RESPONSE TO PUBLIC COMMENTS

U.S. ENVIRONMENTAL PROTECTION AGENCY (EPA)
UNDERGROUND INJECTION CONTROL (UIC) PERMIT # MI-075-2D-0009,
WEST BAY EXPLORATION COMPANY, WEST BAY #22 SWD WELL
JACKSON COUNTY, MICHIGAN

Introduction

This response is issued in accordance with Section 124.17(a), (b), and (c) of Title 40 of the Code of Federal Regulations, 40 C.F.R. § 124.17(a), (b), and (c), which requires that at the time any final EPA permit decision is issued, the Agency shall: (1) describe and respond to all significant comments raised during the public comment period; (2) specify which provisions, if any, of the draft decision have been changed and the reasons for the change; (3) include in the administrative record any documents cited in the response to comments; and (4) make the response to comments available to the public.

Background

A public comment period for this permitting decision began on October 16, 2014, and ended on November 24, 2014, for a total of 40 days. Under 40 C.F.R. § 124.10(b), EPA shall allow at least 30 days for public comment. EPA published a public notice on October 16, 2014, in the Jackson Citizen Patriot, and additionally mailed public notices on October 14, 2014 to: (1) interested parties who had contacted EPA to be placed on the mailing list; (2) people who had made comments during a previous public comment period; and (3) residents within a ¼ mile radius of the proposed West Bay #22 SWD injection well (West Bay #22 well). EPA also provided the West Bay #22 well draft permit to the Jackson Public Library and posted the draft permit on EPA's website for public viewing.

During the comment period, a public hearing was held at Columbia Elementary School in Brooklyn, Michigan, on November 20, 2014. Before the hearing EPA staff answered questions related to the West Bay #22 well. Approximately 20 members of the public attended, with 8 participants providing verbal comments and 2 attendees submitting written comments. Over the course of the comment period, EPA received 2 letters via U.S. Postal Service Standard Mail, and 8 commenters provided EPA with comments via email. Subsequently, EPA reviewed the comments made by the public, documented information necessary to clarify those issues, and developed this response to comments document.

Final Determination

EPA greatly values public input and appreciates the time all commenters took to express their concerns related to the proposed Class II permit for the West Bay #22 well. Many commenters were concerned about the potential for the well to contaminate their present and future sources of drinking water, and frequently asked how the aquifer will be protected.

The purpose of the UIC program is to protect Underground Sources of Drinking Water (USDWs) from endangerment by underground injection practices. The UIC regulations are designed to protect USDWs from contamination by: (1) identifying drinking water sources for protection: (2)

making sure the geological siting is suitable for injection; and (3) applying standards for well construction, operation, and reporting.

The UIC program protects current and future sources of drinking water by defining a USDW broadly. USDWs, by definition, include fresh water aquifers in current use as well as those that meet certain criteria indicating they could be used as drinking water, even if they aren't currently used. USDWs are defined based on quantity, current usage, and the concentration of dissolved solids in the aquifer. The concentration of dissolved solids is an indicator as to whether an aquifer has the potential to be potable, even if it is not currently used for drinking water.

Specifically, UIC regulations (40 C.F.R. §§ 144.3 and 146.3) define a USDW as any aquifer which is currently being used as a drinking water source or which is of sufficient volume and adequate quality to be a source for a public water system. An aquifer or portion of an aquifer which contains less than 10,000 milligrams per liter (mg/L) of total dissolved solids is considered a potential drinking water source and is therefore protected even if it is not in use. Potable water generally contains less than 500 mg/L of total dissolved solids. By protecting water supplies that have more dissolved solids than normal drinking water, the UIC program also protects USDWs that could be used in the future.

Based on the Michigan Hydrogeologic Atlas[1], and drilling and formation records in the vicinity of the West Bay #22 well (i.e., Michigan Department of Environmental Quality permitted wells #59996, #60010, #60011 and #60094)[2], the lowermost USDW has been identified as the Marshall Sandstone. The base of the Marshall Sandstone is located approximately 155 feet below ground surface. According to the United States Geologic Survey (USGS) Summary of Hydrogeologic Conditions by County for the State of Michigan[3], the Marshall aquifer ranges in thickness from 75 feet to more than 200 feet within the State of Michigan. Based on drilling records referenced above, the Marshall Sandstone is topped by unconsolidated glacial drift at a depth of approximately 88 feet to the ground surface. These formations, the Marshall Sandstone and the unconsolidated glacial drift, are considered USDWs in Jackson County, Michigan, because they are aquifers which contain less than 10,000 mg/L of total dissolved solids and are considered potential drinking water sources.

The geologic siting of the West Bay #22 well is suitable for underground injection. Injection will occur in the Niagaran rock formation within the interval between 2,662 and 3,032 feet below ground surface. The top of the injection zone is separated from the bottom of the USDW by approximately 2,436 feet of rock formation layers. The Niagaran, or Niagaran Group, is a vast limestone and dolomite rock structure underlying Michigan and parts of Illinois, Indiana, Ohio, and New York. The Michigan Hydrogeologic Atlas[1] describes the Niagaran rock group as generally very porous and permeable, and readily accepting a wide range of fluids.

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[1] Michigan Hydrogeologic Atlas, Part I (Hydrology for Underground Injection Control in Michigan) and Part II (atlas maps), Department of Geology, Western Michigan University, Kalamazoo, Michigan, 1981.

[2] Document IDs #WB-155, #WB-156, #WB-157, and #WB-158, In West Bay #22 Administrative Record.

[3] Apple, Beth A. and Howard W. Reeves—Summary of Hydrogeologic Conditions by County for the State of Michigan—U.S. Geological Survey Open-File Report 2007-1236, 87 pp. Date Posted: September 21, 2007: [http://pubs.water.usgs.gov/ofr2007-1236/]

The injection zone is topped by the Salina Group. According to the Michigan Hydrogeological Atlas, the Salina group is a thick sequence of carbonate, anhydrite, shale, and salt formations that will act as a confining layer to prevent flow out of the injection zone[4]. The Salina group contains an essentially impermeable formation called the A-1 Evaporite. The Michigan Hydrogeologic Atlas describes the A-1 Evaporite as essentially impermeable and an excellent confining layer[5].

Above the A-1 Evaporite sit multiple formations of carbonate, anhydrite and shale. The Michigan Hydrogeologic Atlas describes each of the above-mentioned formations as excellent confining layers, due to their low permeability and porosity[6]. Formations in this group contain thick salts, which make them "essentially an aquiclude," or a structure preventing passage of water.

In addition, many of the rock layers between the confining zone and the base of the lowermost USDW are impermeable shales and evaporites[7]. These impermeable formations will also prevent injection fluid from moving upward and entering the USDWs, thus acting as additional confining zones. Shale formations acting as additional confining layers above the actual confining zone include the Antrim Formation, Bedford Shale Formation, Bell Shale Formation, Sunbury Shale Formation, and Coldwater Shale Formation[8]. Formation and drilling records for nearby wells, including wells MDEQ #60096, #60011 and #60010[2], indicate that the Coldwater Shale is nearly 1000 feet thick, and is present below the lowest USDW (i.e., Marshall Sandstone) from approximately 217 to 1,200 feet below ground surface.

In addition to the West Bay #22 well being sited in an area in which the geological formations are appropriate for injection, injection wells must be constructed and operated to prevent the injection fluid from contaminating a USDW. The West Bay #22 well will be drilled to approximately 2,950 feet below surface, and will be constructed with three casing strings (steel pipes), set to 350, 900, and 2,680 feet, respectively. All steel casing strings will be cemented over their entire length to preclude the movement of fluids into and between USDWs due to injection operations.

Injection will take place through steel tubing which is set within the long-string casing. A packer set at the bottom of the tubing will seal off the space between the casing and tubing. This space, called the annulus, will be filled with a liquid mixture containing a corrosion inhibitor, and the pressure of the annulus liquid will be monitored to detect changes in pressure which indicate a leak. The pressure in the space between the tubing and casing (annulus) will be tested initially after the completion of the well to ensure that the well has mechanical integrity and monitored weekly thereafter to ensure that the well maintains mechanical integrity.

Any loss of annulus fluid is reported at least quarterly. If monitoring indicates a leak or if the well should fail a mechanical integrity demonstration, then the well will be shut down until corrective actions have been taken and the well has been brought back into compliance. Any

[4] Document ID #WB-146 In West Bay #22 Administrative Record, Page II-42 "Salina Group".
[5] Document ID #WB-146 In West Bay #22 Administrative Record, Page II-43 "A-1 Evaporite".
[6] Document ID #WB-146 In West Bay #22 Administrative Record, Page II-42 to Pages II-55
[7] Document ID #WB-147 In West Bay #22 Administrative Record
[8] Document ID #WB-146 In West Bay #22 Administrative Record, Page II-80, II-83, II-76 & II-91

work performed on the well that requires the moving and/or removal of the tubing or packer must be followed by a mechanical integrity test before authorization to resume injection will be given. Under permit conditions, the injection pressure will be limited to ensure the safe operation of the well and monthly reports of pressure and flow rates must be submitted to EPA for review.

Following review of the permit application, EPA has determined that the permitted well injection will not impact drinking water supplies. The geologic siting, engineering and construction, and operating and monitoring standards applied to the West Bay #22 well are sufficient to protect the USDW. The Agency has determined that the public comments submitted did not demonstrate deficiency of the application based on UIC Program requirements for approval, and did not raise issues which would alter EPA's basis for determining that it is appropriate to issue West Bay Exploration Company a permit to construct and operate the proposed injection well. Therefore, EPA is issuing a final permit for the West Bay #22 well to West Bay Exploration Company.

General and Out of Scope Comments

EPA regulations at 40 C.F.R. Parts 144 and 146 state the requirements and standards that a permit applicant must meet to have a UIC permit application approved. Those regulations define the general scope of EPA's authority and review process. Federal regulations require EPA to briefly describe and respond to significant comments received on UIC draft permits.

This document describes and responds to all written and verbal comments that EPA received during the public comment period and at the November 20, 2014 public hearing. This document paraphrases comments by topic, as in some instances multiple parties submitted comments addressing the same topic.

EPA received some general comments and comments directed at matters outside the scope of the UIC program's purview. EPA acknowledges the submittal of these comments and clarifies that because they raise matters that are not addressed by the UIC regulations and are outside the scope of the UIC permit process, EPA does not respond to them specifically in this document.

The comments falling into the "out of scope" category focus on topics including:

- Background information on the commenters or the West Bay #22 well
- Other Class II wells
- Hydraulic fracturing where other than diesel is used
- Failure rate of injection wells
- Surface facilities
- General introductory statements to specific concerns
- General definitions

These general comments are listed on the next page without response. Specific comments that address topics that are within the scope of this permitting decision, with responses, follow in subsequent sections.

Although EPA is not directly responding to general statements of support and opposition to the permit individually, it did consider them in making its decision to issue the final permit.

- What is the status of West Bay UIC permit #MI-075-2D-0010?
- What is the status of construction at the Haystead #9 SWD well?
- What restrictions are in place concerning the size of propants used?
- What is the number of deep wells in Michigan or nationally, which have failed and polluted groundwater?
- Concerns raised about contamination due to hydraulic fracturing.
- What is the life expectancy of an injection well?
- Would West Bay be able to bring wastewater from its wells in other parts of the state, and inject it into the West Bay #22 well?
- What is the definition of non-hazardous?

Additional out-of-scope comments related to permits needed for remote pipeline(s) used to facilitate injection; concerns about damage to the roads from increased truck traffic; added risk to traveling or walking near roads due to truck traffic; species that may be introduced to the area during pipeline construction; and concerns over noise and smells from the proposed well site. Regarding these concerns, the UIC program does not regulate and the UIC permitting process does not evaluate the broader operation of surface facilities, or surface activities such as the construction of roads, pads, tanks, pipelines, or other surface facilities. Questions about surface activities should be directed to:

Lansing District Office
Office of Oil, Gas, and Minerals
Louis Schineman, Environmental Manager
Constitution Hall, 1st Floor, South East
525 W. Allegan Street, P.O. Box 30242
Lansing, MI 48909-7742
phone: (517) 284-6651
fax: (517) 241-3571

Additionally, you can find MDEQ's website and the Office of Oil, Gas, and Minerals page at http://www.michigan.gov/deq/0,4561,7-135-3306_57064---,00.html

Significant Comments

Comment #1
Provide the status of West Bay Exploration Company's UIC permit #MI-075-2D-0009.

Response to Comment #1 - On October 16, 2014, EPA issued a draft permit for West Bay Exploration Company's (West Bay's) West Bay #22 well (UIC permit #MI-075-2D-0009). A public comment period started on October 16, 2014 and ended on November 24, 2014. EPA collected and reviewed all comments made during the comment period. In accordance with 40

C.F.R. 124.17, EPA prepared this response to comments document, responding to all in-scope comments, and is issuing a final permit decision.

Comment #2
Provide the status of construction at West Bay‘s injection well, the West Bay #22 well.

Response to Comment #2 – No construction has yet occurred. In accordance with 40 C.F.R. §144.11, the construction of any well required to have a permit is prohibited until the permit has been issued. Once the permit decision is made, the permittee cannot begin construction on the well until the effective date of the permit, stated on page 1 of the final permit.

Comment #3
Please explain how the EPA is protecting our environment. In particular, concerns were raised about the safety of the area’s drinking water, watersheds and surrounding lakes and rivers.

Response to Comment #3 – The purpose of the UIC program is to protect underground sources of drinking water (USDWs) from being contaminated by underground injection practices. Regulations at 40 C.F.R. Parts 144 and 146 state the requirements and standards that a permit applicant must meet to have a UIC permit application approved. The UIC regulations are designed to protect USDWs from contamination by: (1) identifying drinking water sources for protection; (2) making sure the geological siting is suitable for injection; and (3) applying standards for well construction, operation, and reporting.

Furthermore, UIC permit requirements will help protect surface water indirectly by protecting the USDW or groundwater aquifers (i.e., freshwater in the Marshall Sandstone and unconsolidated glacial drift USDWs) to which the surface waters may be connected and preventing upward movement of injected fluids. A watershed’s connection with aquifers is limited to the aquifers that have connections with surface bodies of water like rivers. While area lakes and streams, including the River Raisin, may be in hydraulic communication with shallow groundwater or depend on shallow groundwater for flow, they are not deeper than the base of the lowermost USDW and there is no hydrologic connection with the injection zone. Similarly, wetlands such as nearby prairie fens are also shallower than the lowermost USDW. Because the lowermost USDW (i.e., Marshall Sandstone) will be protected, prairie fens that are fed by the subsurface groundwater will also be protected. For more information, please see the “Final Determination” section at the beginning of this document.

Comment #4
Permit terms should be consistent with all the necessary requirements.

Response to Comment #4 – EPA regulations detailed in 40 C.F.R. Parts 144 and 146 state the requirements and standards that a permit applicant must meet to have a UIC permit application approved. Specifically, 40 C.F.R. Part 144, Subpart E – Permit Conditions, outlines all necessary conditions for UIC permits. These regulations deal primarily with the geologic siting, well engineering, operating, and monitoring standards for underground injection wells. The terms of the permit implement these requirements.

Comment #5
There was a failure to notify an appropriate segment of the population about the hearing on November 20th, specifically failure to notify everyone that would be harmed by contaminated water, should the well fail/leak.

Response to Comment #5 – In accordance with 40 C.F.R. §124.10 and §124.12, EPA published a public notice in The Jackson Citizen Patriot, a newspaper serving Jackson County, Michigan to reach people who might have an interest in the draft permit. The public notice was published on October 16, 2014, 33 days prior to the public hearing. EPA also mailed public notices to residents within the ¼-mile area of review, to people on our UIC mailing list[9] (which includes people interested in UIC wells in the state of Michigan that requested to be notified in accordance with §124.10(c)(ix)) and to Federal, State and local officials, on October 14, 2014. These public notices contained website addresses for the draft permit to be viewed on-line and for EPA's UIC website, which contains in-depth information about the Safe Drinking Water Act (SDWA), the UIC program, and Class II wells. The notices included the location, date, and time of the public hearing, the permit writer's name, e-mail address, and phone number, and invited questions and comments. EPA also confirmed that a copy of the West Bay #22 well draft permit was delivered via the United States Postal Service to the Jackson Public Library Reference Department for public viewing.

Comment #6
What will happen if there is a spill on the site, and what will happen if contamination does occur? Who will be responsible for clean up if the well fails/leaks?

Response to Comment #6 – The UIC Class II regulations require the permittee to provide financial assurance of the permittee's ability to properly plug the well at any time, should plugging be necessary. There are no provisions under the SDWA which would allow the EPA to require Class II well owners/operators to be bonded for other reasons, including the cleanup costs of any potential contamination. However, the Class II well owner/operator is responsible for any potential contamination that occurs on or from the site.

The SDWA prohibits contamination of USDW by underground injection. Under Section 1431 of the SDWA, EPA can require operators to clean up any contamination of a USDW due to injection and/or supply alternative water supplies to affected parties. An operator is required to do what any reasonable person would do to correct environmental damage. A reasonable action might be to contain any surface spill and remediate groundwater contamination. Language in the final permit refers to establishing and maintaining mechanical integrity (MI) in accordance with 40 C.F.R. §146.8. Maintaining MI helps to ensure there are no leaks in the well, and in accordance with the permit conditions all injection must cease if MI is not maintained. West Bay will remain responsible for ensuring that the groundwater is protected from contamination due to injection.

The Michigan Department of Environmental Quality (MDEQ), under The Environmental Response Act 307 of 1982, can also require operators to clean up any contamination due to

[9] Document ID #WB-175 In West Bay #22 Administrative Record

injection, and/or supply alternative water supplies to affected parties. Under the terms of the final UIC permit, West Bay will be required to plug the well with multiple cement plugs when it is no longer used, and West Bay has secured a surety bond that will provide the funds for EPA to properly plug the well if West Bay fails to do so. Furthermore, EPA has additional programs (e.g., the Comprehensive Environmental Response, Compensation and Liability Act of 1980 or "CERCLA", and the Resource Conservation and Recovery Act, or "RCRA") to clean up sites and to compel responsible parties to perform cleanups or reimburse the government for EPA-led cleanups.

Comment #7
Concerns were raised regarding groundwater contamination due to unchecked, un-capped and forgotten injection wells near the proposed site.

Response to Comment #7 – In accordance with 40 C.F.R. §146.24 (3), West Bay submitted a tabulation of data on all wells within the area of review. The tabulation included information on well type, construction, date drilled, location, depth, and date of plugging (if applicable). EPA reviewed this data and found that there are no improperly plugged wells that could be a conduit for contamination.

Furthermore, EPA compared this information with an MDEQ online database. MDEQ keeps detailed records of all known wells, including orphan wells, and has a fund to plug them. EPA has searched for historical well records within the ¼ mile area of review (AOR) using MDEQ's GeoWebFace Mapping Application (http://ww2.deq.state.mi.us/GeoWebFace/#) and has not found any improperly plugged wells. It is very unlikely that there is an unknown orphan well in the area of the proposed well, and even less likely that it would serve as a conduit for brine to move upward. However, if that were to occur, West Bay would be required to plug the old well and remediate the surface.

Comment #8
It might be possible for the injection well to leak into the groundwater.

Response to Comment #8 – The risk of a leak from this well is very small, and the risk of contaminating a USDW is much smaller. The design, engineering, construction, operation, and maintenance requirements provide a high level of confidence that a leak will not occur. Furthermore, a confining zone sits above the injection zone to prevent movement of fluids from leaving the injection zone. For more information, please see the "Final Determination" section at the beginning of this document.

Comment #9
Present how West Bay will monitor the integrity of the well for leaks.

Response to Comment #9 – There are several safeguards to prevent the well from contaminating an underground source of drinking water. EPA requires well casings to be cemented from the bottom of the casing to the ground surface. Injection takes place through tubing set within the casing. In addition, the applicant is required to conduct and pass a Mechanical Integrity Test (MIT), in accordance with the permit and 40 C.F.R. § 146.8, before

authorization to inject is granted, and after the well is completed. The applicant is also required to repeat the MIT at least once every five years thereafter. The UIC monitoring and testing requirements are designed to detect pressure changes between the tubing and annulus, thereby promptly detecting a leak. If a leak is detected, the permit requires the operator to immediately cease operating the well until the leak is fixed and the repair is confirmed through testing. West Bay must also comply with all reporting requirements in the final permit, which require monitoring annulus pressure, injection pressure, fluid loss and the specific gravity of the injectate. If monitoring indicates a leak or if the well fails a MIT, then the well will be shut down until corrective actions have been taken and the well has been brought back into compliance.

Comment #10
Was the rock used as a confinement layer ever tested to see if the integrity of the rock can withstand prolonged exposure to brine?

Response#10 – Brine originates from deep rock formations. EPA has reviewed the formations identified as the confining layers. Please see the "Final Determination" section at the beginning of this document and response #11 for more information about the geologic review for the West Bay #22 well. The geology of the site is suitable for injection.

Comment #11
Concerns have been raised over the confining zone, specifically the anhydrite formations, and their ability to confine the injectate in the injection zone.

Response to Comment #11 - The UIC Regulations at 40 C.F.R. §146.3 define a confining zone as a geological formation, group of formations or part of a formation that is capable of limiting fluid movement above an injection zone. The confining zone acts as a barrier to fluid migrating upward out of the injection zone, making it unlikely that the injection fluid will rise above the injection zone. The Salina Group is the primary confining zone for the West Bay #22 well, and is above the injection zone.

The commenter argues that anhydrite layers of rock in the confining zone (i.e., Salina Group) are not adequate confining layers. Specifically the commenter states that anhydrite will dissolve when in contact with the injected fluid, or transform into less competent minerals, and otherwise let injected fluid out of the injection zone, and into contact with ground and possibly surface water. The commenter references laboratory experiments for the basis of his argument.

EPA disagrees with the commenter's statements regarding the confining zone of the West Bay #22 well and anhydrite. The Michigan Hydrogeological Atlas identifies the Salina group as a thick sequence of carbonate, anhydrite, shale, and salt formations that will act as a confining layer to prevent flow out of the injection zone[10]. This sequence of rock blocks the passage of water and is considered a confining unit, due to poor water transmitting rates, as described in the Michigan Hydrogeologic Atlas.

[10] Document ID #WB-146 In West Bay #22 Administrative Record, Page II-42 "Salina Group"

The Salina group contains an essentially impermeable formation called the A-1 Evaporite. The Michigan Hydrogeologic Atlas describes the A-1 Evaporite as essentially impermeable and an excellent confining layer[11]. Above the A-1 Evaporite sit multiple formations of carbonate, anhydrite and shale. Formations in this group contain thick salts, which make them "essentially an aquiclude", or a structure preventing passage of water.

Generally massive anhydrite, including layers such as the Salina A-2 Evaporite (a common formation in the Salina Group), is impermeable. In geology, the term *massive* means homogeneous and crystalline. Anhydrite layers, such as the Salina A-2 Evaporite, are well-documented in the Michigan Hydrogeologic Atlas as geologic barriers to fluid flow. Specifically the Michigan Hydrogeologic Atlas describes the Salina Group as "essentially an aquiclude". Additionally, the Salina A-2 Evaporite is described as often found as a cap rock or salt dome, trapping oil or natural gas in subsurface reservoirs.

EPA has permitted many wells across Michigan with the same injection and confining zones as the West Bay #22 well. The Michigan Hydrogeologic Atlas describes each of the above-mentioned formations as well as the rest of the Salina Group as excellent confining layers, due to their low permeability and porosity[12]. The behavior of a rock layer depends on many factors, such as its thickness, flexibility, and chemical composition, as well as the pressure it is under. Individual factors are not a sole determining factor of a rock group's suitability as a confining zone. Based on technical studies of the geology of Michigan, such as the Hydrogeologic Atlas of Michigan, EPA has determined the Salina Group, including anhydrite layers (e.g., Salina A-2 & A-1 Evaporite), is a suitable confining zone.

In addition, many of the rock layers between the confining zone and the base of the lowermost USDW are impermeable shales and evaporites[13]. These impermeable formations will also prevent injection fluid from moving upward and entering the USDW. These shale formations acting as additional confining layers above the actual confining zone include the Antrim Formation, Bedford Shale Formation, Bell Shale Formation, Sunbury Shale Formation, and Coldwater Shale Formation[14]. These formations are well documented in the Stratigraphic Nomenclature for Michigan and the Michigan Hydrogeologic Atlas.

The commenter cited several sources for anhydrite information in the comment, but these sources do not support findings that the Salina Group is a poor confining zone or that operation of the West Bay #22 well would dissolve anhydrite layers to create a pathway into a USDW. The research cited by the commenter concerns mineral reactions in situations that are not analogous or relevant to the Salina Group below the West Bay #22 well site. For example, the commenter mentions research experiments that investigate chemical reactions at surface conditions or evaluate anhydrite as it is used in cement and concrete. These experiments relate to the formational origin of evaporite minerals, not their behavior at depth with respect to fluids. Such work has little or no relevance to gauging the behavior of the anhydrite layers at approximately 2,600 feet below the surface, where the pressure and temperature regime is much

[11] Document ID #WB-146 In West Bay #22 Administrative Record, Page II-43 "A-1 Evaporite"
[12] Document ID #WB-146 In West Bay #22 Administrative Record, Page II-42 to Pages II-55
[13] Document ID #WB-147 In West Bay #22 Administrative Record
[14] Document ID #WB-146 In West Bay #22 Administrative Record, Page II-80, II-83, II-76 & II-91

different and influences mineral reactions and rock behavior. Other articles submitted provide information about whether gypsum or anhydrite is the preferred depositional mineral phase in present-day environments, as a way of investigating whether gypsum in the rock column was formed from anhydrite or deposited as gypsum. The processes investigated here are the original formation of evaporites in the ancient environment, not the reaction of solutions with crystalline anhydrite beds, and therefore is not an investigation on how rock will behave at depth. This information does not give EPA cause to believe that the geologic siting of West Bay #22 is inappropriate.

MDEQ has permitted several oil production wells, MDEQ permit numbers #59996, #60094, #60011, and #60010, close to the proposed well site. EPA reviewed the drilling and formation records for these wells, which show that the Niagaran is present at those wells at the approximate depths stated in the permit application for the West Bay #22 well. MDEQ permit #59996 will share the same well pad as the West Bay #22 well and will be in the closest proximity to the well site. The drilling records for #59996 show that layers of dolomite and limestone are present at an approximate depth of 2,660 feet below ground surface (bgs). Drilling records for these other wells also show 1) the presence of the Salina Group as the first confining zone; and 2) that the Salina Group's composition is consistent with its description in the Michigan Hydrogeological Atlas[15].

There are several safeguards established to prevent the West Bay #22 well from contaminating an underground source of drinking water. EPA requires well casings to be cemented to the surface. Injection takes place through tubing set within the casing. In addition, the applicant is required to conduct and pass a MIT, in accordance with 40 C.F.R. § 146.8 before authorization to inject is granted, and after the well is completed. The applicant is also required to repeat the MIT at least once every five years thereafter.

The UIC monitoring and testing requirements are designed to detect pressure changes between the tubing and annulus, thereby allowing prompt detection of a leak. If a leak is detected, the UIC regulations require the operator to immediately cease operating the well until the leak is fixed and the repair is confirmed through testing.

The construction proposed in the West Bay #22 application[16] will help ensure protection of the USDWs and is consistent with the UIC regulations. The open hole for the proposed injection well will be from approximately 2,680 feet bgs to the total depth of the well at 2,950 feet bgs. The construction of the well will consist of three separate casings, starting with an 11 3/4-inch diameter casing, set at approximately 350 feet bgs. The second casing will be an 8 5/8-inch diameter casing set at approximately 900 feet bgs inside the first casing. The last casing will be a 5 1/2-inch casing diameter set at an approximate depth of 2,680 feet bgs inside the second casing. Each of these casings will be cemented to the surface to prevent any fluid from migrating past the well casing. As the lowest USDW extends from the surface to 226 feet bgs, the USDWs will be protected with three levels of casing, each cemented to the surface. In addition, the fluid will be injected through tubing inside the third casing. West Bay will be required to submit all

[15] Document ID #WB-146 In West Bay #22 Administrative Record
[16] Document ID #WB-1 In West Bay #22 Administrative Record

well completion records to EPA to ensure both the accuracy of the formation depths, and the construction of the well.

The Michigan Hydrogeological Atlas shows that the confining zone along with other formations of shale and evaporites, such as the Antrim Formation, Bedford Shale Formation, Bell Shale Formation, Sunbury Shale Formation, and Coldwater Shale Formation above the confining zone, will prevent any fluid from migrating upward into a USDW[6]. The Michigan Hydrogeologic Atlas also shows that the proposed injection zone, the Niagaran, will accept the proposed injection fluid. Drilling logs from nearby production wells confirm the presence of the proposed confining layers and injection layers. Given the information above, EPA has determined that the site proposed for the West Bay #22 injection well is acceptable for a brine injection well.

Comment #12
What effect will the well have on habitats of endangered species, in particular the Indiana Bat?

Response to Comment #12 – In accordance with 40 C.F.R. §144.4(c) EPA reviewed the threatened and endangered species lists for Jackson County to ensure that actions authorized by the EPA are not likely to jeopardize the continued existence of any endangered or threatened, or proposed endangered species, or to adversely affect their critical habitats. This information showed that there are currently four species in Jackson County that are federally listed or proposed to be listed as endangered or threatened. These species include:

- Indiana Bat (Myotis sodalis) (endangered)
- Northern Long-Eared Bat (Myotis septentrionalis) (threatened)
- Mitchell's Satyr (Neonympha mitchellii mitchelli) (endangered)
- Poweshiek Skipperling (Oarisma poweshiek) (proposed as endangered)

While reviewing the West Bay #22 well application, EPA took the habitats of these species into consideration. EPA consulted the United States Fish and Wildlife Service (USFWS) fact sheets on each of the species listed in the area. Each fact sheet provided information including a species' habitat in different seasons and information regarding preventing or minimizing potential impacts to that species. According to USFWS, the Indiana Bat roosts in trees in riparian bottomland and in upland forests from approximately April 1 to mid-October[17]. Indiana Bats are known to hibernate in cool humid caves with a specific temperature of 50° F. There are not any suitable winter habitats in the area of the proposed well site. During the summer, bats migrate to wooded areas where they usually roost under loose tree bark or dead trees. They also forage in or along the edges of forested areas[18].

West Bay has previously constructed four production wells permitted by the MDEQ within 1/4 mile of the proposed West Bay #22 well site (MDEQ #59996, #60010, #60011 and #60094). The proposed West Bay #22 well will share the same well pad and access roadway as one of these

[17] "Summer Life History Information for Michigan" January 2007 (http://www.fws.gov/midwest/endangered/section7/s7process/mammals/inba/inbaMIlifehist.html)
[18] Service, U.S. Fish & Wildlife. Indiana Bat Fact Sheet. 4 June 2014. Website/Document. 17 June 2014. <http://www.fws.gov/midwest/endangered/mammals/inba/index.html>.

production wells, MDEQ permit #59996. Since the well pad and access roadway for the West Bay #22 well are already built, construction of the West Bay #22 well will not require clearing any wooded areas, and so would not impact summer habitat for the Indiana Bat.

EPA reviewed the MDEQ permit files for these production wells, on MDEQ's website[19]. Each permit states there will be no clearing of any suitable habitat for endangered species and specifically mentions habitat for the Indiana Bat. Construction of these wells started during months when the bats were hibernating and not roosting in forested areas. During construction of these wells, earthen berms were also constructed around the well sites to protect any existing surface waters that might be a suitable habitat for others among the species listed above.

In August 2013, West Bay hired Westshore Consulting to conduct a biological and ecological site assessment and to gather information regarding endangered, threatened, and candidate species at the proposed West Bay #22 well location[20]. This review covered species, soils, and vegetation, as well as a description of the "action area" which is the area that would be affected by construction of the West Bay #22 well. Westshore's report describes habitats of each of the above species. Each habitat description in the Westshore report matches the USFWS' description of habitats for these species listed above.

The Westshore report describes the action area as predominantly agricultural landscape. According to the Westshore report, there are no reports of any wooded or forested areas in the action area that will provide habitats for endangered or threatened species. There are depressional wetland areas and mixed forested wetlands toward the east of the site, but outside the action area. EPA reviewed the MDEQ wetland map viewer[21] and it states that there are no state protected wetlands within one mile of the site.

Directional photos in the Westshore report[20] indicate that there is little to no vegetation in the action area. Access to the site is by an existing dirt road toward the southeast corner of the site. The action area is in the middle of the existing, plowed field with little to no vegetation. Drilling of the proposed well will not require any clearing or removal of any shrubs or trees and there is no need to build additional roads[20]. The measures taken in construction of the well will have no effect on any threatened, endangered or proposed endangered species or their habitats on the proposed site.

Comment #13
There was an inadequate search for seismic activity in the area.

Response to Comment #13 – Although not required to by regulations pertaining to Class II wells, when reviewing the West Bay #22 well application EPA used multiple means to check for the following conditions at the West Bay #22 well site: 1) stressed faults; 2) pressure build-up;

[19]The Michigan Department of Environmental Quality (MDEQ) Site. The GeoWebFace Web Accessible Maps, Data, Files Application, 2013. Web. 15 March 2013. http://ww2.deq.state.mi.us/GeoWebFace/#
[20]Westshore Consulting -West Bay 22 SWD, Section 22, Novell Township, T4S, R2E, Jackson County, Michigan
[21]Michigan Department of Environmental Quality. One. August 2001-2014. Map Viewer. August 2014. <http://www.mcgi.state.mi.us/wetlands/mapBasic.aspx>.

and 3) a pathway for increased pressure to communicate with any fault[22]. As explained further below, EPA found no evidence of any of these conditions.

EPA used several sources of geologic and seismic data during its evaluation of the West Bay #22 well permit application, and determined that the geologic siting of the well is suitable for underground injection. Stress faults are one of the key components to induced seismicity. Michigan geology has been well documented in the Michigan Hydrogeologic Atlas[23] and the proposed injection zone (the Niagara Group) is not known to have fractures or other faults. In addition, an EPA Geologist and two environmental scientists analyzed seismic data[24] and geophysical profiles submitted by West Bay. The seismic data and geophysical profiles[25] submitted demonstrate that there are no known fractures or faults present in the Niagara injection zone within the vicinity of the proposed site of the West Bay #22.

Furthermore, EPA used USGS on-line tools to evaluate both the seismic history and probability of earthquakes within the region of the proposed well location. More specifically, a search of historic seismic activity of the region using USGS's Global Earthquake Search Application[26] initially revealed no observed earthquakes within 80 km (approximately 50 miles) of the proposed West Bay #22 well during the last 200 years. Upon further review on the USGS website, one seismic event was reported in Coldwater, Michigan in 1947. Even though this event did not appear on an initial search, the distance of this event from the well site and the infrequency of events in the area did not change the outcome of EPA's findings. Knowledge of seismic events originating in the vicinity of the proposed well can be informative about whether faults exist in that location. Faults that commonly cause earthquakes are often in crystalline formations (deeper geologic formations of igneous or metamorphic rock that underlie layers of sedimentary rock) in the basement rock. In this case, the proposed injection zone is much shallower than the basement rock, and is not in a crystalline formation.

The USGS data referenced above indicate that the proposed West Bay #22 well site is not seismically active. The lack of seismic activity is evidence that the geologic siting is appropriate for injection, and indicates that there are no active faults in a stressed state in the area.

EPA also used the USGS's Earthquake Probability Mapping Application[27] to map the probability of an earthquake within 50 km (31.06 miles) of the proposed West Bay #22 well. The results of this query indicate that there is a less than 3% chance of a 5.0 magnitude earthquake or greater occurring within 50 km of the proposed well during the next 250 years. Based on the absence of faults and fractures under stress in the injection zone, review of site-specific seismic data, small

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[22] Workgroup, UIC National Technical. (Draft) 2014. *Minimizing and Managing Potential Impacts of Injection - Induced Seismicity Class II Disposal Wells: Practical Apporaches.* Washington, DC: US Environmental Protection Agency.

[23] Document ID #WB-146 In West Bay #22 Administrative Record

[24] Document ID #WB-161In West Bay #22 Administrative Record

[25] Seismic cross section entitled "Perspective Salt Water Disposal Wells, Napoleon Field, Jackson County, Michigan" in West Bay #22 Admin. Record

[26] Document ID WB-151 In West Bay #22 Administrative Record

[27] Document ID WB-149 In West Bay #22 Administrative Record

earthquake probability and a history of low seismic activity, it is very unlikely that a significant seismic event would occur.

After significant review, EPA concludes that the proposed site for the West Bay #22 well lacks all the conditions that can lead to significant seismic events. The geology of the proposed site is clear of any known faults or fractures that are in such a state of stress as to potentially cause an earthquake. There is no significant history of seismic activity in the area of the proposed well, indicating that the area is not seismically active. The permit for the West Bay #22 well also contains injection limitations to prevent any pressure building up in the injection zone. Increasing formation pressure is also an important factor when considering the potential to induce seismicity. EPA calculates maximum injection pressure (MIP) with conservative values. In particular, EPA adds a safety factor of .05 to the specific gravity of West Bay representative brine analysis when calculating MIP. This prevents formations from fracturing and creating migration pathways. EPA also requires injection pressure monitoring and reporting in our Class II permits. In conclusion, EPA determines that the proposed West Bay #22 site is not seismically active.

Comment #14
The maximum injection pressure is based on false assumptions.

Response to Comment #14 - The maximum injection pressure was calculated using the following formula: [{.80 *psi/ft* - (0.433 *psi/ft*)(specific gravity)} x depth] - 14.7 *psi*. The maximum injection pressure is dependent upon depth and specific gravity of the injected fluid. The Niagara Group at 2,662 feet was used as the depth and a specific gravity of 1.193 was used for the injected fluid.

The specific gravity was taken from a third party analysis of the injectate that will be injected in the proposed well. EPA requires all permittees to submit operating data with the permit application, including source and analysis of the physical and chemical characteristics of the injection fluid. This includes the specific gravity used to calculate the maximum injection pressure. West Bay submitted an analysis with the specific gravity of 1.193.

EPA also adds a safety factor of .05 to the specific gravity, making the specific gravity used to calculate the maximum injection pressure 1.243. Attachment A of the draft permit and likewise now the final permit for the West Bay #22 well requires West Bay to submit a lab analysis with the chemical composition of the injection fluid on an annual basis. This analysis includes specific gravity.

Comment #15
There should be full disclosure on details of the injectate and a requirement by the EPA stating what type, and levels, of toxic substances will be allowed.

Response to Comment #15 - EPA requires all permittees to submit operating data with the permit application, including source and analysis of the physical and chemical characteristics of the injection fluid. Furthermore, the permit requires West Bay to submit an annual chemical composition analysis of the injection fluid. This analysis shall include but is not limited to the

following: sodium, calcium, magnesium, barium, total iron, chloride, sulfate, carbonate, bicarbonate, sulfide, total dissolved solids, pH, resistivity and specific gravity. Submission of this report is required by the permit in attachment A. This information is available to the public.

Comment #16
What happens if West Bay sells the proposed injection well? Will the same injectate be injected?

Response to Comment #16 – 40 C.F.R. §144.41(d) allows for a minor modification due to a change in ownership or operational control. A minor modification of this type is only allowed when EPA determines that no other change in the permit is necessary. If a new company took ownership of the well under this sort of minor modification, the injection would be limited to brine disposal from production wells owned and operated by the new owner. The new owner would be required to follow all of the permit conditions, including 1) monitoring injectate specific gravity 2) limiting injection pressure to limits set in the permit; and 3) submitting an annual chemical composition analysis of the injectate.

Comment #17
There should be creation of a "reporter" chemical, for monitoring the immediate and surrounding water supply.

Response#17 – The final UIC permit has monitoring requirements in place for the West Bay #22 injection well. In particular, it requires monitoring mechanical integrity (MI). An injection well has MI if there is no significant leak in the casing, tubing or packer.

EPA considers MI test failures to be significant non-compliance. If the West Bay #22 should fail any MI demonstration or if monitoring indicates a leak, then the well will be shut down until corrective actions have been taken and the well has been brought back into compliance. Any work performed on the well that requires the moving and/or removal of the tubing or packer must be followed by a MI test before EPA will authorize resuming injection.

Furthermore, the construction of the well and the geology of the site play an important role in the prevention of contamination of any surrounding water supplies. The top of the injection zone is separated from the bottom of the USDW by approximately 2,436 feet of rock formation layers, including the confining zone. The West Bay #22 well will be constructed and operated to prevent the injection fluid from contaminating a USDW. The West Bay #22 well will be drilled to approximately 2,680 feet below surface, and will be constructed with three casing strings (steel pipe), set to 350, 900, and 2,680 feet bgs, respectively. Each of these steel casings will be cemented to the surface, providing additional barriers preventing fluid from migrating upward. For more information, please see the "Final Determination" section at the beginning of this document.

Comment #18
Who is responsible to maintain and monitor the injection well once West Bay is finished at the proposed well site? What is the plan to monitor the wells after plugging?

Response to Comment #18 - The West Bay #22 well permit includes a plugging and abandonment plan that meets UIC regulatory requirements. Before the well can be plugged and abandoned, the operator must notify EPA and the State that it will plug the well in compliance with the plugging and abandonment plan already in the permit. Following well closure, the operator must further submit a cementing record for EPA review to determine if the well was sufficiently closed.

Well closure does not relieve the owner/operator of liability should an endangerment to USDWs occur due to some defect in quantities, methods, or quality of materials used during plugging and abandonment. An owner/operator may still be held liable for such endangerment under provisions in the Safe Drinking Water Act. The UIC regulations do not give EPA authority to require post-closure monitoring for Class II injection wells.

Comment #19
EPA should not make a decision on the proposed permit, the decision should be voted on by the people.

Response #19 – The Safe Drinking Water Act (SDWA) is the main federal law that ensures the quality of Americans' drinking water. Under SDWA, EPA sets standards for drinking water quality and oversees the states, localities, and water suppliers who implement those standards. The SDWA gives EPA authority to regulate the construction, operation, and closure of injection wells.

Comment #20
Procedures for submitting appeals are incorrect, particularly in reference to methods for filing appeals.

Response#20 – Please see the next section. The procedures described therein are correct.

Appeal
In accordance with 40 C.F.R. § 124.19(a), any person who filed comments on the draft permit or participated in the public hearing may petition the Environmental Appeals Board (EAB) to review any condition of the final permit decision. Additionally, any person who failed to file comments on the draft permit may petition the EAB for administrative review of any permit conditions set forth in the final permit decision, but only to the extent that those final permit conditions reflect changes from the proposed draft permit. Any petition shall identify the contested permit condition or other specific challenge to the permit decision and clearly set forth, with legal and factual support, petitioner's contentions for why the permit decision should be reviewed, as well as a demonstration that any issue raised in the petition was raised previously during the public comment period (including the public hearing), to the extent required by these regulations. The petition should also state whether the permit issuer has already responded to the issue raised (including in this response to comments) and an explanation of why the permit issuer's response to comments was inadequate, as required by 40 C.F.R. § 124.19(a)(4).

If you wish to request an administrative review, documents in EAB proceedings may be filed by mail (either through the U.S. Postal Service ("USPS") or a non-USPS carrier), hand-delivery, or

electronically. The EAB does not accept notices of appeal, petitions for review, or briefs submitted by facsimile.

All submissions in proceedings before the EAB may be filed electronically, subject to any appropriate conditions and limitations imposed by the EAB. To view the Board's Standing Orders concerning electronic filing, click on the "Standing Orders" link on the Board's website at www.epa.gov/eab.

All documents that are sent through the USPS, except by USPS Express Mail, must be addressed to the EAB's mailing address, which is: Clerk of the Board, U.S. Environmental Protection Agency, Environmental Appeals Board, 1200 Pennsylvania Avenue, NW, Mail Code 1103M, Washington, D.C. 20460-0001.

Documents that are hand-carried in person, delivered via courier, mailed by Express Mail, or delivered by a non-U.S. Postal Service carrier (e.g., Federal Express or UPS) must be delivered to: Clerk of the Board, U.S. Environmental Protection Agency, Environmental Appeals Board, 1201 Constitution Avenue, NW, WJC East Building, Room 3334, Washington, D.C. 20004.

A petition for review of any condition of a UIC permit decision must be filed with the EAB within 30 days after EPA serves notice of the issuance of the final permit decision. 40 C.F.R. § 124.19(a)(3). When EPA serves the notice by mail, service is deemed to be completed when the notice is placed in the mail, not when it is received. However, to compensate for the delay caused by mailing, the 30-day deadline for filing a petition is extended by three days if the final permit decision being appealed was served on the petitioner by mail. 40 C.F.R. § 124.20(d). Petitions are deemed filed when they are received by the Clerk of the Board at the address specified for the appropriate method of delivery. 40 C.F.R. § 124.19(a)(3) and 40 C.F.R. § 124.19(i). The request will be timely if received within the time period described above.

For this request to be valid, it must conform to the requirements of 40 C.F.R. § 124.19 available electronically at http://www.gpo.gov/fdsys/pkg/CFR-2013-title40-vol23/pdf/CFR-2013-title40-vol23-sec124-19.pdf. This request for review must be made prior to seeking judicial review of any permit decision. Additional information regarding petitions for review may be found in the Environmental Appeals Board Practice Manual (August 2013) and A Citizen's Guide to EPA's Environmental Appeals Board, both of which are available at http://yosemite.epa.gov/oa/EAB_Web_Docket.nsf/General+Information/Environmental+Appeals+Board+Guidance+Documents?OpenDocument.

The EAB may also decide on its own initiative to review any condition of any UIC permit. The EAB must act within 30 days of the service date of notice of the Regional Administrator's action. Within a reasonable time following the filing of the petition for review, the EAB shall issue an order either granting or denying the petition for review. To the extent review is denied, the conditions of the final permit decision become final agency action when a final permit decision is issued by the EPA pursuant to 40 C.F.R. § 124.19(l).

Final Permit

The final permit and Response to Comments document are available for viewing at the Jackson Public Library, 244 West Michigan Ave, Jackson, Michigan.

P. Tinka for Tinka G. Hyde
Director, Water Division
U.S. Environmental Protection Agency
Region 5

Date 12/8/2015