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

STATEMENT OF BASIS

U.S. EPA UNDERGROUND INJECTION CONTROL (UIC)
DRAFT CLASS IID PERMIT REISSUANCE PAS2D902BCLE

FOR

EXCO RESOURCES (PA), LLC
13448 STATE ROUTE 422, SUITE 1
KITTANNING, PA 16201

FOR

A project consisting of one Class IID injection well used for the disposal of produced fluids (brine) associated with oil and gas production located at:

Spencer Land Company Disposal Well #2
Ferguson Township
Clearfield County, Pennsylvania

On June 28, 2019, EXCO Resources (PA), LLC ("EXCO" or "the Permittee") submitted a UIC application for the reissuance of a permit that would allow for the continued operation of a class IID brine disposal injection well located in Ferguson Township, Clearfield County, Pennsylvania, into the Upper Devonian Tiona Sandstone formation. The coordinates for this Injection Well are: Latitude 40º 54' 38.9" and Longitude 78º 35' 54.7". EPA Region III staff reviewed this application and issued a Notice of Deficiency on August 29, 2019. In response to EPA's request, the Permittee supplemented the original permit application on October 8, 2019. After review of this additional information, EPA completed the technical review of the application on November 7, 2019. The Permittee's June 28, 2019 and October 8, 2019 submittals are collectively referred to in this Statement of Basis as the "permit application".

Kerr McGee Corporation of Pittsburgh, PA held the previous permit for the construction and operation of this injection well, effective on August 24, 1988. On March 19, 1991 the permit was transferred to Shawmut Development Corporation of Kittanning, PA. On July 27, 1999, the permit was transferred to Power Gas Marketing & Transmission, Inc. of Warrendale, PA. The permit was then transferred to EXCO on October 23, 2008. The permit expired on October 23, 2018.

Pursuant to the federal Safe Drinking Water Act, 42 U.S.C. §§ 300f *et. seq.*, and its implementing regulations, 40 C.F.R. Parts 144-146, and § 147.235, the EPA UIC Program is responsible

for regulating, through the issuance of permits, the construction, operation, monitoring and closure of injection wells that place fluids underground for disposal or enhanced recovery in oil and gas production. Today's draft permit specifies conditions for injection well construction, operation, monitoring, reporting, and plugging and abandonment which are specified to protect, and prevent the movement of fluids into Underground Sources of Drinking Water (USDW). The Permittee's UIC project and the draft permit conditions specific to the project are described below:

Area of Review: Pursuant to the applicable regulations, 40 C.F.R. §§ 144.3 and 146.6the "Area of Review" is an area surrounding the Injection Well, which the applicant must develop a program for corrective action to address any wells that penetrate the injection zone and which may provide conduits for fluid migration during the injection operation. EXCO calculated a Zone of Endangering Influence (ZEI) using the graphical method first developed by USEPA Region 6. The results indicate that the radial distance of the ZEI is approximately 1000 feet for the Spencer #2 well. EXCO proposed a fixed radius Area of Review (AOR) of one-quarter mile, or 1320 feet. Given that the calculated ZEI is less than the fixed radius (AOR), EPA has deemed one-quarter mile acceptable. In determining the fixed radius, EPA has considered the following information provided by the Permittee: chemistry of injected and formation fluids; hydrogeology, population and ground-water use and dependence; and historical practices in the area. EXCO has provided documentation on the fluid to be injected, the ground-water use in the area, and on the well population within the one-quarter mile of the Area of Review. The injectate is compatible with the formation as evidenced by historical successful use of the Tiona formation by the Spencer #2 well. The Permitee provided the location of all known wells and stated that "based on review of publicly available sources and information otherwise known to EXCO," there are no drinking water wells within the AOR but there are two drinking water wells within a mile radius of the injection well. These wells are shallow and have a maximum depth of 200 feet. The Permittee indicated that there is one plugged and abandoned well within the AOR that penetrates the Tiona Sandstone but was never produced. If any unplugged/abandoned wells that penetrate the injection zone are found within the Area of Review at a later date the draft permit requires the Permittee to perform corrective action.

Underground Sources of Drinking Water (USDW): An USDW is defined by the UIC regulations at 40 C.F.R. § 144.3 as an aquifer or its portion which, among other things, contains a sufficient quantity of ground water to supply a public water system and which also contains fewer than 10,000 mg/L (milligrams per liter) Total Dissolved Solids, and which is also not an exempted aquifer. The Permittee accessed the Pennsylvania Geological Survey's "Ground Water Inventory System" (GWIS) to determine groundwater sources in the site area. The database contained two groundwater wells within a one-mile radius and one of those wells being within ½ mile radius of the injection well. The wells range from 100 to 200 feet in depth. The permitee also reported that the wells yielded 1 to 10 gallons per minute during 120-minute test. Based on GWIS database, the Allegheny Group and the Conemaugh Group, particularly the Glenshaw Formation and the Cassellman Formation, are the primary USDWs that occur in the area around the injection well and Ferguson Township. Based on the two wells in the one-mile radius, 200 feet below ground surface is the lowermost USDW. However, to be conservative in protecting drinking water sources, the Permittee would like to establish 350 feet below ground surface to be the lowermost USDW. The proposed construction of the Injection Well will comply with the regulations at 40 C.F.R. § 147.1955(b), which require installing surface casing from the surface to a depth of at least 50 feet below the base of the lowermost USDW and cementing that entire length of casing back to the surface. EXCO will set the surface casing for the Injection Well at an approximate depth of 913 feet below ground surface and cement the casing back to the surface.

Injection and Confining Zones: The draft permit limits injection of fluids for disposal to the Upper Devonian Tiona Sandstone formation in the subsurface interval between, approximately, 2,600 to 2,620 feet below ground surface. The lowermost USDW is separated from the injection zone by approximately 2,250 feet. According to the geologic data provided by the permittee, the Tiona Sandstone is among the various sandstone and shale formations in the Bradford Group. Immediately above the Tiona are the Warren, Bayard and Fifth formations which are all producing formations within the Bradford Group. The Bradford formations above the Tiona have a thickness of approximately 900 feet that will act as a confining zone.

Injection Fluid: The draft permit limits the injection fluids in these wells to treated fluids produced from EXCO's oil and gas related operations. The draft permit also establishes a maximum daily injection volume of 15,000 barrels per month. One barrel of fluid is equal to 42 gallons.

The permit application includes analyses of the injection fluid that corresponds to the requirements stated in Paragraph II.C.3. in the draft permit. The parameters chosen for sampling reflect some of the typical constituents found in the injection fluid, as well as constituents found in shallow ground water. Should a ground water contamination event occur during the operation of the Injection Well, EPA will be able to compare samples collected from groundwater with the injection fluid analysis to help determine whether operation of the Injection Well may be the cause of the contamination.

Maximum Injection Pressure: The maximum allowable surface injection pressure for the permitted operation will be 1581 pounds/square inch (psi). The maximum pressure was developed using the depth to the Tiona Sandstone injection zone, the specific gravity of fluid injected at the EXCO Irvin 1-A UIC Class IID well (1.15) and a fracture gradient developed by using the instantaneous shut-in pressure. The injectate of the Spencer # 2 well will be similar to that fluid injected at the Irvin 1-A well.

Potential for Seismicity: The SDWA regulations for Class II wells do not require consideration of the seismicity, unlike the SDWA regulations for Class I wells for the injection of hazardous wastes. See regulations for Class I hazardous injection wells at 40 C.F.R. §§ 146.62(b)(1), 146.68(f). Nonetheless, because of public concerns about injection-induced seismicity, EPA evaluated factors relevant to seismic activity as discussed below and addressed more fully in "Region 3 framework for evaluating seismic potential associated with UIC Class II permits". EPA also established a maximum injection pressure which is designed to limit the potential for seismic events.

The region in which the Facility will be located consists of an extensive, thick, sedimentary sequence with numerous confining strata between the surface and the proposed injection zone. In addition, the Tiana Sandstone has been a gas producing interval in the area since at least the 1980s, resulting in a likely overall under-pressured condition, decreasing the risk of induced seismicity.

The permit provides that the Permittee shall inject through the Injection Well only into a formation which is overlain by a confining zone free of known open faults or fractures within the Area of Review as required in 40 C.F.R. § 146.22(a). The Permittee submitted geologic information that indicates the absence of faults within a one-mile radius of the Injection Well. Additionally, the entire Appalachian Plateau, on which the Facility will be located, is considered geologically stable with no active faults.

The available geophysical and seismic information researched by the Permittee, as well as through EPA's review of published information of seismicity in Pennsylvania, shows no evidence of faults that reach the land surface from basement rock. The potential for induced seismicity related to injection

wells is considered to be greater when injected fluids and pressures interact with faults that extend to Precambrian basement rocks. The depth to the Precambrian basement in the site vicinity for this well is estimated to be approximately at 16,400 feet below sea level. The base of the Tiona Sandstone formation is approximately 1,057 feet below sea level, therefore there is roughly three miles between basement and the injection zone.

The Permittee investigated earthquakes that have taken place in Pennsylvania. According to information compiled by the Pennsylvania State Seismic Network, operated by Penn State University, the closest earthquake to the Spencer #2 well was a magnitude 1.4 earthquake that occurred in March 2019 in Phillipsburg, PA which is approximately 6.26 miles away from the Spencer #2 well. The largest earthquake occurred in June 2019 with a magnitude 3.3 near Honey Grove, PA, approximately 67.8 miles away. According to the Pennsylvania Department of Conservation and Natural Resources (PADCNR), the largest magnitude earthquake listed occurred in January 2019 near the town of Cammal, PA at a magnitude of 1.9. Cammal is approximately 76 miles from the injection well. More information can be found on a PADCNR website about Earthquakes in Pennsylvania at (https://www.dcnr.pa.gov/Geology/GeologicHazards/Earthquakes/Pages/default.aspx).

The permit will include injection pressure limits to prevent the initiation or propagation of fractures that could create conduits for the injected fluid to flow to any existing faults. The maximum allowable injection pressure for this permit was calculated by the instantaneous shut-in pressure (ISIP). The ISIP is the minimum pressure necessary to begin to reopen any fractures created during the fracture stimulation process and is significantly lower than the pressure required to fracture the rock. The surface injection pressure is less than both the ISIP and the fracture pressure to prevent the initiation of new, or the propagation of existing, fractures.

Finally, a number of factors help to prevent injection wells from failing in a seismic event and contributing to the contamination of a USDW. Most Class I or Class II injection wells, including this Injection Well, are constructed to withstand significant amounts of pressure. The EXCO Injection Well will be constructed with multiple steel rings of casing that are cemented in place. Furthermore, both the existing and the draft Permits require EXCO to mechanically test the Injection Well to ensure integrity before operations begin and continuously monitor the Injection Well during operations to detect any potential mechanical integrity concerns. The Injection Well is also designed to automatically shut-in and cease operation in the event that the mechanical integrity of the well is compromised, including by a seismic event.

Testing, Monitoring and Reporting Requirements: The Permittee is required to conduct a mechanical integrity test (MIT) after construction of the Injection Well. The MIT consists of a pressure test to make sure the casing, tubing and packer in the well does not leak and a fluid movement test, through the review of cementing records and a cement bond log or a temperature log to make sure that movement of fluid does not occur outside of the injection zone. In addition to the monitoring described above, additional pressure testing of the casing, tubing and packer will occur every five years and whenever a rework on the well requires the tubing and packer to be released and reset.

The Permittee will be responsible for continuously monitoring the injection well for surface injection pressure, flow rate and cumulative volume beginning on the date which the injection well commences operation and concluding when the injection well is plugged and abandoned. The Permittee must submit an Annual Report to the EPA Director summarizing the results of the monitoring required by the draft permit, including monthly monitoring records of the injection fluid, the results of any mechanical

integrity testing and any major changes in the characteristics of the injected fluid. The annual report must be submitted to EPA by January 31 of each year and report the previous calendar year information.

Plugging and Abandonment: The Permittee has submitted a plugging and abandonment plan that will result in an environmentally protective well closure at the time of cessation of operations. The Permittee has established a Trust Fund to ensure proper plugging of the Injection Well. The amount of the Performance Surety Bond shall cover the estimated cost to close, plug and abandon the Injection Well in the amount of at least $61,820. The amount of the Trust Fund is based on an independent third-party estimate for the cost of plugging and abandonment of the injection well. This should preclude the possibility of abandonment without proper closure.

Expiration Date: When issued, a final permit will be in effect for ten years from the date of the permit effective date. EPA will conduct an annual review of the Permittee's operation. The final permit will contain essentially the same conditions of this draft permit unless information is supplied to EPA which would warrant alternative conditions or actions on this permit application.

Additional Information: The Administrative Record for the draft permit is available for public inspection during normal business hours at the offices of U.S. EPA Mid-Atlantic Region, at the address shown below. All information submitted by the Permittee in support of the draft permit, unless deemed confidential, is included in the Administrative Record for the permit and is available to the public for review. Copies of permit applications, the draft permit, the statement of basis, and the administrative record index are available for review and inspection at the Curwensville Public Library which is located at 601 Beech Street, Curwensville, PA 16833. Please direct any questions, comments and requests for additional information to the contact person listed below. EPA has tentatively scheduled a public hearing for January 7, 2020, 6:00 PM at the Curwensville School Auditorium, 650 Beech Street, Curwensville, PA 16833. **Requests to hold this public hearing must be received by December 31, 2019**. When requesting a public hearing, please state the nature of issues you propose to raise. EPA expressly reserves the right not to hold a hearing unless a significant degree of public interest is evidenced on the proposed injection operation**. The Administrative Record for this action will remain open for public comment until January 7, 2020.**

Submit comments or requests for a hearing or for additional information to:

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