UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
REGION III
1650 Arch Street
Philadelphia, Pennsylvania 19103-2029

Response to Comments for The Issuance of an Underground Injection Control (UIC) Permit for Windfall Oil and Gas, Inc.

On November 7, 2012, the U.S. Environmental Protection Agency Region III (EPA) issued a public notice requesting comment and announcing the opportunity for a public hearing for the proposed issuance of an Underground Injection Control (UIC) permit, PAS2D020BCLE, to Windfall Oil and Gas, Inc. (Windfall) for one Class II-D well. EPA received numerous requests to hold this hearing and it was held on December 10, 2012, at the Brady Township Community Center in Luthersburg, Pennsylvania. Over 250 people attended this public hearing and EPA received oral comments from 29 people in attendance at the hearing. At the conclusion of the public hearing, EPA extended the public comment period until December 31, 2012, and invited the submission of any additional written comments. In total, EPA received approximately 2600 comments. During the public comment period, all the information submitted by the applicant was available for review at the Dubois public library and at the EPA regional office.

Comments submitted during the public comment period which ended December 31, 2012, raised substantial questions related to seismicity concerns about the proposed well. Pursuant to 40 C.F.R. 124.14(b), the Region reopened the public comment period on this draft permit. On August 11, 2013, the Region issued a public notice and requested additional public comment on its proposed findings that the well, as permitted, is unlikely to pose a risk of induced seismicity and why any potential earthquakes would not pose a risk to the construction and operation of the injection well. The reopening of the public comment period was limited to these two issues and closed on September 11, 2013.

The response to comments which follows consolidates and provides responses to questions and issues raised from people who either sent timely written public comment during the initial public comment period, sent timely written comments on the issues related to seismicity during the reopening of the comment period, or who provided comment at the hearing. EPA wishes to thank the public for their informative and thoughtful comments and to thank the people from the Brady Township Community Center that assisted EPA in hosting the public hearing.

1) What does EPA's UIC program have jurisdiction and authority to regulate?

Many people raised concerns about matters that the EPA UIC program does not have the regulatory jurisdictional authority to address in the UIC permitting process. Some of the concerns mentioned were the potential for increased truck traffic, the potential for damage to the roads, increased noise, the proposed location of the injection well in a residential area, the potential for the diminishment of property values and the possibility of surface spills. When making the decision on whether to issue a UIC permit for Windfall, EPA's jurisdiction rests solely in determining whether the proposed injection operation will safely protect underground sources of drinking water (USDWs) (i.e., aquifers supplying any public water system or containing a sufficient quantity of ground water to supply a public water system and containing less than 10,000 milligrams per liter total dissolved solids) from the subsurface emplacement of fluids. Although these other concerns may be relevant to residents, they cannot be addressed through the EPA UIC permitting process. Other local, county, state or federal ordinances or regulations may address traffic, road noise, zoning concerns, and surface spill prevention.

EPA notes that the final UIC permit contains several conditions that require the permittee to meet all other local, state or federal laws that are in place. Part I.A. of the permit contains a clause that states, "Issuance of this permit does not convey property rights or mineral rights of any sort or any exclusive privilege; nor does it authorize any injury to persons or property, an invasion of other property rights or any infringement of state or local law or regulations." In addition, Part I.D.12 of the permit states, "Nothing in this permit shall be construed to preclude the institution of any legal action or relieve the permittee from any responsibilities, liabilities, or penalties established pursuant to any applicable state law or regulation." Therefore, EPA's UIC permit is only one of several authorizations that a permittee may be required to obtain before it is allowed to commence construction and/or operation.

2) Do the UIC regulations supersede local land use plans?

Brady Township joined with five other municipalities in Clearfield County to develop the "Northwest Clearfield County Regional Comprehensive Plan" in 2009. This document is a plan for future growth and describes areas of compatible use within the municipalities with respect to residential, commercial and retail development. As mentioned in response number (1), EPA requirements do not supersede local, county or state law or regulations. If state or local law requires Windfall's injection operations to comply with the Comprehensive Plan, the UIC permit would not abrogate those requirements.

3) EPA should require the operator to find another location for disposal.

As stated in the responses to the previous two questions, EPA does not have the jurisdictional authority to direct operators to construct their injection well disposal facility in a particular geographic location. The location chosen by an operator is based on many factors: economics, property ownership and accessibility, geologic suitability, etc. It is EPA's responsibility to review each UIC permit application it receives and make a determination as to whether USDWs will be protected from the proposed operation. Likewise, EPA cannot deny a permit solely because of residents' opposition to the location, if the applicant otherwise meets the requirements of the UIC program.

4) Construction of the injection well should require additional casing to protect shallow underground sources of drinking water.

A provision of the UIC regulations, 40 C.F.R. Section 147.1955(b)(1), requires an injection well's surface casing to be placed 50 feet below the determined lowermost USDW. The lowermost USDW where the injection well will be located is found at a depth of approximately 800 feet. This is consistent with the geology of the area, where water bearing formations that meet the definition of a USDW are limited to the approximate depth of 800 to 1000 feet below land surface. Those formations are generally followed by tight shales and limestone formations, which do not typically bear water, and eventually oil and gas bearing formations. Drilling records of nearby production wells submitted with the application, confirm that drillers were not finding water that would qualify as a USDW below 800 ft. The permit will require surface casing to be placed to a depth of 1000 feet and be cemented back to the surface. This exceeds the requirements of the UIC regulations at 40 C.F.R. Section 147.1955(b)(1). If surface casing were to be placed any deeper it could interfere with formations capable of producing natural gas and could affect the cementing of the casing. This depth also satisfies PADEP requirements. In addition, because most residents obtain their drinking water from much shallower aquifers through private wells, the permit will also require the injection well owner to install two additional water protective strings of casing, one to a depth of 170 feet and the other to a depth of 375 feet. The depths of these additional casings are based on the depth of nearby drinking water wells. Both of these protective strings of casing will be cemented back to the surface. Windfall will also be required to obtain a drilling permit from PADEP and meet any additional well construction requirements that State regulations require under Act 13. After the well casings are installed and cemented, and before the injection operations commence, the well's cementing records and logs will be reviewed and the well will be tested for mechanical integrity, which verifies that the well will not leak during operation.

5) The long string casing should be cemented back to the surface.

Windfall's proposed well construction plan calls for the circulation of cement behind the long string casing to approximately 2300 feet above the well's total depth. The cement placed behind the long string casing is designed to seal and isolate the well to prevent fluid movement out of the injection formation. Windfall's proposed well construction meets EPA's regulatory requirements found in the UIC regulations at 40 C.F.R. §147.1955(b)(5) and to the regulatory requirements were designed to prevent endangerment of the USDWs.

6) A topographic map of one mile, around the proposed well location was not provided by the applicant as required by the regulations.

Windfall did submit a topographic map depicting the area extending one mile around the proposed injection well. The map was titled, "Proposed Disposal/Injection Well for Windfall Oil and Gas" and was developed by Alexander & Associates, 112 Church Street, Falls Creek, PA 15840. The map depicts all topographic features and includes water bodies, streams, wells, residences, etc. within one mile of the proposed well location. This map was available with the permit application materials that were available for review in both the Dubois Public Library and at EPA.

7) The proposed injection well is located close to several geologic faults and this could cause fluid migration and seismic activity.

Although EPA must consider appropriate geological data on the injection and confining zone when permitting Class II wells, the SDWA regulations for Class II wells do not require specific consideration of seismicity, unlike the SDWA regulations for Class I wells used for the injection of hazardous waste. See regulations for Class I hazardous waste injection wells at 40 C.F.R. §§ 146.62(b)(1) and 146.68(f). Nevertheless, EPA evaluated factors relevant to seismic activity such as the existence of any known faults and/or fractures and any history of, or potential for, seismic events in the area of the Injection Well as discussed below and addressed more fully in *"Region 3 framework for evaluating seismic potential associated with UIC Class II permits, updated September, 2013."*

One commenter cited a draft EPA report that looks at injection-induced seismicity ("Minimizing and Managing Potential Impacts of Induced-Seismicity from Class II Disposal Wells: A Practical Approach," EPA UIC National Technical Workgroup, draft as of November 27, 2012[1]) and suggested that EPA follow the recommendations in the draft report. The cited draft report is an initial draft that has not yet been peer reviewed, and thus the Agency is not ready to finalize any recommendations based on the report. Nonetheless, in issuing this permit EPA followed some of the tentative recommendations in the draft report, as they constitute good permit issuance practices. These include: assess regional and local seismicity; correlate any area seismicity with past injection practices; evaluate geological information to assess likelihood to activate faults; evaluate storage capacity of the formation with consideration of porosity and permeability; include operational parameters to limit injection rate and volume and to limit operation at below fracture pressure; and require frequent (continuous in this case) monitoring of injection pressure and rates.

Induced seismicity background

Under certain conditions, disposal of fluids through injection wells has the potential to trigger seismicity. However, induced seismicity associated with brine injection is uncommon, as conditions necessary to trigger seismicity often are not present. Seismic activity induced by Class II wells is likely to occur only where all of the following conditions are present: (1) there is a fault in a near-failure state of stress; (2) the fluid injected has a path of communication to the fault; and (3) the pressure exerted by the fluid is high enough and lasts long enough to allow movement along the fault line. Induced Seismicity Potential in Energy Technologies, National Academy Press, 2013, at p. 10-11. Although there are approximately 144,000 Class II wastewater injection wells operating in the United States, less than a dozen of these wells have triggered earthquakes of any significance and none of these earthquakes, which EPA Region III is aware of, have ever caused injected fluids to flow into or contaminate a USDW.

The presence of a fault in a receiving formation potentially creates a more vulnerable condition for a future seismic event. A fault is a fracture or a crack in the rocks that make up the Earth's crust, along which displacement has occurred. Where a fault is present near an injection site, scientists believe that injection can trigger seismicity when the pore pressure (pressure of fluid in the pores of the subsurface rocks) in the formation increases to such levels as to overcome the frictional force that keeps the fault stable. Pore pressure increases with increases in the volume and rate of injected fluid. Thus, the probability of triggering a significant seismic event during injection, where a fault exists in the receiving formation, increases with the volume and the rate of fluid injected. In addition, the larger the volume injected over time, the more likely a fault could be intersected, because the fluid will travel farther within a formation. When injected fluid reaches a fault, frictional forces that have been maintained within that fault can be reduced by the fluid. At high enough pore pressure, the reduction in frictional forces can result in the formation shifting along the fault line, resulting in a seismic event.

Because increases in pore pressure due to the rate and the volume of injected fluid can act on existing faults and provide a mechanism for induced seismicity, most examples of injection-induced seismicity are in cases where the receiving formation has low permeability and/or the pressure or volume of fluid injected over time is quite large. Formations such as crystalline

[1] The EPA UIC Technical Workgroup has continued its work on this report. The draft cited by the commenter may not be the latest report under review at EPA Headquarters.

basement rock (deeper geological formations of igneous or metamorphic rock that underlie layers of sedimentary rock) have very low permeability. Permeability is the ease with which a fluid can flow through the pores in a rock layer. Where permeability is low, injected fluid cannot flow easily through the pores in this rock and therefore flow is oriented mainly through existing fractures or faults in the rock (secondary permeability). These kinds of rock formations have high transmissivity and low storativity. This means that the formation cannot store a lot of fluid; rather fluid moves farther and faster in these formations than in more porous formations. Because of the high transmissivity and low storativity of these kinds of rocks, the potential exists to induce pore pressure increases at considerable distances away from the injection well.

Faults near the proposed well

The applicant submitted, and EPA obtained, geological information indicating the possible presence of several faults within one-quarter mile of the injection well site. These faults appear to be localized, non-transmissive faults[2]. There is no geologic evidence that indicates these faults are transmissive to the deep Precambrian crystalline basement rock or to the surface. We know that these faults exist because drilling records and geologic cross sections show displacement of the bedrock. Commenters submitted a map of the Precambrian basement in Pennsylvania. While the map does show some faults in the basement rock beneath Clearfield County, the Precambrian basement rock is located approximately 11,000 feet below the proposed injection zone.[3]

The United States Geologic Survey (USGS) tracks, records and maps faults and earthquake epicenters in certain areas throughout the United States. The USGS monitors several active seismometers right in Clearfield County, in the vicinity of the proposed well. The USGS as well as the Pennsylvania Department of Conservation and Natural Resources (PA DCNR) which includes the Bureau of Topographic and Geologic Survey, the principal organization that conducts geologic research in Pennsylvania, have not recorded any seismic activity that has originated in Clearfield County.

USGS has recorded seismic events in Clearfield County although such events are extremely rare. The County is not located in a seismically active area and although there are several sub-surface geologic faults located within one-quarter mile of the injection well site, their presence in the area is due to tectonic activity that occurred many millions of years ago. Please refer to the PA DCNR website which has an interactive seismicity map and catalog of all recorded seismic events in or near Pennsylvania from 1724-present. Earthquakes that have been recorded, as well as felt in the area, were the result of seismic events that had their origins in other parts of the state or outside of the state's borders.

During an earthquake, energy is radiated away from the hypocenter of the fault in the form of seismic waves. This energy causes the ground to move as the seismic waves travel away from the fault. What have been felt in the County are seismic waves that were transmitted through the bedrock from the hypocenter of a seismic event that originated somewhere else. Seismic events

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[2] Transmissive faults allow fluids to move along the fault and between formations. Non-transmissive faults, in contrast, act like a barrier, which would prevent movement of fluid along the fault and into another formation across the fault.

[3] Several commenters also mentioned synclinal and anticlinal features in the geology of the area of the proposed well. Synclines and anticlines refer to folds in geological layers and can be expressed at the surface as hills and valleys. These sinclines and anticlines also occur in the subsurface but they are not relevant to the faults discussed within this section.

which originate elsewhere do not provide information about the geology of Clearfield County, even if these events were felt there. The distance that the seismic waves travel is not indicative of the extent of the fault where displacement occurred due to the earthquake. Although seismic waves can cause the ground to shake a large distance away from the hypocenter of the earthquake, the fault where displacement occurred does not extend everywhere where the earthquake was felt. For this reason, history of seismicity that originates in areas other than the location of the injection well does not provide information about potential faults or formation pressures at the location of the well. For example, in the case of the Northstar 1 injection well in Youngstown, Ohio, the earthquake is believed to have been generated by injection into Precambrian crystalline bedrock, a deeper receiving formation, with different geology, than what is proposed for the Windfall well. The seismic waves radiating away from this area were felt in locations at significant distances away from Youngstown, including western Pennsylvania, but they have no relevancy to the geologic setting in Clearfield County or at the Windfall location.

Factors affecting fluid transmission and pore pressure

The Windfall permit has been developed to prevent the over-pressurization of the injection formation by limiting the surface injection pressure during the injection operations to 2443 psi and the bottom-hole injection pressure to 6425 psi. Research indicates that a very high rate of injection or over-pressurization of a geologic formation can contribute to the possibility of seismic activity. The permit limit for the surface injection pressure and the bottom-hole injection pressure was calculated to ensure that, during operation, the injection will not propagate existing fractures or create new fractures in the formation. Limiting the pressure not only prevents the propagation of fractures that could become potential channels for fluid movement into USDWS but that could also serve as conduits for fluids to travel from the injection zone to known or unknown faults.

The Windfall permit will also require a yearly pressure fall-off test. As part of the test, the rate of fluid and volume injected is increased over a predetermined time period, and then shut off. The pressure is monitored during the test and after shutting-in the injection well. The fall-off testing will assist EPA in determining and monitoring injection reservoir bottom-hole pressure as well as the flow conditions that the injection formation will exhibit during the injection operation. Analyzing flow conditions can help determine whether a preferential flow pattern exists and assist in determining whether that flow could be moving toward or coming into contact with the nearby faults.

A significant volume of gas and brine has already been removed from the proposed injection reservoir, during previous gas production operations, making the Huntersville Chert/Oriskany formation receptive for the disposal of fluid. The Huntersville Chert/Oriskany formation, the intended injection zone, has been a prolific producer of natural gas in this area since the late 1950s/early 1960s. There are still a number of active gas production wells in this area drilled into this formation. Evidence from gas production records from the PA DEP Office of Oil and Gas Management, Oil and Gas Reporting Website, which is a public website located at www.paoilandgasreporting.state.pa.us, indicates that gas production wells located within the fault structure where the injection well has been proposed, have produced significantly greater volumes of natural gas and produced water than gas production wells located outside of this fault structure. For example, gas production well #20333, located between the faults based on drilling records, produced approximately 612,992,000 million cubic feet (Mmcf) of natural gas and 67,115 barrels of brine during a period from 1980 through 2011. This well was drilled in 1960, so there is another, additional, twenty years of production history for this well that has not been recorded. In addition, gas production well #20327 was also drilled in 1960 and is also located within the fault structure based on drilling records. Although the production record for this well is also incomplete, available records indicate that it has produced at least 71,613 Mmcf of natural gas since 1983. The removal of these fluids has not resulted in any seismic activity nor have the presence of the faults allowed fluids to move out of the formation and into USDWs. The removal of both natural gas and brine from the natural pore spaces that exist in this formation have lowered the formation's pore pressure (reservoir pressure) and has created available storage capacity making this reservoir a good candidate for the disposal of fluids. The National Academy of Sciences Report entitled Induced Seismicity Potential in Energy Technologies (2013) indicates that where fluids are injected into sites such as depleted oil, gas or geothermal reservoirs, they can make excellent disposal zones, because in those cases, pore pressures may not reach their original levels, or in some cases, may not increase at all due to the relatives volumes of injection versus extracted fluid.

Other gas production wells drilled outside the fault block in which the Windfall well is located were plugged for lack of production. For example gas production well #20325, was documented as a dry hole and was actually plugged and abandoned in 1960 shortly after completion. This gas well production history helps to illustrate that the displacement of the Huntersville Chert/Oriskany formation created by the faults established confinement of natural gas and formation fluids within the immediate fault block structure and that fluid flow (natural gas and produced water) along or across the faults is not evident. Because of the non-transmissive nature of the faults, fluid that is injected into the Huntersville Chert/Oriskany formation at the proposed injection well location should be confined within the fault block.

One commenter argues that little brine has been removed from the receiving formation during gas production and that therefore there is not much pore space for the injected fluid. Ultimately, the storage capacity of a receiving formation will be determined by the injection well's operating pressure. This particular injection well is limited by the maximum injection pressure established in the permit for the well. See Part III.B.4 of the permit. Therefore, if pressure buildup occurs quickly during operation, an indication of limited storage capacity, the operation of the injection well will be limited by the established maximum injection pressure. As pore space capacity to assimilate injected fluids decreases, the pressure needed to inject fluids will need to increase. Under the operating parameters of the permit, if such pressure reaches the maximum injection pressure, injection cannot proceed (regardless of whether the well has been operating one year or 30). So, even if the commenter was correct that the storage capacity of the receiving formation is limited, the result would be that the life of the well would be shorter than for a well with a receiving formation of greater storage capacity.

The public brought to EPA's attention recent seismic events that have occurred in Ohio, Texas, Oklahoma, West Virginia and Arkansas that were attributed to the underground injection of fluids produced from oil and gas extraction activities. EPA recognizes that there is strong evidence that supports the underground injection of fluids as being the trigger that led to these seismic events. In some cases, these earthquakes occurred in locations were there were no known faults. However, the likely relevant factors behind these seismic events, specifically the geologic setting or the operational history of the injection wells, differ significantly from the proposed Windfall injection operation. Scientific evidence indicates that seismic activity is most likely associated with the depth of a well, the volume and rate of injection, and the injection pressure. In these aspects the Windfall well contrasts greatly with the wells in the known cases of induced-seismicity.

The "Preliminary Report on the Northstar1 Class II Injection Well and the Seismic Events in Youngstown, Ohio Area, Ohio Department of Natural Resources, March 2012", has indicated that the seismic activity associated with the injection of fluid in the Northstar 1 was likely due to the injected fluid coming into contact with a fault system located in deep Precambrian basement crystalline bedrock. This bedrock is located beneath the sedimentary bedrock structure and has very low permeability. Fluid injected in crystalline basement rocks is essentially transmitted by a network of inter-connected fractures and joints. Because of the high transmissivity (the ability of fluids to move through rock) and minimal ability to store fluids in these kinds of rocks, the potential exists to create flow at considerable distances from the injection well. Once flow reaches a fault, it allows the frictional forces that exist to be reduced thereby allowing the rocks to slip, leading to seismic activity. In contrast, the injection zone for the Windfall injection well is the Huntersville Chert/Oriskany formation, a sedimentary rock formation of Lower Devonian age, which has a higher natural porosity and greater interconnection of that pore space throughout the formation than the crystalline bedrock. The Huntersville Chert/Oriskany formation is located at a depth of approximately 7300 feet below land surface (approximately 5600 feet below sea level) at the proposed injection well site. The Precambrian crystalline basement rock in the area of the proposed injection well is located approximately 16,500 feet below sea level, a significant depth below the Huntersville Chert/Oriskany formation (Pennsylvania Geologic Survey – General Geology Open File Report 05-01.0). In the Huntersville Chert/Oriskany formation the rock will more readily store injected fluid and the permeability (the available interconnected space between the grains and natural fractures in the rock) within the rock structure will allow a more uniform flow to occur throughout the formation. So, the geologic setting and reservoir characteristics of the proposed injection well are very different than the circumstances encountered in Ohio. Injection will not occur or flow into the deeper Precambrian crystalline rocks.

Regarding the seismic event in Texas, a study out of the University of Texas at Austin's Institute for Geophysics (Proceedings from National Academy of Sciences, August, 2012), has indicated the seismic activity was likely triggered by the significant volume of fluid that was injected in a relatively short period of time. Approximately 150,000 barrels of fluid per month had been injected down a disposal well since 2006. This equals approximately 75,600,000 gallons of injected fluid, yearly, for about a five year period. The proposed Windfall injection well will be limited to a maximum of 30,000 barrels per month, one-fifth the total of the Texas well. Researchers studying the circumstances that led to the seismic events in both Oklahoma and Arkansas believe that over-pressurization of a nearby fault after years of injection may have led to the seismicity. Similar to what happened in Ohio, injected fluid migrated into Precambrian rocks, which in the case of those wells were found just below the injection zone, and came into contact with a fault ("Science", Volume 335, March 23, 2012). It is believed that the reduction of the frictional stress in the faults led to slippage along the faults (From the journal "Geology", co-authored by researchers with USGS and Oklahoma Geologic Survey, March 3, 2013).

In Braxton, WV, there is no definitive evidence, unlike the evidence produced for Youngstown, OH, that concludes injection was responsible for the seismicity in the area. However, information obtained from the West Virginia Department of Environmental Protection seems to indicate that when the injection rate, and later the injection volume, were reduced in the injection well, seismic activity in the area ceased. The geology where this injection well was completed is also different from the geology of the proposed Windfall injection well. The injection well in West Virginia is drilled into the Marcellus Shale, which has low permeability. The last recorded seismic event in the Braxton, WV area was recorded in January, 2012; the injection well that was suspected of causing the seismicity continues to operate.

8) Endangerment of USDWs due to earthquakes

Of the hundreds of thousands of injection wells operating in the United States, EPA is not aware of any case where a seismic event caused an injection well to contaminate an USDW. An inquiry through EPA regional offices did not reveal any reports of earthquakes having affected the integrity of injection wells in the cases of induced-seismicity in Ohio, Texas, Oklahoma, West Virginia or Arkansas. A number of factors help to prevent injection wells from failing in a seismic event and contributing to the contamination of an USDW. Most deep injection wells, those that are classified as Class I or Class II injection wells are constructed to withstand significant amounts of pressure. They are typically constructed with multiple steel strings of casing that are cemented in place. The casing in these wells is designed to withstand both significant internal and external pressure. The American Petroleum Institute (API) (see www.api.org) and oil and gas service companies such as Halliburton Services (see Halliburton Cementing Tables, 1980), have developed industry standards for casing and cementing wells. Furthermore, brine disposal injection wells are required to be mechanically tested to ensure integrity before they are operated and many are continuously monitored after testing to ensure that mechanical integrity is maintained. If a seismic event were to occur, that affected the operation and mechanical integrity of the Windfall injection well, the well will be designed to automatically detect a failure due to pressure changes in the well and this would cause the well to automatically stop injection. See Part II.C.2 of the Permit.

9) There are no other injection wells in Clearfield County so EPA has no way of knowing that fluids can be safely injected into the Huntersville Chert/Oriskany formation.

Several comments mentioned that since no other brine disposal injection wells exist in Clearfield County, EPA has no basis of knowing that the injection of fluids into the Huntersville Chert/Oriskany formation will work. To the contrary, two Class II-D brine disposal injection wells permitted by EPA Region III are currently injecting produced fluid from oil and gas operations in Clearfield County. Both wells are currently operated by EXCO Resources. One injection well has been operating since 2005 and has injected approximately 623,405 barrels of produced fluid into the Huntersville Chert/Oriskany formation. The other well has been operating since 1989 and has injected approximately 371,481 barrels of produced fluid into a shallower formation known as the Tiona Sandstone. Both totals are based on annual reports submitted by the permittee through 2012. During this period of operation injection pressures continue to remain below the maximum injection pressures permitted indicating each injection zone has been able to accept these large volumes of fluids efficiently without exceeding reservoir fracture pressure.

10) The confining layer is less than 50 feet as depicted in the Statement of Basis.

One commenter observed that EPA's Statement of Basis for the proposed permit was incorrect with respect to the thickness of the confining zone above the injection zone. The Statement of Basis indicated that the thickness of the confining zone, immediately above the injection zone, was 50 feet. This was incorrect. The Windfall application provided information indicating that the confining layer immediately above the injection zone (the Onondaga formation) was 14-18 feet thick. EPA has made this correction in the Statement of Basis. Although the thickness of the Onondaga formation is less than originally mentioned in the Statement of Basis, effective confinement by the Onondaga formation has been established by gas storage in the Huntersville Chert/Oriskany gas pools throughout Pennsylvania. In addition, located above the Onondaga formation, are a series of shale and limestone formations that are also considered confining units. These low-permeability formations also separate the receiving formation from the lowermost USDWs.

11) How will the existing fractures within the injection zone not be compromised by the injection operation?

The maximum injection pressure authorized by the permit was developed to prevent both the development of new fractures as well as the propagation of existing fractures in the injection zone. Since the Windfall injection well has yet to be drilled, Windfall submitted geologic reservoir information from offset gas production wells that were drilled into the Huntersville Chert/Oriskany formation in Clearfield County, located about half mile to a mile from the proposed well location. This data indicates that the fracture pressure gradient for the Huntersville Chert/Oriskany formation ranges from 0.90 to 0.95 psi/ft. EPA used a gradient of 0.90 psi/ft to calculate the maximum injection pressure in the draft permit. In the final permit EPA used a gradient of 0.88 psi/ft. to calculate the maximum injection pressure, to provide a more conservative approach as well as to ensure the prevention of new fractures and the propagation of existing fractures in the injection zone during operation of the injection well. Based on the revised gradient, the maximum surface injection pressure has been reduced to 2443 psi and the maximum bottom-hole injection pressure to 6425 psi, a reduction of 150 psi from the draft permit. The specific gravity of the injection fluid used to calculate the hydrostatic bottom-hole pressure of the fluid in the injection well was 1.26, the same as the draft permit. A specific gravity of 1.26 represents very heavy brine. Fresh water has a specific gravity of 1.00. This is an extremely high specific gravity for brine and it is not anticipated that fluid coming to this injection well will exceed this value. Therefore, the use of a high specific gravity in calculating the maximum bottom-hole injection pressure, reduces the maximum surface injection pressure, accordingly. Dividing the maximum bottom-hole pressure by the anticipated depth of the injection well, results in the established gradient of 0.88 psi/ft.

12) Abandoned or improperly plugged gas wells may pose a risk to drinking water supplies.

It is a fact that abandoned wells can pose a risk to USDWs by providing a conduit for the migration of fluid out of an injection zone. There are several requirements that the UIC regulations, as well as a UIC permit, impose on an operator to ensure that abandoned wells will not pose a risk to USDWs. The operator is required to conduct a thorough evaluation within a specified area around its proposed operation to determine whether any abandoned wells exist within that area which could pose a threat to USDWs. This area is termed the area of review. The area of review can be a fixed radius of not less than one-quarter mile around an injection well or injection wells (i.e., for an area permit) or may be a calculated "zone of endangering influence." The zone of endangering influence calculation is based on geologic parameters found in the injection zone, such as permeability, porosity, injection zone depth and thickness etc. as well as proposed operational conditions, such as injection volumes, rates, length of injection, etc. Within the area of review, the operator must review all information of public record, or information that they have knowledge of, to determine whether any abandoned wells or other potential conduits exist within the area of review or zone of endangering influence, that penetrate the proposed injection zone. If abandoned wells are found to exist, then corrective action, in the form of plugging and abandonment of those wells or the monitoring of the injection formation during operation, must be performed.

Windfall proposed a fixed radius of one-quarter mile for their area of review. Using technical information supplied in the permit application, as well as published information on the geologic characteristics of the Huntersville Chert/Oriskany formation, EPA calculated a zone of endangering influence (ZEI). EPA reviewed the values in the application to ascertain whether they were appropriate, and calculated the ZEI using the modified Theis equation, as specified in the UIC regulations at 40 C.F.R. Section 146.6(a)(2). The permit application and the technical information provided by the applicant were available to the public at the local public library and at the EPA regional office. That ZEI calculation identified that after ten years of operation (the permit has been issued for five years), under the operational parameters of the permit, the ZEI will only extend 400 feet from the injection well's wellbore. Taking into account the population, ground water use, the historical practices and the potential effect of a non-transmissive fault in the area, EPA determined that extending the area of review to the fixed radius of one-quarter mile (1320 ft) was reasonable. There are no documented wells located within the one-quarter mile area of review that penetrate the injection zone and which could allow injected fluids to move upwards out of the injection zone. In addition, there are no drinking water wells located within the one-quarter mile area of review.

13) The zone of endangering influence calculation assumes the injection zone is homogeneous and isotropic and has infinite areal extent.

The zone of endangering influence calculation does assume that the injection zone is homogeneous and isotropic and has infinite areal extent. However, as explained in response 12, the area of review is based on a fixed radius of one-quarter mile that is more than three times greater than the radius determined through the ZEI calculation. So even if the pressure front from injection does not occur in an exact radial shape, it will still be contained within the area of review. The annual pressure fall-off test required by the permit will help to determine flow characteristics and can establish whether there is any preferential flow. The pressure fall-off test will also help to determine whether reservoir pressures are greater than anticipated. If the buildup of reservoir pressure occurs sooner than anticipated, this may require the permittee to change their operational parameters or cease operation so that the maximum injection pressure condition is not violated.

14) Why won't the injection fluid come back up once it's injected? Won't injecting fluids under pressure allow fluids to make its way back to the surface?

Many commenters expressed concern that once the fluid is injected under pressure it will come back to the surface. As discussed in response #10, there is a confining zone immediately above the injection zone, the Onondaga formation. This is a limestone geologic formation which typically has a very low permeability, giving it the ability to confine and trap fluids from migrating upwards. As noted in this document, the Huntersville Chert/Oriskany formation, the intended injection zone, has produced natural gas in this area for many decades. It is the confinement of this natural gas that enabled successful production. The natural gas and fluids in the formation were also under pressure prior to and during production. It was the confining unit above the Huntersville Chert/Oriskany formation, as well as other geologic factors such as the faulting discussed in response #7, that kept this natural gas in place. Natural gas was never able to migrate to the surface on its own from the Hunersville Chert/Oriskany formation. It required gas production wells to be drilled into the formation before natural gas could be recovered.

There are also several other factors that will keep the injected fluid in place and not allow it to migrate out of the injection zone. One factor is that the permit does not allow the injection pressure to exceed the injection formation's fracture pressure and thereby prevents fracturing that could allow fluid to migrate out of the injection zone. In addition, there are no other artificial penetrations (e.g., abandoned wells) that penetrate the injection zone within the area of review. The absence of any other artificial penetration into the injection zone within the area of review will prevent injection fluid from migrating out of the injection zone and into USDWs.

15) Are the fluids being injected toxic, hazardous and/or radioactive? Why don't you just treat the brine water and dispose of it another way?

Individual constituents contained within fluid produced from a oil or gas production reservoir could be determined to be toxic, hazardous or radioactive. However, these fluids, when produced in association with oil and gas production, are exempt from hazardous waste regulation and are not classified as hazardous under the Resource Conservation and Recovery Act, 42 U.S.C. § 6901 et seq. In December 1978, EPA proposed hazardous waste management standards that included reduced requirements for several types of large volume wastes. Generally, EPA believed these large volume "special wastes" were lower in toxicity than other RCRA regulated hazardous wastes. Subsequently, Congress exempted the wastes from RCRA Subtitle C pending a study and regulatory determination by EPA. In 1988, EPA issued a regulatory determination that the control of exploration and production wastes under RCRA Subtitle C was not warranted. Therefore, the UIC program does not regulate fluids produced in association with oil and gas production activities as hazardous waste. Disposal of these fluids is permissible down a Class II brine disposal injection well.

The public also raised the issue that the disposal of these fluids underground is not safe. All waste produced must be managed in a safe manner and best management practices are typically used by an industry or regulatory agency in determining how and where a waste can be disposed in an environmentally safe manner. If managed and operated properly, EPA believes the risk to the environment by injecting fluids deep underground can be considered safer than other methods of disposal, such as allowing them to be discharged into a stream, disposed of in a landfill or treated and stored in containment pits or storage tanks. EPA also believes that the reuse or recycling of produced fluid is a sound environmental management practice. Although produced brine can be treated, recycled and reused in the hydraulic fracturing process or for the enhanced recovery of oil, the byproduct of this continued reuse of the produced fluid eventually becomes very concentrated and must still be disposed of in some manner. Public and privately owned wastewater treatment facilities are unable to adequately remove many constituents found in brine, for example, chlorides and bromides. When these constituents are discharged to streams or rivers they can pose serious risk to fish and other aquatic organisms living in the stream as well as contribute to serious health effects for people who obtain their drinking water from these streams and rivers. The UIC permitting program is designed to ensure that injection covered by the UIC permits can occur in an environmentally protective manner.

16) There are "deep" coal mined areas located beneath the area of review and injection fluids will be able to migrate into these mines from the injection zone and eventually find their way into shallow ground water or surface water.

The deep coal mines mentioned by the public do exist below a portion of the injection well area of review as well as throughout Brady Township and the DuBois area. These mines, however, are not deep relative to the depth of the injection zone and are, in fact, located at a depth that requires USDW protection. EPA is requiring that the injection well have surface casing placed to a depth of 1000 feet below land surface and cemented back to the surface. The depth of the lowermost USDW has been located at a depth of approximately 800 feet. The "deep" coal mines discussed by the public were mined at depths typically less than 800 feet, generally at depths of less than 400 feet below land surface. As discussed more fully in other comments in this document, there are no other wells located within the area of review that penetrate the injection zone that could potentially allow fluid to migrate upwards into these mined locations.

17) Windfall must provide financial resources should a well failure occur.

Under the UIC regulations, owners and operators of injection wells are required to demonstrate financial responsibility for the purpose of properly plugging and abandoning the injection well when the operation ceases and the well is no longer used for injection. The cost of plugging a well depends, among others things, upon the depth of the well, and how the well was constructed. Windfall submitted an estimate from an independent contractor on the cost of plugging the well, as well as a $30,000 letter of credit with a standby trust agreement for the plugging and abandonment of the injection well. EPA Region III reviewed and approved this submission. The permit incorporates the requirement that Windfall maintain financial assurance in the amount of the estimate through a letter of credit. (See Part III.D). The UIC regulations require the permittee to adjust the estimate annually for inflation, and whenever a change in the plugging plan result in an increase in the estimate of the plugging costs. See 40 C.F.R. § 144.62. EPA can also require the permittee to adjust the cost estimate and the financial assurance instrument as necessary. See 40 C.F.R. § 144.52.

Although a separate issue from the financial responsibility required for plugging and abandonment, the public also asked whether the operator is required to set money aside to remediate contamination of their drinking water if the injection operation fails and allows fluids to migrate into a USDW. The operator is not required to set money aside for ground water remediation. However, EPA does have emergency authorities under the Safe Drinking Water Act (SDWA) if endangerment to USDWs should result from injection activities. Section 1431 under the SDWA allows EPA to take an action against a responsible party if the potential for endangerment exists. This action can include a requirement that the responsible party provide alternative drinking water to citizens affected by the endangerment.

18) Wastewater injected in the well should be more fully characterized or should be monitored for other parameters.

EPA believes that the conditions found in Parts II, C.3. and C.4., within the permit, are sufficient to adequately characterize and monitor the wastewater for injection purposes. The purpose of this monitoring is to verify that the fluids injected in the well are the type of fluids authorized in the permit. In addition, many of the parameters monitored in the injection fluid can also be found in shallow ground water. Therefore, if there is evidence of shallow ground water contamination, those results can be compared against the injection fluid analysis to determine whether the injection well is the cause of that contamination. If this wastewater were to be disposed in a different manner (i.e., disposed directly into the environment via stream discharge) then a more extensive characterization would be necessary. However, this wastewater will be injected far below land surface into an existing oil and gas bearing formation similar in nature to where the wastewater was generated. EPA will periodically sample the injection fluid from Windfall's injection operation. If Windfall were to be found injecting fluids not authorized by the permit, which are produced fluids associated with oil and gas production activities, it would be in violation of their permit and subject to enforcement action.

19) What is EPA's role in inspecting this well during construction and during operation?

EPA has direct implementation authority for the UIC program in the Commonwealth of Pennsylvania. Therefore, besides permitting, EPA is also responsible for the inspection of underground injection wells and enforcement of the requirement for the operation of such injection wells. EPA has a full time inspector that will be available to witness the well during construction, test the well for mechanical integrity after construction and periodically inspect the well during operation.

20) Well casing does not last forever. What is the lifetime maintenance plan for this well?

Once the injection well is constructed, EPA will review the construction which includes an evaluation of the well logging and casing and cementing program. In addition, the well will be tested for mechanical integrity. The test involves pressurizing the annulus (space between the injection tubing and long string casing) to an amount at least 10% above the maximum injection pressure authorized in the permit. The pressure must be maintained over a period of 30 minutes for the well to have mechanical integrity. The pressurized annulus tests the mechanical integrity of the long string casing, tubing and packer to ensure that there are no leaks. This test will be performed on a yearly basis. In addition, tests for mechanical integrity are conducted after an injection well has undergone any type of repair, modification or rework, and after the well has been inactive for a period of two years. If there are indications of possible leaks, the test may also include an evaluation of whether fluid movement is occurring outside the casing. EPA also can request the permittee to demonstrate mechanical integrity at any time.

Furthermore, Part II.C.2 of the final permit requires continuous monitoring of the injection well for injection pressure, annular pressure and injected volumes. This will enable the operator as well as EPA to determine whether the integrity of the well's long string casing, tubing and packer are compromised over the course of the well's operation. The well will be designed to detect pressure changes. The well's annulus pressure will be set at a positive pressure considerably lower than the injection pressure. If a leak were to develop in the tubing, packer or long string casing, the pressure in the annulus would change significantly which would automatically trigger the well to shut down and cease operating. This would constitute a mechanical integrity failure of the well, and in accordance with Part II.C.2 of the final permit, the operator would be required to cease injection immediately.

Finally, when the operator no longer wants to operate the injection well, it must be permanently plugged and abandoned in accordance with Part II.D.9 and Part III.C of the final permit, which requires that the permittee plug the well in such a manner that plugging does not allow movement of fluids into or between underground sources of drinking water. Windfall has submitted a plugging and abandonment plan on EPA Form 7520-14 which has been approved by EPA. This plan in provided in Attachment 1 of the final permit.

21) Injection well technology was developed in the 1930s. We should be using twenty-first century technology, not primitive, archaic technology.

Although injection wells were initially used back in the 1930s, the construction and operation of injection wells today cannot be compared to 1930's technology. Today's injection wells are multi-million dollar projects. The well construction today incorporates technologies and materials for casing and cementing that did not exist in the 1930s. Even the injection wells that were constructed in the 1960s, and were responsible for some of the contamination incidents that have been cited across the country (e.g., Hammermill in Erie, Pennsylvania), were inferior to today's well construction and operation standards. Reservoir engineering principles that are an essential part of planning an injection well project, before construction even begins, were not used in the 1930s or 1960s. If the design, construction and operation of an injection well incorporate technologies that are available today, EPA believes that injection wells that are permitted through the UIC program offer one of the safer and more environmentally effective alternatives for the disposal of fluids.

22) The company is responsible for self-reporting to EPA. This does not seem like an acceptable way for EPA to be able to ensure that the well operates properly.

The UIC regulations are similar to most other federal regulations in that they require self-monitoring and reporting to a state or federal agency. EPA expects all operators to comply with the regulatory requirements as well as their permit requirements. Failure of an operator to accurately monitor and report to EPA would subject the operator to possible civil or criminal penalties or both. EPA's inspection of injection well facilities and review of annual reports helps determine operator compliance and supplements self-reporting.

23) EPA should hold another public hearing. The original hearing started an hour late. EPA should have held a second public hearing about seismicity.

At the request of the public, EPA held a public hearing on the proposed permit on December 10, 2012, at the Brady Township Community Center in Luthersburg, Pennsylvania. Over 250 people attended this public hearing and EPA received oral comments from 29 people in attendance at the hearing. Although it is true that the hearing started late due to transportation problems encountered by the stenographer, the hearing did not end until all of those who wanted to speak had an opportunity to present their oral comments. During the time prior to the start of the formal hearing, EPA informally addressed questions which the audience asked. At the conclusion of the public hearing, EPA extended the public comment period, so anyone who did not speak at the hearing was still able to submit comments via email or mail.

In light of the interest and concerns about induced seismicity, EPA decided to explain in more detail why the proposed well is unlikely to pose a risk of induced seismicity, and to provide for public review some of the scientific work supporting the agency's conclusions. There were no changes to the draft permit. Thus the Region prepared a supplemental statement of basis and reopened the comment period under 40 C.F.R. 124.14(b). Reopening of the comment period under 124.14(b) does not require a second public hearing.

24) EPA should adopt the requirements that Ohio and Arkansas have adopted for wasterwater disposal wells.

EPA UIC wells are subject to the permit requirements in the federal UIC regulations. In issuing a permit, the Region considers whether a particular well meets the requirements of the SDWA. Whether a new requirement applicable to all wells of the same class is appropriate is beyond the scope of a permit issuance that focuses on the potential effects of one well.

The Arkansas Oil and Gas Commission has imposed distance restrictions on the construction of new Class II wells from a particular fault system in the state which has been associated with induced earthquakes. The distance restrictions do not apply throughout the state. See Arkansas

Oil and Gas Commissions General Rules and Regulations (Feb. 8, 2013), Rules B-43(c) and H-1(s).

The Ohio EPA also amended its statewide regulations concerning UIC Class II wells. The new regulations, which became final as of October 2012, give the state the discretion to require certain specific geological information and pressure testing as part of the UIC well applications. See OAC 1501:9-3-06(C). The amendments also require continuous monitoring of the annulus pressure and an automatic shut-off device which terminates injection if the maximum allowable pressure is exceeded. EPA typically includes these requirements in Calls II disposal well permits. The operation of the Windfall well includes continuous monitoring and an automatic shut-off device.

25) EPA should conduct an environmental impact assessment prior to issuing the permit.

Part 124.9(b)(6) of Title 40 of the Code of Federal Regulations establishes that UIC permits are not subject to environmental impact statement requirements of the National Environmental Policy Act ("NEPA"). NEPA requires environmental impact statements (EIS) when undertaking certain major federal actions. However, under the judicial doctrine of functional equivalent, where a federal agency is engaged primarily in examining environmental questions and there are procedural and substantive standards for adequate consideration on environmental issues, the NEPA EIS requirement does not apply. *See In re American Soda. LLP*, 9 E.A.D. 280, 290-291 (2000). The EPA Environmental Appeals Board has concluded that under the functional equivalent doctrine and Section 124.9(b)(6), EPA is not required to prepare an EIS in support of UIC permits.

Federal Underground Injection Control Program
Permit Appeals Procedures

The provisions governing procedures for the appeal of an EPA permitting decision are defined at 40 C.F.R. Part 124.19. (Please note that the changes to this regulation became effective on March 26, 2013. See 78 Federal Register 5281, Friday, January 25, 2013.) Any person, who commented on the draft permit, either in writing during the comment period or orally at the public hearing, can appeal the final permit by filing a written petition for review with the Clerk of the EPA Environmental Appeals Board (EAB). Persons who have not previously provided comments are limited in their appeal rights to those points which have been changed between the draft and final permits. Appeals may be made by citizens, groups, organizations, governments and the permittee within this procedural framework.

A petition for review must be filed within thirty (30) days of the date of the notice announcing EPA's permit decision. The petition for review can be filed by regular mail sent to the address listed below with a copy sent to EPA Region III.

Environmental Appeals Board
U.S. Environmental Protection Agency
1200 Pennsylvania Avenue N.W.
Mail Code 1103M
Washington, DC 20460-0001

U.S. Environmental Protection Agency
Ground Water & Enforcement Branch (3WP22)
Water Protection Branch

1650 Arch Street
Philadelphia, PA 19103

See the Federal Register notice cited above or the EAB website: http://yosemite.epa.gov/oa/EAB_Web_Docket.nsf/) for how to file with the EAB electronically or by hand delivery.

The petition must clearly set forth the petitioner's contentions for why the permit should be reviewed. It must specify the contested permit conditions or the specific challenge to the permit decision. The petitioner must demonstrate the issues raised in the petition had been raised previously during the comment period or at the hearing. If the appeal is based on a change between the draft and final permit conditions, it should be so stated explicitly. The petitioner must also state whether, in his or her opinion, the permit decision or the permit's conditions appealed are objectionable because of:

1. Factual or legal error, or

2. The incorporation of a policy consideration which the EAB should, at its discretion, review.

Within a reasonable time of receipt of the Appeals Petition, the EAB will either grant or deny the appeal. Denials are considered final agency action, upon which the permit becomes effective, and the Agency will so notify the petitioner. The petitioner may, thereafter, challenge the permit decision in Federal Court.

When a petition for review is granted, the permit conditions appealed are not deemed to be in effect and if these permit conditions are essential to the operation, the activity may not commence. Individually contested permit conditions are also stayed (not in effect) but other permit conditions are still in effect if they are legally severable from the contested condition.

The EAB will decide the appeal on the basis of the written briefs and the total administrative record of the permit action. If the EAB grants the appeal, it may direct the Region III office to implement its decision by permit issuance, modification or denial. The EAB may order all or part of the permit decision back to the EPA Region III office for reconsideration. In either case, a final agency decision has occurred when the permit is issued, modified or denied and an Agency decision is announced. After this time, all administrative appeals have been exhausted, and any further challenges to the permit decision must be made to Federal Court.