BEFORE THE ENVIRONMENTAL APPEALS BOARD

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY

WASHINGTON, D.C.

In the Matter of:	)
West Bay Exploration Co. of	)
Traverse City, Michigan	)
Haystead #9 SWD	)
Permit No. MI-075-2D-0010	)
Jackson County, Michigan	)

PETITIONER PETER BORMUTH'S INFORMAL LETTER OF APPEAL UNDER 40 CFR 124.5(b)

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Dear Environmental Appeals Board

On November 11, 2016 I, Peter Bormuth, did send a copy of my Request for Termination of Permit #MI-075-2d-0010 under CFR § 124.5 to then EPA Administrator Gina McCarthy; to EPA Acting Regional Administrator Robert Kaplan; and to Region 5 Water Division Director Tinka Hyde by e- mail. Hard copy of copy of my Request for Termination of Permit #MI-075-2d-0010 under CFR § 124.5 was sent to Robert Kaplan, EPA Region 5, Environmental Protection Agency, 77 West Jackson Boulevard, Chicago, IL 60604-3507 by certified mail. (see Exhibit A). I am an interested person under CFR § 124.5(a) and the request was in writing and contained the facts or reasons supporting the request. I requested that the administrator issue a notice of intent to terminate under CFR § 124.5(d) citing § 144.40(a)(2) and (3). The permittee misrepresented relevant facts at the time, and the permitted activity endangers human health and the environment and can only be regulated to acceptable levels by permit termination.

As of today's date, January 8, 2018, I have not heard from the Regional Administrator of the EPA. The EPA has had the relevant scientific information in their hands since 2014 (see UIC 14-66). This BOARD acknowledged the issues raised in my Request for Termination of Permit #MI-075-2d-0010 in Appeal No. UIC 15-03. In this BOARD's Order issued on 08/31/2016 Responding to Motion for Clarification (#36), I was specifically directed to use this procedure to address my concerns with the Haystead #9 permit. ("Nonetheless, as Region 5 points out, if Mr. Bormuth wishes to challenge the Haystead #9 Permit again, he may "pursue his administrative remedy under the UIC regulations and seek modification, termination, or revocation and reissuance of the Haystead #9 Permit under 40 C.F.R. § 124.5." Response to Petitioner's Motion for Clarification at 7.").

Given the serious nature of the petitioners concerns, the 14 month delay in receiving a response from the EPA Administrator is gross negligence. While 40 C.F.R. § 124.5 gives this BOARD 60 days to respond to an informal letter, 40 C.F.R. § 124.5 does not directly address the time period in which the regional administrator must respond to a request for termination. This legislative oversight is being used by the EPA to avoid responding to the petitioner's request. Based on established science, this delay is allowing injected fluid to dissolve the geological anhydrite and salt barriers which the EPA claims will prevent upward migration. Once those barriers are breached, the injected fluid can endanger our underground sources of drinking water. In examining the context of a regulation "the Board looks first to the plain meaning of the regulatory text, then considers the regulations as a whole, the regulatory history, and the agency's post-promulgation guidance documents on the topic." *In re San Pedro Forklift*, slip op. at 26 (citing *In re Clarksburg Casket Co.*, 8 E.A.D. 496, 502-504 (EAB 1999)). Obviously the regulation as a whole seeks to safeguard human health and our underground sources of drinking water. Analogizing from the rules of statutory construction, the words of a regulation must be read in their context and with a view to their place in the regulation's overall scheme. *In re Deseret Power Electric Cooperative*, PSD Appeal No. 07-03, slip op. at 32 (EAB Nov. 13, 2008) 14 E.A.D. (citing *Davis v. Michigan Dep't. of Treasury*, 489 U.S. 803, 809 (1989)). Clearly 40 C.F.R. § 124.5 is meant to facilitate a timely response from the EPA, since a request for termination may involve permitted activity that endangers human health and the environment. The petitioner wishes to seek judicial review under 5 U.S.C. 704 and the EPA inaction is deliberately being used to deny the petitioner that option.

To allow the Regional Administrator an unlimited period to respond to a request for termination is a ludicrous result given the possible danger to human health or the environment. (see *United States v. Meyer*, 808 F. 2d 912, 919 (1st Cir. 1987) holding an unreasonable result is reason to reject an interpretation); see also *Sierra Club v. Train,* 557 F. 2d 485, 490 (5th Cir. 1977) holding, "...where the result of one interpretation is unreasonable, while the result of another interpretation is logical, the latter should prevail."); see also *In the Matter of Deutsch Co.* 1999 EPA ALJ LEXIS 117, *11 (EPA ALJ, May 26, 1999) holding, "...frankly ludicrous results are to be avoided in ascertaining the meaning of statutory or regulatory provisions..."). The petitioner has previously pointed out that Permit Number MI-163-3G-A002 to the Sunoco Inkster Facility establishes that the EPA is aware that anhydrite and salt both dissolve upon contact with fluid, so their own files show that there is a real and present danger to human health and the environment from continued injection at the Haystead #9 SWD site. These evil Christian scum at the EPA are deliberately allowing a known threat to human health or the environment to continue by their gross negligence and inaction. The petitioner requests that the BOARD direct the Regional Administrator to begin termination proceedings under paragraph (c) of section CFR § 124.5.

Respectfully submitted,

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January 9, 2018

Exhibit A

REQUEST FOR TERMINATION OF PERMIT #MI-075-2D-0010 UNDER CFR § 124.5

Peter Bormuth, *Druid*, makes a request of EPA Administrator Gina McCarthy; acting Administrator of Region 5, Robert Kaplan; and Region 5 Water Division Director Tinka Hyde (or Chris Korleski if he has assumed Tinka Hyde's duties) to terminate the Haystead #9 SWD Well Permit #MI-075-2D-0010 under CFR § 124.5 Modification, revocation and reissuance, or termination of permits. I am an interested person under CFR § 124.5(a) and this request is in writing and contains the facts or reasons supporting the request. I request that the administrator issue a notice of intent to terminate under CFR § 124.5(d). The petitioner requests this action under § 144.40(a)(2) and (3). The permittee misrepresented relevant facts at the time; and the permitted activity endangers human health or the environment and can only be regulated to acceptable levels by permit termination.

1. REGION 5 MISREPRESENTED RELEVANT FACTS IN DETERMINING THE UPPER CONFINING ZONE FOR HAYSTEAD #9.

A. THE SALINA GROUP WILL NOT CONFINE THE INJECTED WASTE.

The permittee represented that "the injection zone is topped by the Salina group, an approximately 430 foot thick sequence of carbonate, anhydrite, [anhydritic] shale, and salt, which will act as a confining layer to prevent flow out of the injection zone." This is a false statement.

1. The injection fluid will start a chemical reaction that will convert anhydrite to gypsum, creating enormous pressures before the gypsum dissolves in solution. Anhydrite always converts to gypsum upon exposure to water.

Anhydrite at depth will undergo a transition to gypsum when exposed to water. Laboratory studies demonstrate the chemical mechanism through which the anhydrite to gypsum

conversion process takes place. (See Hardie, *The American Mineralogist,* Vol. 52, January-February 1967 – THE GYPSUM-ANHYDRITE EQUILBRIUM AT ONE ATMOSPHERE PRESSURE; see also Zen, *Journal of Petrology*, Vol. 6, Part 1, 1965 – SOLUBILITY MEASUREMENTS IN THE SYSTEM CaSO4-NaCl-H2O at 35, 50, & 70 degrees C and ONE ATMOSPHERE PRESSURE – publication approved by the Director, U.S. Geological Survey).

Other studies show that massive anhydrite formations undergo this transformation. The Region has consistently claimed that massive anhydrite will not undergo the transformation witnessed in the laboratory. Researchers Rauh & Thuro, *Investigations on the swelling behavior of pure anhydrites,* ENGINEERING GEOLOGY, Technishe Universitat Munchen, clearly state:

> **In contact with water every Anhydrite dissolves or alters to gypsum**...The 60.8% volume increase from anhydrite to gypsum can be calculated from the solids. It is irreversible under atmospheric conditions. (bold emphasis added)
>
> p. 1

The EPA notes that this study and the Steiner study, (Steiner, *International Journal of Rock Mechanics and Mining Sciences & Geomechanics Abstracts,* 30, 4 (1993), SWELLING ROCK IN TUNNELS) are inapposite because atmosphere is introduced into tunnels, thus creating surface conditions. However these studies show that overburden is not a factor in the conversion of massive buried anhydrite and anhydritic shales. The Steiner article shows that such conversion will take place even with 700-1000 meters of overbearing rock strata above the anhydrite bearing layers where the tunnel exists. The pressure of overburden alone will not prevent the conversion process from taking place when anhydrite is exposed to water.

The EPA found the Sass & Burbaum article, (Sass & Burbaum, *ACTA Carsologica* 39/2 Postonjna (2010), DAMAGE TO THE HISTORIC TOWN OF STAUFEN (GERMANY) CAUSED BY GEOTHERMAL

FRILLINGS THROUGH ANHYDRITE-BEARING FORMATIONS) to be inapposite because it concerns a much shallower conversion of anhydrite to gypsum at a depth less than 200 meters. But this study shows that atmosphere did not play a role in this conversion. Water was introduced into the strata through geothermal boreholes. Water alone, without atmosphere, caused this massive buried anhydrite formation to convert to gypsum, swell, and uplift. The chemical reaction took place underground in the absence of atmospheric conditions. This article proves that conversion of massive anhydrite to gypsum will take place upon exposure to water. Exposure to atmosphere is not necessary, and the pressure of overburden will not inhibit this reaction though it would confine the swelling behavior, creating enormous in-situ pressures of up to 2-2.5 MPa.

The Region dismissed the Murray article (Murray, *Origin and Diagenesis of Gypsum and Anhydrite,* 34(3) JOURNAL OF SEDIMENTARY PETROLOGY 512 (1964)) which noted evidence for conversion of anhydrite at a depth of 3500 feet as lacking detail and they ignored the Weaver article (Weaver Frape; Cherry, *Recent cross formational fluid flow and mixing in the shallow Michigan basin*, GEOLOGICAL SOCIETY OF AMERICA, Bulletin 107 (June 1995) which found that anhydrite and halite had been dissolved at depth from the Silurian formations in Michigan (p. 699). The Region also chooses to ignore the additional studies showing conversion at depths, such as the *Bell, Cripps & Culshaw* study (Bell; Cripps; Culshaw, *Groundwater in Engineering Geology*, London (1986) A REVIEW OF THE ENGINEERING BEHAVIOR OF SOILS AND ROCKS WITH RESPECT TO GROUNDWATER) which found that:

> massive anhydrite can be dissolved to produce uncontrollable runaway situations in which seepage flow rates increase in a rapidly accelerating manner. Even small fissures in massive anhydrite can prove dangerous....Within about 13 years the flow rate increases to a runaway situation.
>
> p. 20

and they ignored the Jawarski paper which noted that gypsification of massive anhydrite when exposed to water under natural conditions can occur very quickly: "within few years or even within one year." Jaworski, *InTech: Advances in Crystallization Processes*, (April 2012), CRYSTALLIZATION, ALTERATION AND RECRYSTALLIZATION OF SULPHATES, p. 469

Consideration must also be given to the Klimchouk study, (Klimchouk, *International Journal of Speleology*, 25, (1996) - THE DISSOLUTION AND CONVERSION OF GYPSUM AND ANHYDRITE) which shows that the process of anhydrite conversion is accelerated by two independent factors: pressure and the sodium content of the injected fluid. On page 24 Klimchouk documentes that the solubility of anhydrite increases sharply with the increase in pressure: each 0.01Pa increase in pressure results in a 3 to 5 times increase in solubility. The Steiner and Sass & Burbaum studies confirm this data. The scientific literature (Klimchouk, Conley, Hardie, Singh) also documents that certain salts, particularly sodium chloride and magnesium chloride, activate rather than inhibit the hydration of anhydrite and thus promote the conversion of anhydrite to gypsum. The waste solutions that West Bay is injecting in Haystead #9 are greater activators of the conversion process than fresh water alone.

2. The injection fluid will dissolve the salt layers of the confining zone.

The Bell, Cripps & Culshaw study (Bell; Cripps; Culshaw, *Groundwater in Engineering Geology*, London (1986) A REVIEW OF THE ENGINEERING BEHAVIOR OF SOILS AND ROCKS WITH RESPECT TO GROUNDWATER) clearly states:

> Salt is even more soluble than gypsum and the evidence of slumping, brecciation and collapse structures in rocks which overlie saliferous strata bear witness to the fact that salt has gone into solution in past geological times.
>
> p. 21

The EPA is well aware that the Petitioner's scientific argument is not an untested hypothesis but an established scientific fact upon which an engineering technology has been developed over the last 40 years in the related field of gas storage. Engineers have created caverns in large domal structures (salt) since the 1960's. Today advances in technology allow caverns to be shaped into extensive horizontal strata of salt and anhydrite, typically at depths ranging between 600 and 7000 feet. The EPA has documentation of this process in their files which was not considered when the EPA issued the Haystead #9 permit. This new evidence, EPA Permit #MI-163-3G-A002, for underground injection which was issued June 14, 2006 for the Sunoco Inkster Facility in Wayne County clearly shows that salt and anhydrite layers of the Salina Group will not act as a confining layer. It authorized the dissolution of Salina Group salt and anhydrite layers through injection of salt water for the purpose of enlarging pre-existing natural gas storage caverns. All underground injection regulations this well was required to meet are identical with those that apply to the instant case. The Petitioner asks the Board to look at the permit and the construction and abandonment and plugging diagrams of the Sunoco well and compare them with the Haystead #9 well. This is an identical technology with only one difference: a second string in the well returns brine to the surface. The Sunoco well pumped a 35% saturated brine down into the formation through a borehole (leaching string). A fully saturated brine (95%) was returned through the withdrawal/production string so that the formation was dissolved in a controlled manner. West Bay is going to be injecting fresh drilling water, hydrochloric acid, brines, and other oil field (and possibly fracking) wastewaters into the formation without removing them, thus dissolving the Salina Group salt layers in an uncontrolled manner. The Haystead #9 waste injection well will probably operate for 20 years. The Salina A-2 Evaporate layer, the Salina A-1

Evaporate layer, the B-Salt and B-Unit layers, the D-Unit layer, and the E-Unit layer can all be expected to dissolve or partially dissolve in solution. The EPA's assertion that these layers will confine the injected fluid is contrary to all known scientific theory and all current technological practices.

3. Shale formations in the Salina Group will not contain the injection fluid.

The Steiner study, (Steiner, *International Journal of Rock Mechanics and Mining Sciences & Geomechanics Abstracts,* 30, 4 (1993), SWELLING ROCK IN TUNNELS) shows that anhydritic shales, such as the Salina Group shales, differ from regular shales, and that swelling phenomena are particularly severe in anhydritic shales. They note that for pure clay shales, in situ swelling pressures (from exposure to water) up to 0.3 MPa can be expected. Meanwhile they note that "for anhydritic shale rocks, extreme heave and the crushing of strong inverts were observed" (p. 361) and that "in anhydritic shales, where a chemical component influences swelling behavior, swelling pressures in the range of 2.0 – 2.5 MPa have been observed in situ." (p. 361). The very thin shales of the Salina group will easily fracture under this pressure and allow for fluid migration. As the authors note:

> Not all the interaction phenomena between shale and anhydrite/gypsum are understood, but there is definitely an interaction between swelling of shale (physical) and the transformation of anhydrite into gypsum (chemical effects).
>
> p. 378

The Stratigraphic Lexicon for Michigan, Bulletin 8, (2002) notes that the Salina A-1 Evaporate is salt (halite), and anhydrite. The Salina A-2 Evaporate is salt (halite), and anhydrite. (Salt layers will dissolve in solution and the anhydrite layers will transform to gypsum and dissolve). The

Salina A-2 carbonate is limestone and dolomite (porous and permeable). The Salina B-Unit is a massive salt formation. The Salina C-Unit strata consists of greenish-gray shale containing anhydrite nodules. The Salina E-Unit consists of carbonate and a series of gray, greenish-gray and red shales interbedded with thin porous Dolomites. The Salina F-Unit is salt, thin anhydrites, and thin anhydritic shale beds. The Salina G-Unit is a gray shaley dolomite easily removed by erosion. (porous and permeable). None of these layers will prevent upward migration of fluid.

4. **The injection zone will accept, but not contain the injection fluid. The Niagaran Group is both porous and *permeable*.**

The EPA October 2014 memorandum regarding geologic siting states: "the injection zone consists of dolotomized skeletal limestone and carbonate reef complexes that constitute '**very porous and permeable formations'.**" (bold emphasis added). The RTC likewise states that:

> The Niagaran, or Niagaran Group, is a vast limestone and dolomite rock structure underlying Michigan and parts of Illinois, Ohio, and New York. The Michigan Hydrogeologic Atlas describes the Niagaran rock group as generally very porous **and permeable...** [Att. B-11, p. 2]

Permeable means that fluids can flow through the strata. EPA suggests this will not happen because the injected fluid will spread horizontally, but they offer no evidence to prove this assertion. Meanwhile new evidence shows that there is a natural upward gradient in the southern Michigan basin so that the injected fluid will flow upward and contact the anhydrite confining zone. Petitioner notes that on page 18, ¶3 of their response in the West Bay #22 petition before the EAB, the EPA admitted that "Region 5 cannot say with certainty that upward migration will not occur."

EPA also asserted that their model shows that after 20 years of continuous injection, the injected fluid would migrate between 68 and 835 feet. This is a faulty model. The specific pressure gradient in the Michigan Basin is 0.43 lb/ft, thus the ambient pressure at the depth of this well is roughly 1290 psi. If you take the injection pressure allowed by the permit (683 psi) and add that to the ambient pressure and multiply it by the ability of pressure to move fluid (one atmosphere or 14.7 psi will lift/move water by 34 feet), this well could conceivably move/lift fluid to the surface unless checked by an impenetrable formation. There is also the potential for additional pressure created by the swelling of the Salina A-2 Evaporite formation upon contact with the injected fluid (which could range from 1.7 up to 4.7 MPa) which would dramatically multiply distance fluid is conveyed if such pressures actually came into play. In an over pressurized system, a depth pressure gradient greater than 0.465 psi for brines indicates a potential upward flow. (see Kreitler, Charles, *Journal of Hydrology,* 106 (1989) 29-53, HYDROGEOLOGY OF SEDIMENTARY BASINS).

5. The permittee did not conservatively limit injection pressure

The EPA did not conservatively limited injection pressure. For example, EPA Permit #MI-163-3G-A002, issued June 14, 2006 for the Sunoco Inkster Facility in Wayne County limited the injection pressure to 382 psi to prevent formation fracturing. In making this determination the EPA used 0.433 lb/ft for the specific pressure gradient in the Michigan basin and used 14.7 psi for the value of one atmosphere. The EPA also used a fracture gradient of 0.8 psi/ft as the default value for Michigan. So the EPA has previously determined that an injection pressure of 382 psi is

conservative and safe. But for the Haystead #9 well, the EPA is allowing nearly double this injection pressure. So much for safety.

6. **There are no impermeable formations above the Salina Group that will contain the injection fluid.**

The permittee claimed that "Many of the rock layers between the confining zone and the base of the USDW are impenetrable shales and evaporates which will prevent injection fluid from moving upward to enter the USDW. These shale layers include the Artim Formation, Bedford Shale, Bell Shale, Sunbury Shale, and Coldwater Shale. Formation and drilling records from nearby wells, including wells MDEQ #60076 and #60078, indicate that the Coldwater shale is nearly 1000 feet thick, and is present below the lowest USDW (ie Marshall Sandstone) from approximately 217 to 1,200 feet below ground surface."

Most of the shale layers that the EPA claims will stop upward migration of injected fluid once it escapes the confining zone are Devonian Shales, except for the Coldwater Shale (which is Early Mississippian and full of siltstone and sandstone) and the Sunbury Shale (which is Early Mississippian) according to the Stratigraphic Lexicon for Michigan, Bulletin 8, (2001). The Antrim Shale is Late Devonian. The Bedford Shale is Late Devonian (and full of Berea Sandstone). The Bell Shale is Middle Devonian. The fracture gradient for Devonian Shale varies with depth, according to a study conducted in eastern Kentucky and western West Virginia, ranging from over 1.0 psi/ft at shallow depths to generally between 0.4-0.6 psi/ft at 2,500 to 5,500 feet. It is noted that glacial unloading known to have occurred in the northern part of the basin could have resulted in shallow formations "readjusting" (McKetta, 1980). Devonian shales are water-sensitive formations, and most operators have used nitrogen as a fracturing fluid since the mid-1980s. Gas

pressures of 360 to 380 psi have produced fractures in the bedrock of the Ohio Shale and Berea Sandstone, thus providing far-reaching fractures for gas migration from the deep bedrock (Stidham and Tetrick, 2002). The Devonian Shales the EPA relies on as secondary confining layers are easily fractured. Recall that the EPA is permitting an injection pressure nearly double the pressure required to fracture these shales.

The Petitioner also directs the Board's attention to the drilling record attachments by geologists Fowler/Baker/Vancycle. Permit #60094 shows from 2416 - 2200 ft. a Bass Island/ Bois Blanc which consists of Dolomite (permeable), Anhydrite (subject to chemical change on contact with saltwater, and Limestone (permeable). From 2200 – 1978 ft. a Detroit River formation consisting of Anhydrite (chemical change) and Dolomite/Limestone (permeable). From 1978 – 1744 ft. an unnamed Shale embedded with Dolomite and Limestone (permeable). From 1744 – 1622 ft. a Traverse Limestone containing Bell shale (permeable). From 1622 – 1554 ft. another Traverse Formation Limestone (permeable). From 1554 – 1370 ft. an Antrim shale. From 1370 – 1230 ft. a Sunbury Shale with Berea Siltstone (permeable). And from 1230 – 290 ft. a silty Coldwater Shale (potentially permeable due to fractures created during isostatic rebound following retreat of glaciers).

The drilling record from Permit # 60011 (geologists Fowler/Baker/Vancycle) shows 2685 – 2416 ft. a G-Unit Dolomite grading to Anhydrite (permeable and subject to chemical change). From 2416 – 2200 ft. a Bass Island/Bois Blanc Dolomite, Anhydrite and Limestone formation (permeable and subject to chemical change). From 2200 – 1978 ft. a Detroit River Anhydrite and Dolomite/Limestone (permeable and subject to chemical change). From 1978 – 1744 ft. an

unnamed Shale interbedded with Dolomite and Limestone (permeable). From 1744 – 1622 ft. a Traverse Limestone containing Bell Shale (permeable). From 1622 – 1554 ft. another Traverse Formation Limestone (permeable). From 1554 – 1370 ft. an Antrim shale. From 1370 – 1230 ft. a Sunbury Shale/Berea siltstone (permeable). From 1230 to 290 ft. a silty Coldwater Shale (potentially permeable due to fractures created during isostatic rebound following retreat of glaciers).

7. The permittee misrepresented relevant facts regarding fluid migration.

The Weaver article (*Recent cross formational fluid flow and mixing in the shallow Michigan basin*, GEOLOGICAL SOCIETY OF AMERICA, Bulletin 107 (June 1995) studied an area of southwestern Ontario Canada that borders Michigan, and their analysis extended into central Michigan formations. The authors remark that:

> Other saline end members that could have been involved in this mixing process include the...Detroit River Group (Wilson and Long, 1993) in central Michigan, which are at depths of >1.5 km in the Michigan Basin.
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> p. 702

The authors posit glacial/post glacial origins for the phenomena of cross formation fluid flow and specifically state that:

> Stable-isotope data coincident with the local meteoric water line indicate that leakage of moderately saline, recently recharged meteoric water **has occurred since petroleum production began in the last century.** (bold emphasis added).
>
> p. 697

The authors also note that:

> ...regional fractures could have provided pathways for the large volumes of fluids **required to dissolve sufficient amounts of halite and anhydrite** from the Silurian formations to promote collapse. (bold emphasis added)
>
> p. 699

Please observe (once again!!!) that these geologists believe the dissolution of buried anhydrite by exposure to water to be an accepted scientific fact.

The Weaver article also provides evidence for potential fractures in the shale formations which the EPA states will contain the injected fluid, should it migrate past the anhydrite and salt layers of the Salina confining zone. The authors state:

> Upon deglaciation, bedrock and overburden sequences would have expanded at differential rates because of the different formation compressibility values. In the lithified Paleozoic sequence, this expansion may have created new fractures or reactivated or enlarged existing fractures.
>
> p. 706

And they conclude:

> Results of this research indicate that more recent cross-formational flow has occurred in this region. Saline fluids migrated vertically along fracture networks from depths of several hundred meters...Consequently, the shallow Michigan basin in this area should be viewed as a hydrogeologically active rather than static system.
>
> p. 706

B. THE PERMITTEE MISREPRESENTED THE COLDWATER SHALE AS IMPERMEABLE

The permittee claims that there are no known fractures in the Coldwater shale formation. The Petitioner would like to introduce new evidence to rebut this contention.[1] At the annual Geological Society of America meeting in Vancouver Canada, Wayne State University Department of Geology Professor Amanda M. Pruehs read a paper noting that:

> Existing groundwater flow models in Ann Arbor [Michigan] incorporate Mississippian Coldwater Shale bedrock as an impermeable basal layer. These models incorporate large Kx/Ky anisotropy ratios to correct for contaminant transport that does not follow observed flow path directions. An alternate explanation for contaminant flow pathway orientations is **the potential influence of bedrock as a transmissive basal layer.**
>
> ...Bedrock characteristics were investigated by examining the Coldwater Shale in available core and outcrop. Bedrock topography was remapped using newer well data. Local structural trends were evaluated using regional bedrock maps. **Results of core analysis reveal matrix permeability and low angle horizontal fractures. Observations of mapped Coldwater Shale outcrops document near vertical set joints along with low angle fractures indicating plausible transmissivity at scales that could affect contaminant transport model performance.** (bold emphasis added).

Professor Pruehs is investigating the migration of 1.4-dioxane below Ann Arbor but her investigation clearly shows the horizontal fractures in the Coldwater Shale formation existing due to isostatic rebound following the retreat of glaciers. The Coldwater Shale formation is not impermeable and the injected fluid containing known human carcinogens will migrate into our USDW.

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[1] Pruehs, Amanda, *Modeling Bedrock Transmissivity; Implications for Contaminant Transport in an Overlying Glacial Aquifer System,* Abstract of paper No. 17-11 presented in Vancouver Canada, GEOLOGICAL SOCIETY OF AMERICA, (October 2014).

CONCLUSION

The EPA lists these common components of oil field brines:

Benzene is a "conclusively" known human carcinogen and a notorious cause of bone marrow failure. Vast quantities of epidemiological, clinical, and laboratory data link benzene to aplastic anemia, acute leukemia, kidney cancer, and bone marrow abnormalities. Benzene exposure has been linked directly to neural birth defects, spina bifida, and anencephaly. **Ethylbenzene** exposure can irritate the eyes, nose, and throat. Very high levels can cause paralysis, trouble breathing, and death. High exposure may also damage the liver and chronic long term effects can last for months or years. **Toluene** exposure is associated with effects such as psychoorganic syndrome, visual evoked potential, toxic polyneuropathy, optic atrophy, brain lesions, and cerebellar, congnitive and pyramidal dysfunctions. Low to moderate levels can cause tiredness, confusion, weakness, drunken-type actions, memory loss, nausea, and loss of appetite, hearing, and color vision. **Xylene** is an irritant of the eyes and mucous membranes at concentrations below 200 ppm. Ingestion of xylene causes gastrointestinal distress, disturbances of liver and kidney function and may cause toxic hepatitis. Chronic exposure may cause central nervous system depression, anemia, mucosal hemorrhage, bone marrow hyperplasia, liver enlargement, and liver necrosis. **Naphthalene** is classified as "possibly carcinogenic to humans" and may damage or destroy red blood cells. Exposure may cause confusion, nausea, vomiting, diarrhea, cataracts, blood in the urine, and jaundice. Under California's Proposition 65, naphthalene is listed as "known to the State to cause cancer". **Polycyclic aromatic hydrocarbons** are known for their carcinogenic, mutagenic, and teratogenic properties. Prenatal exposure is associated with lower IQ and childhood asthma. The Center for Children's Environmental Health reports that

exposure to PAH during pregnancy is related to adverse birth outcomes including low birth weight, premature delivery, and heart malformations.

I request that the administrator issue a notice of intent to terminate the Haystead #9 permit under CFR § 124.5(d) to prevent the upward migration of these dangerous chemicals into our USDW. The permittee misrepresented relevant facts at the time; and the permitted activity clearly endangers human health and/or the environment and can only be regulated to acceptable levels by permit termination. The petitioner requests this action under § 144.40(a)(2) and (3).

Respectfully submitted,

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Dated: November 11, 2016

CERTIFICATE OF SERVICE

I hereby certify that on November 11, 2016 I did send a copy of my Request for Termination of Permit #MI-075-2d-0010 under CFR § 124.5 to EPA Administrator Gina McCarthy; EPA Acting Regional Administrator Robert Kaplan; and Region 5 Water Division Director Tinka Hyde by e-mail. Hard copy of copy of my Request for Termination of Permit #MI-075-2d-0010 under CFR § 124.5 was sent to Robert Kaplan, EPA Region 5, Environmental Protection Agency, 77 West Jackson Boulevard, Chicago, IL 60604-3507 by certified mail.

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