92E+03		Ratio factor	from sheet	t "PA super	sack ratio" r	ow 16:	1.095	
10										
11										
2 Total MgO currently be	eing emplaced i	n WIPP				_	İ			
13	<u></u>			!				MgO is from	n Marcinows	ki, 2001
4 Tons	Kg	g	moles	85% react		7.40E+04	short tons			
5 7.67E+03	7674487.43	7.67E+09	1.90E+08	1.61E+08		9.07E-01	conversion	factor		
6						6.71E+04	metric tons			
17										
18										
Safety Factor with ne	w inventory d	ata assumi	ng one mo	ole of C pro	duces one	mole CO2				
20										
21 Safety Factor		1.39E+00								-

APPENDIX F: SNL13.5CPRpanelXupdate.XLS

MgO Dissolved in Brine

	A	В	С	D	E	F	G	H	1
1	-		!						
2									
3									
4		<u> </u>							
5	GWB	Moles of MgC	dissolved in brine	s					
6		<u> </u>	ļ	500		1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1, 1		·	
7		Initial and final	concs by	EQ3	done by	Yongliang Xiong	<u>L. </u>		
8	Concentration of Mg in brine							····	
9		<u> </u>							
10		Initial Conc	Final Conc in equil						<u></u>
11		Mol/L	with MgO, mol/Kg			Molality to molar	rity ratio factor		1.146
	Mg	1.000	7.8996E-01	0.6893194					
13		<u>.</u> .							
14		GWB ends up	with less Mg++ in s	olution and wi	ill be negled	cted for further ca	ics		
15									
16	0111-	0-1	F00						
	Castile	Calculated by	EQ3			Molality to molar	rity ratio factor		1.137
18 19		Initial Comp	Final Cons in an il	Final Care	Mali				
20		Initial Conc Mol/L	Final Conc in equil		Volume	Moles of MgO			
	B.A.		with MgO, mol/Kg	mol/L	m3*	dissolved	<u> </u>		
21 22	ıvıg	0.019	1.0044E-01	8.8338E-02	1.46E+05	1.01E+07			
23				:			· · · · · · · · · · · · · · · · · · ·		
24				·					
25									
26									·
27									
28		.							
29			MDZ G2 OSSNAJA /E	1 6 1000	шуш обаг				
29	* Max brine flow up the bore h	ole at the upper	uhz 53 scenario (E	1 @ 1000+y	rs) in BHA(SPLU ULI I			

PA Supersack Ratio

Γ	I A	ВС	; D	E	F	G	H
1							
2		PER PANEL					
3	Case 1	PA					operational
4		12082	seven packs	İ			10908
5		3	seven packs	per availab	le space		
6		4027.333	supersacks				3636
7		16914800	Mass of MgC) (lb) per pa	ınel		
8		7672425	Mass of MgC	(kg) per pa	anel		<u> </u>
9		<u> </u>					
10	Case 2	operational			<u> </u>		
11		67132800	Mass of MgC			d to be e	mplaced
12		0.1044	Ratio factor f				
13		7008664	Mass of MgC			anel	
14		3678.919	supersacks of	f MgO in or	ne PA panel		<u> </u>
15							
	Ratio	1.094706					
17	# supersacks						
18							
19	- ·-··	supersack	4200	lb			
20		number in one pa	nel 1905	kg	<u> </u>		
21				· 			
22		:					
23							
24	···				<u> </u>		
25	<u></u>	Safety Factor cor	responds to one su	ipersack pe	r stack.		

CH CPR

	Α	В	C	D	É	F	G		I		T K
1			_				of the volume is		nercompacto		
2	Cellulosic number	s aiven by C	. Leigh		Redistic 0	ase The	, t				
3		Formula	Avg Density		volume	weight	weight (kg)	Total moles	Total moles		
4		Wt (g/mol)	(Kg/m3)	equivalent	m3	kg	cell equivalent	of C	of CO2	,	
5	Cellulosics	162	6.1E+01	6.06E+01		1.07E+06	·			·	
6	Rubber	162	1.5E+01	1.48E+01		2.62E+05					
7	Plastics	162	4.4E+01	7.43E+01		7.71E+05					_
8	Container plastic	162	1.6E+01	2.64E+01		2.74E+05		_	_		
9	Total Cellulosics			176.18287	1.8E+04	2.4E+06	3.11E+06	1.15E+08	1.15E+08		
10											
11											
	Wang and Brush (1996)									
13					···	<u> </u>	<u>.</u>				
14	P kg of plastics an	d R kilogram	ns of rubbers	are equivaler	nt to the Q	dograms of	cellulosics, base	ed on carbon	equivalence:		Q=1.7P+R
15	160 -/						· · · · · · · · · · · · · · · · · · ·				
17	162 g/mol was use	ed for all cell	liosics					········		<u>.</u>	-
\rightarrow	PA parameter data	hasa									
	Total volume of Ch			1.69E+05	nu						
	Ratio factor for one			0.1044					!		
	Total volume of Ch		NF nanel	1.76E+04				· · · · · · · · · · · · · · · · · ·			
22	10.0.1.0 0, 01	T TV COLO TOT C	one panor	11/02/01				······································			.
	Moles of Nitrate a	nd Sulfate	Initially Pres	ent in the W	aste	*from "Estir	nate of Oxyanior	n in a Single	Panel in the V	NIPP Re	pository
24							of AP-107 Super				
25		kg*	g	<u>fw</u>	moles	· · · · ·	· · · · · · · · · · · · · · · · · · ·				
26	Nitrate (NO3)	2.56E+05	2.56E+08	62.01	4.13E+06						i
27	Sulfate (SO4)	3.63E+04	3.63E+07	96.06	3.78E+05						
28											
29						fraction %					
	Molar fraction of co	ellulosics bio	degraded via	denitrificatio	<u>n</u>	4.48					
31						MANAGARAN W. M. V.					
	Molar fraction of co	ellulosics bio	<u>degraded via</u>	sulfate redu	ction	0.66			-		<u> </u>
33	1.4.1					9125 C					
	Molar fraction of co	ellulosics fro	m metnanoge	nisis		94.86					
35 36											
	Total CO2 produc	tion for the	ropositor		moles						
3/	Total CO2 produc	LION IOF THE	repository	<u> </u>	6.05E+07		<u></u>				

2H CPR

	Α	В	C	D	E	F	G	Н	ı	J	K
1	Letter 2003, Waste N	<mark>/laterial Para</mark>	ameter Dispo	sal Inventor	Υ	Average d	rum of RH v	vaste for on	e panel		
2											
3		Formula	Avg Density	Cellulosic	volume	weight	weight for	Total moles	Total moles		
4	-	Wt (g/mol)	(Kg/m3)	equvialent	m3	kg	one panel	of C	of CO2		
5	Cellulosics	162	6.1	6.1							
6	Rubber	162	3.6	3.6							
7	Plastics	162	7	11.9							
8	Total Cellulosics			2.25504	7.4E+02	1.7E+03	174.01573	6.4E+03	3.2E+03		
9											
10							-				
11	Wang and Brush (19	96)									
12											
13	P kg of plastics and F	R kilograms	of rubbers a	re equivalen	t to the Q k	ilograms of	cellulosics, b	ased on car	bon equivale	nce:	Q=1.7P+R
14			<u></u>								
	162 g/mol was used	for all cellulo	osics]			
16		J									
-	PA parameter data b										
18	Total volume of RH w	vaste	7.08E+03				<u></u>				!

Safety Factor

	Α	В	С	D	E	F	G	Н		J	Κ
1			· · · · · · · · · · · · · · · · · · ·								
2	Total MgO required for	dissolving in b	rine and re	acting with	CO2 genera	ated by mici	robial activit	ty.			
3					 						
4			Volume								
5		Moles	m3						· 		
	Mg dissolved	1.06E+06]		<u> </u>	<u> </u>			
	Max CO2 generated	6.05E+07									
	Max CO2 (RH)	3.22E+03						L			
9	Total MgO required	6.16E+07	1.55E+03		Ratio factor	r from shee	t "PA super	sack ratio" r	ow 16:	1.095	
10										į	
11											
12	Total MgO currently be	ing emplaced	in WIPP						MgO is fror	n Marcinows	ki, 2001
13]					short tons			
14	Tons	Kg	g	moles	85% react		9.07E-01	conversion	factor		
15	7.67E+03	7674487.43	7.67E+09	1.90E+08	1.61E+08		6.71E+04	metric tons			
16										i	
17											
18											
	Safety Factor with ne	w inventory d	ata assumi	ing one mo	ole of C pro	duces one	mole CO2				
20											
21	Safety Factor		2.62E+00								

APPENDIX G: EPA54CPRpaneIX.XLS

MgO Dissolved in Brine

		В	С	D	E	F	G	Н	1
1									
2									
3									
4	·								
	GWB	Moles of MgC	dissolved in brine	es					
6			! 						
7		Initial and final	concs by	EQ3	done by	Yongliang Xiong			
	Concentration of Mg in brine								
9									
10		Initial Conc	Final Conc in equil						
11		Mol/L	with MgO, mol/Kg			Molality to molar	rity ratio facto	or	1.146
12	Mg	1.000	7.8996E-01	0.6893194					
13		_j							
14		_GWB ends up	with less Mg++ in s	olution and w	ill be negled	cted for further ca	lcs		
15									
16				<u> </u>					
	Castile	Calculated by	EQ3			Molality to molar	ity ratio facto	r	1.137
18						<u>j</u>			
19		Initial Conc	Final Conc in equil	Final Conc	Volume	Moles of MgO			
20		Mol/L	with MgO, mol/Kg	mol/L	m3 *	dissolved			
21	Mg	0.019	1.0044E-01	8.8338E-02	1.46E+05	1.0†E±07			
22									
23									
24									
25				l i					
26									
27						<u> </u>			
28									
29	* Max brine flow up the bore he	ole at the upper	DRZ S3 scenario (E	1 @ 1000+ y	rs) in BRA(SFLO			

PA Superpack Ratio

	A	В	С	D	E	F	G	Н
1				1				
2		PER PANEL						
3	Case 1	PA						operational
4		12082		seven packs				10908
5		3		seven packs	per availab	le space		
6		4027.333		supersacks	!			3636
7		16914800		Mass of MgC				
8		7672425		Mass of MgC	(kg) per p	anel		
9				<u> </u>				
10	Case 2	operational		<u> </u>				
11		67132800		Mass of MgC			ed to be e	mplaced
12		0.1044		Ratio factor f				
13		7008664		Mass of MgC				
14		3678.919		supersacks c				
15								
	Ratio	1.094706		 				
17	# supersacks							
18						<u> </u>		
19		supersack		4200	<u>lb</u>			
20		number in or	ie panel	1905	kg			
21		1						
22						<u> </u>		
23								
24					<u> </u>			
25		Safety Facto	r corresp	onds to one su	ipersack pe	er stack.		

CH CPR

	Α	B	С	D	E	F	G _	Н	I	J	K
1		Average di	rum of CH wa	ste for pane	l X assumi	ing 54% of	the containers	originated fr	om INEEL		
2	Cellulosic numbers	s given by C	. Leigh	i							
3		Formula	Avg Density	Cellulosic	volume	weight	weight (kg)	Total moles	Total moles		
4		Wt (g/mol)	(Kg/m3)	equivalent	m3	kg	cell equivalent	of C	of CO2		
5	Cellulosics	162	8.8E+01	8.84E+01		1.56E+06					
6	Rubber	162	2.3E+01	2.28E+01		4.02E+05					
7	Plastics	162	6.1E+01	1.04E+02		1.08E+06					
8	Container plastic	162	1.3E+01	2.24E+01		2.32E+05					
9	Total Cellulosics			237.61591	1.8E+04	3.3E+06	4.19E+06	1.6E+08	1.55E408		
10											
11											
12	Wang and Brush (1996)									
13											
	P kg of plastics and	d R kilogram	is of rubbers a	are equivalen	t to the Q k	ilograms of	cellulosics, base	d on carbon (equivalence:		Q=1.7P+R
15			<u></u>								<u></u>
16	162 g/mol was use	d for all cell	ulosics					=::			
17			·								
$\overline{}$	PA parameter data										
19	Total volume of Ch			1.69E+05							
-	Ratio factor for one			0.1044							
21	Total volume of Ch	I waste for C	ONE panel	1.76E+04							

PH CPR

	Α	В	C	D	E	F	G	Н	, <u> </u>	J	K
1	Letter 2003, Waste N	<u> laterial Para</u>	ameter Dispo	sal Inventor	Υ	Average d	rum of RH w	vaste for on	e panel		
2_											
3_		Formula	Avg Density	Cellulosic	volume	weight	weight for	Total moles	Total moles		
4		Wt (g/mol)	(Kg/m3)	equvialent	m3	kg	one panel	of C	of CO2		
5	Cellulosics	162	6.1	6.1						_	
6	Rubber	162	3.6	3.6				_			
7_	Plastics	162	7	11.9							
8	Total Cellulosics	1		2.25504	7.4E+02	1.7E+03	174.01573	6.4E+03	6.4E+03		
9											
10											
11	Wang and Brush (19	<u>96)</u>									
12		<u> </u>		ll		l					
13	P kg of plastics and I	R kilograms	of rubbers a	re equivalen	t to the Q k	ilograms of	cellulosics, b	ased on carl	oon equivale	nce:	Q=1.7P+R
14		<u> </u>	 								
15	162 g/mol was used	for a <mark>ll cellui</mark> c	sics								
16					· · · <u></u> -						
17	PA parameter data b	<u>ase</u>									
18	Total volume of RH v	vaste	7.08E+03								

Safety Factor

	A	В	С	D	E	F	T G	Н		ī	Τκ
1		<u> </u>			<u> </u>	J"	 G	 	<u> </u>	J	
-	Total MgO required for	dissolving in h	rine and rea	acting with	CO2 genera	ated by mi	icrobial activi	tv			
3	Total ingo roquirou ior		mio una ro	doming with	OOE gonore	atod by tin	Didi dolivi		 -		
4		 	Volume				!				
5		Moles	m3		 		-				
6	Mg dissolved	1.06E+06			··· 	_	-			-	
	Max CO2 generated	1.55E+08			-						
8	Max CO2 (RH)	6.45E+03							· .		
9	Total MgO required	1.56E+08	3.93E+03				Ţ	1.			
10											
11						Ratio fact	tor from shee	t "PA supers	sack ratio" r	ow 16:	1.095
12	Total MgO currently be	ing emplaced i	in WIPP								
13								ric Tons of N	IgO is from	Marcinow	/ski, 2001
14	Tons	Kg	_ g	moles	85% react		7.40E+04	short tons			
15	7.67E+03	7674487.43	7.67E+09	1.90E+08	1.61E+08		9.07E-01	conversion	factor		
16		<u> </u>				·	6.71E+04	metric tons			
17											
18		1			<u> </u>		<u> </u>				
	Safety Factor with ne	w inventory d	ata assumi	ng one mo	ple of C pro	duces on	e mole CO2				
20	THE RESERVED AND ADDRESS OF THE PROPERTY OF TH										
21	Safety Factor		1.03E+00								

APPENDIX H: SNL54CPRpaneIX.XLS

MgO Dissolved in Brine

		В	С	D	E	F	G	Н	T T
1									
2									
3_									
4			 	<u></u>			<u> </u>		
5_	GWB	Moles of MgC	dissolved in brine)s					
6_					<u> </u>				
7		Initial and fina	concs by	EQ3	done by	Yongliang Xiong			
	Concentration of Mg in brine								
9									
10		Initial Conc	Final Conc in equil						
11		Mol/L	with MgO, mol/Kg	mol/L	<u></u>	Molality to molar	ity ratio factor	<u> </u>	1.146
	Mg	1.000	7.8996E-01	0.6893194					
13			l	l i		<u>.</u> ,			
14		_GWB ends up	with less Mg++ in s	olution and w	ill be negled	cted for further cal	ics		
15			<u> </u>						
16		<u> </u>							
	Castile	Calculated by	EQ3			Molality to molar	ity ratio factor	·	1.137
18		T 1 711 1 A	<u> </u>			January : January			
19		Initial Conc	Final Conc in equil		Volume	Moles of MgO			
20		Mol/L	with MgO, mol/Kg	mol/L	m3.4	dissolved			
	Mg	0.019	1.0044E-01	8.8338E-02	1.46E+05	1.01E+07		-· ·	
22						!			
23									
24			<u> </u>	-		<u> </u>			·
25		<u> </u>					 _		
26	-								
27						 			
28		E. J. J. P. S. P. M. M. G. S. D. S. M. S.							
29	* Max brine flow up the bore ho	ole at the upper	umz 53 scenario (E	:1 @ 1000+ y	rs) in BRAC	STLO -			

PA supersack Raho

	А	ВС		D	Е	F	G	Н
1			1				=	
2		PER PANEL	L			i		
3	Case 1	PA						operational
4		12082	sever	packs				10908
5		3			oer availab	e space		
6		4027.333		sacks				3636
7_		16914800			(lb) per pa			
8		7672425	Mass	of MgO	(kg) per pa	inel		
9_	<u></u>							
10	Case 2	operational						
11		67132800				itly schedule	ed to be e	mplaced
12		0.1044			r one PA p			
13		7008664				ced in one p	panel	
14		3678.919	super	sacks of	MgO in or	e PA panel		
15								
	Ratio	1.094706						
<u> 17</u>	# supersacks				v		<u> </u>	
18			<u> </u>					
19		supersack		200	lb	· 		
20		number in one pa	ınel 19	905	kg			
21								
22		<u> </u>						
23								
24]		
25		Safety Factor cor	responds to	one su	persack pe	r stack.		

CH CPR

Γ	A	В	C	D	E	F	G	Н	 	J	K
1	Average drum of								 		
2	Cellulosic numbers						i	 -			
3		Formula	Avg Density	Cellulosic	volume	weight	weight (kg)	Total moles	Total moles		
4		Wt (g/mol)	(Kg/m3)	equivalent	m3	kg	cell equivalent	of C	of CO2		
5	Cellulosics	162	8.8E+01	8.84E+01		1.56E+06					
6	Rubber	162	2.3E+01	2.28E+01		4.02E+05					
7	Plastics	162	6.1E+01	1.04E+02		1.08E+06					
8	Container plastic	162	1.3E+01	2.24E+01		2.32E+05	_			· .	
9	Total Cellulosics			237.61591	1.8E+04	3.3E+06	4.19E+06	1.6E+08	1.6E+08		
10											
11		<u></u>									
	Wang and Brush (1996)									
13											
14	P kg of plastics an	d R kilogran	ns of rubbers	are equivaler	nt to the Q	ilograms of	cellulosics, base	ed on carbon	equivalence:		Q=1.7P+R
15									<u> </u>		
	162 g/mol was use	ed for all cell	ulosics								
17											
	PA parameter data			1 005 05		·					
	Total volume of Cl- Ratio factor for one			1.69E+05 0.1044					<u> </u>		<u> </u>
21	Total volume of Ch		ONE panal	1.76E+04							·
22	Total volume of Cr	1 waste for C	JINE parier	1.700+04							
	Moles of Nitrate a	and Sulfate	Initially Pres	ent in the W	aeta	*from "Fetir	mate of Oxyanio	n in a Single	Panel in the \	MIDD D	 enository
24	Moles of Middle	ilia Saliate	inidally i ica				of AP-107 Super				epository
25	<u> </u>	ka*	<u> </u>	<u>fw</u>	moles	in Capport	01711 107 Capel	ocace Emili	<u> </u>	·	
26	Nitrate (NO3)	2.31E+05	2.31E+08	62.01	3.73E+06	L 					
27	Sulfate (SO4)	1.20E+04	1.20E+07	96.06	1.25E+05						
28					::::::::::::::::::::::::::::::::::::::				·		
29						fraction %			 		
30	Molar fraction of co	ellulosics bio	degraded via	denitrificatio	n	3.00					
31				-		BRANCE CONTRACTOR					
32	Molar fraction of co	ellulosics bio	degraded via	sulfate redu	ction	0.16	· 				
33						ACRES					
	Molar fraction of co	ellulosics fro	m methanoge	nisis		96.84					
35											
36					moles						
37	Total CO2 produc	ction for the	repository		8.01E+07					·	

RH CPR

	A	В	С	D	E	F	G	Н			K
1	Letter 2003, Waste N	/laterial Para	ameter Dispo	sal Inventor	У	Average d	rum of RH w	aste for one	e panel		
2											
3		Formula	Avg Density	Cellulosic	volume	weight	weight for	Total moles	Total moles		
4		Wt (g/mol)	(Kg/m3)	equvialent	m3	kg	one panel	of C	of CO2		
5	Cellulosics	162	6.1	6.1							
6	Rubber	162	3.6	3.6							
7	Plastics_	162	7	11.9							
8	Total Cellulosics			2.25504	7.4E+02	1.7E+03	174.01573	6.4E+03	3.2E+03		
9											
10			!			<u> </u>					
11	Wang and Brush (19	<u>96)</u>									
12	" -		<u> </u>		·		<u>. </u>				
13	P kg of plastics and I	R kilograms	of rubbers a	re equivalen	t to the Q k	ilograms of	cellulosics, b	ased on carl	oon equivale	nce:	Q=1.7P+R
14		<u> </u>									
15	162 g/mol was used	for all cellulo	osics								
16		<u></u>		!							
	PA parameter data b		<u> </u>								
18	Total volume of RH v	vaste	7.08E+03					L <u>-</u>			

Safety Factor

_	32210 1170						1				16
	Α	B	<u> </u>	D	<u>E</u>	F	G	Н	l	J	K
1											
2	Total MgO required for	dissolving in b	rine and rea	acting with	CO2 genera	ated by mi	icrobial activit	ty.			1
3		ļ									
4			Volume								
5		Moles	m3								
6	Mg dissolved	1.06E+06	-								
7	Max CO2 generated	8.01E+07									
8	Max CO2 (RH)	3.22E+03									
9	Total MgO required	8.11E+07	2.04E+03								
10											
11				_							
12	Total MgO currently be	ing emplaced i	n WIPP			Ratio fact	tor from shee	t "PA super	sack ratio"	row 16:	1.095
13									i		
14	Tons	Kg	g	moles	85% react		Total Mete	ric Tons of	MgO is from	n Marcinows	ki, 2001
15	7.78E+03	7776113.06	7.78E+09	1.93E+08	1.63E+08		7.40E+04	short tons		1	
16					THE STATE OF THE S		9.07E-01	conversion	factor	T	-
17							6.71E+04	metric tons			
18								; ·			-
19	Safety Factor with new	w inventory da	ata assumi	ng one mo	ole of C pro	duces on	e mole CO2		:		
20							i	·		T	
21	Safety Factor		2.01E+00								

APPENDIX I: MgOsafetyfactorSNLPAcalcs.XLS

Mgo Dissolved in Brine

		В	С	D	Ē	F	G	H	1
1						1			
2									
3									
4									
-	GWB	Moles of MgC	dissolved in brine	es					
6									
7		Initial and final	concs by	EQ3	done by	Yongliang Xiong			
	Concentration of Mg in brine								
9									
10		Initial Conc	Final Conc in equil			!			
11		Mol/L	with MgO, mol/Kg	mol/L		Molality to molar	rity ratio facto	or	1.146
12	Mg	1.000	7.8996E-01	0.6893194					
13		.j							
14		GWB ends up	with less Mg++ in se	plution and w	ill be negled	ted for further ca	lcs		
15									
16									
	Castile	Calculated by	EQ3		77-70-4	Molality to molar	rity ratio facto	or	1.137
18									
19		Initial Conc	Final Conc in equil		Volume	Moles of MgO			
20		Mol/L	with MgO, mol/Kg	mol/L	* m3 *	dissolved			
	Mg	0.019	1.0044E-01	8.8338E-02	1.46E+05	1.01E+07			
22									
23									
24									
25					·				
26									
27									
28	TO SELECT THE TO SELECT THE SELEC	000000000000000000000000000000000000000	TÄYE BENGANNAN MANANGAN ANGAN ESCRIPTION OF A PROPERTY OF A STANDARD OF THE						
29	Max brine flow up the bore ho	ole at the upper	DRZ S3 scenario (E	1 @ 1000+ y	rs) in BRAC	:FLO			

Conservative Case

	Α	В	С	D	E	F	G	Н	i	J	κ	L	М
1											!		
2													
3		<u> </u>					ļ	: 				- ·	
4	Conserva	tive Case			<u> </u>					<u></u>	<u> </u>		
5					grams			number	m3	m3	%	%	
6	Total		Cellulosics	<u>Plastics</u>	Rubber	Plastic Liners	· 	containers waste			of total	of total	
7	Panel X		1.56E+06	1.08E+06	4.02E+05	2.32E+05	ļ	for panel X	<u>volume</u>	volume	containers	<u>volume</u>	
8			 			<u>.</u>					ļ!		
	Per conta	iner				<u> </u>							
	SC	<u>-</u>	114.71	77.52	30.29	00	i	!	0.379				
	TDOP	<u> </u>	12.86	16.99	0.04	91.55			4.79				
	SWB	<u> </u>	5.17	6.72	0.02	30.24			1.89				
	55 gal	- 	7	5.51	1.48	3.73	<u>!</u>		0.208		ļ		· · · · · · · · · · · · · · · · · · ·
14	 	-	<u>]</u>	1		ļ		 		<u> </u>			ļ
	Total	IN CET	4 455 00	0	0.00= 0=	0.00= 0=		10000		1776 757	4, =		
_	SC	INEEL	1.45E+06	9.77E+05	3.82E+05	0.00E+00		12603		4776.537	44.3	27.5	84.2
17		INEEL	2.17E+04	2.87E+04	6.76E+01	1.55E+05		1691		8099.89	5.95	46.6	
	SWB	INEEL	4.77E+03	6.20E+03		2.79E+04		922		1742.58	3.24	10.0	
	55 gal		9.25E+04	7.28E+04	1.95E+04	4.93E+04		13208		2747.264	46.5	15.8	15.8
20	<u> </u>										i		
21	Check	Total	1.56E+06	1.08E+06	4.01E+05	2.32E+05		2.84E+04		17366.27			
22			!										
23	Total	INEEL	1.47E+06	1.01E+06	3.82E+05	1.83E+05							
24		with the bear of the second							Al Aurana				
25													
26													
27			Kilogi					number					
28		!	<u>Nitrates</u>	Sulfates				containers waste			<u>,</u>		
29	Panel X	<u>:</u>	2.31E+05	1.20E+04				for panel X					
30		<u>i</u>											
	Per conta	iner											
	SC		0	0						<u></u>			
	TDOP		91.16	1.22						<u></u>			<u> </u>
	SWB		36.08	0.6							ļ		<u> </u>
	55 gal	ļ	3.31	0.71				ļ <u>.</u>					
36	<u> </u>							ļ					
	Total	ļ		l									
	SC	INEEL	0.00E+00	0.00E+00		<u> </u>		12603					
30	TDOP	INEEL	1.54E+05	2.06E+03				1691	·				
	SWB	INEEL	3.33E+04	5.53E+02				922					
40		_	4.075.04	9.38E+03				13208					
40 41	55 gal		4.37E+04	8.30E+03									
40 41 42									. ,				
40 41 42 43		Total	2.31E+05	1.20E+04				2.84E+04					
40 41 42		Total						2.84E+04					

CH CPR

	A	В	С	Г	E	F	G	Н	 	J	K
	Average drum of					 		' ' '	<u>'</u>		
2		<u> </u>	10 11121, 10								
3		Formula	Avg Density	Cellulosic	volume	weight	equivalent cell wt	Total moles	Total moles		
4		Wt (g/mol)	(Kg/m3)	equivalent	m3	kg	Kg	of C	of CO2		
5	Cellulosics	162	5.24E+00	5.24E+00		9.25E+04					
6	Rubber	162	1.11E+00	1.11E+00		1.95E+04					
7	Plastics	162	4.13E+00	7.01E+00		7.28E+04	i	·	ĺ		
8	Container plastic	162	2.79E+00	4.75E+00		4.93E+04					
9	Total Cellulosics			18.112517	1.8E+04	3.2E+05	3.20E+05	1.2E+07	1.2E+07		
10											
11											
	Wang and Brush (<u>1996)</u>							<u> </u>		
13											
	P kg of plastics and	d R kilogran	ns of rubbers	are equivale	nt to the Q I	kilograms of	cellulosics, based of	on carbon eq	uivalence:		Q=1.7P+R
15	100		· • • • • • • • • • • • • • • • • • • •								<u> </u>
16	162 g/mol was use	od for all cell	ulosics		–						
-	DAi			<u>-</u>	<u> </u>	<u> </u>					
	PA parameter data Total volume of CH			1.69E+05							
20	Total volume of CF	ı wasıe		1.09E+05	· -						
21	,										
22			<u> </u>				<u> </u>				
	Moles of Nitrate a	nd Sulfate	Initially Pres	ent in the W	aete						
24		a canate									
25	· · · · · · · · · · · · · · · · · · ·	kg*	g	<u>fw</u>	moles						
26	Nitrate (NO3)	4.37E+04	4.37E+07	62.01	7.05E+05	l					
27	Sulfate (SO4)	9.38E+03	9.38E+06	96.06	9.76E+04						
28					TO COMPANY OF THE PARTY OF THE						
29				1		fraction %					
	Molar fraction of ce	ellulosics bio	degraded via	denitrificatio	<u>on</u>	7,44					
31											
	Molar fraction of ce	ellulosics bio	degraded via	sulfate redu	ction	1.65					
33											
34	Molar fraction of ce	ellulosics fro	m methanoge	nisis		90.91					
35											
36		L			<u>moles</u>	<u> </u>					
37	Total CO2 produc	tion for the	repository		6.5E+06						

INEEL CPP

	Α	В	С	П	E	F	G	Н	ı	J	Τκ
1	Average drum of	_	_	_		. '		• • •	'		
2	-										
3		Formula	Avg Density	Cellulosic	volume	weight	equil cell wt	Total moles	Total moles		
4		Wt (g/mol)	(Kg/m3)	equvialent	m3	kg	Kg	of C	of CO2		
5	Cellulosics	162	8.33E+01	8.33E+01		1.47E+06					=
6	Rubber	162	2.17E+01	2.17E+01		3.82E+05					
7	Plastics	162	5.72E+01	9.73E+01		1.01E+06					i
8	Container plastic	162	1.04E+01	1.76E+01		1.83E+05					
9	Total Cellulosics			2.20E+02	1.8E+04	3.9E+06	3.88E+06	1.4E+08	1.4E+08		
10									3		
11											
12	Wang and Brush (1996)									
13											
	P kg of plastics and	d R kilogram	ns of rubbers a	are equivaler	nt to the Q k	ilograms of	cellulosics, bas	sed on carbo	n equivalence	9:	Q=1.7P+R
15			<u></u>								
	162 g/mol was use	d for all cell	ulosics								
17											
	PA parameter data										
19	Total volume of Ch	l waste	. ,	1.69E+05							
20											
21	re nomas laust nganuga	. 0 4 6 0 0 0 0		 							
22	one mole of C ⊨ or	ne half mole	of CO2								
23											
24											
25											
	Moles of Nitrate a	ind Sulfate	Initially Pres	ent in the W	aste						
27		1		c							
28	Nitrata (NICO)	<u>kg*</u>	<u>g</u>	<u>fw</u>	moles 3.02E+06						
29 30	Nitrate (NO3)	1.87E+05	1.87E+08	62.01	at transfer to a tradition of the second						
31	Sulfate (SO4)	2.62E+03	2.62E+06	96.06	2.73E+04						
32						fraction %					ļ
	Malay frantism of a	allulaaiss kis	 	alamitulfiaali-					<u> </u>		
34	Molar fraction of ce	enulosics Dio	uegraded Via	denitrincatio	<u>[]</u>	2.62			; 		
	Molar fraction of ce	allulaaisa bis	dograded : !-	j Audiota nadin	otion	0.04					-
36	INDIAL HACTION OF CO	HUIOSICS DIC	inegraded via	sunate redu	CHOIL	0.04					1
	Molar fraction of a	allulasias fra	i m mathanasa	L		97.34					
	Molar fraction of ce	enulosics fro	m memanoge 	<u>1111515</u>					· · · · · · · · · · · · · · · · · · ·		
38 39					malac					 	
	Total CO2 made:	stian far the	rongelter:		moles 7.4E+07	,					
40	Total CO2 produc	tion for the	repository	<u> </u>	/.4E+U/						

PH CPTC

	Α	В	С	D	E	F	G	Н	j j	J	K
1	Letter 2003, Waste M	Material Para	ameter Dispo	sal Inventor	Υ	Average d	lrum of RH v	vaste			
2									•		·
3		Formula	Avg Density	Cellulosic	volume	weight	Total moles	Total moles			
4		Wt (g/mol)	(Kg/m3)	equvialent	m3	kg	of C	of CO2		İ	
5	Cellulosics	162	4.5	4.5							
6	Rubber	162	3.1	3.1							
7	Plastics	162	6.3	10.71							
8	Total Cellulosics			18.31	7.4E+02	1.4E+04	5.0E+05	2.5E+05			
9											
10											
11	Wang and Brush (19	<u>96)</u>									
12											
13	P kg of plastics and F	R kilograms	of rubbers a	re equivalen	t to the Q k	ilograms of	cellulosics, b	ased on carb	on equival	ence:	Q=1.7P+R
14		:		:			,				
15	162 g/mol was used t	for all celluk	osics	:			<u> </u>				
16							1				
	PA parameter data b										
18	Total volume of RH v	vaste	7.08E+03								

Safety Factor

	A	В	С	D	E	F	G	" Н	1
1		-							
2	Total MgO required for dissolving	in brine and r	eacting with	CO2 gene	rated by mi	crobial activ	ity.	!	
3									
4			Volume						
5		Moles	m3						
6	Mg dissolved	1.06E+06							
7	Max CO2 without INEEL (46%)	6.46E+06			·				
8	Max CO2 INEEL (54%)	7.38E+07					MgO is fro	m Marcinows	ki, 2001
9	Mas CO2 (RH)	2.51E+05	5 (5 (5 (5 (NCT) PEC L L L RECTORISMONISMO 1000			short tons			
	Total MgO required	8.15E+07	2.05E+03			conversion			
11					6.71E+04	metric tons	; ,		
12									
13		ced in WIPP							
14		<u> </u>							
15		Tons	Kg	g	moles	85% react			
16	<u> </u>	6.71E+04	67132800			1.41E+09	/		
	Panel X	7008.66432	7008664	7.01E+09	1.74E+08	1.47E+08			
18						r			
19			_		<u> </u>		l <u>-</u>		
20	Safety Factor with new invento	ry data assun	ning one m	ole of C pr	oduces on	e/half mole	CO2		,
<u>21</u>	TOTAL TERMINE THE THE CHARGE SON THOU THE CAREE OF THE CA		in <u>Samundi</u> na <u>se</u> a,						
22	Safety Factor		1.80E+00						

PA Request (EPA)

		U							
	Α	В	C	D	E	F	G	H	
1								1	·
_	PER ONE PA PANEL								
3	,,								
4									
	Total MacO required for allered	ling in bring and	noting with CO2 =====	d bu migrabial = -4	l	-			
12	Total MgO required for dissolv	ring in prine and rea	acting with CO2 generate	o by microbial acti	IVIÇY.				
	Asumes one mole of $C = 1/2$	mole of CO2							
7									
8			Volume						
9		Moles	m3						
10	Mg dissolved	1.06E+06				'			
11	Max CO2 without INEEL (46%	1.18E+07							
	Max CO2 INEEL (54%)	1.44E+08							
13	Max CO2 RH	2.51E+05				i			
	Total MgO required	1.57E+08					-		
15	Total MgO required	Indicator		Topo	len .	-	moles	males #059/	
	Total Mac augus all the la	l nlesset in 14455	F	Tons	kg	g 0.715.40	moles	moles *85%	
	Total MgO currently being em	placed in WIPP	ļ	6.71E+04	67132800	6.71E+10	1.67E+09	1.41E+09	
17		ļ				<u> </u>	·		
	Total MgO for one PA panel			7008.66432	7008664.32	7.01E+09	1.74E+08	1.47E+08	
19		J		ĺ					
20		Safety Factor		9.38E-01				:	
21]						!	
22						1			
23	Data for following table calcula	ations		-		÷			
24	Detail of following Labor ballouis					: 		+	
	Given								
150	cellulosis descit			00.40	1, a / 0	+			
	cellulosic density	:		36.42	kg/m3				
27	Super sack volume	:		47.60	ft3	1.35E+00	<u>m</u> 3		
28	MgO mass per sack			4200.00	lb	1.91E+06	g		
	Super sack density			1413395.25	g/m3				
30	panel CH volume			17643.60	m3			1	
31									
32									
32 33									
34									
35						+			
00			I ******* **** ** *** *** * *** * * * *						
36									
37									
38			· -						
39									
40						i			
41									- 1
42									
43									
44						1	Currently	Total	
45		Scaled %	INEEL	Scaled %	Waste without INEEL	INEEL	emplaced	MgO	
	Waste without INEEL m3	OCAIRU 76	ma ma	ocaled %				MIGU	
46					moles	molės	MgO mol	moles	E. G. C. M. D. C. M. GORGE CONTROL OF CONTROL SANCES OF CONTROL NO.
47	1	6.33	0	0	7.49E+07	0.00E+00	1.47E+08	7.62E+07	1.93E+00
48	0.99	6.27	0.01	0.01	7.42E+07	1.71E+06	1.47E+08	7.72E+07	1.91E+00
49	0.98	6.20	0.02	0.02	7.34E+07	3.41E+06	1.47E+08	7.81E+07	1.88E+00
49 50	0.97	6.14	0.03	0.04	7.27E+07	5.12E+06	1.47E+08	7.91E+07	1.86E+00
51	0.96	6.08	0.04	0.05	7.19E+07	6.83E+06	1.47E+08	8.00E+07	1.84E+00
52	0.95	6.01	0.05	0.06	7.12E+07	8.53E+06	1.47E+08	8.10E+07	1.82E+00
	5.55		0.00	0.00	7.756,07	0.002.00	7. Y/ C (V C	V. 1V-1V!	1.000

PA Request (EPA) continued

	A	В	С	D	É	F	G	Н	I
45	Waste without INEEL	Scaled %	INEEL	Scaled %	Waste without INEEL	INEEL	emplaced	MgO	Safety
46	Em lilling		m3 s		moles	moles	MgO mol	moles	Factor IIII
53	0.94	5.95	0.06	0.07	7.04E+07	1.02E+07	1.47E+08	8.20E+07	1.80E+00
54	0.93	5.89	0.07	0.08	6.97E+07	1.19E+07	1.47E+08	8.29E+07	1.77E+00
55	0.92	5.82	0.08	0.10	6.89E+07	1.37E+07	1.47E+08	8.39E+07	1.75E+00
56	0.91	5.76	0.09	0.11	6.82E+07	1.54E+07	1.47E+08	8.48E+07	1.73E+00
57	0.9	5.70	0.1	0.12	6.74E+07	1.71E+07	1.47E+08	8.58E+07	1.71E+00
58	0.89	5.63	0.11	0.13	6.67E+07	1.88E+07	1.47E+08	8.68E+07	1.70E+00
59	0.88	5.57	0.12	0.14	6.59E+07	2.05E+07	1.47E+08	8.77E+07	1.68E+00
60	0.87	5.51	0.13	0.15	6.52E+07	2.22E+07	1.47E+08	8.87E+07	1.66E+00
61	0.86	5.44	0.14	0.17	6.44E+07	2.39E+07	1.47E+08	8.96E+07	1.64E+00
62	0.85	5.38	0.15	0.18	6.37E+07	2.56E+07	1.47E+08	9.06E+07	1.62E+00
63	0.84	5.32	0.16	0.19	6.29E+07	2.73E+07	1.47E+08	9.15E+07	1.61E+00
64	0.83	5.25	0.17	0.20	6.22E+07	2.90E+07	1.47E+08	9.25E+07	1.59E+00
65	0.82	5.19	0.18	0.21	6.14E+07	3.07E+07	1.47E+08	9.35E+07	1.57E+00
66	0.81	5.13	0.19	0.23	6.07E+07	3.24E+07	1.47E+08	9.44E+07	1.56E+00
67	0.8	5.06	0.2	0.24	5.99E+07	3.41E+07	1.47E+08	9.54E+07	1.54E+00
68	0.79	5,00	0.21	0.25	5.92E+07	3.58E+07	1.47E+08	9.63E+07	1.53E+00
69	0.78	4.94	0.22	0.26	5.84E+07	3.75E+07	1.47E+08	9.73E+07	1.51E+00
70	0.77	4.87	0.23	0.27	5.77E+07	3.93E+07	1.47E+08	9.82E+07	1.50E+00
71	0.76	4.81	0.24	0.29	5.69E+07	4.10E+07	1.47E+08	9.92E+07	1.48E+00
72	0.75	4.75	0.25	0.30	5.62E+07	4.27E+07	1.47E+08	1.00E+08	1.47E+00
73	0.74	4.68	0.26	0.31	5.54E+07	4.44E+07	1.47E+08	1.01E+08	1.46E+00
74	0.73	4.62	0.27	0.32	5.47E+07	4.61E+07	1.47E+08	1.02E+08	1.44E+00
75	0.72	4.56	0.28	0.33	5.39E+07	4.78E+07	1.47E+08	1.03E+08	1.43E+00
76	0.71	4,49	0.29	0.34	5.32E+07	4.95E+07	1.47E+08	1.04E+08	1.41E+00
77	0.7	4,43	0.3	0.36	5.24E+07	5.12E+07	1.47E+08	1.05E+08	1.40E+00
78	0.69	4.37	0.31	0.37	5.17E+07	5.29E+07	1.47E+08	1.06E+08	1.39E+00
79	0.68	4.30	0.32	0.38	5.09E+07	5.46E+07	1.47E+08	1.07E+08	1.38E+00
80	0.67	4,24	0.33	0.39	5.02E+07	5.63E+07	1.47E+08	1.08E+08	1.36E+00
81	0.66	4,18	0.34	0.40	4.94E+07	5.80E+07	1.47E+08	1.09E+08	1.35E+00
82	0.65	4,11	0.35	0.42	4.87E+07	5.97E+07	1.47E+08	1.10E+08	1.34E+00
83	0.64	4.05	0.36	0.43	4.79E+07	6.14E+07	1.47E+08	1.11E+08	1.33E+00
84	0.63	3.99	0.37	0.44	4.72E+07	6.31E+07	1.47E+08	1.12E+08	1.32E+00
85	0.62	3.92	0.38	0.45	4.64E+07	6.49E+07	1.47E+08	1.13E+08	1.31E+00
86	0.61	3.86	0.39	0.46	4.57E+07	6.66E+07	1.47E+08	1.14E+08	1.30E+00
87	0.6	3.80	0.4	0.48	4.49E+07	6.83E+07	1.47E+08	1.15E+08	1,28E+00
88	0.59	3.73	0.41	0.49	4.42E+07	7.00E+07	1.47E+08	1.15E+08	1.27E+00
89	0.58	3.67	0.42	0.50	4.34E+07	7.17E+07	1.47E+08	1.16E+08	1.26E+00
90	0.57	3.61	0.43	0.51	4.27E+07	7.34E+07	1.47E+08	1.17E+08	1.25E+00
91	0.56	3,54	0.44	0.52	4.20E+07	7.51E+07	1.47E+08	1.18E+08	1.24E+00
92	0.55	3.48	0.45	0.53	4.12E+07	7.68E+07	1.47E+08	1.19E+08	1.23E+00
93	0.54	3.42	0.46	0.55	4.05E+07	7.85E+07	1.47E+08	1.20E+08	1.22E+00
94	0.53	3.35	0.47	0.56	3.97E+07	8.02E+07	1.47E+08	1.21E+08	1.21E+00
95	0.52	3.29	0.48	0.57	3.90E+07	B.19E+07	1.47E+08	1.22E+08	1.20E+00
96	0.51	3.23	0.49	0.58	3.82E+07	8.36E+07	1.47E+08	1.23E+08	1.19E+00
97	0.5	3.16	0.5	0.59	3.75E+07	8.53E+07	1.47E+08	1.24E+08	1.19E+00
98	0.49	3.10	0.51	0.61	3.67E+07	8.70E+07	1.47E+08	1.25E+08	1.18E+00
99	0.48	3.04	0.52	0.62	3.60E+07	8.88E+07	1.47E+08	1.26E+08	1.17E+00
100	0.47	2.97	0.53	0.63	3.52E+07	9.05E+07	1.47E+08	1.27E+08	1.16E+00
101	0.46	2.91	0.54	0.64	3.45E+07	9.22E+07	1.47E+08	1.28E+08	1.15E+00
102	0.45	2.85	0.55	0.65	3.37E+07	9.39E+07	1.47E+08	1.29E+08	1.14E+00

PA Request (EPA) continued

	Α	В	T c T	D	E	F	G	Н	1
45	Waste without INEEL	Scaled %	INEEL	Scaled %	Waste without INEEL	INEEL	emplaced	MgO	
46	Light in the state of the state		m3		moles	moles	MgO mol	moles	
103	0.44	2.78	0.56	0.67	3.30E+07	9.56E+07	1.47E+08	1.30E+08	1.13E+00
104	0.43	2.72	0.57	0.68	3.22E+07	9.73E+07	1.47E+08	1.31E+08	1.12E+00
105	0.42	2.66	0.58	0.69	3.15E+07	9.90E+07	1.47E+08	1.32E+08	1.12E+00
106	0.41	2.59	0.59	0.70	3.07E+07	1.01E+08	1.47E+08	1.33E+08	1.11E+00
107	0.4	2.53	0.6	0.71	3.00E+07	1.02E+08	1.47E+08	1.34E+08	1.10E+00
108	0.39	2.47	0.61	0.72	2.92E+07	1.04E+08	1.47E+08	1.35E+08	1.09E+00
109	0.38	2.41	0.62	0.74	2.85E+07	1.06E+0B	1.47E+08	1.36E+08	1.09E+00
110	0.37	2.34	0.63	0.75	2.77E+07	1.08E+08	1.47E+08	1.37E+08	1.08E+00
111	0.36	2.28	0.64	0.76	2.70E+07	1.09E+08	1.47E+08	1.38E+08	1.07E+00
112	0.35	2.22	0.65	0.77	2.62E+07	1.11E+08	1.47E+08	1.38E+08	1.06E+00
113	0.34	2.15	0.66	0.78	2.55E+07	1.13E+08	1.47E+08	1.39E+08	1.06E+00
114	0.33	2.09	0.67	0.80	2.47E+07	1.14E+08	1.47E+08	1.40E+08	1.05E+00
115	0.32	2.03	0.68	0.81	2.40E+07	1.16E+08	1.47E+08	1.41E+08	1.04E+00
116	0.31	1.96	0.69	0.82	2.32E+07	1.18E+08	1.47E+08	1.42E+08	1.03E+00
117	0.3	1.90	0.7	0.83	2.25E+07	1.19E+08	1.47E+08	1.43E+08	1.03E+00
118	0.29	1.84	0.71	0.84	2.17E+07	1.21E+08	1.47E+08	1.44E+08	1.02E+00
119	0.28	1.77	0.72	0.86	2.10E+07	1.23E+08	1.47E+08	1.45E+08	1.01E+00
120	0.27	1.71	0.73	0.87	2.02E+07	1.25E+08	1.47E+08	1.46E+08	1.01E+00
121	0.26	1.65	0.74	0.88	1.95E+07	1.26E+08	1.47E+08	1.47E+08	1.00E+00
122	0.25	1.58	0.75	0.89	1.87E+07	1.28E+08	1.47E+08	1.48E+08	9.94E-01
123	0.24	1.52	0.76	0.90	1.80E+07	1.30E+08	1.47E+08	1.49E+08	9.87E-01
124	0.23	1.46	0.77	0.91	1.72E+07	1.31E+08	1.47E+08	1.50E+08	9.81E-01
125	0.22	1.39	0.78	0.93	1.65E+07	1.33E+08	1.47E+08	1.51E+08	9.75E-01
126	0.21	1.33	0.79	0.94	1.57E+07	1.35E+08	1.47E+08	1.52E+08	9.69E-01
127	0.2	1.27	0.8	0.95	1.50E+07	1.37E+08	1.47E+08	1.53E+08	9.63E-01
128	0.19	1.20	0.81	0.96	1.42E+07	1.38E+08	1.47E+08	1.54E+08	9.57E-01
129	0.18	1.14	0.82	0.97	1.35E+07	1.40E+08	1.47E+08	1.55E+08	9.51E-01
130	0.17	1.08	0.83	0.99	1.27E+07	1.42E+08	1.47E+08	1.56E+08	9.45E-01
131	0.158	1	0.842	1	1.18E+07	1.44E+08		1.57E+08	9.38E-01
132	0.15	0.95	0.85	1.01	1.12E+07	1.45E+08	1.47E+08	1.58E+08	9.33E-01
133	0.14	0.89	0.86	1.02	1.05E+07	1.47E+08	1.47E+08	1.59E+08	9.28E-01
134	0.13	0.82	0.87	1.03	9.74E+06	1.48E+08	1.47E+08	1.60E+08	9.22E-01
135	0.12	0.76	0.88	1.05	8.99E+06	1.50E+08	1.47E+08	1.60E+08	9.17E-01
136	0.11	0.70	0.89	1.06	8.24E+06	1.52E+08	1.47E+08	1.61E+08	9.11E-01
137	0.1	0.63	0.9	1.07	7.49E+06	1.54E+08	1.47E+08	1.62E+08	9.06E-01
138	0.09	0.57	0.91	1.08	6.74E+06	1.55E+08	1.47E+08	1.63E+08	9.01E-01
139	0.08	0.51	0.92	1.09	5.99E+06	1.57E+08	1.47E+08	1.64E+08	8.95E-01
140	0.07	0.44	0.93	1.10	5.24E+06	1.59E+08	1.47E+08	1.65E+08	8.90E-01
141	0.06	0.38	0.94	1.12	4.49E+06	1.60E+08	1.47E+08	1.66E+08	8.85E-01
142	0.05	0.32	0.95	1.13	3.75E+06	1.62E+08	1.47E+08	1.67E+08	8.80E-01
143	0.04	0.25	0.96	1.14	3.00E+06	1.64E+08	1.47E+08	1.68E+08	8.75E-01
144	0.03	0.19	0.97	1.15	2.25E+06	1.66E+08	1.47E+08	1.69E+08	8.70E-01
145 146	0.02	0.13	0.98	1.16	1.50E+06	1.67E+08	1.47E+08	1.70E+08	8.65E-01
146	0.01	0.06	0.99	1.18	7.49E+05	1.69E+08	1.47E+08	1.71E+08	8.60E-01
[[47]	V	υ	1	1.19	0.00E+00	1.71E+08	1.47E+08	1.72E+08	8.56E-01

PA Request (DOE)

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tal MgO required for disso	Ning in bidge and re	acting with CO2 gener	ated by microbial	icivity		<u> </u>		į		<u> </u>		·				
umes one male of C = 1/2	mole of CO2					1	***************************************					†		- 		
	1										k	<u> </u>				
		Volume		i		i		1		1				1		
	Moles :	m3														
i dissolved	1.06E+06				,	ļ										
ax CO2 without INEEL (46°	6.46E+06									<u> </u>						
ex CO2 INEEL (54%) ex CO2 RH	7.38E+07 2.51E+05		g	· · · · · · · · · · · · · · · · · · ·		ļ				<u> </u>		 				
ntal MgO required	8.15E+07		· · · · · · · · · · · · · · · · · · ·	į												
mings is juiced	1		Tona	ka	а	moles	moles *65%									
tal MgO currently being en	nolaced in WIPP	***************************************	6.71E+04	67132800	6.71E+10	1.67E+09	1.41E+09					f			.,	
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tal MgO for one PA panel			7008.65432	7008864.32	7.01E+09	1.74E+08	1.47E+08	:								
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MD.	***************************************		Ĭ			?i										
lulosic density	i i		36.42	kg/m3		iI		[1		
per sack volume			47,60	#3	1.35E+00	m3								<u> </u>		
O masa bet sack	ļ		4200.00	jb_	1.91E+06	9										
per sack density	ļ		1413396.26	g/m3								<u></u>				
nel CH volume	ļ		17643.60	m3												
iss of Nitrate and Suffate	a faithally Present le	the Weste		·												
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CH without INEEL	ka*	<u> </u>	be	moles		INEEL	kg*	9	b¥	moles				T		
Nitrate (NO3)	4.37E+04	4.37E+07	52.01	7.056(05		Nitrate (NOS)	1.87E+05	1.87E+08	62.01	3.02E+00						
Sulfate (SO4)	9,38€+03	9.38E+06	96.06	9.76E+04		Sulfate (SO4)	2.82E+03	2.62E+06	96.08	2785-04				ļ		
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	1		1			of CO2 produced		# 434 154	8 M. M.	Allerene & Sudese	of CO2 produced	化化多氯化二基 [4]	H . 75:11	Sullate		
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Waste delpoint INEEL	Scaled %	INEEL ms	Scaled %	Waste villions INEEL	INESL moles	Sullate, and	Fraction %	Fraction % suifate reduction	Fraction % methanogenesis:	waste wilkout 19675. mai	Sulfate, and	Fraction % Fraction denitrification suitate red			emplaced MaO mol	MgC 1
november (III)	6.98	m3 - 9 m - 4 m - 1		CTIVE A COST SOUTH OF THE	H DEGELOO II	methanogenises	dentification	Bullate reduction.	methanogeneak	mo S S F C	Methanogeniese	denitrification suitate rac	uotionethenogene	Will Hill (MACA)		moles ***
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6.88° (4.38)	8.20	50g				4 5 5 6 6 F 1			96.63	ATEUT	4 NEIDS	110.48	12.03	3.6E+06	1,5765-08	225+07 3
0.97	6.14	0.03	0.04	3.96E+07	2.63E+06	7.27E+07	1.21	0.27	98.52	3.7E+07	5.12E+06	73.62 1.07		4.5E+06	1.47E+08 4	
0.96	80.6		0.05	3.92E+07	3.50E+06	7.19E+07	1.22	0.27		3.6E+07					1.47E+08 4	l.31E+07 3.
0.95		0.04							98.50		6.83E+06	55.22 0.80				
	6.01 E 96	0.05	0.06	3.88E+07	4.38E+06	7.12E+07	1.24	0.27	95.49	3.6E+07	5.53E+06	44.17 0.64	55.19	6.2E+06	1.47E+08 4	
0.94 D.93	5.95	0.05 0.08	0.06 0.07	3.88E+07 3.84E+07	4.38E+06 5.26E+06	7.12E+07 7.04E+07	1.25	0.28	98.49 98.47	3.6E+07 3.6E+07	8.53E+06 1.02E+07	44.17 0.64 38.61 0.53	55.19 62.66	6.2E+06 7.0E+06	1.47E+08 4 1.47E+08 4	.41E+07 3.
D.94 D.93 D.92		0.05	0.06	3.88E+07	4.38E+06	7.12E+07			95.49	3.6E+07	5.53E+06 1.02E+07 1.13E+07	44.17 0.64 36.61 0.53 31.55 0.46	55.19 62.66 67.99	6.2E+06 7.0E+06 7.9E+08	1.47E+08 4 1.47E+08 4 1.47E+08 4	l.41E+07 3. l.46E+07 3.
D.93	5.95 5.89	0.05 0.06 0.07	0.06 0.07 0.08	3.88E+07 3.84E+07 3.80E+07	4.38E+06 5.26E+06 6.13E+06	7.12E+07 7.04E+07 6.97E+07	1.25 1.26	0.28 0.28	98,49 98,47 98,46	3.6E+07 3.6E+07 3.5E+07	8.53E+06 1.02E+07 1.13E+07 1.37E+07	44.17 0.64 38.61 0.53	55.19 62.66 67.99 71.99	6.2E+06 7.0E+06 7.9E+06 8.7E+06	1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4	k.41E+07 3 k.46E+07 3 k.50E+07 3
0.93 0.92 0.91 0.9	5,95 5,89 6,82 5,78 5,70	0.05 0.06 0.07 0.08 0.09 0.09	0.06 0.07 0.08 0.10 0.11 0.12	3.84E+07 3.84E+07 3.80E+07 3.76E+07 3.72E+07 3.68E+07	4.38E+06 5.26E+06 6.13E+06 7.01E+06 7.88E+06 8.76E+06	7.12E407 7.04E407 6.97E407 6.89E407 6.89E407 6.82E407	1.25 1.26 1.28 1.28 1.23	0.28 0.28 0.28 0.28 0.29	98.43 98.47 98.45 98.44 98.42 98.42	3.6E+G7 3.6E+G7 3.6E+G7 3.6E+G7 3.6E+G7 3.6E+G7	8.53E+06 1.02E+07 1.19E+07 1.37E+07 1.54E+07 1.71E+07	44.17 0.64 36.81 0.53 31.55 0.48 27.61 0.40 24.54 0.36 22.09 0.32	55.19 62.66 67.99 71.99 75.10 77.59	6.2E+06 7.0E+06 7.9E+06 8.7E+06	1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4	1.41E+07 3 1.46E+07 3 1.50E+07 3 1.55E+07 3 1.60E+07 3
0.93 0.92 0.91 0.9 0.89	5.95 5.89 6.82 5.76 5.70 5.63	0.05 0.08 0.07 0.08 0.08 0.08 0.1	0.06 0.07 0.08 0.10 0.11 0.12 0.13	3.88E+07 3.84E+07 3.80E+07 3.76E+07 3.72E+07 3.68E+07 3.64E+07	4.38E+06 5.26E+06 6.13E+06 7.01E+06 7.88E+06 8.76E+06 9.64E+06	7.12E407 7.04E407 6.97E407 6.69E407 6.69E407 6.74E407 8.67E407	1.25 1.26 1.28 1.29 1.31 1.32	0.28 0.28 0.28 0.29 0.29 0.29	98.43 98.47 98.45 98.44 96.42 96.40 96.39	3.65-47 3.65-47 3.55-407 3.55-407 3.55-407 3.45-407	8.53E+08 1.02E+07 1.19E+07 1.37E+07 1.54E+07 1.71E+07 1.88E+07	44.17 0.64 36.81 0.53 31.55 0.46 27.51 0.40 24.54 0.30 22.09 0.32 20.08 0.29	55.19 62.66 67.99 71.99 75.10 77.59 79.63	6.2E+06 7.0E+06 7.9E+06 8.7E+06 9.6E+06 1.0E+07 1.1E+07	1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4	1.41E+07 3 1.46E+07 3 1.50E+07 3 1.55E+07 3 1.66E+07 3
0.93 0.92 0.91 0.9 0.89	5.95 5.89 6.82 5.78 5.70 5.63 6.67	0.05 0.06 0.07 0.08 0.09 0.09 0.1 0.11	0.06 0.07 0.08 0.10 0.11 0.12 0.13	3.885-07 3.845-07 3.805-07 3.765-07 3.725-07 3.585-07 3.645-07 3.605-07	4.38E+06 5.26E+06 6.13E+06 7.01E+06 7.88E+06 8.76E+06 9.64E+06 1.05E+07	7.12E+07 7.04E+07 6.97E+07 6.69E+07 6.62E+07 6.74E+07 8.67E+07 6.69E+07	1,25 1,26 1,28 1,29 1,31 1,31 1,32 1,34	0.28 0.28 0.28 0.28 0.29 0.29 0.29	98.49 98.47 98.45 98.44 96.42 96.40 98.39	3.65-07 3.65-07 3.55-07 3.55-07 3.45-07 3.45-07 3.45-07 3.35-07	5.53E406 1.02E407 1.19E407 1.37E407 1.54E407 1.71E407 1.88E407 2.05E407	44.17 0.64 38.81 0.55 51.55 0.48 27.61 0.40 24.54 0.36 22.09 0.32 20.08 0.29 18.44 0.27	55.19 62.66 67.99 71.99 75.10 77.59 79.63 81.33	6.2E+06 7.0E+06 7.9E+06 8.7E+06 9.5E+06 1.0E+07 1.1E+07	1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4	.41E+07 3 .46E+07 3 .50E+07 3 .55E+07 3 .60E+07 3 .65E+07 3 .70E+07 3
0.93 0.92 0.91 0.9 0.89 0.89 0.85	5.95 5.89 5.82 5.76 5.70 5.63 5.67 5.61	0.05 0.06 0.07 0.08 0.09 0.1 0.11 0.12 0.13	0.06 0.07 0.08 0.10 0.12 0.12 0.13 0.14	3.84E-07 3.84E-07 3.80E-07 3.76E-07 3.72E-07 3.88E-07 3.64E-07 3.65E-07	4.38E+05 5.26E+06 6.13E+06 7.01E+06 7.88E+06 8.76E+06 9.64E+06 1.05E+07 1.14E+07	7.12E-07 7.04E-07 6.97E-07 6.89E-07 6.02E-07 6.74E-07 6.67E-07 6.69E-07 6.59E-07	1,25 1,26 1,28 1,28 1,31 1,32 1,34 1,36	0.20 0.28 0.28 0.29 0.29 0.29 0.30	98.49 98.47 98.46 98.44 96.42 98.40 98.39 98.37 98.35	3.65-07 3.65-07 3.55-07 3.55-07 3.55-07 3.45-07 3.45-07 3.35-07 3.35-07	5.53E408 1,02E407 1,19E407 1,37E407 1,37E407 1,54E407 1,71E407 1,86E407 2,05E407 2,25E407	44.17 0.64 36.61 0.53 31.55 0.46 27.61 0.40 24.54 0.56 22.99 0.32 20.08 0.29 18.41 0.27 16.99 0.55	55.19 62.66 67.99 71.99 75.10 77.59 79.63 81.33	6.2E+06 7.0E+06 7.9E+06 8.7E+06 9.5E+06 1.0E+07 1.1E+07 1.2E+07 1.5E+07	1.47E+06 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4	.41E+07 3 3.46E+07 3 3.50E+07 3 3.55E+07 3 3.66E+07 3 3.65E+07 3 3.70E+07 3
0.93 0.92 0.91 0.9 0.89 0.86 0.87	5.95 5.89 5.78 5.78 5.70 5.53 6.57 6.57	0.05 0.06 0.07 0.08 0.08 0.1 0.11 0.12 0.13 0.14	0.06 0.07 0.08 0.10 0.11 0.12 0.19 0.14 0.16	3.885-47 3.845-47 3.805-47 3.765-47 3.725-47 3.885-47 3.645-47 8.655-47 3.515-47	4.38E-06 5.26E-06 6.13E-06 7.01E-06 7.88E-06 8.76E-06 9.64E-06 1.05E-07 1.14E-07	7.12E-07 7.04E-07 6.97E-07 6.88E-07 6.02E-07 6.74E-07 6.67E-07 5.59E-07 6.52E-07	1.25 1.26 1.28 1.29 1.31 1.32 1.34 1.36 1.37	0.28 0.28 0.28 0.29 0.29 0.29 0.30 0.30	98.49 98.47 98.45 98.44 96.42 98.40 98.39 96.37 96.35	3.65-07 3.65-07 3.55-07 3.55-07 3.55-07 3.45-07 3.45-07 3.35-07 3.35-07	5.53E-06 1.02E-07 1.19E-07 1.37E-07 1.54E-07 1.54E-07 1.86E-07 2.05E-07 2.22E-07 2.39E-07	44.17 0.54 36.81 0.55 31.55 0.44 27.61 0.40 24.54 0.36 20.00 0.32 20.00 0.23 18.41 0.27 16.99 0.22	55.19 62.66 67.99 71.99 75.10 77.59 79.63 81.33 82.76 84.00	6.2E+08 7.0E+06 7.9E+06 8.7E+06 9.6E+06 1.0E+07 1.1E+07 1.2E+07 1.3E+07	1.47E+06 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4	.41E+07 3 .46E+07 3 .50E+07 3 .55E+07 3 .66E+07 3 .70E+07 3 .70E+07 3 .79E+07 3
0.93 0.92 0.93 0.9 0.9 0.89 0.86 0.87 0.86	5.95 5.89 6.82 5.76 5.70 6.53 6.57 5.51 5.44	0.05 0.06 0.07 0.00 0.08 0.1 0.11 0.12 0.13 0.14	0.06 0.07 0.08 0.10 0.11 0.12 0.13 0.14 0.16 0.17	3.845-47 3.845-47 3.805-47 3.765-47 3.725-47 3.845-97 3.845-97 3.855-47 3.815-47 3.815-47	4.38E-06 5.26E-06 6.13E-06 7.01E-06 7.89E-06 8.76E-06 9.64E-06 1.05E-07 1.14E-07 1.23E-07	7.12E-07 7.04E-07 6.97E-07 6.97E-07 6.62E-07 6.74E-07 6.76E-07 5.59E-07 5.52E-07 6.37E-07 6.37E-07	1.25 1.26 1.28 1.29 1.31 1.32 1.34 1.36 1.37	0.50 0.28 0.28 0.28 0.29 0.29 0.29 0.30 0.30 0.30	98.49 98.47 98.45 98.44 96.42 96.40 98.39 98.37 96.35 96.33 96.33	3.65-07 3.65-07 3.55-07 3.58-07 5.55-07 3.48-07 3.48-07 3.48-07 3.58-07 3.58-07 3.58-07 3.58-07	8.53E-08 1.02E-07 1.19E-07 1.37E-07 1.37E-07 1.54E-07 1.71E-07 1.88E-07 2.05E-07 2.22E-07 2.39E-07 2.56E-07	94.17 0.64 95.61 0.53 31.55 0.46 27.51 0.40 24.54 0.25 20.08 0.25 20.08 0.25 16.41 0.27 16.99 0.25 15.78 0.25 14.72 0.21	55.19 62.66 67.99 71.99 75.10 77.59 79.63 81.33 82.76 84.00 85.06	6.2E+06 7.0E+06 7.0E+06 8.7E+06 9.EE+06 1.0E+07 1.1E+07 1.2E+07 1.3E+07 1.4E+07 1.5E+07 1.5E+07	1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4	.41E+07 3 .46E+07 3 .50E+07 3 .55E+07 3 .60E+07 3 .65E+07 3 .70E+07 3 .79E+07 3 .84E+07 3
0.98 0.92 0.91 0.9 0.89 0.88 0.67 0.85 0.85	5.95 5.99 6.92 5.76 5.70 6.65 6.57 6.51 5.44 6.38 5.32	0.05 0.06 0.07 0.08 0.09 0.1 0.1 0.12 0.13 0.14 0.15 0.16	0.06 0.07 0.08 0.10 0.11 0.12 0.13 0.14 0.16 0.17 0.19	3.845-07 3.845-07 3.805-07 3.765-07 3.725-07 3.885-07 3.845-07 3.855-07 3.815-07 3.475-07 3.435-07	4.38E-06 5.26E-06 6.13E-06 7.01E-06 7.88E-06 8.76E-06 1.05E-07 1.14E-07 1.23E-07 1.31E-07 1.40E-07	7.12E-07 7.04E-07 6.97E-07 6.89E-07 6.82E-07 6.74E-07 6.67E-07 5.59E-07 5.59E-07 5.44E-07 5.37E-07 5.37E-07	1.25 1.26 1.28 1.29 1.31 1.32 1.34 1.36 1.37	0.28 0.28 0.28 0.29 0.29 0.29 0.30 0.30 0.30 0.30 0.31	98.49 98.47 98.46 98.44 98.42 98.40 98.39 98.37 96.35 98.35 98.31	3.65-07 3.65-07 3.51-07 3.51-07 3.51-07 3.48-07 3.48-07 9.58-07 9.58-07 9.58-07 9.28-07 9.28-07 9.28-07	5.53E-08 1.02E-07 1.19E-07 1.3E-07 1.54E-07 1.71E-07 1.71E-07 1.88E-07 2.05E-07 2.22E-07 2.39E-07 2.56E-07 2.56E-07 2.73E-07	44.17 0.64 38.61 0.53 31.55 0.46 27.61 0.40 24.54 0.35 22.99 0.32 20.08 0.22 16.41 0.27 15.78 0.25 14.72 0.21 13.80 0.20	55.19 62.66 57.99 71.99 75.10 77.59 79.63 81.33 82.76 84.00 85.06	6.2E+06 7.0E+06 7.0E+06 8.7E+06 9.EE+06 1.0E+07 1.1E+07 1.3E+07 1.3E+07 1.4E+07 1.5E+07 1.5E+07 1.5E+07	1.47E-08 4 1.47E-08 4	.41E+07
0.93 0.92 0.93 0.9 0.9 0.89 0.86 0.87 0.85	5.96 5.99 5.76 5.76 5.73 6.63 6.67 5.61 5.44 5.38 5.32 5.32	0.05 0.06 0.07 0.00 0.08 0.1 0.11 0.12 0.13 0.14	0.06 0.07 0.08 0.10 0.11 0.12 0.13 0.14 0.16 0.17	3.845-47 3.845-47 3.805-47 3.765-47 3.725-47 3.845-97 3.845-97 3.855-47 3.815-47 3.815-47	4.38E-06 5.26E-06 6.13E-06 7.01E-06 7.89E-06 8.76E-06 9.64E-06 1.05E-07 1.14E-07 1.23E-07	7.12E-07 7.04E-07 6.97E-07 6.97E-07 6.62E-07 6.74E-07 6.76E-07 5.59E-07 5.52E-07 6.37E-07 6.37E-07	1,25 1,26 1,28 1,28 1,31 1,31 1,92 1,94 1,95 1,37 1,38 1,40	0.50 0.28 0.28 0.28 0.29 0.29 0.29 0.30 0.30 0.30	98.49 98.47 98.45 98.44 96.42 96.40 98.39 98.37 96.35 96.33 96.33	3.65-07 3.65-07 3.55-07 3.58-07 3.58-07 3.48-07 3.48-07 3.28-07 3.28-07 3.28-07 3.28-07 3.28-07 3.28-07	8.53E-08 1.02E-07 1.19E-07 1.37E-07 1.37E-07 1.54E-07 1.71E-07 1.88E-07 2.05E-07 2.22E-07 2.39E-07 2.56E-07	94.17 0.64 95.61 0.53 31.55 0.46 27.51 0.40 24.54 0.25 20.08 0.25 20.08 0.25 16.41 0.27 16.99 0.25 15.78 0.25 14.72 0.21	55.19 62.66 67.99 71.99 75.10 77.55 79.63 81.33 82.76 84.00 85.06 85.06 86.00	6.2E+06 7.0E+06 7.9E+06 8.7E+06 9.EE+06 1.0E+07 1.1E+07 1.2E+07 1.5E+07 1.5E+07 1.5E+07 1.6E+07 1.6E+07	1.47E+08 4 1.47E+08 4	.41E+07 3 .46E+07 3 .50E+07 3 .50E+07 3 .60E+07 3 .70E+07 3 .70E+07 3 .74E+07 3 .79E+07 3 .49E+07 3
0.93 0.92 0.93 0.9 0.89 0.85 0.67 0.86 0	5.96 5.90 5.76 5.70 5.70 5.53 5.57 5.51 5.44 5.38 5.32 5.25 5.19	0.05 0.06 0.07 0.08 0.11 0.12 0.13 0.14 0.15 0.16 0.17 0.18	0.06 0.07 0.08 0.10 0.11 0.12 0.13 0.14 0.15 0.17 0.19 0.19 0.20 0.21	3.88E-607 3.80E-607 3.90E-607 5.76E-607 5.72E-607 3.84E-607 3.85E-607 3.85E-607 3.47E-607 3.48E-607 3.39E-607 3.35E-607	4.38E-05 5.25E-06 6.13E-06 7.01E-06 7.01E-06 8.76E-06 9.64E-06 105E-07 1.14E-07 1.3E-07 1.40E-07 1.40E-07 1.40E-07	7.12E-07 7.04E-07 6.97E-07 6.82E-07 6.82E-07 6.74E-07 6.74E-07 6.52E-07 6.52E-07 6.44E-07 6.37E-07 6.22E-07 6.14E-07 6.14E-07	1.25 1.26 1.28 1.29 1.31 1.32 1.32 1.34 1.35 1.37 1.38 1.40	0.28 0.28 0.28 0.28 0.28 0.29 0.29 0.30 0.30 0.30 0.30 0.31 0.31 0.31	55.45 55.47 58.46 58.44 56.42 56.40 56.30 56.35 56.35 66.35 66.31 56.29 56.27 56.27 56.27	3.65-07 3.65-07 3.51-07 3.51-07 3.51-07 3.41-07 3.31-07 3.31-07 3.31-07 3.21-07 3.21-07 3.21-07 3.21-07 3.21-07 3.21-07 3.21-07 3.21-07 3.21-07	5.58E.06 1.02E.07 1.19E.07 1.19E.07 1.37E.07 1.54E.07 1.71E.07 1.88E.07 2.05E.07 2.29E.07 2.29E.07 2.56E.07 2.39E.07 2.39E.07	44.17 0.64 35.81 0.55 31.55 0.49 27.51 0.40 24.51 0.55 20.06 0.32 16.41 0.27 16.59 0.55 15.78 0.29 14.72 0.21 13.80 0.20 12.99 0.10	55, 19 62,65 67,99 71,99 75,10 77,51 77,63 81,33 82,76 84,00 85,06 86,00 86,02 86,62 87,55	6.2E+06 7.0E+06 7.0E+06 8.7E+06 9.0E+06 1.0E+07 1.1E+07 1.2E+07 1.4E+07 1.4E+07 1.5E+07 1.6E+07 1.6E+07 1.6E+07 1.6E+07 1.6E+07 1.6E+07	1.47E+08 4 1.47E+08 4	.41E+07 3 .46E+07 3 .50E+07 3 .55E+07 3 .65E+07 3 .65E+07 3 .70E+07 3 .74E+07 3 .74E+07 3 .84E+07 3 .84E+07 3 .84E+07 3 .84E+07 2 1 98E+07 2
0.93 0.92 0.51 0.9 0.86 0.86 0.87 0.87 0.86 0.85 0.05 0.04 0.83 0.85 0.65 0.64 0.83	5.96 5.96 5.76 5.70 5.53 6.53 6.51 5.44 6.38 5.32 5.32 5.15 6.15 6.15	0.05 0.06 0.07 0.00 0.00 0.1 0.11 0.12 0.13 0.14 0.15 0.15 0.15 0.15	0.06 0.07 0.08 0.10 0.11 0.12 0.13 0.14 0.15 0.17 0.19 0.19 0.20 0.21 0.23	3.88E-607 3.84E-607 3.76E-67 3.76E-67 3.88E-607 3.86E-607 3.86E-607 3.56E-607 3.51E-607 3.47E-607 3.39E-607 3.35E-607 3.35E-607 3.31E-607 3.31E-607	4.38E-06 6.18E-06 6.18E-06 7.01E-06 7.78E-08 8.76E-08 8.76E-08 1.95E-07 1.14E-07 1.31E-07 1.49E-07 1.58E-07 1.58E-07 1.58E-07	7. 125-07 7.045-07 6.975-07 6.805-07 6.805-07 6.745-07 6.755-07	1.25 1.26 1.26 1.28 1.23 1.31 1.32 1.34 1.35 1.37 1.38 1.40 1.42 1.43 1.43	0.28 0.28 0.28 0.29 0.29 0.29 0.29 0.29 0.30 0.30 0.30 0.31 0.31 0.31 0.32 0.32 0.32	98.49 98.47 98.46 98.42 98.42 98.30 98.37 96.37 96.37 96.35 98.31 98.23 98.27 98.25 98.25 98.25	3.65-07 3.65-07 3.65-07 3.55-07 3.55-07 5.55-07 3.45-07 3.55-07 3.55-07 3.55-07 3.55-07 3.55-07 3.55-07 3.55-07 3.55-07 3.55-07 3.55-07 3.55-07 3.55-07 3.55-07 3.55-07 3.55-07 3.55-07 3.55-07 3.55-07 3.55-07	5.53E-06 1.02E-07 1.02E-07 1.02E-07 1.07E-07 1.07E-07 1.08E-07 1.08E-07 2.05E-07 2.09E-07 2.06E-07 2.06E-07 2.06E-07 3.07E-07 3.07E-07 3.14E-07 3.14E-07	44.17 054-64 30.91 053-75 31.55 044-75 27.51 040 24.54 035-75 20.08 029-75 16.41 027 16.89 029-75 14.72 021-75 15.80 020-75 14.72 021-75 15.80 020-75 15.80 02	55.19 62.65 67.99 71.99 75.10 77.59 79.65 81.33 82.76 84.00 85.06 86.02 86.82 86.82 86.82 86.82 86.82 86.82 86.82 86.82 86.82 86.82 86.82 86.82	6.2E-06 7.0E-06 8.7E-06 8.7E-06 9.5E-06 1.0E-07 1.1E-07 1.2E-07 1.3E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07	1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 5 1.47E+08 5	.41E+07 348E+07 350E+07 350E+07 350E+07 360E+07 370E+07 374E+07 348E+07 384E+07 384E+07 384E+07 284E+07 284E+07 2.
0.93 0.92 0.91 0.9 0.89 0.66 0.67 0.065 0.055 0.04 0.83 0.83 0.85 0.81 0.81	5.95 5.92 5.76 5.70 6.63 6.67 5.67 5.44 5.32 5.25 5.19 6.13	0.05 0.06 0.07 0.08 0.08 0.1 0.11 0.12 0.13 0.14 0.15 0.16 0.16 0.17 0.17	0.06 0.07 0.00 0.10 0.11 0.12 0.14 0.15 0.17 0.18 0.19 0.20 0.21 0.21	3.885-67 3.905-67 3.905-67 5.726-67 5.726-67 5.956-67 3.965-67 3.956-67 3.956-67 3.956-67 3.956-67 3.956-67 3.956-67 3.956-67 3.956-67 3.956-67	4.38E-05 5.28E-06 6.13E-06 7.01E-06 7.08E-06 8.76E-06 9.64E-06 1.05E-07 1.14E-07 1.23E-07 1.40E-07 1.49E-07 1.58E-07 1.58E-07 1.58E-07	7, 125-07 7,045-07 6,975-07 6,975-07 6,985-07 6,925-07 6,755-07 6,955-07 6,955-07 6,445-07 6,755-07 6,255-07 6,275	1.25 1.26 1.26 1.29 1.29 1.31 1.32 1.34 1.36 1.36 1.49 1.49 1.42 1.45 1.47	0.28 0.28 0.28 0.29 0.29 0.29 0.29 0.30 0.30 0.30 0.31 0.31 0.31 0.32 0.32 0.33 0.33 0.33 0.33	95.49 95.47 98.46 98.44 96.40 96.39 96.37 96.37 96.35 96.35 98.35 98.35 98.31 98.27 98.27 98.27 98.27 98.27 98.23	3.65-07 3.65-07 3.55-07 3.55-07 3.55-07 3.45-07 3.45-07 3.85-07	5.53E-00 1.02E-07 1.19E-07 1.37E-07 1.57E-07 1.77E-07 1.77E-07 1.88E-07 2.32E-07 2.39E-07 2.78E-07 2.30E-07 2.30E-07 3.24E-07 3.24E-07 3.24E-07 3.24E-07 3.24E-07 3.24E-07	44.17 054 56.81 053 31.55 044 27.61 046 2.54 055 2.50 052 50.68 022 16.40 027 16.50 025 16.78 025 14.72 021 13.80 020 12.99 018 12.27 018 11.62 017 11.64 017 11.64 016	55.19 52.65 67.99 71.99 75.10 77.55 79.63 81.33 82.76 84.00 85.06 86.00 86.02 86.82 87.86 88.80 88.80	6.2E-05 7.0E-06 8.7E-06 8.7E-06 9.5E-06 1.0E-07 1.1E-07 1.2E-07 1.5E-0	1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 4 1.47E+08 5 1.47E+08 5 1.47E+09 5	.41E+07 348E+07 348E+07 355E+07 365E+07 365E+07 370E+07 370E+07 370E+07 344E+07 349E+07 349E+07 349E+07 349E+07 349E+07 349E+07 349E+07 249E+07 249E+07 249E+07 249E+07 249E+07 249E+07 249E+07 249E+07 249E+07 2.
0.93 0.92 0.97 0.99 0.89 0.86 0.87 0.85 0.85 0.85 0.85 0.84 0.83 0.85 0.84 0.83 0.84 0.83 0.84 0.83 0.85 0.84 0.85 0.85 0.86 0.86 0.86 0.87	5.95 5.96 5.92 5.76 5.70 5.63 5.67 5.61 5.44 5.38 5.32 5.25 5.10 6.13	0.05 0.07 0.08 0.07 0.08 0.1 0.11 0.12 0.14 0.15 0.16 0.16 0.17 0.16	0.06 0.07 0.08 0.10 0.11 0.12 0.13 0.14 0.15 0.17 0.19 0.20 0.21 0.21 0.22	3.885-407 3.846-407 3.906-407 3.726-407 3.726-407 3.868-407 3.868-407 3.858-407 3.478-407 3.478-407 3.358-407 3.358-407 3.358-407 3.358-407 3.358-407 3.358-407 3.358-407 3.358-407 3.358-407 3.358-407 3.358-407	4.38E-05 6.18E-06 6.18E-06 7.01E-06 7.01E-06 8.76E-06 8.76E-06 1.05E-07 1.14E-07 1.31E-07 1.40E-07 1.49E-07 1.58E-07 1.58E-07 1.58E-07 1.58E-07 1.58E-07	7. 125-07 7. 045-07 6. 075-07 6. 085	125 1.26 1.26 1.29 1.31 1.32 1.34 1.35 1.37 1.39 1.40 1.42 1.43 1.43 1.44 1.43 1.45 1.47	0.20 0.28 0.28 0.29 0.29 0.29 0.29 0.30 0.30 0.30 0.31 0.31 0.31 0.32 0.32 0.32 0.33 0.33	58.49 58.47 58.46 58.42 58.42 58.42 58.30 58.37 58.37 58.37 58.37 58.37 58.37 58.37 58.33 58.31 58.29 58.27 58.25 58.25 58.25 58.25 58.25 58.25 58.25 58.25 58.25 58.35 58	3.65-07 3.65-07 3.55-07 3.55-07 3.55-07 3.55-07 3.45-07 3.55-07	5-53E-00 102E-07 1.15E-07 1.17E-07 1.3FE-07 1.3FE-07 1.8BE-07 2.05E-07 2.22E-07 2.39E-07 2.7SE-07 2.7SE-07 2.7SE-07 3.0FE-07 3.48E-07 3.88E-07 3.58E-07	44.17 054-64-65-65-65-65-65-65-65-65-65-65-65-65-65-	55.19 52.65 57.99 71.99 75.10 77.59 79.63 79.63 81.33 82.76 82.76 84.00 85.06 86.02 86.02 86.02 86.02 86.03 86.03	6.22-08 7.02-08 7.02-08 9.72-08 9.72-08 9.72-08 1.02-07	1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 5 1.47E-08 5 1.47E-08 5	.41E+07 3 .48E+07 3 .48E+07 3 .50E+07 3 .50E+07 3 .50E+07 3 .70E+07 3 .74E+07 3 .74E+07 3 .74E+07 3 .44E+07 3 .84E+07 3 .84E+07 3 .84E+07 2 .50E+07 2 .50E+07 2 .50E+07 2 .50E+07 2 .50E+07 2
0.93 0.92 0.91 0.9 0.89 0.66 0.67 0.06 0.05 0.05 0.05 0.05 0.05 0.05 0.05	5.95 5.92 5.76 5.70 6.63 6.67 5.67 5.44 5.32 5.25 5.19 6.13	0.05 0.06 0.07 0.08 0.08 0.11 0.12 0.13 0.14 0.15 0.16 0.16 0.17 0.16 0.17 0.19 0.2	0.06 0.07 0.00 0.10 0.11 0.12 0.13 0.14 0.15 0.17 0.18 0.19 0.20 0.20 0.21 0.21 0.25 0.25	3.885-607 3.905-607 3.705-607 5.726-607 5.726-607 5.966-607 5.966-607 3.966-607 3.976-607 3.986-607 3.986-607 3.986-607 3.986-607 3.986-607 3.986-607 3.986-607 3.986-607 3.986-607 3.986-607 3.986-607	4.38E-05 5.26E-06 6.13E-06 7.01E-06 7.01E-06 8.76E-06 8.76E-06 1.05E-07 1.14E-07 1.23E-07 1.40E-07 1.40E-07 1.40E-07 1.40E-07 1.58E-07	7. 125-07 7. 045-07 6. 075-07 6. 085-07 6. 085-07 6. 085-07 6. 075-07 6. 085-07 6. 085	1.25 1.26 1.23 1.23 1.31 1.32 1.34 1.35 1.39 1.40 1.42 1.45 1.47 1.47 1.49 1.49	0.20 0.28 0.28 0.29 0.29 0.29 0.30 0.30 0.30 0.30 0.31 0.31 0.31 0.31	58.49 58.47 59.46 58.44 56.42 56.42 56.42 56.39 56.37 56.35 56.35 66.33 68.29 58.27 58.25 58.25 58.25 58.20 59.16 59.16 59.17 59.18	3.65-67 3.55-67	5.53E-00 1.02E-07 1.19E-07 1.37E-07 1.37E-07 1.57E-07 1.77E-07 1.86E-07 2.55E-07 2.96E-07 2.78E-07 2.96E-07 3.76E-07 3.16E-07 3.56E-07 3.56E-07 3.56E-07 3.56E-07 3.56E-07 3.56E-07 3.56E-07 3.56E-07 3.56E-07 3.56E-07 3.56E-07	44.17 05-5 50.81 0.53 31.55 0.44 27.61 0.52 27.61 0.47 2.54 0.52 2.50 0.52 2	55.19 52.59 57.39 71.59 77.59 77.55 81.33 82.76 84.00 85.06 86.00 86.00 86.00 86.00 86.00 86.00 86.00 86.00 86.00	6.25-05 7.05-08 7.05-08 9.76-06 9.76-06 9.56-06 1.05-07 1.56-0	1.47E-08 4 1.47E-08 1 1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 6 1.47E-08 6 1.47E-08 5 1.47E-08 5 1.47E-08 5 1.47E-08 5 1.47E-08 5 1.47E-08 5 1.47E-08 5 1.47E-08 5	.41E-07 3 .46E-07 3 .46E-07 3 .45E-07 3 .45E-07 3 .45E-07 3 .45E-07 3 .47E-07 3 .74E-07 3 .47E-07 3 .47E-07 3 .47E-07 3 .47E-07 3 .47E-07 3 .47E-07 2 .47E-07 2 .47E-07 2 .47E-07 2 .47E-07 2 .47E-07 2
D.93 D.92 D.91 D.90 D.90 D.90 D.80 D.88 D.86 D.87 D.86 D.85 D.85 D.85 D.85 D.85 D.85 D.85 D.85	5.95 5.99 6.92 5.70 5.63 5.67 6.81 5.32 5.32 5.25 5.13 5.06 6.00 4.94	0.05 0.07 0.08 0.07 0.08 0.1 0.11 0.12 0.14 0.15 0.16 0.16 0.17 0.16	0.06 0.07 0.08 0.10 0.11 0.12 0.13 0.14 0.15 0.17 0.19 0.20 0.21 0.21 0.22	3.885-407 3.846-407 3.906-407 3.726-407 3.726-407 3.868-407 3.868-407 3.858-407 3.478-407 3.478-407 3.358-407 3.358-407 3.358-407 3.358-407 3.358-407 3.358-407 3.358-407 3.358-407 3.358-407 3.358-407 3.358-407	4.30E-05 5.26E-05 6.3E-05 7.01E-06 7.01E-06 8.76E-06 8.76E-06 1.05E-07 1.14E-07 1.23E-07 1.40E-07 1.40E-07 1.58E-07 1.58E-07 1.58E-07 1.58E-07 1.58E-07 1.58E-07 1.58E-07 1.58E-07 2.01E-07	7. 125-07 7. 045-07 6. 075-07 6. 085-07	1,25 1,26 1,28 1,28 1,31 1,31 1,32 1,34 1,35 1,47 1,49 1,49 1,45 1,47 1,47 1,49 1,49 1,53 1,53	0.20 0.28 0.28 0.29 0.29 0.29 0.29 0.30 0.30 0.30 0.31 0.31 0.31 0.32 0.32 0.32 0.33 0.33 0.33	98.49 98.47 98.46 98.44 98.42 98.40 98.39 98.37 98.35 98.31 98.27 98.27 98.25 98.25 98.25 98.31 98.27 98	3.65-07 3.65-07 3.55-07 3.55-07 5.55-07 5.55-07 3.45-07 3.45-07 3.45-07 3.25-07 3.25-07 3.25-07 3.25-07 3.25-07 3.25-07 3.25-07 3.25-07 3.25-07 3.25-07 3.25-07 3.25-07 3.25-07 3.25-07 3.25-07 3.25-07 3.25-07 3.25-07	8.53E-00 1.02E-07 1.19E-07 1.37E-07 1.54E-07 1.54E-07 1.71E-07 1.88E-07 2.25E-07 2.25E-07 2.39E-07 2.39E-07 2.39E-07 3.05E-07 3.05E-07 3.48E-07 3.55E-07 3.55E-07 3.39E-07 4.10E-07	44.17 054-64-65-65-65-65-65-65-65-65-65-65-65-65-65-	55.19 67.39 71.39 77.50 77.50 77.50 81.33 82.76 84.00 85.00 86.02 96.82 97.55 98.67 98.67 98.67 99.33	6.25-05 7.05-05 7.05-05 7.05-05 0.75-05 0.75-05 0.75-05 0.75-05 0.75-05 0.75-07 1.15-07 1.25-07 1.55-0	1.47E-06 4 1.47E-08 1 1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 5 1.47E-08 5 1.47E-08 5 1.47E-08 5 1.47E-08 5 1.47E-08 5 1.47E-08 5 1.47E-08 5 1.47E-08 5	.41E-07 346E-07 350E-07 350E-07 355E-07 355E-07 355E-07 370E-07 370E-07 370E-07 370E-07 384E-07 3.
0.93 0.92 0.91 0.9 0.89 0.66 0.67 0.06 0.05 0.05 0.05 0.05 0.05 0.05 0.05	5.95 5.99 5.99 5.82 5.76 5.53 5.57 5.51 5.51 5.52 5.32 5.32 5.32 5.19 6.13 6.06 5.06 5.06 5.06 5.06 5.06 5.06 5.06	0.05 0.06 0.07 0.09 0.09 0.1 0.11 0.12 0.13 0.14 0.16 0.16 0.17 0.19 0.19 0.2 0.2 0.2 0.2 0.2 0.2 0.2	0.06 0.07 0.00 0.10 0.12 0.13 0.14 0.15 0.17 0.18 0.19 0.20 0.20 0.21 0.22 0.21	3.885-807 3.805-807 3.905-807 3.725-807 3.956-807 3.956-807 3.956-807 3.956-807 3.956-807 3.956-807 3.956-807 3.956-807 3.956-97 3.956-97 3.956-97 3.956-97 3.956-97 3.956-97 3.956-97 3.956-97	4.38E-05 5.26E-06 6.13E-06 7.01E-06 7.01E-06 8.76E-06 8.76E-06 1.05E-07 1.14E-07 1.23E-07 1.40E-07 1.40E-07 1.40E-07 1.40E-07 1.58E-07	7. 12±07 7.04±07 6.97±07 6.85±07 6.02±07 6.07±07 6.05±07 6.05±07 6.42±07 6.42±07 6.42±07 6.42±07 6.42±07 6.22±07 6.12±07 6.22±07 6.42±07 6.42±07 6.42±07 6.42±07 6.42±07 6.42±07 6.42±07 6.52±07	1.25 1.26 1.23 1.23 1.31 1.32 1.34 1.35 1.39 1.40 1.42 1.45 1.47 1.47 1.49 1.49	0.20 0.28 0.28 0.29 0.29 0.29 0.29 0.29 0.30 0.30 0.30 0.30 0.31 0.31 0.31 0.32 0.32 0.32 0.33 0.35 0.35 0.35 0.35 0.35 0.35 0.35	58.49 58.47 59.46 58.44 56.42 56.42 56.40 56.33 56.35 56.35 66.35 66.35 68.27 58.27 58.25 58.25 58.25 58.25 58.25 58.25 58.31 59.11 59.11 59.11 59.11	3.65-67 3.55-67	5.53E-00 1.02E-07 1.19E-07 1.37E-07 1.37E-07 1.57E-07 1.77E-07 1.86E-07 2.02E-07 2.29E-07 2.29E-07 2.29E-07 2.29E-07 2.29E-07 3.24E-07 3.24E-07 3.44E-07 3.58E-07 3.58E-07 3.58E-07 3.58E-07 4.00E-07 4.0	44.17 05-5 50.81 0.53 31.55 0.44 27.61 0.52 27.61 0.47 2.54 0.52 2.50 0.52 2	55.19 52.59 57.39 71.59 77.51 77.55 81.53 82.76 84.00 86.00 86.00 86.00 86.00 86.00 86.00 86.00 86.00 86.00 89.05 89.05 89.05 90.05	6.25-05 7.05-08 7.05-08 7.05-08 9.76-06 9.76-06 9.76-06 9.76-06 9.76-06 9.76-06 9.76-07 9.76-07 1.56-07	1.47E-08 1.47E-08	.41E-07 346E-07 350E-07 355E-07 255E-07 2.
0.93 0.92 0.91 0.9 0.89 0.86 0.66 0.67 0.06 0.85 0.85 0.85 0.85 0.85 0.85 0.85 0.87 0.87 0.87 0.77 0.76 0.76	5.95 5.99 5.99 5.70 5.70 5.53 5.67 5.61 5.44 5.39 5.32 5.25 5.19 5.19 5.06 4.94 4.87 4.81 4.87 4.86 4.82	0.05 0.06 0.07 0.09 0.09 0.1 0.11 0.12 0.13 0.14 0.15 0.16 0.16 0.17 0.16 0.17 0.12 0.22 0.21 0.22 0.23	0.06 0.07 0.08 0.10 0.11 0.12 0.19 0.14 0.16 0.17 0.18 0.20 0.21 0.24 0.24 0.25 0.25 0.25 0.27	3.885-607 3.805-607 3.905-607 5.726-607 5.958-607 5.968-607 5.968-607 5.968-607 5.968-607 5.968-607 5.968-607 5.968-607 5.968-607 5.968-607 5.968-607 5.968-607 5.968-607 5.968-607 5.968-607 5.968-607 5.968-607 5.968-607	4.38E-905 5.26E-905 6.18E-906 7.91E-908 7.98E-906 8.76E-906 1.96E-97 1.31E-97 1.31E-97 1.49E-97 1.49E-97 1.58E-97 1.58E-97 1.58E-97 1.58E-97 1.58E-97 1.58E-97 2.91E-97 2.10E-97 2.10E-97 2.10E-97 2.28E-97 2.28E-97	7. 125-07 7. 045-07 6. 075-07 6. 085-07	1.25 1.26 1.26 1.28 1.29 1.39 1.39 1.34 1.39 1.39 1.40 1.47 1.45 1.45 1.47 1.49 1.49 1.51 1.51	0.20 0.28 0.28 0.29 0.29 0.29 0.29 0.29 0.30 0.30 0.30 0.30 0.31 0.31 0.31 0.32 0.32 0.32 0.35 0.35 0.35 0.35 0.35 0.35	98.49 98.47 98.46 98.46 98.40 98.39 98.37 98.37 98.37 98.27 98.27 98.27 98.27 98.23 98.11 98.11 99.11 99.10 99.06	3.65-07 3.55-07 3.55-07 3.55-07 3.55-07 3.45-07 3.45-07 3.55-0	8.53E-00 1.02E-07 1.19E-07 1.37E-07 1.54E-07 1.54E-07 1.71E-07 1.88E-07 2.25E-07 2.25E-07 2.39E-07 2.39E-07 2.39E-07 3.05E-07 3.05E-07 3.48E-07 3.55E-07 3.55E-07 3.39E-07 4.10E-07	44.17 05-5 50.81 0.55 31.55 0.44 27.61 0.55 27.61 0.47 2.54 0.55 50.68 0.25 50.68 0.25 16.41 0.27 16.40 0.27 17.70 0.21 1	55.19 62.69 67.99 71.92 75.10 77.59 79.63 81.93 82.76 84.00 86.92 86.92 96.93 99.93 99.93	6.25+06 7.05+06 7.05+06 7.05+06 8.75+06 9.55+06 9.55+06 9.55+06 9.55+06 9.55+06 9.55+06 9.55+07 9.55+0	1.47E-08 4 1.47E-08 1 1.47E-08 1 1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 4 1.47E-08 5 1.47E-08 5 1.47E-08 6 1.47E-08 6 1.47E-08 6 1.47E-08 6 1.47E-08 6 1.47E-08 6 1.47E-08 6 1.47E-08 6 1.47E-08 6	.41E-07 346E-07 350E-07 355E-07 355E-07 355E-07 355E-07 355E-07 355E-07 376E-07 376E-07 384E-07 384E-07 384E-07 384E-07 384E-07 286E-07 2.
D.93 0.92 0.91 0.90 0.80 0.88 0.86 0.87 0.86 0.85 0.85 0.85 0.84 0.82 0.84 0.82 0.81 0.77 0.76 0.77 0.76 0.77	5.95 5.99 5.99 5.82 5.70 5.53 5.51 5.51 5.54 5.52 5.32 5.25 5.19 6.13 6.05 5.06 5.06 5.06 5.06 5.06 5.06 5.06	0.05 0.06 0.07 0.09 0.09 0.1 0.11 0.12 0.13 0.14 0.16 0.16 0.16 0.17 0.19 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2	0.06 0.07 0.08 0.10 0.11 0.12 0.14 0.16 0.17 0.18 0.19 0.20 0.21 0.23 0.24 0.24 0.24 0.25 0.25 0.25 0.25 0.25	3.885-607 3.805-607 3.765-607 3.765-607 3.765-607 3.865-607 3.865-607 3.856-	4.93E-60 5.20E-60 6.19E-60 7.01E-60 7.01E-60 7.00E-60 7.00E-60 7.00E-60 7.00E-60 1.05E-60 1.0	7. 12±407 7. 04±407 6. 977±407 6. 977±407 6. 625±407 6.	1,25 1,26 1,28 1,29 1,31 1,31 1,32 1,32 1,34 1,35 1,40 1,40 1,40 1,40 1,41 1,45 1,47 1,49 1,15 1,15 1,15 1,15 1,15 1,15 1,15 1,1	0.20 0.23 0.23 0.23 0.23 0.23 0.23 0.23	98.49 98.47 98.46 98.46 98.44 98.42 98.37 98.37 98.37 98.37 98.37 98.27 98.27 98.27 98.27 98.27 98.27 98.27 98.27 98.27 98.27 98.29 98.27 98.27 98.27 98.27 98.29 98.31 98.29 98.31	3.65-07 3.65-07 3.55-07 3.55-07 3.55-07 3.55-07 3.45-07 3.55-0	8.53E-00 1.02E-07 1.19E-07 1.19E-07 1.54E-07 1.5	44.17 054-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6-6	55. 19 52.50 57.59 77.59 77.59 77.50 77.50 18 1.33 12 76 84.00 86.00 86.00 86.80 86.80 86.80 86.80 90.00 90.70	6.22+06 7.05+08 7.05+08 7.05+08 8.75+06 9.55+06 9.55+06 9.55+06 9.55+06 9.55+06 9.55+06 9.55+07 9.55+07 1.55+07 1.55+07 1.55+07 1.55+07 1.55+07 2.55+07	1.47E-08 1.47E-08	.41E-07 3 .44E-07 3 .44E-07 3 .44E-07 3 .50E-07 3 .55E-07 3 .65E-07 3 .75E-07
0.93 0.92 0.91 0.90 0.80 0.85 0.65 0.67 0.65 0.61 0.61 0.62 0.63 0.65 0.67 0.67 0.77 0.76 0.76	5.95 5.99 5.99 5.70 5.70 5.53 6.67 5.65 5.32 5.32 5.32 5.13 5.06 5.00 4.94 4.87 4.87 4.87 4.87 4.87 4.87 4.87 4.8	0.05 0.07 0.09 0.09 0.01 0.11 0.12 0.13 0.14 0.15 0.16 0.17 0.18 0.17 0.19 0.2 0.2 0.2 0.2 0.2 0.2 0.3 0.4 0.15 0.15 0.16 0.17 0.16 0.17 0.17 0.18 0.19 0.2 0.2 0.2 0.2 0.2 0.2 0.3 0.4 0.4 0.5 0.6 0.7 0.7 0.8 0.8 0.8 0.8 0.8 0.8 0.8 0.8	0.06 0.07 0.08 0.10 0.11 0.12 0.19 0.14 0.16 0.17 0.19 0.19 0.20 0.21 0.24 0.24 0.25 0.24 0.25 0.27	3.88E-607 3.90E-607 3.90E-607 5.72E-607 5.98E-607	4.98(±00 5.05(±00 6.18(±00 7.08(±00 7.08(±00 8.76(±00 9.66(±00 9.66(±00 1.05(±01 1.16(±01	7. 128-07 7. 048-07 6. 075-07 6. 0825-07 6. 0825-07 6. 0825-07 6. 085-07 6.	1.25 1.26 1.26 1.28 1.29 1.39 1.39 1.39 1.39 1.39 1.49 1.42 1.42 1.44 1.45 1.47 1.49 1.55 1.55 1.55 1.55 1.55 1.55 1.55 1.5	0.20 0.28 0.28 0.29 0.29 0.29 0.29 0.30 0.30 0.30 0.30 0.31 0.31 0.31 0.31	98.47 98.46 98.47 98.46 98.42 98.49 98.49 98.35 98.35 98.37 98.27 98.27 98.27 98.17 98.18 98.19 98.10 98	3.65-07 3.55-07 3.55-07 3.55-07 3.55-07 3.45-07 3.45-07 3.45-07 3.55-0	5.53E-00 1.02E-07 1.19E-07 1.3F-07 1.3F-07 1.3F-07 1.3F-07 1.3F-07 1.3F-07 1.3F-07 2.3E-07 2.3E-07 2.3E-07 3.3F-07 3.1E-07 3.1S-07 3.1S-07 4.10E-07	44.17 05-5 50.81 0.53 51.55 0.44 2.54 0.55 51.55 0.44 2.54 0.55 50.68 0.22 50	55. 19 52.50 67.93 77.93 77.50 77.50 77.50 77.50 82.77 84.50 86.00	6.25-05 7.05-05 7.05-05 8.76-05 8.76-05 9.56-06 9.56-06 9.56-07 1.66-07 1.66-07 1.66-07 1.66-07 1.76-07	1.47E-08 1.47E-08	.46E-07 3 .50E-07 3 .55E-07 3 .65E-07 3 .75E-07 3 .75E-07 3 .75E-07 3 .84E-07 2 .84E-07 2 .98E-07 2 .98E-07 2 .98E-07 2 .75E-07
0.93 0.92 0.91 0.90 0.80 0.80 0.85 0.85 0.85 0.85 0.85 0.8	5.95 5.99 5.99 5.70 5.70 5.53 6.57 5.51 5.44 6.53 5.52 5.25 5.25 5.25 5.19 6.13 6.13 6.14 6.13 6.14 6.14 6.15 6.14 6.15 6.14 6.15 6.14 6.15 6.15 6.15 6.15 6.15 6.15 6.15 6.15	0.05 0.06 0.07 0.09 0.09 0.1 0.11 0.12 0.13 0.14 0.16 0.16 0.17 0.16 0.17 0.19 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.3 0.3 0.4 0.4 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1	0.06 0.07 0.08 0.10 0.11 0.12 0.14 0.15 0.17 0.18 0.20 0.21 0.23 0.23 0.24 0.25 0.27 0.20 0.30 0.30 0.30 0.30 0.30 0.30 0.30	3.88E-607 3.80E-607 3.90E-607 3.76E-607 3.76E-607 3.86E-607 3.86E-607 3.85E-607	4.33E-06 5.26E-06 6.13E-06 6.13E-06 6.13E-06 7.08E-06 7.08E-06 8.76E-06 8.76E-06 8.76E-06 1.3E-07 1.4E-07 1.3E-07 1.4E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 2.0E-07 2.1E-07	7. 12±407 7. 04±407 6. 977±407 6. 977±407 6. 625±407 6.	1,25 1,26 1,28 1,29 1,31 1,31 1,32 1,34 1,35 1,40 1,40 1,40 1,42 1,45 1,47 1,49 1,49 1,53 1,53 1,53 1,53 1,53 1,53 1,53 1,53	0.20 0.23 0.23 0.23 0.23 0.23 0.23 0.23	58.47 58.46 58.47 58.46 68.42 68.42 68.43 69.37 69.35 69.37 69.35 69.37 69	3.65-07 3.65-07 3.55-07 3.55-07 3.55-07 3.67-07 3.67-07 3.87-0	8.53E-00 1.02E-07 1.19E-07 1.19E-07 1.47E-07 1.54E-07 1.54E-07 1.71E-07 1.88E-07 1.88E-07 2.05E-07 2.05E-07 2.09E-07 2.09E-07 2.09E-07 2.09E-07 2.09E-07 2.09E-07 3.07E-07 3.0	44.17 054-64 50.91 0.53 51.55 0.64 27.61 0.52 27.61 0.52 20.08 0.22 20.08 0.22 20.08 0.22 18.41 0.27 15.89 0.22 15.89 0.22 15.80 0.22 15.80 0.22 15.80 0.22 15.80 0.22 15.80 0.22 15.80 0.22 15.80 0.22 15.80 0.22 15.80 0.22 15.80 0.22 15.80 0.22 15.80 0.22 15.80 0.22 15.80 0.22 15.80 0.22 15.80 0.22 15.80 0.44 15.70 15.70 15.70 15.70 15.70 15.70 15.70 15.70 15.70 15.70 15.70 15.70 15.70	55. 19 50.06 67.99 77.99 75. 10 77. 5.9 10.53 10.53 10.53 10.50	6.22+06 7.05+06 7.05+06 7.05+06 8.75+06 9.55+06 9.55+06 9.55+06 9.55+06 9.55+06 9.55+07 1.55+07 1.55+07 1.55+07 1.55+07 1.55+07 1.55+07 1.55+07 2.55+07 2.25+07 2.35+0	1.47E-08 1.47E-08	.415407 34465407 34465407 34465407 34565407 36555407 36555407 36555407 37565407 37565407 37565407 37565407 38465407 38465407 38465407 38465407 28465407 28565407 2.
0.93 0.92 0.91 0.96 0.89 0.86 0.65 0.67 0.65 0.61 0.83 0.83 0.83 0.83 0.83 0.87 0.77 0.76 0.77 0.72 0.72 0.71 0.72 0.71 0.72 0.71 0.72 0.71 0.72 0.71 0.72 0.71 0.72 0.72 0.71 0.72 0.71 0.72 0.71 0.72 0.72 0.71 0.71 0.72 0.72 0.71 0.72 0.72 0.73 0.72 0.74 0.75 0.74 0.76 0.74 0.76 0.76 0.71 0.76 0.76 0.71 0.76 0.88	5.95 5.99 5.99 5.70 5.70 5.53 5.57 5.65 5.44 5.39 5.32 5.25 5.19 5.13 5.06 5.00 4.94 4.87 4.87 4.88 4.89 4.49 4.43	0.05 0.07 0.09 0.09 0.11 0.11 0.12 0.13 0.14 0.15 0.16 0.17 0.16 0.17 0.19 0.2 0.2 0.2 0.2 0.2 0.3 0.3 0.4 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1	0.06 0.07 0.08 0.10 0.10 0.12 0.13 0.14 0.15 0.17 0.19 0.19 0.21 0.21 0.21 0.22 0.24 0.25 0.25 0.25 0.25 0.25 0.25 0.25 0.25	3.88E-607 3.90E-607 3.90E-607 3.72E-607 3.98E-607	4.93E-90 5.20E-90 6.13E-90 7.01E-90 8.70E-90 9.64E-90 9.64E-90 9.64E-90 1.05E-97 1.23E-97 1.24E-97 1.25E-97 1.25E-97 1.25E-97 1.25E-97 1.25E-97 1.25E-97 2.2	7. 128-07 7. 048-07 6. 975-07 6. 985-07 6. 985-07 6. 985-07 6. 974-07 6. 978-07 6. 988-07 6. 988-07	1.25 1.26 1.26 1.28 1.29 1.39 1.39 1.39 1.39 1.39 1.49 1.47 1.45 1.47 1.45 1.47 1.49 1.51 1.51 1.51 1.53 1.55 1.55 1.55 1.55	0.20 0.28 0.28 0.28 0.29 0.29 0.29 0.29 0.30 0.30 0.30 0.31 0.31 0.31 0.31 0.32 0.32 0.32 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35	98.47 98.46 98.47 98.46 98.44 98.42 98.42 98.35 98.35 98.35 98.37 98.27 98.27 98.25 98.10 99.11 99.11 99.10 99.00 90.00 90.00 90.00 90.00 90.00 90.00 90	3.65-07 3.55-07 3.55-07 3.55-07 3.55-07 3.45-07 3.45-07 3.45-07 3.55-0	5.53E-00 1.02E-07 1.19E-07 1.3F-07 1.3F-07 1.5F-07 1.5F-07 1.5F-07 1.7F-07 1.5F-07 2.5E-07 2.5E-07 2.5E-07 2.5E-07 3.0F-07 3.11E-07 3.0F-07 3.	44.17 05-5 50.81 0.53 51.55 0.44 27.51 0.55 52.54 0.55 52.54 0.55 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.22 52.5	55. 19 26.26 27. 39 27. 10 27. 20 27.	6.25-05 7.05-05 7.05-05 7.05-05 9.75-105 9.75-105 9.75-105 9.75-105 9.75-105 9.75-105 9.75-105 9.75-105 9.75-107 9.75-10	1.47E-08 1.47E-08	.415.07 3 .446E-07 3 .446E-07 3 .456E-07 3 .556E-07 3 .656E-07 3 .756E-07 3
0.93 0.92 0.91 0.90 0.80 0.80 0.85 0.85 0.85 0.85 0.85 0.8	5.95 5.99 5.99 5.70 5.70 5.53 6.57 5.51 5.44 6.53 5.52 5.25 5.25 5.25 5.19 6.13 6.13 6.14 6.13 6.14 6.14 6.15 6.14 6.15 6.14 6.15 6.14 6.15 6.15 6.15 6.15 6.15 6.15 6.15 6.15	0.05 0.06 0.07 0.09 0.09 0.1 0.11 0.12 0.13 0.14 0.16 0.16 0.17 0.16 0.17 0.19 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.3 0.3 0.4 0.4 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1 0.1	0.06 0.07 0.08 0.10 0.11 0.12 0.14 0.15 0.17 0.18 0.20 0.21 0.23 0.23 0.24 0.25 0.27 0.20 0.30 0.30 0.30 0.30 0.30 0.30 0.30	3.88E-607 3.80E-607 3.90E-607 3.76E-607 3.76E-607 3.86E-607 3.86E-607 3.85E-607	4.33E-06 5.26E-06 6.13E-06 6.13E-06 6.13E-06 7.08E-06 7.08E-06 8.76E-06 8.76E-06 8.76E-06 1.3E-07 1.4E-07 1.3E-07 1.4E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 1.5E-07 2.0E-07 2.1E-07	7. (2±-407 7. (0±-407 6. 97E-407 6. 97E-407 6. 92E-407 6. 92E	1,25 1,26 1,28 1,29 1,31 1,31 1,32 1,34 1,37 1,48 1,49 1,49 1,45 1,47 1,49 1,49 1,49 1,53 1,53 1,53 1,53 1,53 1,53 1,53 1,53	0.20 0.23 0.23 0.23 0.23 0.23 0.23 0.23	58.47 58.46 58.47 58.46 68.42 68.42 68.43 68.35 68.35 68.35 68.37 68.35 68.31 68	3.65-07 3.65-07 3.55-07 3.55-07 3.55-07 3.55-07 3.45-07 3.45-07 3.45-07 3.55-0	8.53E-00 1.02E-07 1.19E-07 1.19E-07 1.47E-07 1.54E-07 1.5	44.17 0.64-6.17 0.65-6.17	55. 19 50.06 67.99 77.99 77.90 75. 10 77.50 18.53 18.276 40.00 66.	6.25-06 7.05-08 7.05-08 7.05-08 0.75-06 0.55-06 0.55-06 0.55-06 0.55-06 0.55-06 0.55-07 1.55-0	1.47E-08 1.47E-08	.415.07 3 .405.07 3 .505.07 3 .505.07 3 .505.07 3 .505.07 3 .505.07 3 .705.07 3 .505.0
0.93 0.92 0.91 0.90 0.80 0.86 0.86 0.86 0.86 0.86 0.86 0.8	5.95 5.99 5.99 5.02 5.76 5.70 5.65 5.65 5.44 5.39 5.32 5.25 5.19 5.19 5.06 4.94 4.87 4.87 4.87 4.89 4.89 4.89 4.89 4.89 4.89 4.89 4.89	0.05 0.06 0.07 0.09 0.09 0.1 0.11 0.12 0.13 0.14 0.16 0.16 0.17 0.16 0.17 0.19 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.3 0.3 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4 0.4	0.06 0.07 0.08 0.10 0.11 0.12 0.13 0.14 0.15 0.17 0.18 0.20 0.21 0.23 0.21 0.24 0.24 0.27 0.30 0.32 0.32 0.32 0.32	3.88E-607 3.80E-607 3.90E-607 3.90E-607 5.72E-607 5.86E-607	4.33E-06 5.26E-06 6.13E-06 6.13E-06 6.13E-06 7.08E-06 7.08E-06 8.76E-06 8.76E-06 8.76E-06 1.3E-07 1.4E-07 1.3E-07 1.4E-07 1.3E-07 1.4E-07 1.5SE-07 1.5SE-07 1.5SE-07 1.5SE-07 2.0E-07 2.1E-07	7. 128-07 7. 048-07 6. 977-07 6. 987-07 6. 982-07 6. 982-07 6. 982-07 6. 974-07 6. 975-07 6. 982	1.25 1.26 1.26 1.28 1.29 1.39 1.39 1.39 1.39 1.39 1.49 1.47 1.45 1.47 1.45 1.47 1.49 1.51 1.51 1.51 1.53 1.55 1.55 1.55 1.55	0.20 0.28 0.28 0.28 0.29 0.29 0.29 0.29 0.30 0.30 0.30 0.31 0.31 0.31 0.31 0.32 0.32 0.32 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35	98. 47 98. 46 98. 47 98. 46 98. 42 98. 42 98. 40 98. 37 98. 35 98. 37 98. 37 98. 37 98. 37 98. 37 98. 37 98. 37 98. 37 98. 77 98. 27 98. 77 98	3.65-07 3.55-07 3.55-07 3.55-07 3.55-07 3.45-07 3.45-07 3.45-07 3.55-0	5.53E-00 1.02E-07 1.19E-07 1.3F-07 1.3F-07 1.3F-07 1.3F-07 1.3F-07 1.3F-07 1.3F-07 1.3F-07 2.3E-07 2.3E-07 2.3F-07 3.1F-07 3.1F-07 3.1F-07 3.1F-07 4.10E-07 4.10E-07 4.10E-07 4.10E-07 4.10E-07 4.10E-07 4.10E-07 4.10E-07 5.12E-07	44.17 05-5 50.81 0.53 51.55 0.44 27.51 0.55 52.54 0.55 52.54 0.55 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.68 0.22 52.55 0.22 52.5	55. 19 26.26 27. 39 27. 50 27. 50 27. 50 27. 50 27. 50 27. 50 27. 50 27. 50 27. 50 27. 50 28. 70 28. 70 28. 70 28. 70 28. 70 28. 80 29. 70 20. 70 20.	6.25-05 7.05-05 7.05-05 7.05-05 8.76-05 9.56-06 9.56-06 9.56-06 1.56-07	1.47E-08 1.47E-08	.441E-07 3 .50E-07 3 .50E-07 3 .50E-07 3 .50E-07 3 .50E-07 3 .50E-07 3 .70E-07 3
0.93 0.92 0.91 0.91 0.80 0.86 0.86 0.87 0.85 0.85 0.83 0.82 0.82 0.83 0.87 0.77 0.76 0.76 0.73 0.72 0.70 0.70 0.88 0.88 0.88 0.88 0.86 0.67 0.66	5.95 5.99 5.99 5.92 5.76 5.70 5.65 5.65 5.52 5.32 5.19 5.06 4.9 4.9 4.9 4.9 4.9 4.9 4.9 4.9 4.9 4.9	0.05 0.06 0.07 0.09 0.09 0.01 0.11 0.12 0.13 0.14 0.15 0.16 0.17 0.16 0.17 0.19 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2 0.2	0.06 0.07 0.08 0.10 0.11 0.12 0.13 0.14 0.15 0.17 0.19 0.20 0.21 0.21 0.22 0.22 0.22 0.22 0.22	3.885-07 3.905-07 3.905-07 3.905-07 3.725-07 3.885-07 3.885-07 3.855-07 3.515-07 3.475-07 3.355-07 3.375-07 3.395-07 3.315-07 3.395-07 3.315-07 3.3	4.381-00 5.001-00 6.131-00 7.081-00 7.0	7. 128-07 7. 048-07 6. 977-07 6. 987-07 6. 982	1.25 1.26 1.26 1.28 1.29 1.39 1.39 1.39 1.39 1.39 1.39 1.39 1.3	0.20 0.28 0.28 0.28 0.29 0.29 0.29 0.29 0.30 0.30 0.30 0.31 0.31 0.31 0.31 0.32 0.32 0.32 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35	98.47 98.46 98.47 98.46 98.42 98.47 98.56 98.57 98.57 98.57 98.57 98.57 98.57 98.77	3.65-07 3.65-07 3.65-07 3.55-07 3.55-07 3.45-07 3.45-07 3.55-0	8.53E-00 1.02E-07 1.19E-07 1.19E-07 1.47E-07 1.54E-07 1.5	#4.17 04-6 96.81 0.53 31.55 0.44 24.54 0.55 27.61 0.40 24.54 0.55 20.08 0.29 20.08 0.29 20.08 0.29 20.08 0.29 20.08 0.29 20.08 0.29 20.08 0.29 20.08 0.29 20.08 0.29 20.08 0.29 20.08 0.29 20.08 0.29 20.08 0.29 20.08 0.29 20.08 0.29 20.08 0.29 20.08 0.29 20.08 0.29 20.08 0.39	55. 19 25.06 67.99 17.92 17.92 17.93 17.93 17.93 18.33 18.27 18.33 18.276 18.00 65.00 66.82 66.00 66.82 66.00 66.82 67.555 68.21 68.82 69.33 19.38 19.	6.22+05 7.06+08 7.06+08 0.76+06 0.26+06 0.26+06 0.26+06 0.26+06 0.26+07 1.16+07 1.26+0	1.47E-08 1.47E-08	.415-07 9 4.465-07 9 5.505-07 9 5.505-07 9 6.555-07 3 6.555-07 3 6.555-07 3 7.748-07 3 6.455-07 9 6
0.93 0.92 0.91 0.90 0.80 0.86 0.86 0.86 0.86 0.86 0.86 0.8	5.95 5.99 5.99 5.92 5.70 5.53 6.67 5.61 5.44 5.99 5.32 5.19 5.13 5.00 4.94 4.61 4.64 4.64 4.64 4.64 4.64 4.64 4.6	0.05 0.06 0.07 0.09 0.09 0.01 0.11 0.11 0.12 0.13 0.14 0.16 0.16 0.17 0.18 0.17 0.18 0.19 0.22 0.23 0.24 0.25 0.25 0.25 0.26 0.27 0.29 0.29 0.29 0.29 0.29 0.29 0.29 0.29	0.06 0.07 0.08 0.10 0.11 0.12 0.14 0.16 0.17 0.18 0.20 0.21 0.23 0.23 0.24 0.25 0.25 0.25 0.25 0.30 0.30 0.30 0.30 0.30 0.30 0.30 0.3	3.885-607 3.805-	4.32E-06 5.26E-06 6.13E-06 6.13E-06 6.13E-06 7.08E-06 6.13E-06 7.08E-06 7.08E-06 7.08E-06 7.08E-07 1.45E-07 1.45E-07 1.45E-07 1.45E-07 1.45E-07 1.55E-07 1.55E-07 1.55E-07 1.55E-07 2.15E-07 2.1	7. (22-407 7. (042-407 6. 977-407 6. 987-407 6. 982-407 6. 98	1,25 1,26 1,28 1,28 1,29 1,31 1,32 1,34 1,35 1,46 1,47 1,49 1,47 1,49 1,47 1,49 1,47 1,49 1,53 1,75	0.26 0.28 0.28 0.28 0.28 0.29 0.29 0.30 0.30 0.30 0.30 0.31 0.31 0.31 0.31	58.47 58.46 58.46 58.46 58.46 58.42 58.45 58.55 68.55 68.55 68.55 68.55 68.55 68.55 68.57 68.55 68.57 68.59 68.77 68.59 68.79 68	3.65-07 3.65-07 3.55-07 3.55-07 3.55-07 3.55-07 3.45-07 3.45-07 3.45-07 3.45-07 3.25-07 3.25-07 3.25-07 3.25-07 3.25-07 3.25-07 3.25-07 3.25-07 3.25-07 3.25-07 3.25-07 3.25-07 3.25-07 3.25-07 3.25-07	8.53E-00 1.02E-07 1.19E-07 1.37E-07 1.47E-07 1.47E-07 1.48E-07 1.4	44.17 054-64 50.91 0.53 51.55 0.64 24.54 0.55 22.59 0.52 20.08 0.25 20.08 0.25 18.41 0.27 18.69 0.25 18.72 0.21 18.90 0.25 18.90 0.25 18.90 0.25 18.90 0.25 18.90 0.25 18.90 0.25 18.90 0.25 18.90 0.44 18.90 0.44 18.90 0.45	55. 19 56.06 67.99 77.99 77.51 77.59 18.33 18.33 18.276 18.33 18.33 18.276 18.33 18.33 18.276 18.33 18.33 18.276 18.33 18.33 18.276 18.33 19.35	6.22+06 7.05+06 7.05+06 7.05+06 8.75+06 9.55+06 9.55+06 9.55+06 9.55+06 9.55+06 9.55+06 9.55+06 9.55+06 9.55+07	1.47E-06 1.4	.441E-07 3 .50E-07 3 .70E-07
0.93 0.92 0.91 0.90 0.80 0.86 0.86 0.87 0.86 0.86 0.86 0.86 0.87 0.83 0.87 0.87 0.77 0.77 0.76 0.76 0.77 0.77 0.76 0.76	5.95 5.99 5.99 5.02 5.76 5.70 5.53 5.57 5.55 5.32 5.32 5.13 5.06 5.39 5.32 5.13 5.00 4.94 4.87 4.87 4.87 4.87 4.87 4.87 4.87 4.8	0.05 0.06 0.07 0.09 0.01 0.11 0.12 0.13 0.14 0.16 0.16 0.17 1.18 0.19 0.22 0.21 0.22 0.23 0.24 0.25 0.25 0.30	0.06 0.07 0.08 0.10 0.11 0.12 0.13 0.14 0.15 0.17 0.19 0.20 0.21 0.23 0.24 0.25 0.25 0.25 0.25 0.25 0.25 0.25 0.25	3.885-97 3.905-97 3.905-97 3.905-97 3.905-97 3.985-97 3.985-97 3.985-97 3.955-97 3.9	4.381-00 5.001-00 6.131-00 7.081-00 7.0	7. 128-07 7. 048-07 6. 977-07 6. 982	1.25 1.26 1.26 1.28 1.29 1.39 1.39 1.39 1.39 1.39 1.39 1.39 1.49 1.40 1.47 1.45 1.47 1.49 1.51 1.55 1.55 1.55 1.57 1.59 1.66 1.66 1.68 1.77 1.78 1.78 1.78	0.20 0.28 0.28 0.28 0.29 0.29 0.29 0.30 0.30 0.30 0.31 0.31 0.31 0.31 0.32 0.32 0.33 0.33 0.33 0.35 0.35 0.35 0.35 0.35	98.47 98.46 98.47 98.46 98.47 98.46 98.47 98.57 98.57 98.57 98.57 98.57 98.57 98.57 98.77 98.77 98.77 98.77 98.77 98.77 98.77 98.77 98.77 98.77	3.65-07 3.65-07 3.65-07 3.55-07 3.55-07 3.45-07 3.45-07 3.35-07 3.35-07 3.35-07 3.25-07	5.53E-00 1.02E-07 1.19E-07 1.3FE-07 1.3FE-07 1.3FE-07 1.3FE-07 1.25E-07 2.3E-0-07 2.3E-0-07 2.3FE-07 2.3FE-07 3.4FE-07 3.4FE-07 3.4FE-07 3.4FE-07 4.1FE-07 4.1FE-07 4.1FE-07 4.1FE-07 5.2E-07 5.3E-07	44.17 054 55.81 0.53 51.55 0.44 2.54 0.55 27.61 0.40 2.54 0.55 16.58 0.25 17.59 0.11 17.62 0.16 17.62 0.17 17.62 0.17 17.62 0.17 17.62 0.17 17.62 0.17 17.62 0.17 17.62 0.17 17.62 0.17 17.62 0.17 17.62 0.17 17.62 0.17 17.62 0.17 17.62 0.17 17.62 0.17 17.63 0.17 17.65 0.17 17.	55. 19 52.06 57.93 77.93 77.50	6.22+05 7.06+08 7.06+08 7.06+08 0.76+06 0.56+06 0.56+06 1.06+07 1.16+07 1.26+0	1.47E-08 1.47E-08	.441E-07 3 .50E-07 5 .50E-
D.93 0.92 0.91 0.90 0.80 0.86 0.86 0.86 0.86 0.86 0.85 0.85 0.85 0.85 0.85 0.85 0.85 0.85	5.36 5.39 5.99 5.92 5.70 5.70 5.65 5.65 5.44 5.32 5.15	0.05 0.06 0.07 0.09 0.09 0.01 0.11 0.12 0.13 0.14 0.15 0.16 0.17 0.16 0.17 0.18 0.17 0.22 0.23 0.24 0.25 0.25 0.25 0.25 0.25 0.25 0.29 0.29 0.29 0.29 0.29 0.29 0.29 0.29	0.06 0.07 0.08 0.10 0.11 0.12 0.14 0.16 0.17 0.18 0.20 0.21 0.23 0.24 0.23 0.24 0.25 0.21 0.25 0.30 0.30 0.30 0.30 0.30 0.30 0.30 0.3	3.88E-607 3.80E-607 3.90E-607	4.32E-06 5.26E-06 6.13E-06 6.13E-06 6.13E-06 7.08E-06 6.13E-06 7.08E-06 7.08E-06 7.08E-06 7.08E-06 7.08E-07 1.14E-07 1.14E-07 1.14E-07 1.15E-07 1.15E-07 1.15E-07 1.15E-07 1.15E-07 1.15E-07 1.15E-07 1.15E-07 2.15E-07 2.1	7. 12±407 7. 04±407 6. 977±407 6. 977±407 6. 625±407 6.	1.25 1.26 1.26 1.28 1.28 1.31 1.32 1.34 1.35 1.39 1.40 1.42 1.43 1.44 1.45 1.47 1.49 1.55 1.55 1.55 1.55 1.55 1.55 1.55 1.5	0.28 0.28 0.28 0.28 0.28 0.29 0.29 0.30 0.30 0.30 0.30 0.31 0.31 0.31 0.31	58.47 58.46 58.47 58.46 58.47 58.46 58.47 58.46 58.47 58.47 58.47 58.57 58.57 58.57 58.57 58.57 58.57 58.57 58.57 58.57 58.57 58.57 58.77 58.77 58.77 58.77 58.77 58.77 58.77 58.77 58.77 58.77	3.65-07 3.65-07 3.55-07 3.55-07 3.55-07 3.55-07 3.45-07 3.45-07 3.45-07 3.15-0	8.53E-00 1.02E-07 1.19E-07 1.37E-07 1.37E-07 1.38E-07 1.38E-07 1.38E-07 1.38E-07 1.38E-07 2.05E-07 2.05E-07 2.05E-07 2.05E-07 2.05E-07 3.07E-07 3.0	44.17 0.64-6. 96.91 0.53-6. 97.51 0.40 24.54 0.55-6. 24.54 0.55-6. 25.00 0.52-6. 18.41 0.27 18.69 0.25-6. 18.72 0.21 18.69 0.25-6. 18.72 0.21 18.90 0.20 18.90 0.10 18.90 0.11	55. 19 56.06 67.99 77.99 77.51 77.59 18.33 18.33 18.35	6.22+05 7.05+06 7.05+06 7.05+06 8.75+06 9.55+06 9.55+06 9.55+06 9.55+06 9.55+06 9.55+06 9.55+06 9.55+06 9.55+07	1.47E-06 1.47E-06	.4.41E-0/7 3 .50E-0/7 3 .70E-0/7
D.\$3 0.92 0.91 0.90 0.80 0.86 0.86 0.87 0.86 0.86 0.86 0.87 0.83 0.83 0.84 0.83 0.84 0.83 0.84 0.87 0.89 0.89 0.89 0.89 0.89 0.89 0.89 0.89	5.95 5.99 5.99 5.02 5.70 5.53 5.57 5.51 5.32 5.25 5.19 5.06 4.94 4.87 4.87 4.87 4.87 4.87 4.87 4.87 4.8	0.05 0.06 0.07 0.08 0.1 0.11 0.12 0.13 0.14 0.16 0.16 0.17 1.18 0.19 0.2 0.2 0.2 0.2 0.2 0.3 0.3 0.3 0.14 0.16 0.17 0.18 0.19 0.19 0.2 0.2 0.3 0.3 0.3 0.3 0.3 0.3 0.3 0.3	0.06 0.07 0.08 0.10 0.11 0.12 0.13 0.14 0.16 0.17 0.18 0.20 0.21 0.23 0.24 0.25 0.25 0.25 0.26 0.30 0.30 0.30 0.37 0.38 0.39 0.40 0.40 0.45 0.45	3.88E-807 3.80E-807 3.90E-807 3.72E-807 3.86E-807 3.86E-807 3.86E-807 3.85E-807 3.47E-807 3.35E-807	4.381-00 5.001-00 6.138-00 7.381-00 7.3	7. 128-07 7. 048-07 6. 977-07 6. 982	1.25 1.26 1.26 1.26 1.28 1.29 1.31 1.32 1.32 1.34 1.35 1.39 1.39 1.40 1.47 1.45 1.47 1.45 1.47 1.49 1.51 1.51 1.55 1.55 1.55 1.55 1.55 1.5	0.20 0.28 0.28 0.28 0.29 0.29 0.29 0.29 0.30 0.30 0.30 0.31 0.31 0.31 0.31 0.32 0.32 0.32 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35	88.47 88.46 88.47 88.46 88.42 88.42 88.42 88.42 88.43 88.35 88.35 88.35 88.35 88.35 88.35 88.36 89.37 88.26 89.27	3.65-07 3.65-07 3.65-07 3.95-07 3.95-07 3.45-07 3.45-07 3.95-0	8.53E-00 1.02E-07 1.19E-07 1.37E-07 1.36E-07 1.37E-07 1.48E-07 1.71E-07 1.88E-07 2.53E-07 2.53E-07 2.50E-07 2.50E-07 2.50E-07 3.54E-07 3.54E-07 3.54E-07 3.55E-07 3.5	#4.17 04-6 96.81 0.53 31.55 0.44 24.54 0.55 27.61 0.40 24.54 0.55 20.08 0.29	55. 19 25.266 67.799 17.929 17.929 17.939 17.939 18.333 18.276 14.000 65.000 65.000 66.82 66.000 66.82 66.000 66.82 67.555 68.21 68.82 69.33 100.56 1	6.22+05 7.06+08 7.06+08 1.76+06 9.56+06 9.56+06 1.06+07 1.16+07 1.26+0	1.47E-008 1.47E-	
0.93 0.92 0.91 0.90 0.80 0.86 0.86 0.86 0.86 0.86 0.86 0.8	5.95 5.99 5.99 5.92 5.70 5.53 5.57 5.51 5.44 5.92 5.32 5.19 5.19 5.00 4.94 4.11 4.15 4.15 4.15 4.15 4.15 4.15 4.1	0.05 0.06 0.07 0.09 0.09 0.01 0.11 0.13 0.14 0.16 0.16 0.17 0.18 0.17 0.18 0.17 0.19 0.22 0.23 0.24 0.25 0.25 0.27 0.26 0.27 0.28 0.29 0.30 0.31 0.33 0.34	0.06 0.07 0.08 0.10 0.11 0.12 0.13 0.14 0.16 0.17 0.18 0.20 0.21 0.23 0.24 0.23 0.24 0.25 0.21 0.25 0.30 0.30 0.30 0.30 0.30 0.30 0.30 0.3	3.88E-807 3.80E-807 3.80E-807 3.90E-807	4.32E-06 5.26E-06 6.13E-06 6.13E-06 6.13E-06 7.86E-06 6.13E-06 7.86E-06 8.76E-06 8.76E-06 8.76E-06 8.76E-06 1.3E-07 1.4E-07 1.3E-07 1.4E-07 1.3E-07 1.4E-07 1.3E-07 1.4E-07 1.55E-07 1.55E-07 1.55E-07 1.55E-07 2.15E-07 2.	7. (22-407 7. (044-07 6. 977-407 6. 977-407 6. 982-407	1.25 1.26 1.26 1.28 1.29 1.31 1.32 1.32 1.34 1.35 1.39 1.49 1.40 1.41 1.42 1.43 1.45 1.47 1.49 1.51 1.53 1.55 1.55 1.55 1.55 1.55 1.55	0.28 0.28 0.28 0.28 0.28 0.29 0.29 0.30 0.30 0.30 0.31 0.31 0.31 0.31 0.32 0.32 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35	58.47 58.46 58.47 58.46 58.47 58.46 58.47 58.46 58.47 58.47 58.47 58.57 58.57 58.57 58.57 58.57 58.57 58.57 58.57 58.57 58.57 58.57 58.57 58.77	3.65-07 3.65-07 3.55-07 3.55-07 3.55-07 3.55-07 3.45-07 3.45-07 3.45-07 3.45-07 3.15-07 3.25-07	8.53E-00 1.02E-07 1.19E-07 1.37E-07 1.37E-07 1.38E-07 1.38E-07 1.38E-07 1.38E-07 1.38E-07 2.05E-07 2.05E-07 2.05E-07 2.05E-07 2.05E-07 3.07E-07 3.0	44.17 0.64-6.17 0.65-6.17	55. 19 56.06 67.99 77.99 77.99 75. 10 77.59 18.33 18.276 18.33 18.276 18.38 19.39 19	6.25-06 7.05-06 7.05-06 7.05-06 7.05-06 8.75-06 9.55-06 9.55-06 9.55-06 9.55-06 9.55-06 9.55-06 9.55-06 9.55-06 9.55-07 1.55-0	1.47E-06 1.47E-06	.41EAU 3 3.46EAU 3 4.46EAU 3 3.50EAU
0.93 0.92 0.91 0.90 0.80 0.86 0.86 0.87 0.86 0.86 0.86 0.87 0.88 0.82 0.83 0.82 0.87 0.77 0.78 0.77 0.77 0.77 0.77 0.77	5.95 5.99 5.99 5.02 5.76 5.70 5.53 5.57 5.55 5.32 5.32 5.13 5.06 5.39 5.32 5.13 5.06 4.14 4.17 4.17 4.17 4.17 4.17 4.18 4.19 4.19 4.19 4.19 4.19 4.19 4.19 4.19	0.05 0.06 0.07 0.09 0.01 0.11 0.12 0.13 0.14 0.16 0.17 0.18 0.17 0.18 0.19 0.2 0.2 0.2 0.2 0.3 0.3 0.14 0.15 0.16 0.17 0.18 0.19 0.2 0.2 0.3 0.3 0.4 0.5 0.5 0.5 0.7 0.7 0.7 0.7 0.7 0.7 0.7 0.7	0.06 0.07 0.08 0.10 0.11 0.12 0.13 0.14 0.16 0.17 0.18 0.20 0.21 0.23 0.24 0.24 0.25 0.25 0.25 0.30 0.30 0.30 0.37 0.38 0.39 0.40 0.46 0.46	3.885-807 3.905-607 3.905-607 3.725-607 3.986-	4.381-06 5.302-06 6.138-06 7.381-06 7.381-06 7.381-06 7.381-06 7.381-06 7.381-06 7.381-06 7.381-06 7.381-07 7.3	7. 128-407 7. 048-407 6. 977-407 6. 982-407	1.25 1.26 1.26 1.26 1.26 1.28 1.29 1.39 1.39 1.39 1.39 1.39 1.39 1.39 1.49 1.47 1.45 1.47 1.49 1.51 1.55 1.55 1.55 1.55 1.55 1.55 1.5	0.20 0.28 0.28 0.28 0.29 0.29 0.29 0.29 0.30 0.30 0.30 0.31 0.31 0.31 0.31 0.32 0.32 0.32 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35	98.49 98.47 98.46 98.47 98.46 98.47 98.46 98.47 98.50 98.50 98.50 98.50 98.10 98.60 98.70	3.65-07 3.65-07 3.65-07 3.95-07 3.95-07 3.45-07 3.45-07 3.35-07 3.35-07 3.35-07 3.25-07	8.53E-00 1.02E-07 1.19E-07 1.49E-07 1.49E-07 1.49E-07 1.49E-07 1.49E-07 1.49E-07 2.53E-07 2.53E-07 2.53E-07 2.53E-07 2.53E-07 2.53E-07 3.07E-07 3.41E-07 3.45E-07 3.45E-07 4.75E-07 4.75E-07 4.75E-07 4.75E-07 6.46E-07	44.17 044. 56.91 0.33 31.55 0.44 24.54 0.32 20.08 0.29 20.08 0.29 20.08 0.29 20.08 0.29 16.41 0.27 16.59 0.25 14.72 0.21 15.78 0.22 11.82 0.17 11.92 0.11 15.90 0.10 10.52 0.16 10.52 0.16 10.52 0.16 10.52 0.17 20.50 0.19 20.50	55. 19 25.266 67.799 17.292 17.529 17.550 17.550 18.333 18.276 14.000 65.000 65.000 66.82 67.555 68.271 68.000 69.33 100.26 00.565 00.565 00.565 00.565 00.565 00.570 00.587 00.5	6.22+05 7.06+08 7.06+08 7.06+08 0.76+06 0.56+06 0.56+06 0.56+06 0.56+07 1.56+0	1.47E-008 1.47E-	
0.93 0.92 0.91 0.90 0.80 0.86 0.86 0.87 0.86 0.85 0.86 0.85 0.85 0.84 0.83 0.82 0.84 0.85 0.87 0.77 0.76 0.77 0.76 0.77 0.79 0.71 0.71 0.68 0.66 0.66 0.66 0.66 0.63 0.62 0.64 0.62 0.64	5.95 5.99 5.99 5.92 5.70 5.53 5.57 5.51 5.44 5.92 5.32 5.19 5.19 5.00 4.94 4.11 4.15 4.15 4.15 4.15 4.15 4.15 4.1	0.05 0.06 0.07 0.09 0.09 0.01 0.11 0.13 0.14 0.16 0.16 0.17 0.18 0.17 0.18 0.17 0.19 0.22 0.23 0.24 0.25 0.25 0.27 0.26 0.27 0.28 0.29 0.30 0.31 0.33 0.34	0.06 0.07 0.08 0.10 0.11 0.12 0.13 0.14 0.16 0.17 0.18 0.20 0.21 0.23 0.24 0.23 0.24 0.25 0.21 0.25 0.30 0.30 0.30 0.30 0.30 0.30 0.30 0.3	3.88E-807 3.80E-807 3.80E-807 3.90E-807	4.32E-06 5.26E-06 6.13E-06 6.13E-06 6.13E-06 7.86E-06 6.13E-06 7.86E-06 8.76E-06 8.76E-06 8.76E-06 8.76E-06 1.3E-07 1.4E-07 1.3E-07 1.4E-07 1.3E-07 1.4E-07 1.3E-07 1.4E-07 1.55E-07 1.55E-07 1.55E-07 1.55E-07 2.15E-07 2.	7. (22-407 7. (044-07 6. 977-407 6. 977-407 6. 982-407	1.25 1.26 1.26 1.28 1.29 1.31 1.32 1.32 1.34 1.35 1.39 1.49 1.40 1.41 1.42 1.43 1.45 1.47 1.49 1.51 1.53 1.55 1.55 1.55 1.55 1.55 1.55	0.28 0.28 0.28 0.28 0.28 0.29 0.29 0.30 0.30 0.30 0.31 0.31 0.31 0.31 0.32 0.32 0.35 0.35 0.35 0.35 0.35 0.35 0.35 0.35	58.47 58.46 58.47 58.46 58.47 58.46 58.47 58.46 58.47 58.47 58.47 58.57 58.57 58.57 58.57 58.57 58.57 58.57 58.57 58.57 58.57 58.57 58.57 58.77	3.65-07 3.65-07 3.55-07 3.55-07 3.55-07 3.55-07 3.45-07 3.45-07 3.45-07 3.45-07 3.15-07 3.25-07	8.53E-00 1.02E-07 1.19E-07 1.37E-07 1.37E-07 1.38E-07 1.38E-07 1.38E-07 1.38E-07 1.38E-07 2.05E-07 2.05E-07 2.05E-07 2.05E-07 2.05E-07 3.07E-07 3.0	44.17 0.64-6.17 0.65-6.17	55. 19 56.06 67.99 77.99 77.99 75. 10 77.59 18.33 18.276 18.33 18.276 18.33 18.276 18.33 18.33 18.276 18.33 18.376 18.33 18.376	6.25-06 7.05-06 7.05-06 7.05-06 7.05-06 8.75-06 9.55-06 9.55-06 9.55-06 9.55-06 9.55-06 9.55-06 9.55-06 9.55-06 9.55-07 1.55-0	1.47E-06 1.47E-06	4.41E.07 3 4.46E.07 3 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5 5

PAREQUEST (DUE) continued

	A	В	C	_ D	E	F		н	1		K	i	М	N D	Р	9	8	8
143				ļ			original moles of CG2 produced			11 4 4 4 3	Mitraio & Sulfate	original moles of CO2 produced			Nitrate &		·····	
44		f	<u> </u>	f	†		before Nitrate				affect on	belore Nitrale		1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1. 1	affect on	Currently	Total	
45	Waste without INEEL	Scaled %	INÉÉL IMS	Scaled %	Waste William INCEL	INEEL	Sustate, and	Fraction %	Fraction %	Praction %	MANUS AND COLUMN NEED.	Sulfinte, and	Fraction %	Fraction % Fragtion %	INESL.	emplaced	MgO	
46 92	0.55	3.48	0.46	0.63	2.25E+07	moles 3.94E+07	methanogeniani 4.12E+07	denitriBoation 2.14	guillate reduction	methanogeneek 97.39	2.1E+07	methaeogenisse::	denilrification 4,91	outsie reductioneitherogene:	mol 4.0E+07	1,47E+08	moles 6.28E+07	2.34E+00
93	0.64	3.42	0.46	0.56	2.21E+07	4.03E+07	4.06E+07	2 16	0.4B	97.34	2.16+07	7 85E+07	4.80	0.07 95.02 0.07 95.13	4.1E+07			2.34E+00
94	0.63	3.35	0.47	0.56	2.17E+07	4.12E+07	3.97E+07	2.22	0.49	97.29	2.0E+07	8 02E+07	4.70	0.07 96.29	4.2E+07	1.47E+08		2.31E+00
95	0.62 0.61	3.29 3.23	0.48	0.57 0.58	2.12E+07 2.08E+07	4.21E+07 4.29E+07	3.90E+07 3.82E+07	2.26 2.31	0.50	97.24 97.16	2.0E+07 2.0E+07	8 19E+07 8 36E+07	4.60 4.51	0.07 95.39 0.07 95.49	4.8E+07 4.4E+07	1.47E+08 1.47E+08		2.29E+00 2.27E+00
137	0.5	3.16	D.5	0.59	2.04E+07	4.38E+D7	3.75E+07	2.35	0.52	97.13	1.95+07	8.63E+07	4.42	D.05 95.52	4.5E+07	1.47E+08		2.25E+00
98	0.49	3.10	0.51	0.61	2.00E+07	4.47E+07	3.67E+07	2.40	0.63	97.07	1.9E+07	8.70E+07	4.33	D.06 95.61	4.5E+07	1.47E+Q8	6.66E+07	2.24E+00
100	0.48 0.47	3.04 2.97	0.52 0.53	0.62	1.96E+07 1.92E+07	4.56E+07 4.64E+07	3.60E+07 3.52E+07	2.45	0.54 0.55	97.01 96.94	1.9E+07 1.8E+07	8.86E+07 9.06E+07	4.25 4.17	D.Q5 95.69 D.Q6 95.77	4.6E+07 4.7E+07			
101	0.45	2.91	0.54	0.64	1.88E+07	4.73E+07	3.45E+07	2.56	0.57	96.66	1.8E+07	9.22E+07	4,08	0.06 25.65	4.6E+07	1.47E+08	6.71E+07	
102		2.85	0.56	0.85	1.84E+07	4.82E+07	3.37E+07	2.61	0.58	96.61	1.7É+07	9.39E+07	4.02	0.06 26.93	4.9E+07		6.75E+07	2.18E+00
103	0.44	2.78 2.72	0.56 0.57	0.57 0.68	1.80E+07	4.91E+07 4.99E+07	3.80E+07 3.22E+07	2.67 2.73	0.69	96.73 96.66	1.7E+07 1.7E+07	9.56E+07	3.94	0.06 96.00 0.06 96.07	5.0E+07			2.16E+00
105	0.42	2.66	0.60	0.69	1.76E+07 1.72E+07	6.08E+07	3.15E+07	2.80	G.61 G.62	96.68	1.6E+07	9.73E+07 9.90E+07	3.67 3.81	0.08 96.07 0.06 96.14	5.1E+07 5.1E+07			2.15E+00 2.13E+00
106	D.41	2.59	0.59	0.70	1.68E+07	5.17E+07	3.07E+07	2.87	Q.B4	96.60	1.6E+07	1.DIE+D8	3.74	0.05 96.20	5.2E+07	1.47E+0B	6.95E+07	2.12E+00
107	0.4	2.53	0.6	0.71	1.63E+07	5.26E+07	3.00E+07	2.94	0.65	96.41	1.6E+07	1.02E+08	3.68	0.05 96.27	5.3E+07			2.10E+00
108	0.39	2.47	0.61	0.72	1.59E+07 1.55E+07	5.34E+07 5.43E+07	2.92E+07 2.85E+07	3.02	0.67	96.82 96.22	1.6E+07 1.6E+07	1.04E+08 1.06E+08	3.62	0.05 96.39 0.05 96.39	5.4E+07 5.5E+07			2.09E+00 2.08E+00
110	0.37	2.34	0.63	0.75	1.51E+07	5.52E+07	2.77E+07	3.18	0.70	96.12	1.4E+07	1.08E+08	3.51	0.05 96.44	5.6E+07			2.06E+00
111	0.96	2.28	0.64	0.76	1.47E+07	5.61E+07	2.70E+07	3.27	0.72	96.01	1.4E+07	1.09E+08	3.45	0.05 96.50	5.7E+07			2.05E+00
112	0.35	2.22	0.66	0 77 0 76	1.43E+07 1.39E+07	5.69E+07 5.78E+07	2.62E+07 2.66E+07	3,36 3,46	0.74	95.90 95.77	1.4E+07 1.3E+07	1.11E+08 1.13E+08	3.40 3.35	0.05 96.66 0.05 96.61	5.7E+07 5.8E+07	1.47E+08		2.03E+00 2.02E+00
114	0.33	2.09	0.67	0.80	1.35E+07	5.87E+07	2,47E+07	3,56	0.79	95.65	1.3E+07	1.14E+08	3.30	0.05 96.66	5.9E+07	1.47E+08		2.01E+00
116	0.32	2.03	0.68	081	1.31E+07	5.98E+07	2.40E+07	3,67	0.61	95.51	1.3E+07	1.16E+08	3.25	0.05 96.71	6 0E+07	1.47E+08		1.99E+00
116	0.31	1.96 1.90	0.69 0.7	0.62	1.27E+07 1.23E+07	6.04E+07 6.13E+07	2.92E+07 2.26E+07	3.79	0.84 0.87	95.87 95.21	1.2E+07 1.2E+07	1.18E+08 1.19E+08	3.20 3.16	0.05 96.76 0.05 96.80	6 1E+07 6.2E+07	1.47E+08		1.98E+00
118	0.29	1.84	0.71	0.84	1.18E+07	6.22E+07	2.17E+07	4.05	0.90	95.05	1.1E+07	1.21E+08	3.11	0.05 96.84	6.3E+07	1.47E+0B	7.52E+07	1.95E+00
118	0.28	1.77	0.72	0.66	1.14E+07	6.31E+07	2.10E+07	4.20	0.93	94.87	1.1E+07	1.23E+08	3.07	0.04 96.89	6 3E+07		7.57E+07	1.94E+00
120	0.27 0.26	1.71 1.65	0.73 0.74	0.67	1.10E+07 1.06E+07	6.40E+07 6.48E+07	2.02E+07 1.96E+07	4.36 4.52	0.97 1.00	94.68 94.47	1.1E+07 1.0E+07	1.25E+08 1.26E+08	3.03 2.98	0.04 96.93 0.04 96.97	6.4E+07 6.5E+07			1.93E+00 1.92E+00
122	0.25	1.58	0.75	0.89	1.02E+07	6.67E+07	1.87E+07	4.70	1.04	94.25	9.9E+06	1.28E+08	2.94	0.04 97.01	6.6E+07			1.92E+00
123	0.24	1.52	0.76	0.90	9.81E+08	6.66E+07	1.80E+07	4.90	1.09	94.01	9.5E+08	1.3GE+08	2.91	0.04 97.06	6.7E+07		7.76E+07	1.90E+00
븲	0.23 0.22	1.46	0.77 0.78	0.91	9.40E+08 8.99E+08	6.75E+07 6.83E+07	1.72E+07 1.65E+07	5.11	1.13	93.76	9.2E+06 9.8E+06	1.31E+08 1.33E+08	2.87	0.04 97.09 0.04 97.13	6.BE+07			1.B8E+00
123	0.21	1.33	0.79	0.94	B.58E+06	8.92E+07	1.67E+07	6.60	1.19	93.47 93.16	8.4E+06	1,35E+08	2.83 2.80	0.04 97.13 0.04 97.16	6.6E+07 6.9E+07	1.47E+08	7.86E+07	1.87E+00
127	0.2	1.27	0.8	0.95	B.17E+06	7.01E+07	1.50E+07	6.88	1.30	92.82	8.0E+06	1.37E+08	2.76	0.D4 97.20	7.0E+07	1.47E+08	7.95E+07	1.85E+00
128	0.19 0.18	1.20 1.14	0.81	0.96	7.76E+06	7.10E+07	1.42E+07	6.19	1,97	92.44	7.7E+06	1.38E+08	2.73	0.04 97.23	7.1E+07			1.B4E+00
133	0.18	1.14	D.82 D.83	0.97 0.99	7.36E+06 6.96E+06	7.18E+07 7.27E+07	1.35E+07 1.27E+07	6.53 6.92	1.45 1.63	92.02 91.55	7.3E+06 6.9E+06	1.40E+08 1.42E+08	2.69 2.66	0.04 97.27 0.04 97.30	7.2E+07 7.3E+07			1.63E+00 1.82E+00
131	0.158	1	G 842	1	8.48E+08	7.38E+07	1.18E+07	7.44	1.66	90.91	6.5E+05	1.44E+08	2.62	0,04 97.34	7.4E+07	1.47E+08	8.15E+07	1.80E+00
132	0.16	0.95	D.85	1.01	6.13E+06	7.45E+07	1.12E+07	7.84	1.74	90.42	6.2E+08	1.46E+08	2.60	0.04 97.36	7.4E+07			1.80E+00
134	0.14 0.13	0.89 0.82	D.87	1.02	6.72E+06 6.31E+08	7.53E+07 7.62E+07	1.05E+07 9.74E+06	8.40 9.05	1.96 2.01	89.74 88.95	5.8E+05 5.4E+06	1.47E+08 1.48E+08	2.67 2.64	0.04 97.39 0.04 97.42	7.5E+07 7.6E+07			1.79E+00 1.78E+00
136	0.12	0.76	0.86	1.05	4.90E+06	7.71E+07	6.99E+06	9.50	2.17	66.03	5.0E+06	1.50E+08	2.61	0.04 97.45	7.7E+07			1.77E+00
136	0.11	0.70	0.89	1.05	4.49E+06	7.80E+07	6.24E+06	16.69	2.37	86.94	4.7E+06	1.52E+08	2.48	0.04 97.48	7.8E+07			1.76E+00
137	D.1 0.09	0.63 0.57	0.9 0.91	1.07	4.09E+06 3.68E+06	7.88E+07 7.97E+07	7.49E+06 6.74E+06	11.76 13.07	2.61 2.90	85.53 64.04	4.9E+06 3.9E+06	1.54E+08 1.55E+08	2,46 2,43	0.04 97.51 0.04 97.54	7.9E+07 8.0E+07			1.75E+00
132	0.08	0.51	0.92	1.09	3.27E+06	8.08E+07	5 99E+06	14.70	3.26	82.04	3.5E+06	1.57E+0B	2.40	0.03 97.56	B.0E+07			1.73E+00
140	0.07	0.44	0.99	1.10	2.86E+06	8.16E+07	5.24E+06	16.60	3.72	79.48	3.2E+06	1.59E+08	2.37	0.03 97.59	8.1E+07			1.72E+00
141	0.06 0.05	0.36 0.32	0.94 0.95	1.12	2.45E+06 2.04E+06	8.24E+07 8.32E+07	4.49E+06 3.75E+06	19.60 23.52	4.35 5,21	76.06 71.27	2.8E+06 2.4E+06	1.50E+08 1.52E+08	2.35 2.32	0.03 97.62 0.03 97.64	8.2E+07 8.3E+07			1.71E+00
143	0.04	0.25	0.96	114	1.63E+06	8.41E+07	3.00E+06	29.40	6.52	64.08	2.0E+06	1.64E+08	2.30	0.03 97.67	8.4E+07			1.70E+00 1.69E+00
144	0.03	Q.19	0.97	1.15	1.23E+06	8.60E+07	2.25E+06	39.20	9,69	52.11	1.7E+06	1.66E+08	2.28	0.03 97.69	8.5E+07	1.47E+08	8.77E+07	1.68E+00
145	D.02 D.01	0.13 0.06	0.98	1.16	B.17E+05	8.69E+07 8.67E+07	1.50E+06 7.49E+05	58.80 117.59	13.04	28.17 -43.66	1,3E+06 9,1E+06	1.67E+08	2.25	0.03 97.71 0.03 97.74	8.6E+07			1.67E+00
147	0	0	1 0.88	1.19	4.09E+05 0.00E+00	8.67E+07	0.00E+00	0.00	26.07 0.00	0.00	0.05+00	1.69E+08 1.71E+08	2.23	0.03 97.74 0.03 97.76	8.6E+07 8.7E+07		B.86E+07	1.66E+00
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