

# PANTEX ENVIRONMENTAL RESTORATION

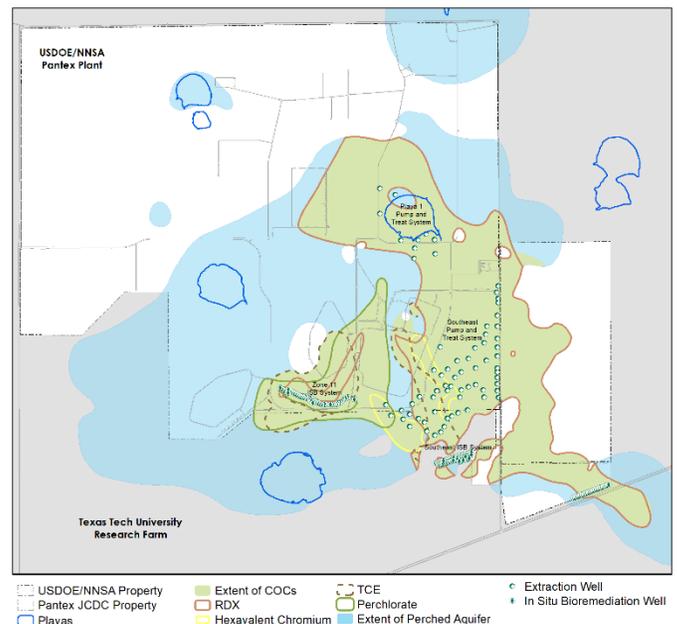


## *In Situ Groundwater Bioremediation Systems*

The Pantex Groundwater Resource Conservation and Recovery Act Facility Investigation Report identified impacts to perched groundwater that require corrective action. The Pantex Site Wide Human Health Risk Assessment found that perched groundwater underneath the Pantex Plant contains high explosives and other constituents that could migrate over time to the Ogallala Aquifer, the main drinking water source for the area. A Record of Decision (ROD) was issued in 2008 with concurrence of the Environmental Protection Agency (EPA) and Texas Commission on Environmental Quality (TCEQ) to address cleanup of the legacy contamination at the Pantex Plant. The Selected Remedy for perched groundwater is a combination of extraction and treatment in areas with greater than 15 feet of saturation and in situ treatment in the thinner areas.

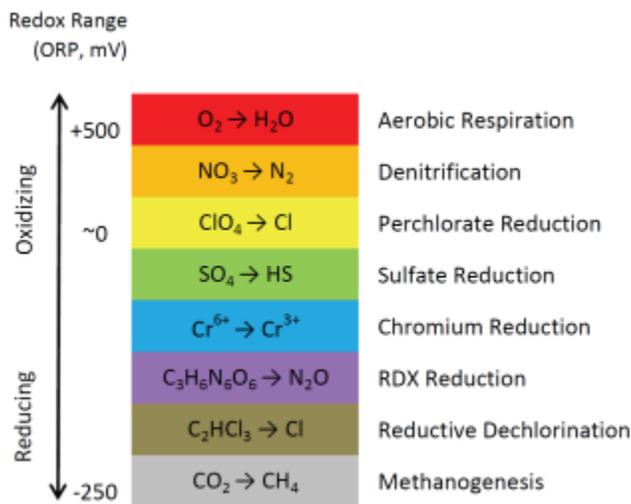
The area of primary concern for in situ treatment is in the area southeast of the main Plant on the adjacent Texas Tech University property. The fine-grained zone prevents vertical migration in most areas, but becomes thinner and more permeable in the southeast, so migration to the Ogallala Aquifer is more probable there. The area to the southeast also has thin saturated thickness so pump and treat technology is not a viable option in portions of that area. Another area identified for cleanup is located south of Zone 11 on Pantex property and is a concern for migration offsite to the Texas Tech University property. Another area to the southeast was identified after the first Five-Year Review where it was noted that the area was not under control of the pump and treat system and the high explosive plume was continuing to migrate to the southeast.

To address the areas of concern, Pantex operates three in situ bioremediation (ISB) systems consisting of 121 active injection wells and 17 downgradient wells to monitor the effectiveness of the treatment zone. The Southeast ISB was installed in the southeast area of the plume on Texas Tech property where the fine-grained zone is more permeable. The Southeast ISB Extension was installed at the southeast property boundary east of FM 2373 to prevent further offsite movement of the perched groundwater plumes. The Zone 11 ISB was installed to intercept contaminants moving towards Texas Tech University property to the south and to address multiple contaminants that are treatable with ISB technology.



*Plume Boundary and Groundwater Remedies, 2019*

The objective of the ISB systems is to establish an anaerobic biodegradation treatment zone capable of reducing contaminants to levels that are safe for residential use. This is accomplished by injecting the necessary amendments or nutrients into the treatment zone wells to stimulate resident bacteria. As the naturally occurring bacteria feed and multiply, oxygen is removed from the injected area and deep reducing conditions are established for treatment of the contaminants. The ISB must achieve reducing conditions for perchlorate, chromium, RDX, and reductive dechlorination (TCE). The figure below shows the reducing conditions required to breakdown various contaminants.



Pantex monitors the treatment zone to evaluate the health of the bacteria so injection frequencies and volume of food source can be adjusted. Downgradient wells are also monitored to evaluate the effectiveness of treatment. As long as optimal subsurface reducing conditions and a food source is available, a diverse bacterial community can be sustained which leads to in situ treatment of contaminants.

The Southeast ISB system was installed in 2007 on the Texas Tech University property, as an early action. The injection wells were drilled in a line perpendicular to the hydraulic gradient so the water flowing through the treatment zone will be treated before reaching the area beneath Texas Tech property where the fine-grained zone layer becomes thinner and more permeable.



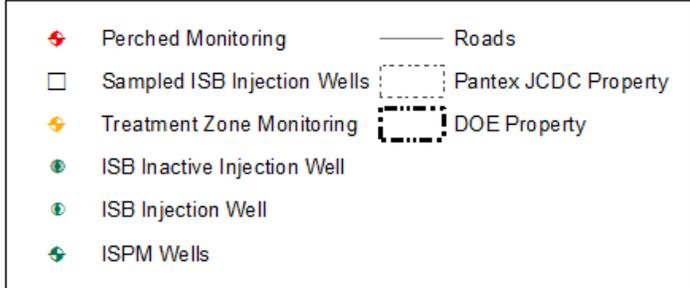
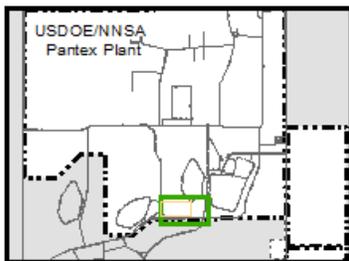
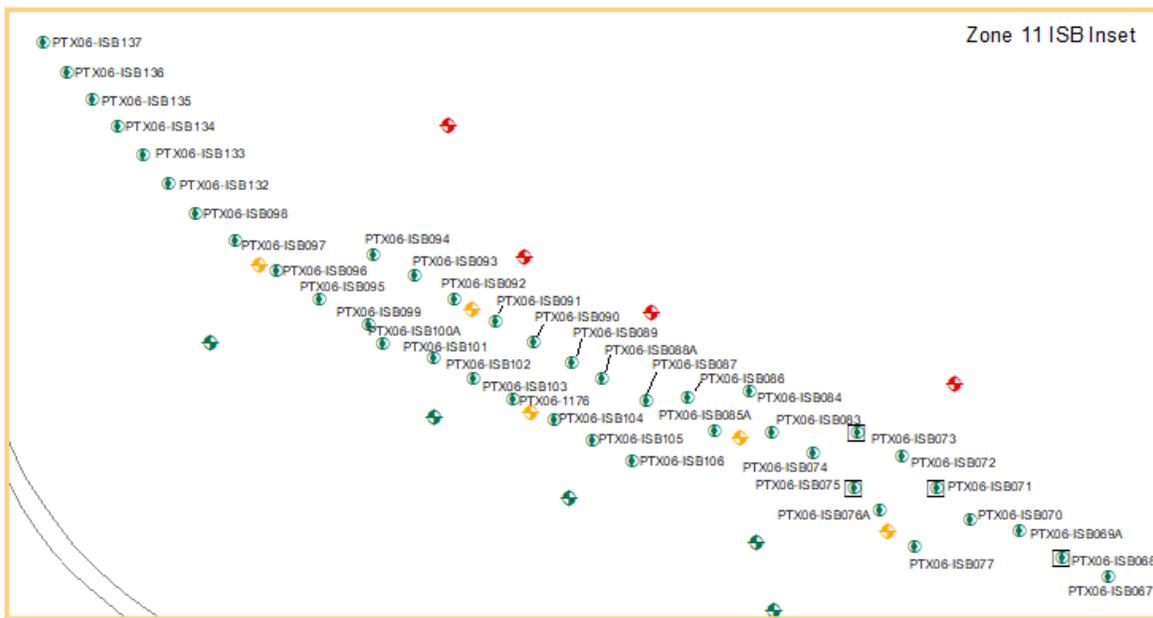
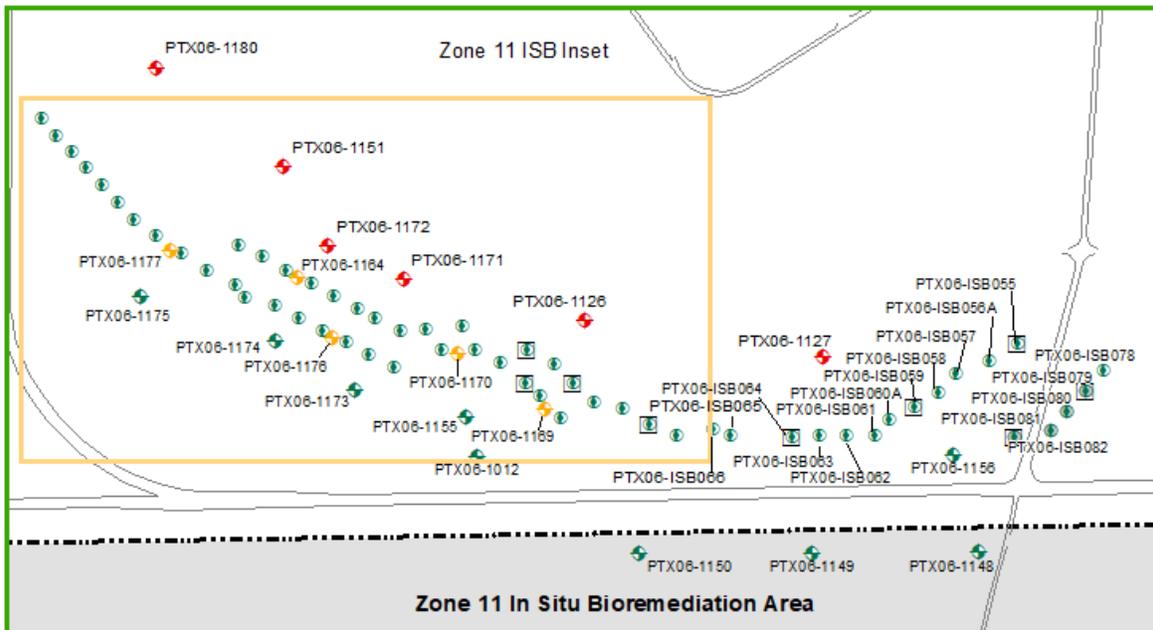
Amendment Tanks and Control Buildings at the ISBs

Based on the rate of perched groundwater flow and estimated amendment longevity, injections are necessary about every 18-36 months. Injection frequencies/volumes are expected to change over time at this system as the Pump and Treat Systems continue to operate and remove water that could move south through the Southeast ISB.

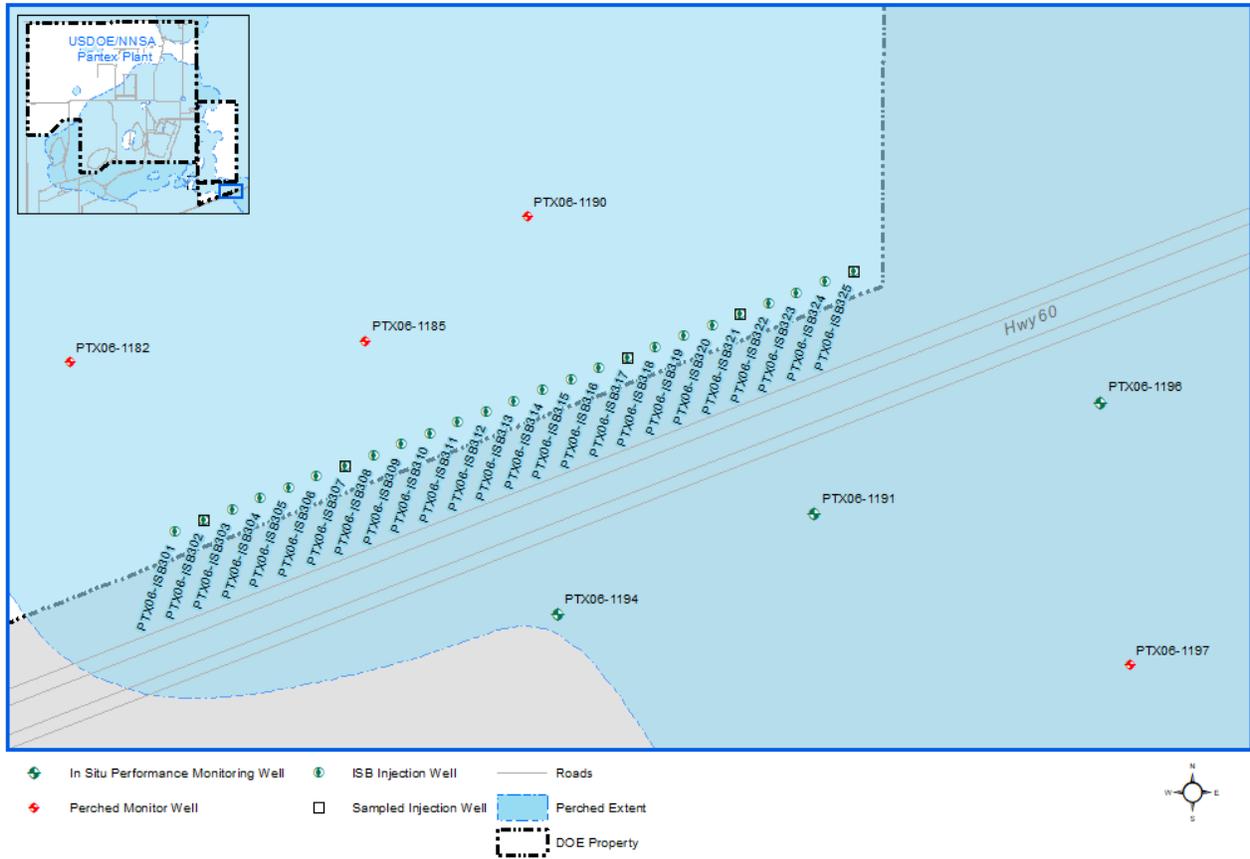
The Southeast ISB Extension was installed in 2017 after discovery of the high explosive plume expansion beyond the property boundary. The system was designed to prevent further movement of the groundwater plume offsite in areas that are not captured by the pump and treat system and water is too thin to pump. Based on the rate of perched groundwater flow and estimated longevity of molasses, injections are necessary every 6-9 months.

The Zone 11 ISB system was installed in 2009 as part of the final Remedy with an expansion occurring after initial treatment and again in 2014. The injection wells were drilled in a line perpendicular to the hydraulic gradient so water flowing through this zone will be treated before it reaches the area south on Texas Tech property near Playa 4. Based on the rate of perched groundwater flow and estimated longevity of molasses, injections are necessary every 9-12 months.





Zone 11 ISB System, 2019



Southeast Extension ISB System, 2019