BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	AS 07 - 06
PETITION OF CABOT CORPORATION	)	(Adjusted Standard)
FOR AN ADJUSTED STANDARD FROM	)	
35 Ill. Adm. Code Part 738, Subpart B	)	

NOTICE OF FILING

TO: SEE ATTACHED SERVICE LIST

PLEASE TAKE NOTICE that I have today filed with the Office of the Clerk of the Pollution Control Board Cabot Corporation's **Motion to Lift the Stay of Proceedings and to Amend the Petition for Reissuance of Adjusted Standard.**

DATED: June 14, 2010

CABOT CORPORATION

By/s/Eric E. Boyd
One of Its Attorneys

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SEYFARTH SHAW LLP
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SERVICE LIST

Illinois Pollution Control Board
Attention: Clerk
100 W. Randolph Street
James R. Thompson Center, Suite 11-500
Chicago, Illinois 60601-3218

Illinois Environmental Protection Agency
Division of Legal Counsel
Attention: Kyle Nash Davis, Esq.
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

Carol Webb
Hearing Officer
Illinois Pollution Control Board
1021 North Grand Avenue East
P.O. Box 19274
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BEFORE THE ILLINOIS POLLUTION CONTROL BOARD

IN THE MATTER OF:	)	
	)	AS 07-06
PETITION OF CABOT CORPORATION	)	(Adjusted Standard)
FOR AN ADJUSTED STANDARD FROM	)	
35 Ill. Adm. Code Part 738, Subpart B	)	

MOTION TO LIFT THE STAY OF PROCEEDINGS AND TO AMEND THE PETITION FOR REISSUANCE OF ADJUSTED STANDARD

Cabot Corporation ("Cabot"), through its attorneys, Seyfarth Shaw LLP, and pursuant to 35 Ill. Admin. Code §§ 101.500, 100.514 and 104.418, asks the Board to lift the current stay of proceedings and to allow Cabot to amend the Petition for Reissuance of Adjusted Standard. In support of this motion, Cabot states as follows:

1. On May 29, 2007, Cabot filed a Petition with the Board seeking reissuance of its adjusted standard from the Illinois state underground injection control ("UIC") regulations for Wells Nos. 2 and 3 at its Tuscola, Illinois facility ("Facility").

2. At the same time, Cabot filed a Motion to Stay Proceedings. The Motion to Stay requested that the Board stay further action on the Petition until the U.S. EPA took final action on a similar petition under the federal program. The Motion to Stay explained that staying the proceeding until the U.S. EPA took action, "will assist the Board in making the appropriate determination and ensure that the Board does not apply more stringent law to Cabot than is warranted under the circumstances." May 29, 2007 Motion to Stay, at Par. 9.

3. On August 9, 2007, the Board entered the initial order staying this proceeding. The August 9, 2007 Order stated that the parties could request subsequent extensions of the initial stay through the Hearing Officer.

4. The Hearing Officer granted several subsequent motions to extend the stay. The most recent Hearing Officer Order, dated January 11, 2010, extended the stay to August 9, 2010, and the deadline for the IEPA's Recommendation to September 23, 2010.

5. The U.S. EPA has now approved Cabot's exemption request. On June 1, 2010, the U.S. EPA published its Notice of Final Decision on the Petition. 75 Fed. Reg. 30392 (June 1, 2010) (attached). The Notice indicated that although the U.S. EPA had previously issued a fact sheet and public notice describing the reasons for granting the exemption in detail, no comments on the proposed exemption had been received.

6. Now that the EPA has approved Cabot's petition, Cabot requests that the Board lift the Stay and proceed to a decision in this matter. Cabot asks that the Board's Order lifting the Stay provide the IEPA forty-five (45) days to file its Recommendation and Cabot fourteen (14) days thereafter to file its Response (if necessary).

7. Cabot also requests leave to amend the record in this matter. The record should be supplemented with the attached copy of the U.S. EPA's Notice. In addition, Cabot requests that the Board allow Cabot to amend the Petition with additional documents that have been previously submitted to the U.S. EPA. The supplemental documents (which are also attached) were submitted to the U.S. EPA on December 2, 2008 in response to a conference call between Cabot and the U.S. EPA representatives that took place on November 10, 2008.

8. If the Board grants Cabot's request to amend the Petition, then the Board will have all of the information that the U.S. EPA had before it when it granted Cabot's petition. The Board granted an earlier motion to Amend the Petition on November 5, 2008.

9. No substantive change in the relief requested by the May 29, 2007 petition is sought. Re-noticing the amended petition pursuant to 35 Ill. Admin. Code §104.408, therefore, is not necessary.

10. Cabot has not requested a hearing in this matter.

WHEREFORE, Cabot Corporation requests that the Board lift the stay and allow Cabot to amend the Petition to include the additional documents described herein.

DATED: June 14, 2010

Respectfully submitted,

CABOT CORPORATION

By /s/ Eric E. Boyd
One of Its Attorneys

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CERTIFICATE OF SERVICE

I, Eric E. Boyd, hereby certify that on June 14, 2010, I caused a copy of Cabot Corporation's **Motion to Lift the Stay of Proceedings to Amend the Petition for Reissuance of Adjusted Standard** to be served upon the parties listed below via First Class U.S. Mail:

Illinois Environmental Protection Agency
Division of Legal Counsel
Attention: Kyle Nash Davis, Esq.
1021 North Grand Avenue East
P.O. Box 19276
Springfield, Illinois 62794-9276

Carol Webb
Hearing Officer
Illinois Pollution Control Board
1021 North Grand Avenue East
P.O. Box 19274
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By:/s/Eric E. Boyd
One of Its Attorneys

Printed on Recycled Paper

CABOT TUSCOLA, IL
Response to
EPA PETITION COMMENTS AND DEFICIENCIES May 22, 2008
Revisions from November 10, 2008 EPA Conference Call

Index of Revisions

Final Cabot NOD Responses 11-24-08 (updated comments and answers)

Section 2.0 Geology

Replacement Pages 2-25; 2-29

Figure 2-1a Illinois Geologic Column

Appendix 2-1 Cover Page; Illinois Earthquakes thru 2008; Updated Earthquake Search

Section 3.0 Modeling

Replacement Pages 3-14; 3-17; 3-18; 3-34; 3-35; 3-37; 3-38; 3-47; 3-48

Figure 3-16 Conservative Operational Plume Boundary at Year-End 2006

CABOT TUSCOLA, IL
Response to
EPA PETITION COMMENTS AND DEFICIENCIES May 22, 2008
Revisions from November 10, 2008 EPA Conference Call

INDEX OF REPLACEMENT AND NEW PAGES

Replacement Pages

Attachments

Replacement Tables

Replacement Figures

Replacement Appendices

CITED REFERENCE APPENDIX – COPIES OF PERTINANT PAGES

Appendix 3-12 Revised Model Runs in Response to EPA 5-22-08 NOD Comments (see CD-ROM of model run files)

CABOT TUSCOLA, IL
EPA PETITION COMMENTS AND DEFICIENCIES

I. Site Information

Figures 1.5, 1.6, 1.7, Well Completion Schematic

- Provide explanations for all acronyms used.

Response: Cabot has created an acronym list that includes explanations for all acronyms used on Figures 1.5, 1.6, and 1.7.

GLOSSARY AND DEFINITION OF ACRONYMS
For Figures 1-5, 1-6, 1-7

RKB	-	rotary kelly bushing
ppf	-	pounds per foot
DV tool	-	cementing stage tool
EUE	-	external upset ends – forging in ends on API pipe to provide additional thickness for strengthening connections
TAM	-	TAM International (oilfield services company)
RTS	-	radioactive tracer survey
H-40	-	API pipe grade
J-55	-	API pipe grade
K-55	-	API pipe grade
ST&C	-	short thread & coupled
LT&C	-	Long thread & coupled
sx	-	sacks
ID	-	inside diameter
PBR	-	polished bore receptacle
EPSEAL	-	epoxy resin cement

See new page 1-38a

II. Geology

As this is a renewal petition, U.S. EPA is concerned with whether the understanding of the geology of the injection and confining zones has improved since the last petition. Section 2 would therefore be strengthened by incorporation of more recent references, two of which follow. Submit an update to Section 2, incorporating these references. A third useful reference, although not recent, is included.

- Kolata, D.R., 2005, Bedrock Geology of Illinois, Illinois State Geological Survey Illinois Map 14: 1:500,000.
- Nelson, W.J., 1995, Structural features in Illinois, Illinois State Geological Survey Bulletin 100, 144 p.
- Piskin and Bergstrom, 1975, Glacial drift in Illinois: thickness and character, Illinois State Geological Survey Circular 490:35.

Response: These references have been included in the text

See Replacement page 2-13, 2-14, 2-27, 2-28, 2-37, 2-45, 2-46, 2-47, 2-59

<u>Section 2.1 Introduction</u>

- Page 2-2, Why was 45 miles chosen as the radius for the area of interest?

<u>Response:</u> The text has been revised to explain the area of interest. The area of interest was defined as 45 miles in the original 1990 *Final Report on Supplemental Characterization for Cabot Tuscola WDW-1 & 2 No Migration Petition Demonstration* as prepared by Albert S. Nieto, Consultant. This current Cabot Petition Renewal for exemption from the Land Ban Restrictions maintained this 45 mile radius to be consistent with previous documents.

<u>See Replacement page 2-2</u>

<u>Section 2.2 Regional Geology</u>

- Page 2-5, The Stratigraphic Column (Fig 2-1) should include the deeper formations discussed at the top of this page.

<u>Response:</u> The Stratigraphic Column (Figure 2-1) was revised to include the older (deeper) formations discussed.

<u>See Replacement Figure 2-1; New Figure 2-1a Stratigraphic Column</u>

- Page 2-10, What hydraulic conductivity or other data are available to support the contention that the interbedded sandstones will dissipate pressure?

<u>Response:</u> The text has been revised to support the contention that the interbedded sandstones will dissipate pressure. Specific hydraulic conductivity data to support the assertion that the sands behave as pressure relief dissipaters does not

exist. General accepted empirical data is that sands have higher permeability than shales or limestone which would provide pressure relief.

See Replacement page 2-10

- Page 2-13, Please revise "Pennsylvanian rocks form the bedrock surface in Illinois" to "Pennsylvanian rocks form the bedrock surface *for most of* Illinois". Also, please provide a reference for drift thickness discussed on this page.

Response: **The text has been revised as suggested regarding the bedrock surface. The drift thickness reference has been added to the text (Piskin, 1975).**

See Replacement page 2-13

Section 2.3 Local Geology

- Page 2-28, Please clarify the "Cabot formations" discussed in the second paragraph.

Response: **Cabot has revised the text to describe and clarify the "Cabot formations". These formations are the Franconia, Potosi, Eminence, and Oneota Formations of the Injection Zone, and the Shakopee Formation of the Confining Zone.**

See Replacement page 2-28

- Page 2-29, The authors claim that "the waste injectate from the site will migrate to the northwest". This claim seems plausible but why wouldn't the waste also migrate to the ENE up the anticline (see Figure 2-14, 2-15 & 2-27)? It seems that numerical modeling is needed to evaluate waste migration possibilities. Does the USI injection well affect flow from the Cabot wells?

Response: **Based on the limited structural data and mapping in the area, on the Potosi-Eminence formation, there exists potential for the waste to migrate to the northwest, but as the plume gets larger and spreads laterally, the structural high to the east-northeast may become prominent in trapping the waste fluid over 10,000-years. In either eventuality, Cabot has provided various models of the long-term waste drift plume cases in Section 3.0 Modeling. The long-term plume from Equistar tends to influence the Cabot waste plumes to orient more southeasterly due to the injected volume derived from Equistar displacing Cabot waste (see Figures 3-16 and 3-18).**

See Replacement page 2-29, 29a (response included in text)

- Page 2-29, In Section 2.3.2, oil and gas operations were described. Are they expected to affect lateral plume movement from the injection wells?

<u>Response:</u> Cabot has revised the text regarding the effects of oil and gas operations. The oil and gas operations within the local area (5 mile radius) will have no effect on the lateral plume movement from the injection wells since they are shallower than the injection interval. The oil and gas operations to the northwest and southwest of the Cabot site are separated by a vertical thickness of greater than 2,000 feet of permeable and multiple impermeable sediments. There is no hydraulic communication between these producing intervals and the Cabot injection interval.

- Page 2-37, In the last paragraph, the authors refer to "Pennsylvanian bedrock valleys". The bedrock valleys have eroded the Pennsylvanian and older bedrock materials. Please revise.

<u>Response:</u> Cabot has revised the text as suggested.

<u>See Replacement page 2-37</u>

<u>Section 2.4 Hydrogeology</u>

- Page 2-45, Please expand on the shallow monitoring well program that was used to determine the direction of shallow groundwater flow. Please discuss the number of wells, well depth, dates, etc.

<u>Response:</u> Cabot has included additional text describing the shallow monitoring program at the site. A copy of the shallow monitoring well program is included as Appendix 2-8, however this represents the historical monitoring program, which has evolved with some of the original monitor wells plugged. Presently the current program uses a limited number (6 site monitor wells) to monitor a horizon at 60-foot. The following text has been inserted and incorporated as part of the document.

The shallow monitoring well program data is taken from: *Assessment of Fourth Quarterly (Annual 1991) Collected Groundwater Samples, Closed RCRA Impoundment, Cabot Corporation Plant, Tuscola, IL,* prepared by Hydropoll, Inc. in December 1991. A total of 25 wells are present on the plant grounds. Of this total, 19 are included in the monitoring system for the closed impoundment as approved by the Illinois Environmental Protection Agency. Nine wells are completed in the weathered till at depths of 20 to 30 feet, five wells are completed in a deeper sand unit in the till at approximately 100 feet, four wells are completed in the till at depths of 50 to 75 feet, and one deeper well drilled to a depth of 212 feet and screened in a silt from 199 to 203 feet. Four wells of the 19 total are located singly and 15 are located in multiple well clusters. One of the clusters is located upgradient and the remaining five clusters is located down gradient of the closed impoundment

Potentiometric maps were constructed from the water level data in the weathered till and in the deeper sand unit. The potentiometric surface map of the shallow groundwater showed the direction of the regional groundwater flow. The regional flow is to the southeast. A groundwater divide, across which no flow occurs, is

located just north of the closed impoundment. The divide prevents flow of groundwater from the closed impoundment. The calculated field hydraulic conductivity in the shallow weathered till was 62.1 ft/year. Effective porosity of the weathered till is estimated to be 0.10. A groundwater velocity of 4.0 ft/yr was calculated using these values.

Water levels in the deep sand did not vary significantly between the wells. A water level difference of only 0.57 feet was measured between the wells. The water flow direction within the deeper sand was tentatively determined to be to the west. Field hydraulic conductivity was determined as 3400 ft/yr. Effective porosity of the deep sand is estimated as 0.20. A groundwater velocity of 42.5 ft/yr was calculated using these values.

Water level differences in the well clusters indicated that the groundwater moves downward between the shallow till wells and the deep sand wells in the same cluster.

See Replacement Pages 2-vi, 2-45, 2-45a; new Appendix 2-8

- Page 2-46, The discussion of the Mahomet aquifer needs to be revised. My suggested rewrite for the first two sentences—

  The Banner Formation of east-central Illinois includes a thick, extensive sand member, the Mahomet Sand Member. This member is a valley train deposit which may be over 150 feet thick and is composed of clean sand, gravel, and minor amounts of silt and clay (Kempton et al., 1982).

Response: Cabot has revised the text as suggested.

See Replacement page 2-46

- Page 2-47, The authors should clearly discuss that Tuscola used bedrock wells for their water supply for over 50 years. These bedrock wells were completed in the Silurian dolomite. Details about Tuscola's water supply are available in Illinois State Water Survey Bulletin 40.

Response: Cabot has added text to this section which details the use of the bedrock wells for the city of Tuscola's water supply. The city of Tuscola utilized wells completed in the Silurian dolomite for public water supply for over 50 years. These wells were typically openhole completions in the Niagaran Formation at depths below 400 feet. The well yields from these wells were generally less than 200 gallons per minute with varying water level drawdowns of 40 to 100 feet in specific wells (ISGS, 1950).

See Replacement page 2-47

- Page 2-48, Please describe the technique used to estimate the hydraulic conductivity values discussed in the third paragraph.

Response: This text has an excerpt from the original 1990 Cabot Petition document. Specific documentation of the technique used to estimate the hydraulic conductivity values listed was not presented in the original document.

- Page 2-49, Please clarify in which formation/aquifer you are describing the direction of groundwater flow.

Response: The text has been revised to clarify the aquifers for which the direction of groundwater flow is described. The groundwater flow within the Mocassin Springs Formation (lowermost USDW) is believed to be to the southwest due to the strutural and hydrologic influence of the high-relief Tuscola Anticline located to the northeast of the Cabot location.

See new Attachments 1 and 2

- Page 2-51, In Sections 2.4.4 and 2.4.5, the authors use single data points to discuss the potentiometric surface. Please discuss the vertical and horizontal hydraulic gradients (assuming data are available to do so).

Response: Cabot contends that no specific data exists to calculate the vertical and horizontal hydraulic gradients because each of the pressure measurements was taken from a single point (depth) within the Well No. 3 wellbore.

Seismicity and Earthquake Update to November 2008

Cabot has searched the USGS and NEIC: Earthquake Database and compiled a table of search results performed for reported earthquakes within a 100 km and 175 km radius from the Tuscola site. No earthquakes other than the events previously identified in the January 3, 2007 data search were found. This database earthquake catalog listing is provided for inclusion into Appendix 2-1.

One significant event occurred on April 18, 2008 approximately 105 miles south-southeast of the Cabot facility. This 5.3 magnitude earthquake occurred within the Wabash Valley seismic zone, which is defined by a zone of earthquakes that are scattered across a large area of southeastern Illinois and southwestern Indiana. The depth of the epicenter was calculated to be 7.2 miles (~38,000 feet). Earthquakes of this size can cause slight damage within a few tens of miles of the epicenter. Due to the event's location, over 153 km from the Tuscola site, it had no impact on site operations or the injection wells.

III. Flow and Containment Modeling

Section 3.2 Model Description

- Page 3-9, bottom paragraph; The description of the ideal plume is a valid tool for getting to the ideal form of a plume, but, in fact, besides complete homogeneity, the viscosity of the injected fluid needs to be relatively high and there must be a strong surface tension between very immiscible fluids to get that ideal cylinder.

Response: **Per July 10, 2008 EPA meeting, no response required.**

- Page 3-14, second paragraph; The vertical permeation model must take diffusive movement into account as well as pressure drive effects.

Response: **The vertical permeation model does take both diffusive movement and pressure drive effects into account with the calculation performed in two parts. For the operational and future operational period, the DuPont Multi-Layer Vertical Permeation Model is used to determine the vertical movement due to pressure drive effects. The assumptions used in the model are described in detail in Appendix 3-4. The DuPont Molecular Diffusion Model is used separately to determine the vertical movement due to diffusion. The assumptions used are described in detail in Appendix 3-5. A sample calculation is also provided on page 3-27.**

Section 3.7.5.3, Vertical Extent at 2057, states the most conservative determination of the maximum vertical permeation due to pressure effects at the Cabot site is 1.224 feet. As described in Section 3.8.2 Long-Term Vertical Extent, the most conservative determination of the maximum vertical movement due to diffusion during the 10,000 year period is 55 feet. The vertical movement due to diffusion for each waste stream constituent is shown in Table 3-12. The total vertical permeation at the end of the 10,000 year period would be the sum of the movement due to pressure effects plus diffusion (1.224 feet + 55 feet = 56.224 feet).

See Replacement Pages 3-14, 3-14a ***(response included in text)***

- Page 3-17, second paragraph; How is the geometric correction factor designed to be pessimistic?

Response: **A detailed description of the geometric correction factor, G, is provided in Appendix 3-5 DuPont Molecular Diffusion Model, beginning on page 3-6. Tortuosity of the pore channels lengthens the total path over which molecules must travel. As a result, the diffusion coefficient of a solute species within a water saturated porous medium is always lower than in free water solution. In general it is found that the influence of the microgeometry can be characterized in terms of a "geometric correction factor" G. G is equal to the ratio of the effective diffusion coefficient in the matrix, D*, to the diffusion coefficient in the free solution D_0.**

The pessimistic, or conservative nature of G is determined by a number of margins of safety that are inherent in the molecular diffusion model and in the recommended procedure for determination of the key input parameter, the effective diffusion coefficient D*. This is summarized as follows:

- **Concentration at z=0 assumed equal to the waste concentration for all times.**
- **Chemical interactions with the aquitard are neglected, such as adsorption, ion exchange, molecular hindrance, and osmosic membrane effects.**
- **Horizontal movement of waste is neglected.**
- **Waste assumed to be no more dense than formation brine.**
- **Effective diffusion coefficient is determined conservatively.**
- **Chemical destruction of contaminants is neglected.**

Additional detail is provide in Appendix 3-5, Section V. Margins of Safety (page 24).

<u>See Replacement pages 3-17, 3-17a (response included in text)</u>

- Page 3-18, third paragraph; Despite the fact that the distance of movement due to diffusion is relatively small, it should be included in calculations.

<u>Response:</u> Molecular diffusion is included in the vertical plume movement calculations, as described in Section 3, Flow and Containment Modeling of the 2007 Petition Renewal Document, and in the previous response.

The DuPont 10,000 Year Plume Model computer simulation software considers the effect of dispersion and density driven lateral plume movement. The effect of diffusion on lateral plume movement is considered in a separate calculation as described in Appendix 3-5 DuPont Molecular Diffusion Model. Table 3-12 shows the results of the calculation. Since lateral plume movement is through the injection interval which is predominantly dolomite, the values determined for a lithology of dolomite apply. Table 3-12 shows that the 10,000 year maximum lateral movement due to molecular diffusion is 15 feet for the waste constituent cyanide.

<u>See Replacement pages 3-18, 3-18a response (included in text)</u>

<u>Section 3.5 Characteristics of the Injection Reservoir</u>

- Page 3-26, top of third paragraph; When a feature is invoked, a reference which will allow the reviewer to confirm the claim should be listed.

<u>Response:</u> The first sentence of the third paragraph on Page 3-26 states that "Analysis of electric well logs from the injection wells, and distant offset penetration wells, allow the construction of subsurface geologic cross sections that indicate that the proposed injection and confining dolomite and shale layers are continuous and generally uniform in thickness". A sentence has been added to the page and states: "This is shown in the Geology Section, Figure 2-3."

<u>See Replacement page 3-26</u>

- Page 3-34 and Figures 3-13 thru 3-14; The figures indicate a very poor calibration. They do indicate that the model yields higher injection pressures than have been measured. Please revise.

Response: **The objective of the model calibration effort is to demonstrate that the model prediction is conservative, not to match the observed pressures exactly. A conservative model approach was employed to over-estimate pressures. Based on a permeability of 3.6 darcies, and an interval thickness of 280 feet, the model predicts a pressure increase of approximately 10-15 psi. The measured annual well recorded pressure data indicates that injection interval pressure has decreased by 10-15 psi. This is unlikely, and is probably due to the initial pressure measurement being too high due to the inaccuracies inherent in the measurement of static reservoir pressures. This variability in pressures can occur due to gauge measurement error, directly from variation in shut-in times, or changes in injection rates from survey to survey. In any event, it is impossible for the model to show a decrease in pressure with injection, since this violates the principles of Darcy's Law for fluid flow in porous media.**

Appendix 3-7 indicates that a calibration run sensitivity case (Run 2) was performed to predict the pressure increase using the 1990 Cabot Petition original model inputs of 446 feet thickness and 3.6 darcies permeability. This sensitivity case resulted in a predicted pressure buildup that was less than the base case, and is therefore considered less conservative and not appropriate.

See Replacement pages 3-34, 3-34a (response included in text)

- Page 3-34, top of last paragraph; Please illustrate how permeabilities are derived from log readings. Why were not the limestone porosities converted to dolomite porosities before whatever calculations were used were made?

Response: **Permeability is not directly measured from open hole logs. However, an estimation of permeability can be calculated from other log derived parameters such as porosity and residual water saturation, and this is commonly done in computer analyzed logs. These estimates are commonly thought of as an "order of magnitude" permeability estimate. A commonly used correlation by Dresser-Atlas and others is the Timur Equation (Reference: Timur, A. An Investigation of Permeability, Porosity and Residual Water Saturation Relationships for Sandstone Reservoirs (Paper J). Transactions, SPWLA, June, 1968). Another commonly used correlation by Dresser-Atlas Services and others is the Morris and Biggs Equation (Reference: Morris, R. L., and Biggs, W.P. Using Log-Derived Values of Water Saturation and Porosity (Paper X). Transactions, SPWLA, 1967).**

The Dresser-Atlas processed log assumed a limestone matrix density in the preparation of the log. It is common logging industry practice to use a limestone matrix as a default when computing porosity from density/neutron logs since lithology is often unknown. As mentioned in this paragraph, the assumption of a limestone matrix is conservative since this results in a lower calculated porosity than

that calculated directly using a dolomite matrix. Use of a lower value for porosity would result in a larger value for lateral waste movement. Therefore, this approach is conservative, since the calculated permeability is a direct function of porosity, the calculated permeability would also be lower, which would result in greater values of lateral pressurization.

See Replacement pages 3-34, 3-34a, 34-b (response included in text)

See Cited Reference Appendix, Timur, 8-1, 8-2, Morris and Biggs 8-2.

- Page 3-36, top of page; If the highest vertical permeability measured in the Potosi was 2.0 x 10^{-7} darcys, the permeability is very low without further reducing the permeability. Please provide a calculation to show the effect of reducing the permeability even further. Why not assume the vertical permeability to be zero?

Response: "The aquiclude (dolomite or shale) layer permeabilities used for the determination of lateral pressurization are 1.00 E-16 darcies (see Table 3-1) are very low compared to the core measured values and are essentially "zero" in the model. This input minimizes vertical flow, and maximizes horizontal flow, which remains conservative for the lateral injection interval pressurization predictions.

To be conservative for the determination of vertical permeation, Cabot used a value of 1.0E-7 darcies. This maximized the waste interval pressurization values, and movement in the vertical direction.

- Page 3-36, last paragraph in section 3.5.2.3; Please provide a citation for the literature referenced.

Response: This paragraph states: "The aquiclude (dolomite or shale) layer permeabilities (see Table 3-1) for the reservoir model were determined from the literature correlations." This sentence has been removed and replaced with the following statement:

"The aquiclude (dolomite or shale) layer permeabilities used for the reservoir model are 1.00E-16 darcies (see Table 3-1) which are very low, essentially zero, and are very conservative for the lateral pressurization predictions. With regard to the vertical permeation case, based on Injection Well No. 3, the highest value for the vertical brine core permeability is 7.07E-8 darcies. To be conservative for vertical permeation, Cabot used a value of 1.0E-7 darcies."

See Replacement page 3-36

- Page 3-37, top of the second paragraph; Please provide some support for the statement that results are not particularly sensitive to the values for dolomite layer porosities. Reading on, why is waste drift related to porosity? Drift is governed by the rates of regional flow and buoyant flow. How are these related to porosity (unless you begin with head difference and other basic reservoir properties instead of a previously calculated rate of regional flow)?

<u>Response:</u> The lateral pressurization model is more sensitive to permeability than porosity. This is described in detail in Appendix 3-2, which provides a detailed description of the DuPont Multi-Layer Pressure Model. Appendix 3-4 Page 4 states that: " Porosity enters into the model only through the contribution of fluid compressibility to the overall layer storativities. Storativity is a reservoir parameter which expresses the combined effects of layer porosity and compressibility. The model results are quite insensitive to the layer storativities, and therefore, also to the porosity values used. Typically, a 10 percent change in porosity will result in less than a 0.5 percent change in the predicted pressure buildup.

Appendix 3-6 (DuPont 10,000 Year Plume Model) Page 10 provides the analytical solution to the equations for flow for a circular waste plume with density effects. As can be seen by examining the equation, buoyant waste movement velocity is inversely proportional to porosity. Therefore, assuming that all other parameters in the equation remain unchanged, an increase in porosity will result in a decrease in buoyant waste movement velocity.

<u>See Replacement page 3-37; 3-37a (response included in text)</u>

- Page 3-38, first paragraph; ". . . since permeation is inversely proportional to the dolomite or shale porosity." Seems to conflict with the statement in the last sentence of the second paragraph which states, "Predictions of injection interval pressure build up and . . . lateral waste movement . . . are entirely independent of the values specified for shale layer porosities." Any material diverted from storage in the more porous dolomite layers will not contribute to pressure increase and lateral movement. Given the large surface areas involved and number of interbedded shale and dolomite layers, it would seem that the influence might be significant. Please provide an illustration using the base equations used by the DuPont models.

<u>Response:</u> The conflicting statement in the last sentence of the second paragraph is not correct and has been removed.

The equations used in the DuPont Multi-Layer Vertical Permeation Model are shown in Appendix 3-4, pages 15 through 23. This determines vertical waste movement due to pressure effects of the injected fluid. The determination of vertical movement due to diffusion is described in Appendix 3-5, DuPont Molecular Diffusion Model. A sample calculation is provided on pages 27-28 of the Appendix that illustrates the methodology used.

<u>See Replacement page 3-38; 3-38a (response included in text)</u>

- Page 3-39, first paragraph; Please provide the information cited. Unless in one of the background documents we have already assembled, the pages including the information cited must be provided as well as the proper citation.

Response: **The first paragraph of Page 3-39 states: "Sediment compressibility values for the various layers in the geological model were established on the basis of information presented in Freeze and Cherry (1979) and developed by Neuzil (1987). The compressibility of the dolomite layers was taken as 1.8 x 10^{-7} pounds per square inch (psi), while those for the shales were specified higher at 1.3 x 10^{-7} psi^{-1}. The dolomite compressibilities are consistent with values used in other published literature for Midcontinent formations".**

This section has been modified and replaced with the following:

"A review of published literature values of sedimentary formation compressibility (α) indicated a range of 10^{-6} to 10^{-11} in units of m^2/N or Pa^{-1} , equivalent to 10^{-4} to 10^{-9} psi^{-1} (Freeze and Cherry, 1979; Neuzil, 1987, see Cited Reference Appendix for a copy of the pertinent pages). Yale, et al., 1993, developed correlations to calculate formation compressibility based on rock type, depth, reservoir pressure, and overburden gradient (see Cited Reference Appendix for a copy of the pertinent pages in Yale's paper). For this demonstration, the technique developed by Yale, et al. was used to determine a unique value of compressibility for each layer in the DuPont model. The value for the injection interval dolomite was determined to be 1.8 x 10^{-7} psi^{-1}; the value for the overlying shale arresting layer was determined to be 1.3 x 10^{-7} psi^{-1}. These values are all well within the range of the published literature values mentioned previously."

See Replacement page 3-39

See Cited Reference Appendix, Freeze and Cherry p 55; Neuzil p 1176, Yale p 436, p 438.

- Page 3-42, equation; Please provide a tabulation of the measurements with information about their origin. Do they cover the entire injection interval? If the injection interval is randomly divided, do the measurements for each division yield the same multiplier?

Response: **This equation describes one method of calculating the multiplying factor, M as a function of porosity and permeability values from core data. Since site specific core data was not available for the Potosi-Eminence Dolomite injection interval, this technique was not used at Cabot to determine M. The second paragraph from the bottom of page 3-42 states the following: "Applying the above formula to the results of permeability and porosity measurements from Cabot Injection Well No. 3, a multiplying factor M of 2.54 was obtained for the injection dolomite interval." This paragraph is incorrect and was revised in response to this comment.**

The value of M = 2.54 was obtained using an alternative technique based on Gaussian dispersion predictions. The determination of M via this method is described in detail on pages 3-43 and 3-44.

See Replacement page 3-42

- Page 3-43, end of first paragraph; The dispersivity values used in many other demonstrations range up to 600 feet. Please provide a sensitivity analysis demonstrating what effect increasing longitudinal dispersivity will have on plume spreading.

Response: Section 3.5.6.2 was modified to provide additional justification for the dispersivities used for the Cabot site.

The value for dispersivity is site and lithology dependant and in general is a function of travel distance. Therefore, although a value of 600 feet may be appropriate for another site, but this value is not appropriate for the Cabot site. Site specific parameters that affect dispersivities are injected waste volume, injection interval thickness, porosity, background velocity, and buoyant movement which is a function of formation dip angle and density difference between injectate and formation fluid. The equations developed by Xu and Eckstein (1995) were used to calculate longitudinal dispersivity for the Cabot site. An upper-end value of 123 feet for longitudinal dispersivity was calculated for the 2027 year-end operational plume, and the value of 252 feet was calculated for the longitudinal dispersivity utilized in the 10,000 Year Waste Plume Model. Based on Walton (1985), a value of 25 feet was determined to be appropriate for transverse dispersivity input values for the DuPont 10,000 Year Waste Plume Model.

For the 10,000-year plume modeling, porosity, formation dip, and waste density changes and variations were run in Sensitivity Model Cases 1-4. Table 3-10 presents these model inputs while Table 3-11 presents results of this sensitivity modeling, and Figures 3-22 through 3-27 provide graphical plots of model results. Table 3-11 shows a summary of the 10,000-Year Plume Model Results, consisting of a base case and 4 sensitivity runs. The development of the sensitivity cases is described in detail in Section 3.8 Long-Term (10,000-Year) Waste Containment, addressing the possible geologic, and waste density cases suitable for modeling.

See Replacement pages 3-43, 3-44, 3-45, 3-45a

- Page 3-45, second to last paragraph; It would be more appropriate to obtain the average surface temperature from climatic information. The temperature log of Cabot Injection Well No. 3 which was shut in for months before injection began should also be more accurate than measurements made during drill stem tests. The temperature in the region should be between 50 and 5° F. Please confirm the average surface temperature.

Response: The DuPont Multi-layer Model consists of 26 layers representing a depth interval from 3371 feet to 5392 feet. The temperature profile used for this interval to determine fluid viscosity in the model is well established by original openhole logs and temperature logs in the area and is independent of the average surface temperature.

- Page 3-46 top of the page; What is the basis for the estimation of the base of USDWs? Please reference the section where it was discussed.

__Response:__ **The base of the lowermost USDW was conservatively determined at the Cabot site to be situated within the Moccasin Springs Formation at a depth of 2,700 feet. Original openhole logs and total dissolved solids (TDS) measurements were used to make this determination. The details regarding the basis for this determination are described in 2.0 Geology, Section 2.4.3 Determination of the Lowermost USDW.**

- Page 3-46, table; We learned from the second to last paragraph of the previous page that there were drill stem tests used to collect water samples during the drilling of Injection Well No. 1. Why are none listed?

__Response:__ **A review of Cabot files indicates that temperature and fluid samples were taken, but in Injection Well No. 1 but no fluid sample TDS measurements were made.**

- Page 3-47, third paragraph; How does this single pressure measurement yield a gradient of 0.435 psi/ft? Why is this measurement not included on Figure 3-12?

__Response:__ **Page 3-47 states that, "The first estimate of the original formation pressure for the injection dolomite was derived from an August 1, 1966, drill stem test measurement in Injection Well No. 1 (Cabot, 1966). The measured pressure was 1,915 pounds per square inch gauge (psig) at a depth of 4,580 feet BGL (temperature 109° F), which is a gradient of 0.435 psi/ft (see Figure 3-12). The pressure was corrected to the top of the injection interval (5,003 feet below ground level-BGL), using the above gradient."**

This initial wellbore fluid gradient of 0.435 psi/foot listed on Table 3-6 comes from the original 1990 Cabot Petition page 10-9. Since this is almost identical to a fresh water gradient (0.433 psi/ft) it is likely that fresh water was in the hole at the time the static gradient pressure survey was taken, although it cannot be confirmed from records. The table of recorded drill stem test measurements below, yields a gradient of 1915 psig/4580 feet BGL = 0.418 psi/ft, which is not considered accurate as compared to the annual static formation testing performed on the wells with better gauges.

Depth	Pressure psig	Gradient
0	0	
1500	585	0.3900
3000	1230	0.4100
3580	1484	0.4145
4080	1701	0.4169
4580	1915	0.4181
4861	2035	0.4186

__*See Replacement pages 3-47, 3-47a (response included in text)*__

• Page 3-47, last paragraph; Why isn't the pressure measurement described here included in Table 3-6? This paragraph speaks of one footage depth and two pressures and "this gradient . . ." How was a gradient calculated from this information? Please include all information necessary to reach the results.

Response: This paragraph states that "In Cabot Injection Well No. 2, an Otis bottomhole pressure gauge was lowered to 5,200 feet into the freshwater filled wellbore on January 12, 1976, and recorded a pressure of 2,189 psig with a maximum recorded temperature of 112° F. The pressure recorded at the Eminence formation gradient stop was 2,102 psig. This gradient of 0.435 psi/ft reflects the freshwater in the wellbore. A follow-up bottomhole pressure gauge was lowered into Well No. 2 to a depth of 5,000 feet and a pressure of 2,096 psi was recorded (see Table 3-6)."

This pressure measurement is recorded on Table 3-6. Table 3-6 lists the pressure as pounds per square inch absolute (psia) which includes atmospheric pressure. Pressure recorded as pounds per square inch gauge (psig) can be converted to psia by adding the atmospheric pressure, 14.7 psi. In Table 3-6 this pressure is recorded as 2117 psia (2102 psig + 14.7 psi = 2117 psia). The follow-up pressure gauge recorded 2096 psig, which is listed in Table 3-6 as 2111 psia (2096 psig + 14.7 psi = 2111 psia).

The wellbore fluid gradient of 0.435 psi/foot listed on Table 3-6 comes from the original 1990 petition page 10-9. Since this is almost identical to a fresh water gradient (0.433 psi/ft) it is likely that fresh water was in the hole at the time the static gradient pressure survey was done.

See Replacement pages 3-48, 3-48a (response included in text)

• Page 3-48, third paragraph, How is the gradient indicated by a pressure measurement of 2035 psi at 4861 feet 0.432 psi/ft? Here 5003 feet is said to be the mid point depth. On the previous page, it was the depth to the top of the injection interval. Please correct this.

Response: This paragraph states that "An initial bottom hole pressure of 2,035 psig was measured at a depth of 4,861 feet in 1966, during testing of Cabot Injection Well No. 1. This corresponds to an average pressure gradient from surface to 4,861 feet of 0.432 psi/foot. Subsequent testing and model calculations utilize a midpoint depth datum of 5,003 feet for the Potosi-Eminence Dolomite Injection Interval."

The gradient listed here is a pressure vs. depth gradient, not a fluid gradient, and was calculated as follows: 2035 psig / 4861 feet = 0.4186 psi/foot.

See Replacement page 3-48

• Page 3-49, first paragraph; This paragraph says that the pressure gradient indicated by a pressure measurement of 2035 psi at a depth of 4861 feet is 0.4181 psi/ft. That is mathematically correct, and this tells us that the reservoir pressure won't support a column of fresh water to the surface. Other than that, the value has little application. Was this pressure measured or is it an estimate?

<u>Response:</u> This paragraph states that "Figure 3-12 is a graph of compiled well and formation pressures measured from historical pressure tests and also includes a graph of these pressure gradients plotted versus depth. It can be seen that slightly different slopes are apparent within the scatter trend of the distributed data. The data corresponds with the overlying formation units and the Potosi-Eminence Dolomite Injection Interval. From these relationships, a detailed evaluation of the data indicates that the estimated original formation pressure (pre-injection) of the Potosi-Eminence Injection Dolomite Interval used in the model should be approximately 2,035 psi at a depth of 4,861 feet BGL, which is equal to a gradient of 0.4181 psi/ft. This formation pressure is supported by the data and derived from the calibration of the pressure model with the recent pressure measurements in Injection Well Nos. 2 and 3. This represents a conservative and reasonable value based on site-specific Cabot Plant data which has been plotted (Figures 3-13 through 3-15) and evaluated for its integrity."

This is a sub-hydrostatic gradient typical of older mid continent formations. It is based on site-specific historical formation pressure measurements vs. depth using a DST measurement and confirmed by pressure model results.

<u>Section 3.6 Model Calibration</u>

- Page 3-54, bottom paragraph; The pressure records indicate that there is direct pressure communication between the wells. However, the pressure changes measured in one well are not equal to the pressure changes measured in the other well. Therefore, the wells are not in direct hydraulic communication. That is, there is intact formation separating the caverns at the bottoms of the two wells.

<u>Response:</u> This paragraph states that "In 2006, an interference test was performed with Injection Well No. 3 and recorded a pressure increase of 0.65 psi at Injection Well No. 3 with a final pressure of 2,104.77 pounds per square inch absolute (psia) (datum of 5,005 feet). Within Injection Well No. 2, the final recorded pressure was 2,104.13 psia, representing a gain of only 0.09 psi over the recorded static pressure. This proves the wells and intervals are in direct communication."

<u>Response:</u> The wells are in direct hydraulic communication, since the pressure pulse caused by injection into Well No. 3 was observed in Well No. 2. If the wells were not in hydraulic communication, injection into Well No. 3 would cause zero pressure response in Well No. 2. The presence of more accurate and higher resolution gauges in later testing years have proven direct communication with a low response but direct effect of interference.

- Page 3-55, second paragraph; The injection of 250 gallons per minute (gpm) at the Equistar well seems to have an inordinate effect at the Cabot site. The pressure mound at Equistar is about equivalent to the pressure mound at the Cabot site where 400 gpm are injected. The 2006 interference test resulted in a pressure increase at the inactive well of just 0.09 psi at the inactive well. The injection rate is not provided, but it seems obvious that the injection activity at Equistar is going to have very little effect at the Cabot site. The statement that permeability has to be increased to result in a greater over prediction of pressure may be true if the desire is to increase the effect of injection at the Equistar site. However, it would seem that the reverse is true if the effect of injection at the Cabot site is to be maximized. Please clarify.

<u>Response:</u> Cabot re-ran the model (revising the model volume inputs for Equistar) and provided the results with replacements of Pages, Tables, Figures, and Appendix (CD-ROM). (see later NOD response beginning with Section 3.7 Model Predictions....Figure 3-16)

The injection interval is modeled as a system, which incorporates injection at both the Cabot and Equistar sites, Ignoring injection at Equistar would reduce modeled pressure and would not be representative of the injection horizons, making the model output less conservative. Figure 3-19 is a pressure isopleth contour map that shows the model predicted pressure increase due to injection at year end 2027. The 400 gpm into the Cabot site is split between Well Nos. 2 and Well No. 3 with injection at 200 gpm per well. Injection into the Equistar well at 250 gpm is represented by the AP#3 location. The areal extent of the pressure mound at the Equistar well is less than at the Cabot site, which is reasonable since the total injection rate is less. The splitting of the Cabot total injection rate of 400 gpm into 2 wells results in a per well rate of 200 gpm, which is less than the modeled Equistar rate of 250 gpm down one well. The result of this scenario is to reduce the pressure peak at the Cabot location, since pressure increase at each well location is a direct function of the individual well injection rate. The model predicts that the pressure increase at Well No. 2 is 18.9 psi, at Well No. 3 is 18.8 psi, and at the Equistar well the pressure increase is 19.1 psi. The higher pressure increase at the Equistar well is reasonable, since the injection rate here is 250 gpm as compared to the 200 gpm per well rate for the Cabot injection wells.

Since the actual measured pressure increase due to injection during the 2006 interference test was only 0.65 psi at the injector, this implies that the permeability value of 3.6 darcies used for the injection interval is low, and therefore very conservative, since a pressure increase of around 18-19 psi was predicted.

The statement that permeability has to be increased to result in a greater over prediction of pressure is not correct; this has been changed to say that permeability has to be <u>lowered</u> to result in a greater overprediction of pressure.

<u>See Replacement page 3-55</u>

- Page 3-56, second paragraph; The figures showing the relationship of predicted to measured pressures show that the model grossly over predicts pressure increases resulting from injection. The model can only be considered calibrated if the aim was to grossly over predict pressure increases. Sensitivity testing should be used to determine what the effects of this relatively great over prediction are.

Response: The objective of the model calibration effort is to demonstrate that the model prediction is conservative, i.e. not to match the observed pressures. Based on a permeability of 3.6 darcies, and a thickness of 280 feet, the model predicts a pressure increase of approximately 10-15 psi. The measured pressure data indicates that injection interval pressure has decreased by 10-15 psi. This is unlikely, and is probably due to the initial pressure measurement being too high due to the inaccuracies inherent in the measurement of static reservoir pressure. This can occur due to gauge measurement error, variation in shut in times, or changes in injection rates from survey to survey. It is impossible for the model to show a decrease in pressure with injection, since this violates the principles in Darcy's Law for fluid flow in porous media.

All of the subsequent pressures fall below the original model predicted values and at this permeability will still overmatch the pressure data. Appendix 3-7 indicates that a calibration run sensitivity case (Run 2) was performed to predict the pressure increase with the 1990 original petition model inputs of 446 ft thickness and 3.6 darcies permeability. This sensitivity case resulted in a predicted pressure buildup less than the base case, and is therefore less conservative.

- Page 3-56, table; What do these data represent? What is their significance?

Response: This paragraph states: "Various samples were taken, with final TDS measured at the end of sampling consisting of 18,720 ppm with a pH of 5.75 suggesting that the leading edge of waste plume spent-acid and waste reaction products are present in these samples."

Swabbed fluid (bbls)	**TDS (ppm)**
+ 1626 (1626 bbls total)	**18,900 (conductivity method)**
	24,856 (residual solids method)
+ 274 (1900 bbls total)	**18,720**

This allows judgement to be made on contamination of fluid or formation brine-plume fluid mixing. Generally the last sample set should be the cleanest and most valid.

- Page 3-57, second paragraph; The conclusion of the first sentence is in no way proven by the opening statement that heterogeneity is pronounced in the injection formations.

Response: **The first sentence states: 'Since the Potosi-Eminence Injection Interval is represented by virgin native high permeability intervals, with cavernous and vuggy sections, as observed from drilling, the wells are proven to be directly connected (2006 Cabot Interference or pulse test, between Injection Well No. 2 and No. 3, yielded 0.65 psi increase)."**

This sentence has been modified as follows:

The Potosi-Eminence Injection Interval is represented by virgin native high permeability intervals, with cavernous and vuggy sections, as observed from drilling. The wells are in hydraulic communication, as demonstrated by the results of the 2006 Cabot Interference Test that indicated pressure communication between Well Nos. 2 and 3.

See Replacement page 3-57

It is unclear how the penetration of the edges of the plumes proves anything. The model didn't predict penetration at any particular point in the plume, and there is no way to tell where in the plume the penetration occurred.

Response: **The model correctly predicted that the recently drilled Well No. 3 would penetrate the plumes generated by Well Nos. 1 & 2, as confirmed by the temperature log run on Well No. 3. A model predicted non-encounter would indicate that the employed porosity-thickness input values are too large, since the modeled plume extent would be smaller than the actual plume. Therefore, it can be concluded that the employed porosity-thickness values are not too large.**

The penetration of the plume does not involve an assumption of homogeneity because all that is demonstrated is a chance encounter. Neither does the result tell us that dispersion needs to be accounted for.

Response: **Cabot modeled the lateral waste plume movement based on Gaussian dispersion predictions. This conservatively models heterogeneity and dispersion, as described in detail in response to the EPA comment below.**

There will be dispersion because permeability is very irregular. That qualitative observation is insufficient to base a multiplier value on. There must be some data on which the multiplier was based. That data and the relation of the multiplier to the data must be clarified.

Response: **The value of M = 2.54 was obtained using by using a technique based on field-scale Gaussian dispersion predictions. The determination of M is described in detail in pages 3-43 and 3-44. The multiplier M is a function of the nominal plume radius (5252 feet, based on the injection volume, net thickness of 280 feet, and porosity of 4%), the concentration reduction factor (1 x 10^{-6}), and the dispersivity (123 feet, based on the equations developed by Xu and Eckstein, see page 3-46 of the revised modeling section). Since Gaussian dispersion predictions are expected to**

provide upper bounds to the advective dispersion present in the region near the source (Walton, 1985; Molz et al., 1983), the calculation of waste plume growth using a multiplying factor of M = 2.54 is very conservative.

Section 3.7 Model Predictions

- Figure 3-16; The large size of the Equistar plume in relation to the Cabot plumes indicates the lack of a realistic result of the modeling. The actual volume injected to date should be easily available from the Illinois EPA and should have been used rather than the 250 gpm maximum allowable rate. The AOR radii are not marked on the figures.

Response: **Cabot requested that the Illinois EPA (IEPA) provide all the injection volume data for the Equistar Well. This was done via a Freedom of Information Act (FOIA) request. IEPA only provided some of the data in paper form, as well as data on a CD-ROM which consisted of multiple pdf files that were copies of submittals made by the operator. Although injection into the Equistar well began in the latter part of 1970, the IEPA data only goes back to 1992.**

At year end 2006 (12/31/2006), IEPA data indicated that 14.228532 billion gallons was injected into the Equistar Well. This is unlikely, since assuming that the well injected at 250 gpm throughout its entire history to 12/31/2006, this results in a volume of only 4.777470 billion gallons, which was the historical volume Cabot used in the Petition Reissuance submittal for the Equistar Well. After examining the data, it is Cabot's opinion that Equistar had made a +12.0 billion gallon error in reporting the cumulative injected volume in October of 1999. At the end of September of 1999, Equistar reported a cumulative injected volume of 1.374440 billion gallons. In October of 1999, Equistar reported a previous cumulative injected volume of 13.374440 billion gallons, an increase of 12.0 billion gallons.

Correcting the Equistar reported cumulative volume results in a cumulative injected volume of 2.228532 billion gallons as of 12/31/2006. The average rate over the approximately 36 year injection history for this well beginning in late 1970, is 114.1 gpm. This appears to be reasonable considering that the maximum permitted rate for this well is 250 gpm.

The model calibration cases and the model pressure and plume cases were rerun to reflect the actual Equistar historical injection volumes as determined above. These new results are shown in the revised model calibration Figures 3-13, 3-14, 3-15, revised pressure and plume plots Figures 3-17 through 3-19, revised upward permeation Figure 3-20, and revised model predicted presure increase at the injection wells, Figure 3-21. Tables 3-4 and 3-9 were also revised as result of the new model runs.

Per EPA's request, the 2.0 mile AOR was also drawn on the plume plots.

See Replacement Pages 3-59, 3-60, 3-61, 3-62, 3-63, 3-64, 3-67
See Replacement Figures 3-13, 3-14, 3-15, 3-17, 3-18, 3-19, 3-20, 3-21;

See Replacement Tables 3-4, and 3-9.
See new Appendix 3-12 CD-Rom of Model Runs

- Page 3-61, first complete paragraph; The pressure effect of the Equistar well should not be greater than the pressure effect of the Cabot wells.

Response: **Based on the modeled injection rates, the pressure increase at the Equistar well should be greater than the pressure increase at the Cabot Wells. At year-end 2006, the modeled injection rate into the Equistar well was 250 gpm. At year-end 2006, the modeled average historical injection rate into the Cabot Well No.1 was 0 gpm; 75.4 gpm into Cabot Well No. 2, and 96.2 gpm into Cabot Well No. 3. Even using the actual Equistar rate of 114.1 gpm, a higher pressure results. Since predicted pressure increase is a direct function of injection rate at each well, the model predicted results are entirely reasonable.**

- Page 3-61, second complete paragraph; The first sentence states that the pressure build up, at the present, is due to a 400 gpm injection rate at the Cabot wells. This cannot be accurate because the Equistar well injecting at 250 gpm has a greater pressure effect.

Response: **The sentence that says the Cabot wells injected at 400 gpm is not correct (see response to the previous comment). This sentence was replaced with the following: "For the Cabot wells, the maximum pressure increase at year-end 2006 occurs at the Injection Well No. 3 and was calculated to be 11.08 psi."**

See Replacement Page 3-61

Section 3.8 Long-term Waste Containment

- Page 3-69, bottom; How was the direction of regional fluid movement determined? The text says that this velocity is consistent with the findings of several studies. Did these studies include the Illinois Basin? What do studies which focused on the Illinois Basin conclude? What is meant by "the sweeping action of the formation fluid?" What happens to constituents which are swept away? There must be some alteration of the plume configuration if there is such an effect. How was the work of the cited authors factored into the prediction?

Response: **The natural regional background drift velocity was estimated to be a maximum of 0.33 ft/yr in the downdip direction. Illinois Basin studies focus on regional shallow groundwater flow which is not applicable to the deep subsurface at 5000 feet where the Cabot waste is injected. The conservative assumption made in this study that the direction of regional groundwater movement is downdip relative to the Potosi-Eminence top of structure.**

This assumption is conservative for a waste which is more dense than the formation dip, since it maximizes waste movement (see results for Sensitivity Case 4, Figure 3-26). For the buoyant waste cases (Base Case, Sensitivity Cases 1 & 2), since buoyancy causes the plume to move updip, it is more conservative to assume that there is no

natural regional background drift velocity, since this results in maximum waste movement.

The sweeping action of the formation fluid results in a closer grouping of the concentration contours at the leading edge of the plume. The constituents are not swept away from the plume entirely. They are redistributed along the length of the plume which causes the elongated teardrop shape with a sharp frontal edge.

The work of cited authors demonstrate that the value of 0.33 ft/year used in this study is appropriate. Clark (1988), concludes in his study that published literature and research show that deep saline aquifers have natural groundwater flow rates that are on the order of inches per year compared to the shallow freshwater aquifers which are often measured in feet per year. Bethke (1988), states that "Sediments generally accumulate in basins at fractions of millimeters per year, and fluids may move only in centimeters per year"

- Page 3-70, second paragraph; How are the effects of dispersion added to these distances?

<u>**Response:**</u> **The effect of dispersion is included in the DuPont 10,000 year model by inputting a value of 252 feet for horizontal dispersivity and 25 feet for transverse dispersivity. This paragraph was revised to state the following:**

"Density-driven drift is predicted to be a major factor in contributing to the long-term horizontal movement of waste at Cabot. The waste will travel in the long-term period as the average of the historical injectate density. The minimum modeled waste exhibits a lower density (0.990 g/cc) (buoyant-case) than the native formation fluid (1.02 g/cc) and will therefore tend to drift in the updip direction. Neglecting dispersion, the waste velocity due to buoyancy differences is approximately 4.4 ft/yr in the updip direction. Hydrodynamic dispersion will act to reduce the density-driven contribution to the overall velocities in the 10,000-Year Waste Plume Model. Considering dispersion, the Potosi-Eminence Dolomite waste plume would travel approximately 40,000 feet (7.57 miles)."

<u>***See Replacement Page 3-70***</u>

- Page 3-71, second paragraph; The range of concentrations, hazardous concentration threshold, and reduction factors to bring the maximum measured concentrations to the hazardous limits should be tabulated here or such a table should be referenced.

<u>**Response:**</u> **The calculated concentration reduction factors for the Cabot waste constituents is shown in Table 3-7. This sentence has been added to the referenced paragraph.**

<u>***See Replacement Page 3-71***</u>

- Figure 3-22; How were these distances calculated? If empirical calculations were used, then the details should be provided here.

Response: The numerical data used to create this plot was generated by the DuPont 10,000-Year Plume Model. Values of C/Co (concentration reduction factor) versus x, y distance in feet were output by the model, then input into the Surfer contouring package to create the plume plots (Figures 3-22 through 3-26).

- Page 3-75, bottom paragraph; What are the boundary assumptions which result in the distances cited? For instance, what is the starting concentration? Does this remain constant? What are the geometric correction factors for the two lithologies?

Response: The assumptions used for the distances cited due to the model predicted molecular diffusion distances are shown in Table 3-12. The assumed initial concentration for each constituent is 1.0. The description of the DuPont Molecular Diffusion Model is provided in detail in Section 3.2.4 DuPont Molecular Diffusion Model and Appendix 3-4. The geometric correction factor for shale is $G = \phi^2$, where ϕ is porosity expressed as a fraction. For dolomite, $G = \phi$ (see Appendix 3-5 page 29).

What are the sources for the diffusion coefficients?

Response: The diffusivity in free solution is found using well-established predictive methods documented in the open literature (e.g., Lerman, 1988; Treybal, 1955; Bird et al., 1960; De Kee and Laudie, 1973) for both electrolyte (ionic) and non-electrolyte solutions. This is stated in the third paragraph in Section 3.2.4, DuPont Molecular Diffusion Model.

Long-Term Waste Plume and the Tuscola Geologic Feature

The areal extent of the Tuscola Geologic Feature is approximately a minimum of 6400 acres (see Figure 4-8 map), and is vertically ~ 100 of closure, which is equivalent to 640,000 acre-feet, which can hold 17.37 billion gallons. The total model predicted injected Cabot +Equistar historical and projected future volume is 15.01 billion gallons, or ~ 552,797 acre-feet, or 357.4 MM gallons. The plume track will pool at the top of the Tuscola Structural feature and reside on the indicated model track to the structure.

since the last reported earthquake in 1996, which was located approximately 83 kilometers from the site. Copies of the updated earthquake database searches are included in Appendix 2-1.

Nelson and Lumm (1984) cite numerous studies, primarily from southern Illinois, which indicate that the modem stress field is one of compression, with the principle stress axis oriented in an east-west to northeast-southwest direction. Where strain gauge measurements were taken, maximum lateral recorded compressive force was more than three times the vertical loading. These lateral stresses are apparently creating thrust faults in near surface strata and producing earthquakes through reverse and strike-slip offset in deeper rocks.

As previously noted, there has been no observed increase in earthquake activity near the Cabot site since injection began. There is no danger of injection induced earthquakes since the pressure required to induce fracturing in the injection interval has been calculated to be in excess of 800 pounds per square inch (psi), and the maximum permitted allowable surface pressure for the Cabot facility is limited to 50 psi.

A seismic risk map, Figure 2-22, divides the state into three areas of expected damage from an earthquake. Region three in southern Illinois has the greatest risk for severe damage from an earthquake. The risk in this region is attributed to the higher frequency of occurrence of earthquakes associated with the New Madrid fault and seismic area. However, earthquakes of magnitudes greater than 5.7 are very infrequent and, north of this area, the risk of severe damage decreases since the area becomes less seismically active with distance.

Seismicity and Earthquake Update to November 2008

Cabot has searched the USGS and NEIC: Earthquake Database and compiled a table of search results performed for reported earthquakes within a 100 km and 175 km radius from the Tuscola site. No earthquakes other than the events previously identified in the January 3, 2007 data search were found. This database earthquake catalog listing is provided for inclusion into Appendix 2-1.

One significant event occurred on April 18, 2008 approximately 105 miles south-southeast of the Cabot facility. This 5.3 magnitude earthquake occurred within the Wabash Valley seismic zone, which is defined by a zone of earthquakes that are scattered across a large area of southeastern Illinois and southwestern Indiana. The depth of the epicenter was calculated to be 7.2 miles (~38,000 feet). Earthquakes of this size can cause slight damage within a few tens of miles of the epicenter. Due to the event's location, over 153 km from the Tuscola site, it had no impact on site operations or the injection wells.

No. 1. No. 2. and No.3, as depicted in Figures 2-26, 2-28, and 1-19, the waste injectate from the site will migrate to the northwest.

Based on the limited structural data and mapping in the area, on the Potosi-Eminence formation, there exists potential for the waste to migrate to the northwest, but as the plume gets larger and spreads laterally, the structural high to the east-northeast may become prominent in trapping the waste fluid over 10,000-years. In either eventuality, Cabot has provided various models of the long-term waste drift plume cases in Section 3.0 Modeling. The long-term plume from Equistar tends to influence the Cabot waste plumes to orient more southeasterly due to the injected volume derived from Equistar displacing Cabot waste (see Figures 3-16 and 3-18).

2.3.2 Oil and Gas Operations

Effects from offset oil and gas operations for the study area were reviewed to ascertain whether induced pressure from man-made activities (injection and oil and gas extraction) are expected to have a major effect on the lateral plume movement during either the operational time period or during the early portion of the 10,000-year time plume drift period for the Cabot facility.

The area around the Cabot plant site was an active area for oil exploration in the 1960's. The Hayes Oil Field, located approximately five miles northeast of the Cabot site, was discovered in 1962. Oil was produced from the Ordovician Galena Group at a depth of approximately 1,040 feet which is considerably shallower than the Cabot Injection (~ 4,470 feet) or Confining Zone (~ 4,125 feet) formations. Production has since declined, and the field has been essentially abandoned.

Approximately 3 miles to the southwest of the Cabot site is the Bourbon Consolidated Field. Oil is produced from the Mississippian Aux Vases, Spar Mountain, and McClosky sandstones and limestones. Depth of oil production ranges from approximately 1,512 feet to 1,980 feet which is also at depths considerably shallower than the Cabot Injection (~ 4,470 feet) and Confining Zones (~ 4,125 feet).

2.3.3 Stratigraphy of Injection and Confining Layers

Prior to the drilling and installation of Cabot Injection Well No. 3, only very limited well data and core information was available from the earlier Cabot wells. The stratigraphy at the site was derived from area well logs and literature concerning geology and oil production in the Tuscola area. Cuttings and core data that were obtained from Well No. 3 agreed well with the data from other sources documenting the local stratigraphy. Figure 2-30 is a stratigraphic column depicting Cabot's defined Injection Zone, Injection Interval, Containment Interval, and Confining Zone. Figure 2-31 is a stratigraphic cross-section that provides the typical thickness and continuity of the formations near the Cabot site.

APPENDIX 2-1

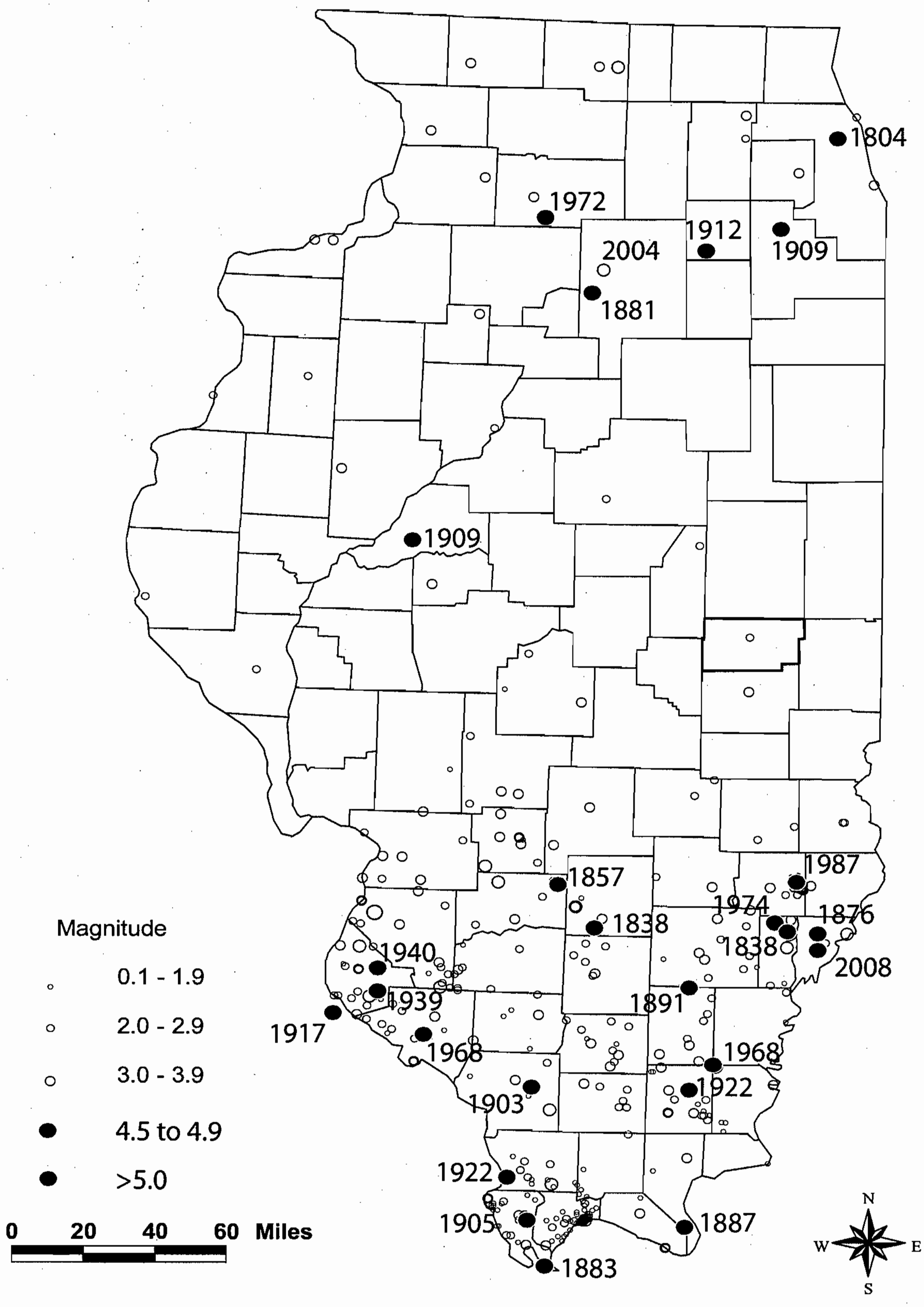
NGDC and NEIC Earthhquake Data

[Seismicity Tables Updated to November 24, 2008]

Earthquakes In Illinois

1795 - 2008

Illinois State Geological Survey



NEIC: Earthquake Search Results

U. S. GEOLOGICAL SURVEY

EARTHQUAKE DATA BASE

FILE CREATED: Mon Nov 24 15:08:07 2008
Circle Search Earthquakes= 3
Circle Center Point Latitude: 39.794N Longitude: 88.336W
Radius: 100.000 km
Catalog Used: PDE
Data Selection: Historical & Preliminary Data

CAT	YEAR	MO	DA	ORIG TIME	LAT	LONG	DEP	MAGNITUDE	IEM NFO TF	DTSVNWG	DIST km
PDE	1974	11	25	233405.10	40.30	-87.40		2.4 LgSLM	2F.	....	97
PDE	1990	04	24	094124.30	39.56	-88.23	10	3.0 LgGS	3F.	....	27
PDE	1996	12	16	015831.35	39.50	-87.40	5	3.1 LgGS	5F.	....	86

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NEIC: Earthquake Search Results

U. S. GEOLOGICAL SURVEY

EARTHQUAKE DATA BASE

FILE CREATED: Mon Nov 24 15:09:28 2008
Circle Search Earthquakes= 47
Circle Center Point Latitude: 39.794N Longitude: 88.336W
Radius: 175.000 km
Catalog Used: PDE
Data Selection: Historical & Preliminary Data

CAT	YEAR	MO	DA	ORIG TIME	LAT	LONG	DEP	MAGNITUDE	IEM NFO TF	DTSVNWG	DIST km
PDE	1974	04	03	230502.50	38.59	-88.09	11	4.7 LgSLM	6D.	....	135
PDE	1974	11	25	233405.10	40.30	-87.40		2.4 LgSLM	2F.	....	97
PDE	1978	06	02	020728.80	38.42	-88.46	20	3.5 UKBLA	5F.	....	152
PDE	1978	08	29	070550.30	38.53	-88.22	17		.F.	....	140
PDE	1978	12	05	014801.30	38.62	-88.36	25	3.5 UKSLM	5F.	....	130
PDE	1981	04	08	015313.20	38.87	-89.39	7	3.8 LgSLM	.F.	....	136
PDE	1983	05	15	051621.60	38.77	-89.57	8	4.4 LgGS	6D.	....	155
PDE	1984	04	17	044443.80	38.38	-88.43	20	3.4 LgSLM	4F.	....	157
PDE	1984	06	12	182648.22	38.92	-87.46	3	3.4 LgSLM	4F.	....E..	122
PDE	1984	07	28	233927.38	39.22	-87.07	10	4.0 LgSLM	5F.	....	126
PDE	1984	08	29	065056.49	39.37	-87.22	10	3.2 LgSLM	5F.	....	106
PDE	1985	02	13	102224.14	38.42	-87.51	15	3.0 LgSLM	...	....	168
PDE	1985	12	29	085656.34	38.55	-88.96	5	3.5 LgGS	5F.	....	148
PDE	1986	10	29	050341.30	38.44	-89.04	5	2.7 LgGS	3F.	....	162
PDE	1987	06	10	234854.88	38.71	-87.95	9	5.1 LgSLM	6C.	....	124
PDE	1988	01	05	143917.96	38.74	-87.96	5	3.3 LgSLM	4F.	....	121
PDE	1988	10	05	003852.27	38.69	-87.93	5	3.6 LgSLM	4F.	....	127
PDE	1990	03	02	070147.73	38.87	-89.22	10	3.6 LgGS	5F.	....	127
PDE	1990	04	24	094124.30	39.56	-88.23	10	3.0 LgGS	3F.	....	27
PDE	1990	10	24	082004.30	38.31	-88.99	5	3.5 LgGS	4F.	....	174
PDE	1990	12	17	052459.10	40.07	-87.04	10	3.2 MDSLM	4F.	....	114
PDE	1990	12	20	140417.12	39.57	-86.67	10	3.6 LgBLA	5F.	....	144
PDE	1991	04	16	040639.30	38.56	-87.99	15	3.0 LgGS	.F.	....	140
PDE	1991	11	11	092047.40	38.71	-87.89	10	3.8 LgSLM	3F.	....	125
PDE	1993	01	29	135623.21	39.04	-89.04	5	3.2 MDSLM	3F.	....	103
PDE	1995	09	05	230121.20	38.36	-89.04	3	2.9 MDSLM	4F.	....	170
PDE	1996	12	16	015831.35	39.50	-87.40	5	3.1 LgGS	5F.	....	86
PDE	2000	04	14	035420	39.76	-86.75	5	3.6 LgSLM	.F.	....	135
PDE	2005	12	06	162413	38.44	-89.19	5	2.7 LgGS	...	....	167
PDE-W	2008	04	18	093659.11	38.45	-87.89	14	5.3 MwGCMT	7DM	....	153
PDE-W	2008	04	18	095931.12	38.47	-87.79	10	2.6 LgGS	...	....	154
PDE-W	2008	04	18	1004	38.45	-87.86	13	2.6 LgGS	...	....	154
PDE-W	2008	04	18	103632.80	38.46	-87.86	17	3.4 LgGS	.F.	....	154

PDE-W	2008	04	18	115558	38.44	-87.89	11	2.6 MDCERI	...	....		155
PDE-W	2008	04	18	151416.40	38.48	-87.85	10	4.7 MwGCMT	.FM	....		152
PDE-W	2008	04	19	030553	38.44	-87.89	14	2.8 LgGS	...	....		155
PDE-W	2008	04	19	165517	38.44	-87.90	14	2.8 MDCERI	...	....		154
PDE-W	2008	04	20	050242	38.44	-87.85	16	2.8 LgCERI	...	....		156
PDE-W	2008	04	21	053829.20	38.50	-87.85	10	4.0 MwSLM	5FM	....		149
PDE-W	2008	04	24	114424	38.45	-87.90	18	2.6 LgCERI	...	....		153
PDE-W	2008	04	25	1731	38.45	-87.87	13	3.7 MwSLM	4FM	....		154
PDE-W	2008	04	30	192919	38.45	-87.87	15	2.6 MDCERI	...	....		154
PDE-W	2008	05	01	053037.68	38.45	-87.86	14	3.3 LgCERI	4F.	....		154
PDE-W	2008	06	01	145612	38.45	-87.85	14	1.6 MDCERI	.F.	....		154
PDE-W	2008	06	05	071314.83	38.44	-87.84	5	3.4 MwSLM	4FM	....		155
PDE-W	2008	06	24	222009	38.45	-87.86	14	2.9 MDCERI	3F.	....		154
PDE-W	2008	07	18	025855.89	38.46	-87.84	10	3.1 LgGS	3F.	....		154

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3.2.3 DuPont Multi-layer Vertical Permeation Model

The DuPont Multi-layer Vertical Permeation Model is used to predict vertical fluid movement within the Injection Zone, providing the third dimension to plume geometry. This model is an extension of an earlier development presented by Miller, et al., (1986) and includes the effects of multi-layer stratigraphy and aquitard compressibility. (documentation is presented in Appendix 3-4).

The DuPont Multi-layer Vertical Permeation Model performs a separate calculation for each of the two key time frames for possible maximum fluid movement. The short term sub-model focuses on the injection period and includes the effects of compressive fluid storage in the aquitard layers. The long term sub-model calculates the residual fluid movement 10,000 years into the future, based on the relaxation of pressure after injection ceases.

The vertical permeation model does take both diffusive movement and pressure drive effects into account with the calculation performed in two parts. For the operational and future operational period, the DuPont Multi-Layer Vertical Permeation Model is used to determine the vertical movement due to pressure drive effects. The assumptions used in the model are described in detail in Appendix 3-4. The DuPont Molecular Diffusion Model is used separately to determine the vertical movement due to diffusion. The assumptions used are described in detail in Appendix 3-5. A sample calculation is also provided on page 3-27.

Section 3.7.5.3, Vertical Extent at 2057, states the most conservative determination of the maximum vertical permeation due to pressure effects at the Cabot site is 1.224 feet. As described in Section 3.8.2 Long-Term Vertical Extent, the most conservative determination of the maximum vertical movement due to diffusion during the 10,000 year period is 55 feet. The vertical movement due to diffusion for each waste stream constituent is shown in Table 3-12. The total vertical permeation at the end of the 10,000 year period would be the sum of the movement due to pressure effects plus diffusion (1.224 feet + 55 feet = 56.224 feet).

3.2.3.1 Mechanism of Injection Induced Permeation

Waste injection elevates the pressure within the injection reservoirs both during injection and for a period of time afterward. This elevated pressure provides the driving force for the vertical (seepage) movement of injected waste and formation fluid into the overlying aquiclude bounding the injection reservoir within the permitted injection zone.

While injection is occurring, fluid enters the base of the overlying aquitard and compresses some of the native brine immediately above it. This compression raises the pressure within the lower portion of the aquitard and expands the aquitard pores. The combined effects of native brine compression and aquitard pore expansion provide the necessary space to store the entering fluid. As time progresses, the portion of the aquiclude affected by brine compression and pore expansion grows. The short term sub-model calculates the vertical distance that the native fluids and injected waste will move into overlying aquicludes.

After injection has been discontinued or has ceased for an extensive period of time, the pressure driving force for vertical seepage will dissipate, along with the compressive

Kee and Laudie, 1973) for both electrolyte (ionic) and non-electrolyte solutions. These methods are typically accurate to plus or minus 10 percent (Bird et al., 1960; Lerman, 1988).

The geometric complexities of the pore channels are accounted for in the model by multiplying the diffusivity value for free solution by a "Geometric Correction Factor," G. The Geometric Correction Factor for a particular porous aquitard layer is determined using a correlation developed in Appendix 3-5, which predicts G as a function of porosity and sediment lithology. This correlation is based on a host of literature data using a variety of very different experimental techniques and, moreover, is supported by theoretical evaluations of diffusion behavior in porous media. Furthermore, the correlation is very conservative in that it is designed to always overestimate the value of the diffusion coefficient.

For diffusion in a shale or clay aquitard layer in which the particles are plate-like in character, $G \leq \phi^2$ where ϕ is porosity expressed as a fraction. For cases in which the layer is composed of particles which tend to be rounded, such as clean sands, $G \leq \phi$ (see Appendix 3-5 page 29).

In addition to the margins of safety identified above, the molecular diffusion model also implicitly contains a number of other margins of safety. It neglects chemical effects, such as adsorption and ion-exchange of contaminant species onto the walls of the aquitard pore channels. Although sometimes difficult to quantify, these phenomena are known to retard the movement of contaminant ions and molecules through typical aquitard lithologies such as clays and shales (Faust and Hunter, 1967; Freeze and Cherry, 1979). In addition, if an aquitard layer is highly compacted, the diffusing ion or molecule may be too large to fit through the pores (Lerman, 1988; Deen, 1987). Finally, the presence of an electrical charge on the walls of the pores, as in the case of a clay or shale aquitard, will tend to

A detailed description of the geometric correction factor, G, is provided in Appendix 3-5 DuPont Molecular Diffusion Model, beginning on page 3-6. Tortuosity of the pore channels lengthens the total path over which molecules must travel. As a result, the diffusion coefficient of a solute species within a water saturated porous medium is always lower than in free water solution. In general it is found that the influence of the microgeometry can be characterized in terms of a "geometric correction factor" G. G is equal to the ratio of the effective diffusion coefficient in the matrix, D*, to the diffusion coefficient in the free solution D_o .

The pessimistic, or conservative nature of G is determined by a number of margins of safety that are inherent in the molecular diffusion model and in the recommended procedure for determination of the key input parameter, the effective diffusion coefficient D*. This is summarized as follows:

- Concentration at z=0 assumed equal to the waste concentration for all times.
- Chemical interactions with the aquitard are neglected, such as adsorption, ion exchange, molecular hindrance, and osmosic membrane effects.
- Horizontal movement of waste is neglected.
- Waste assumed to be no more dense than formation brine.
- Effective diffusion coefficient is determined conservatively.
- Chemical destruction of contaminants is neglected.

Additional detail is provide in Appendix 3-5, Section V. Margins of Safety (page 24).

prevent ionic (charged) species from even entering the rock matrix. This latter effect has been identified as the mechanism for the so-called "osmosis" phenomenon (Freeze and Cherry, 1979).

3.2.4.1 Molecular Diffusion Transport

Molecular diffusion is a transport phenomenon in which molecules or ions of one substance are able to infiltrate another substance, driven by the random thermal movement and "bumping" ("Brownian Motion"), experienced by the diffusing submicroscopic particles. This process is relevant on all time scales, but usually becomes the dominant vertical transport mechanism on the 10,000-year time scale.

In demonstrating no migration at an underground injection site, molecular diffusion in the horizontal direction is much less significant than diffusion in the vertical direction. The lateral movement of waste resulting from other transport mechanisms will virtually always greatly exceed the lateral transport caused by molecular diffusion. Diffusion will typically contribute less than 500 feet to the total horizontal transport distance, even on the 10,000-year time scale. This is negligible compared to bulk lateral plume movement and mechanical dispersion, both of which are included in the other horizontal transport models employed in this petition.

Molecular diffusion is included in the vertical plume movement calculations. The DuPont 10,000 Year Plume Model computer simulation software considers the effect of dispersion and density driven lateral plume movement. The effect of diffusion on lateral plume movement is considered in a separate calculation as described in Appendix 3-5 DuPont Molecular Diffusion Model. Table 3-12 shows the results of the calculation. Since lateral plume movement is through the injection interval which is predominantly dolomite, the values determined for a lithology of dolomite apply. Table 3-12 shows that the 10,000 year maximum lateral movement due to molecular diffusion is 15 feet for the waste constituent cyanide.

3.2.4.2 Long-term Horizontal Drift Mechanisms

After injection operations have been discontinued, the waste plume can drift laterally at a very slow rate as a result of (a) natural background fluid movement, and (b) density-driven drift. Natural background movement refers to the indigenous velocity of groundwater horizontally within a deep underground formation, driven by a very low hydraulic gradient characteristic of sedimentary basins. These velocities will typically be on the order of inches/year (Clark, J. E., 1988, 1989; Bethke et al.., 1988).

Density-driven drift can occur when the waste is more or less dense than the formation fluid; and, in addition, if the formation is not perfectly horizontal (i.e., dipping). This viscosity. In calibrating the Multilayer Pressure Model to the results of well tests and to the history of shut-in pressure measurements at the Cabot Injection Well Nos. 1, 2 and 3, it is the transmissivity rather than the permeability that is employed as the key tuning parameter (together with initial formation pressure). Once the value of the transmissivity has been established, the layer permeability can be deduced from knowledge of the fluid viscosity and layer thickness. Broad trends in carbonate heterogeneity injection dolomite permeability variation can then be taken into account.

The objective of the model calibration effort is to demonstrate that the model prediction is conservative, not to match the observed pressures exactly. A conservative model approach was employed to over-estimate pressures. Based on a permeability of 3.6 darcies, and an interval thickness of 280 feet, the model predicts a pressure increase of approximately 10-15 psi. The measured annual well recorded pressure data indicates that injection interval pressure has decreased by 10-15 psi. This is unlikely, and is probably due to the initial pressure measurement being too high due to the inaccuracies inherent in the measurement of static reservoir pressures. This variability in pressures can occur due to gauge measurement error, directly from variation in shut-in times, or changes in injection rates from survey to survey. In any event, it is impossible for the model to show a decrease in pressure with injection, since this violates the principles of Darcy's Law for fluid flow in porous media.

Appendix 3-7 indicates that a calibration run sensitivity case (Run 2) was performed to predict the pressure increase using the 1990 Cabot Petition original model inputs of 446 feet thickness and 3.6 darcies permeability. This sensitivity case resulted in a predicted pressure buildup that was less than the base case, and is therefore considered less conservative and not appropriate.

3.5.2.1 Dolomite Layer Permeability

The permeabilities of the non-injection dolomite layers were determined from whole core analyses of cores recovered during drilling of Cabot's Injection Wells (see Appendix 2-2, core reports). If core data were not available for dolomite layers, the permeability was either inferred from nearby core data or conservatively estimated. Note that the model remains insensitive to permeability values for dolomite or other layers not used for injection (see Appendices 3-2 and 3-3). The permeability of the injection interval dolomite has been further defined through calibration of the Multilayer Pressure Model to the history of observed pressures at Cabot Injection Well Nos. 1, 2, and 3 (see Figures 3-13, 14, and 15, Model Calibration graphs).

Computed and processed log analysis from Injection Well No. 3 (using a limestone matrix—which are more pessimistic than dolomite matrix, but conservative) indicates that computed permeabilities range from 1 – 10 millidarcies (md) over the length of the Potosi interval, and from 1-10 md over most of the Eminence Dolomite. However, some sections show computed permeability of 10 – 100 md within high density porosity sections in the interval. This is based on the use of a limestone matrix, although physical core samples and drill cuttings from the mudlog show a predominantly dolomite matrix (see Figures 3-6 and 3-10). Therefore, these values are somewhat pessimistic and read low considering that a dolomite formation is present, thereby, the representative values should be higher.

Permeability is not directly measured from open hole logs. However, an estimation of permeability can be calculated from other log derived parameters such as porosity and residual water saturation, and this is commonly done in computer analyzed logs. These estimates are commonly thought of as an "order of magnitude" permeability estimate. A commonly used correlation by Dresser-Atlas and others is the Timur Equation (Reference: Timur, A. An Investigation of Permeability, Porosity and Residual Water Saturation Relationships for Sandstone Reservoirs (Paper J). Transactions, SPWLA, June, 1968). Another commonly used correlation by Dresser-Atlas Services and others is the Morris and Biggs Equation (Reference: Morris, R. L., and Biggs, W.P. Using Log-Derived Values of Water Saturation and Porosity (Paper X). Transactions, SPWLA, 1967).

The Dresser-Atlas processed log assumed a limestone matrix density in the preparation of the log. It is common logging industry practice to use a limestone matrix as a default when computing porosity from density/neutron logs since lithology is often unknown.

As mentioned in this paragraph, the assumption of a limestone matrix is conservative since this results in a lower calculated porosity than that calculated directly using a dolomite matrix. Use of a lower value for porosity would result in a larger value for lateral waste movement. Therefore, this approach is conservative, since the calculated permeability is a direct function of porosity, the calculated permeability would also be lower, which would result in greater values of lateral pressurization.

Injection Wells Nos. 1, 2, and 3. Average porosities for dolomite layers where no log or core data was available were estimated and employed conservative values.

The porosity of the Potosi-Eminence Dolomite Injection Interval was determined from the average of all core measurements from Cabot Injection Well Nos. 1, 2, and 3 (see Appendix 2-2, for copies of reservoir analysis core reports). The combined average porosity from cores was only 2.49 percent from the 18 samples taken. This is not considered representative of the more developed section where porosity is present. The average porosities from logs analyzed from Injection Well No. 3 averaged 8 percent, and in Injection Well No. 1, yielded 7-8 percent also within developed intervals (see Figure 3-10).

The results derived from the flow and containment modeling calculations are not particularly sensitive to the values employed for the dolomite layer porosities. Only the results from the lateral waste transport models (i.e., the Basic Plume Model for injection and the 10,000-Year Waste Plume Model for long-term post-injection) show mild sensitivities to injection interval dolomite porosities. The predicted lateral extent of a waste plume during injection varies roughly in inverse proportion to the square root of dolomite porosity. Therefore, a decrease in porosity from 0.30 to 0.25 would result in an increase in the extent of a one-mile plume (radius) by about 0.1 mile. The extent of lateral waste drift during the 10,000-year period following injection is inversely proportional to the porosity.

Predictions of injection interval dolomite pressure buildup from the Multilayer Pressure Model are only slightly influenced by the value employed for the porosity of the injection interval. Predictions of vertical waste permeation into the dolomite or shale layer overlying the injection interval from the Multilayer Vertical Permeation Model and predictions of the extent of molecular diffusion into the overlying dolomite or shale layer are completely independent of injection interval dolomite porosities (see Appendices 3-3 and 3-4).

The lateral pressurization model is more sensitive to permeability than porosity. This is described in detail in Appendix 3-2, which provides a detailed description of the DuPont

Multi-Layer Pressure Model. Appendix 3-4 Page 4 states that: " Porosity enters into the model only through the contribution of fluid compressibility to the overall layer storativities. Storativity is a reservoir parameter which expresses the combined effects of layer porosity and compressibility. The model results are quite insensitive to the layer storativities, and therefore, also to the porosity values used. Typically, a 10 percent change in porosity will result in less than a 0.5 percent change in the predicted pressure buildup.

Appendix 3-6 (DuPont 10,000 Year Plume Model) Page 10 provides the analytical solution to the equations for flow for a circular waste plume with density effects. As can be seen by examining the equation, buoyant waste movement velocity is inversely proportional to porosity. Therefore, assuming that all other parameters in the equation remain unchanged, an increase in porosity will result in a decrease in buoyant waste movement velocity.

3.5.3.1 Dolomite and Shale Layer Porosity

The extent of vertical permeation of waste into dolomite or shale aquitards overlying an injection interval were determined using the Multilayer Vertical Permeation Model, since permeation is inversely proportional to the dolomite or shale porosity. Therefore, in performing modeling calculations to predict an upper bound to the vertical permeation distance, it is conservative to employ a reasonable lower bound to the dolomite or shale layer porosity. The so-called "effective" porosity of a shale, which neglects the bound water present within the clay structure, as well as water contained inside dead end pores, represents an appropriate choice of a porosity value for such a calculation. This "effective" porosity is considerably lower than the total porosity of a dolomite or shale.

Effective porosities for the shale layers in the Cabot stratigraphic model were established using estimates and well logs. This correlation is based on a wide range of literature data and provides a worst-case lower bound to the effective shale porosity as a function of depth.

The extent of molecular diffusion of a contaminant species vertically into a dolomite (or shale) aquitard layer overlying an injection interval, determined using the Molecular Diffusion Model, increases roughly in direct proportion to the layer porosity. Therefore, in calculations to predict a conservative upper bound to the vertical diffusion distance, a reasonable upper limit to the porosity should be employed. The present modeling calculations use the total dolomite or shale porosity in the prediction of the vertical diffusion distance in order to maintain the conservative approach.

Predictions of injection interval pressure buildup from the Multilayer Pressure Model, predictions of the lateral movement of waste from the Basic Plume Model, and the 10,000-Year Waste Plume Model are entirely independent of the values specified for the overlying dolomite or shale layer porosities.

The equations used in the DuPont Multi-Layer Vertical Permeation Model are shown in Appendix 3-4, pages 15 through 23. This determines vertical waste movement due to pressure effects of the injected fluid. The determination of vertical movement due to diffusion is described in Appendix 3-5, DuPont Molecular Diffusion Model. A sample calculation is provided on pages 27-28 of the Appendix that illustrates the methodology used.

3.5.7.3 Density

The density of the formation fluid in the injection interval and the density of the waste are very important input parameters in long term plume models. The density of the formation fluid was determined from the TDS and formation temperature relationships previously developed. The density of a formation fluid containing 25,000 ppm TDS or approximately 2.5 percent salt at a maximum formation temperature of 114° F is estimated to be 1.02 gm/cc. This density value is uncorrected for pressure. Injection Well No. 2 recorded a density of 1.02 gm/cc from the openhole section of the Potosi and Eminence Dolomites.

3.5.8 Original Formation Pressure

The original formation pressure of the injection dolomite is not a direct input to the models, but is necessary for model pressure calibration and evaluation. During pressure calibration, historical measured formation pressures are compared with model predicted formation pressures. The modeled formation pressures are expressed only as the increase in pressure over original formation pressure. Therefore, a valid approximation of the original formation pressure for the injection dolomite is essential.

The first estimate of the original formation pressure for the injection dolomite was derived from an August 1, 1966, drill stem test measurement in Injection Well No. 1 (Cabot, 1966). The measured pressure was 1,915 pounds per square inch gauge (psig) at a depth of 4,580 feet BGL (temperature 109° F), which is a gradient of 0.435 psi/ft (see Figure 3-12). The pressure was corrected to the top of the injection interval (5,003 feet BGL), using the above gradient.

This initial wellbore fluid gradient of 0.435 psi/foot listed on Table 3-6 comes from the original 1990 Cabot Petition page 10-9. Since this is almost identical to a fresh water gradient (0.433 psi/ft) it is likely that fresh water was in the hole at the time the static gradient pressure survey was taken, although it cannot be confirmed from records. The table of recorded drill stem test measurements below, yields a gradient of 1915 psig/4580 feet BGL = 0.418 psi/ft, which is not considered accurate as compared to the annual static formation testing performed on the wells with better gauges.

Depth	Pressure psig	Gradient
0	0	
1500	585	0.3900
3000	1230	0.4100
3580	1484	0.4145
4080	1701	0.4169
4580	1915	0.4181
4861	2035	0.4186

In Cabot Injection Well No. 2, an Otis bottomhole pressure gauge was lowered to 5,200 feet into the freshwater filled wellbore on January 12, 1976, and recorded a pressure of 2,189 psig with a maximum recorded temperature of 112° F. The pressure recorded at the Eminence gradient stop was 2,102 psig. This gradient of 0.435 psi/ft reflects the freshwater in the wellbore. A follow-up bottomhole pressure gauge was lowered into Well No. 2 to 5,000, feet and a pressure of 2,096 psi was recorded (see Table 3-6).

This pressure measurement is recorded on Table 3-6. Table 3-6 lists the pressure as pounds per square inch absolute (psia) which includes atmospheric pressure. Pressure recorded as pounds per square inch gauge (psig) can be converted to psia by adding the atmospheric pressure, 14.7 psi. In Table 3-6 this pressure is recorded as 2117 psia (2102 psig + 14.7 psi = 2117 psia). The follow-up pressure gauge recorded 2096 psig, which is listed in Table 3-6 as 2111 psia (2096 psig + 14.7 psi = 2111 psia).

The wellbore fluid gradient of 0.435 psi/foot listed on Table 3-6 comes from the original 1990 petition page 10-9. Since this is almost identical to a fresh water gradient (0.433 psi/ft) it is likely that fresh water was in the hole at the time the static gradient pressure survey was done.

The original formation pressure for the Potosi-Eminence Injection Interval is used as the reference point for the DuPont Multi-layer Pressure Model, which predicts the pressure increase above the background or initial pressure. The static reservoir pressure from original drill stem test measurements for Well No. 1 in the Potosi-Eminence Dolomite model layer is shown in Figure 3-13 and in Table 3-6, which recorded an initial pressure before injection.

An initial bottom hole pressure of 2,035 psig was measured at a depth of 4,861 feet in 1966, during testing of Cabot Injection Well No. 1. This corresponds to an average pressure gradient from surface to 4,861 feet of 0.432 psi/foot. Subsequent testing and model calculations utilize a midpoint depth datum of 5,003 feet for the Potosi-Eminence Dolomite Injection Interval.

A record of historical wellhead pressures from Cabot Injection Well Nos. 1, 2, and 3 is present in Table 3-6, which were also used as historical formation pressure measurements.

Pressure gauges are more accurate today and offer less drift and influence from temperature and fluid variations during testing periods. Recent pressure tests for Injection Well Nos. 2 and 3 since 2002, indicate that these early values (Amerada pressure gauge) may be off, although it is difficult to determine since little or no pressure buildup is present, and wells go on vacuum during the annual shut-in and fall-off pressure tests, making detailed analysis complex. Table 3-6 compiles historical bottom-hole pressure measurements recorded from all of the wells on site.

Figure 3-12 is a graph of compiled well and formation pressures measured from historical pressure tests and also includes a graph of these pressure gradients plotted versus depth. It can be seen that slightly different slopes are apparent within the scatter trend of the distributed data. The data corresponds with the overlying formation units and the Potosi-

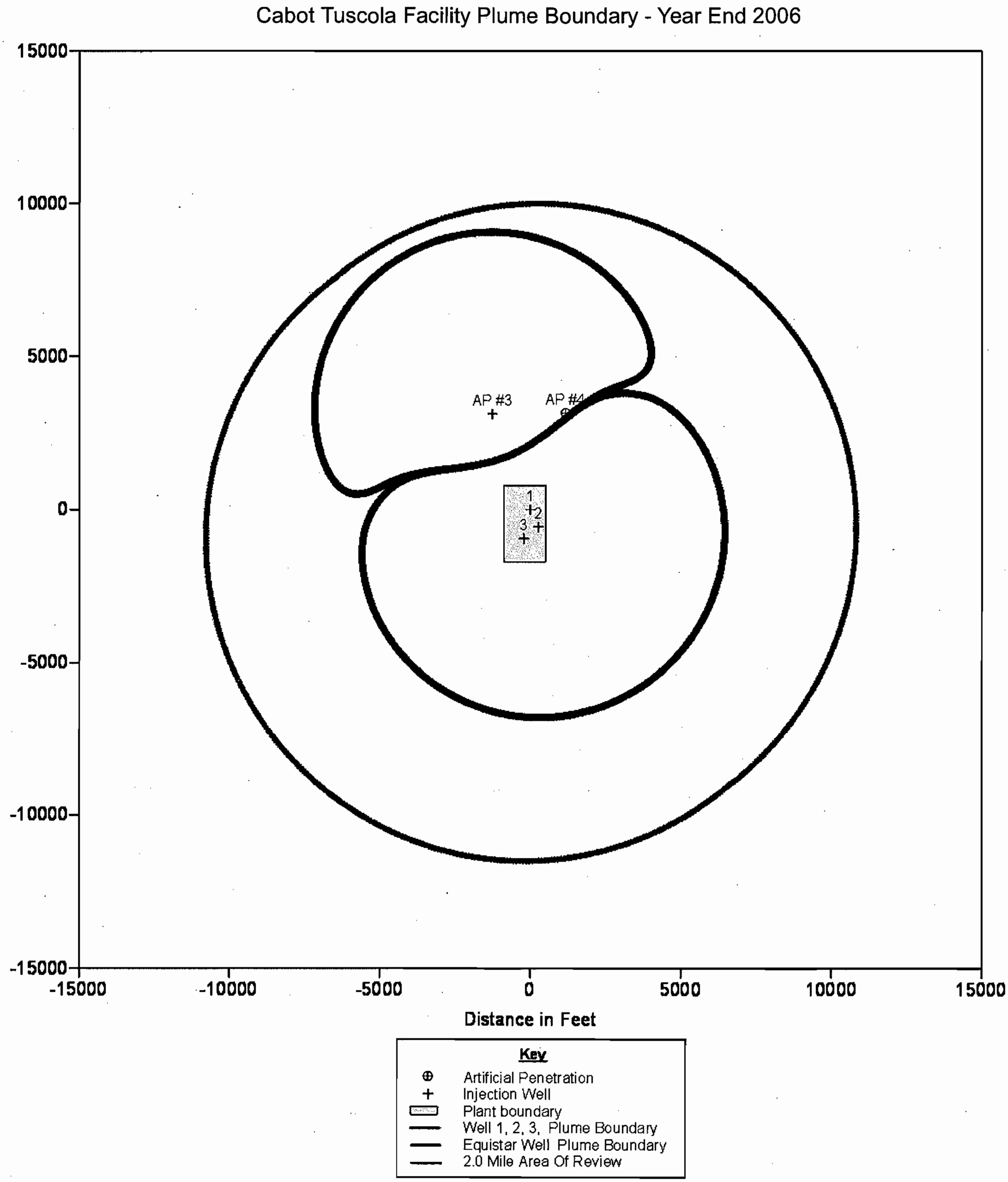

Figure 3-16 Conservative Operational Plume Boundary at Year-End 2006, due to Injection Into the Potosi-Eminence Injection Interval, Base Case, h=280', porosity=4%, M=2.54

Docket Numbers: ER10–1282–000.

Applicants: Progress Energy, Inc.

Description: Carolina Power & Light Co. *et al.* submits Third Revised Sheet 210 *et al.* to FERC Electric Tariff, Fourth Revised Volume 3 for inclusion in their Joint Open Access Transmission Tariff.

Filed Date: 05/20/2010.

Accession Number: 20100520–0207.

Comment Date: 5 p.m. Eastern Time on Thursday, June 10, 2010.

Any person desiring to intervene or to protest in any of the above proceedings must file in accordance with Rules 211 and 214 of the Commission's Rules of Practice and Procedure (18 CFR 385.211 and 385.214) on or before 5 p.m. Eastern time on the specified comment date. It is not necessary to separately intervene again in a subdocket related to a compliance filing if you have previously intervened in the same docket. Protests will be considered by the Commission in determining the appropriate action to be taken, but will not serve to make protestants parties to the proceeding. Anyone filing a motion to intervene or protest must serve a copy of that document on the Applicant. In reference to filings initiating a new proceeding, interventions or protests submitted on or before the comment deadline need not be served on persons other than the Applicant.

The Commission encourages electronic submission of protests and interventions in lieu of paper, using the FERC Online links at *http://www.ferc.gov.* To facilitate electronic service, persons with Internet access who will eFile a document and/or be listed as a contact for an intervenor must create and validate an eRegistration account using the eRegistration link. Select the eFiling link to log on and submit the intervention or protests.

Persons unable to file electronically should submit an original and 14 copies of the intervention or protest to the Federal Energy Regulatory Commission, 888 First St., NE., Washington, DC 20426.

The filings in the above proceedings are accessible in the Commission's eLibrary system by clicking on the appropriate link in the above list. They are also available for review in the Commission's Public Reference Room in Washington, DC. There is an eSubscription link on the Web site that enables subscribers to receive e-mail notification when a document is added to a subscribed dockets(s). For assistance with any FERC Online service, please e-mail *FERCOnlineSupport@ferc.gov.* or call (866) 208–3676 (toll free). For TTY, call (202) 502–8659.

Nathaniel J. Davis, Sr.,
Deputy Secretary.

[FR Doc. 2010–12983 Filed 5–28–10; 8:45 am]

BILLING CODE 6717–01–P

DEPARTMENT OF ENERGY

Federal Energy Regulatory Commission

[Project No. 1888–027]

York Haven Power Company, LLC; Notice of Dispute Resolution Panel Meeting and Technical Conference

May 24, 2010.

On May 19, 2010, Commission staff, in response to the filing of a notice of study dispute by the Pennsylvania Department of Environmental Protection on April 29, 2010, convened a single three-person Dispute Resolution Panel (Panel) pursuant to 18 CFR 5.14(d).

The Panel will hold a technical conference at the time and place noted below. The technical conference will address a dispute pertaining to the study of resident fish passage at the York Haven East Channel Fishway.

The purpose of the technical session is for the disputing agencies, applicants, and Commission to provide the Panel with additional information necessary to evaluate the disputed study. All local, State, and Federal agencies, Indian Tribes, and other interested parties are invited to attend the meeting as observers. The Panel may also request information or clarification on written submissions as necessary to understand the matters in dispute. The Panel will limit all input that it receives to the specific studies or information in dispute and will focus on the applicability of such studies or information to the study criteria stipulated in 18 CFR 5.9(b). If the number of participants wishing to speak creates time constraints, the Panel may, at their discretion, limit the speaking time for each participant.

Technical Conference

Date: Monday, June 14, 2010.

Time: 1 p.m.–5 p.m. (EDT)

Place: Harrisburg Holiday Inn and Conference Center, I–83 & PA Turnpike, Exit 242, New Cumberland, PA.

Kimberly D. Bose,
Secretary.

[FR Doc. 2010–12992 Filed 5–28–10; 8:45 am]

BILLING CODE 6717–01–P

DEPARTMENT OF ENERGY

Federal Energy Regulatory Commission

[Docket No. RM07–10–002]

Transparency Provisions of Section 23 of the Natural Gas Act; Notice of Extension of Time

May 24, 2010.

In comments following the March 25, 2010 Technical Conference in the above-referenced proceeding, the Natural Gas Supply Association, Shell Producers,[1] Process Gas Consumers Group, and Independent Petroleum Association of America (Commenters) requested that the Commission extend the deadline for filing the 2009 Form No. 552 for an additional 60 to 90 days from the current deadline of July 1, 2010. The Commenters contend that the additional time will allow filers to prepare the Form No. 552 based on any additional guidance that the Commission will provide in the future.

Upon consideration, notice is hereby given that all natural gas market participants are granted an extension of time until September 1, 2010 to file their Form No. 552 for calendar year 2009.

Kimberly D. Bose,
Secretary.

[FR Doc. 2010–12995 Filed 5–28–10; 8:45 am]

BILLING CODE 6717–01–P

ENVIRONMENTAL PROTECTION AGENCY

[FRL–9156–8]

Approval of a Petition for Exemption from Hazardous Waste Disposal Injection Restrictions to Cabot Corporation Tuscola, Tuscola, IL

AGENCY: Environmental Protection Agency.

ACTION: Notice of final decision on petition.

SUMMARY: Notice is hereby given by the United States Environmental Protection Agency (EPA) that an exemption to the land disposal restrictions under the 1984 Hazardous and Solid Waste Amendments (HSWA) to the Resource Conservation and Recovery Act (RCRA) has been granted to Cabot Corporation Tuscola Plant (Cabot Corporation) of Tuscola, Illinois, for two Class I injection wells located in Tuscola, Illinois. As required by 40 CFR part 148,

[1] Shell Gulf of Mexico, Shell Offshore Inc., and SWEPI LP.

Cabot Corporation has demonstrated, to a reasonable degree of certainty, that there will be no migration of hazardous constituents out of the injection zone or into an underground source of drinking water (USDW) for at least 10,000 years. This final decision allows the continued underground injection by Cabot Corporation of specific restricted wastes from the silica production processes (codes D002, F003, and F039 under 40 CFR part 261), into two Class I hazardous waste injection wells specifically identified as Injection Wells No. 2 and No. 3 at the Tuscola facility. This decision constitutes a final EPA action for which there is no Administrative Appeal.

DATES: This action is effective as of June 1, 2010.

FOR FURTHER INFORMATION CONTACT: Dana Rzeznik, Lead Petition Reviewer, EPA, Region V, telephone (312) 353–6492. Copies of the petition and all pertinent information relating thereto are on file and are part of the Administrative Record. It is recommended that you contact the lead reviewer prior to reviewing the Administrative Record.

SUPPLEMENTARY INFORMATION:

Background

Cabot Corporation submitted a petition for renewal of an existing exemption from the land disposal restrictions of hazardous waste on March 8, 2007. EPA personnel reviewed all data pertaining to the petition, including, but not limited to, well construction, well operations, regional and local geology, seismic activity, penetrations of the confining zone, and computational models of the injection zone. EPA has determined that the geologic setting at the site as well as the construction and operation of the well are adequate to prevent fluid migration out of the injection zone within 10,000 years, as required under 40 CFR part 148. The injection zone at this site is composed of the Upper Franconia, Potosi, Eminence and Oneota formations at depths between 4,442 feet and 5,400 feet below ground level. The confining zone is the Shakopee formation at depths between 4,101 feet and 4,442 feet below ground level. The confining zone is separated from the lowermost underground source of drinking water (at a depth of 2700 feet below ground level) by a sequence of permeable and less permeable sedimentary rocks, which provide additional protection from fluid migration into drinking water sources.

EPA issued a draft decision, which described the reasons for granting this exemption in more detail, a fact sheet, which summarized these reasons, and a public notice on December 28, 2009, pursuant to 40 CFR 124.10. The public comment period expired on February 1, 2010. EPA received no comments on the proposed exemption granted to Cabot Corporation. A final exemption is therefore granted as proposed.

Conditions

This exemption is subject to the following conditions. Non-compliance with any of these conditions is grounds for termination of the exemption:

(1) All regulatory requirements in 40 CFR 148.23 and 148.24 are incorporated by reference;

(2) The exemption applies to two existing injection wells, Well #2 and Well #3 located at the Cabot Corporation facility at 700 E. U.S. Highway 36, in the City of Tuscola in Douglas County, Illinois;

(3) Injection is limited to that part of Upper Franconia, Potosi, Eminence and Oneota formations at depths between 4,442 and 5,400 feet;

(4) Only wastes denoted by the waste codes D002, F003 and F039 may be injected;

(5) The concentrations of constituents of the injected waste will not exceed the amounts listed in Table 1–1 in the petition document;

(6) The volume of wastes injected in any month through the wells must not exceed 17,280,000 gallons;

(7) This exemption is approved for the 21-year modeled injection period, which ends on December 31, 2027. Cabot Corporation may petition EPA for a reissuance of the exemption beyond that date, provided that a new and complete petition and no-migration demonstration is received at EPA, Region 5, by July 1, 2027;

(8) Cabot Corporation shall quarterly submit to EPA a report containing a fluid analysis of the injected waste which shall indicate the chemical and physical properties upon which the no-migration petition was based, including the physical and chemical properties listed in Conditions 5 and 6 of this exemption approval;

(9) Cabot Corporation shall annually submit to EPA a report containing the results of a bottom hole pressure survey (fall-off test) performed on Well #2 and Well #3 (alternating years). The survey shall be performed after shutting in the well for a period of time sufficient to allow the pressure in the injection interval to reach equilibrium, in accordance with 40 CFR 146.68(e)(1). The annual report shall include a comparison of reservoir parameters determined from the fall-off test with parameters used in the approved no-migration petition;

(10) The petitioner shall fully comply with all requirements set forth in Underground Injection Control Permit UIC–011–CC issued by the Illinois Environmental Protection Agency; and

(11) Whenever EPA determines that the basis for approval of a petition may no longer be valid, EPA may terminate this exemption and will require a new demonstration in accordance with 40 CFR 148.20.

Dated: March 5, 2010.

Tinka G. Hyde,

Director, Water Division, EPA Region 5.

[FR Doc. 2010–13089 Filed 5–28–10; 8:45 am]

BILLING CODE 6560–50–P

ENVIRONMENTAL PROTECTION AGENCY

[FRL–9157–2; Docket ID No. EPA–HQ–ORD–2009–0934]

The Effects of Mountaintop Mines and Valley Fills on Aquatic Ecosystems of the Central Appalachian Coalfields and a Field-Based Aquatic Life Benchmark for Conductivity in Central Appalachian Streams

AGENCY: Environmental Protection Agency (EPA).

ACTION: Extension of Public Comment Period to July 13, 2010.

SUMMARY: EPA is announcing an extension of the public comment period for two related draft documents: (1) "The Effects of Mountaintop Mines and Valley Fills on Aquatic Ecosystems of the Central Appalachian Coalfields" (EPA/600/R–09/138A) and (2) "A Field-based Aquatic Life Benchmark for Conductivity in Central Appalachian Streams" (EPA/600/R–10/023A). We are specifically extending the comment period to give the public an opportunity to evaluate the data used to derive a benchmark for conductivity. By following the link below, reviewers may download the initial data and EPA's derivative data sets that were used to calculate the conductivity benchmark. These reports were developed by the National Center for Environmental Assessment (NCEA) within EPA's Office of Research and Development as part of a set of actions taken by EPA to further clarify and strengthen environmental permitting requirements for Appalachian mountaintop removal and other surface coal mining projects, in coordination with Federal and State regulatory agencies (*http://www.epa.gov/owow/wetlands/guidance/mining.html*).

Illinois Geologic Column

Figure 2-1a Stratigraphic Column

Stratigraphic Column for the Illinois Basin Showing Vertically Stacked Reservoirs

Pennsylvanian coal beds are continuous across large areas of the Illinois Basin and are an active exploration target for coalbed methane.

Mississippian oil reservoirs are the most prolific oil reservoirs within the Illinois Basin and represent 80 percent of Illinois oil production. The Mount Simon Sandstone underlies the Illinois Basin, except in local areas where it failed to cover the hills on the Pre-Cambrian surface. The Mount Simon Sandstone attains a maximum thickness of 2,600 feet in east-central Illinois and west-central Indiana.

Adapted from Illinois Geological Survey website. website.