

# 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. The area of primary concern is in the 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.

To address the areas of concern, Pantex operates two in situ bioremediation (ISB) systems consisting of 94 injection wells and 13 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. 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.

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. The microbial growth creates reducing geochemical conditions. Under reducing conditions, biological and chemical treatment mechanisms are carried out. 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. Results of the treatment are monitored in wells downgradient from the treatment zone wells.



***Amendment Tanks and Control Buildings at the ISBs***

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.

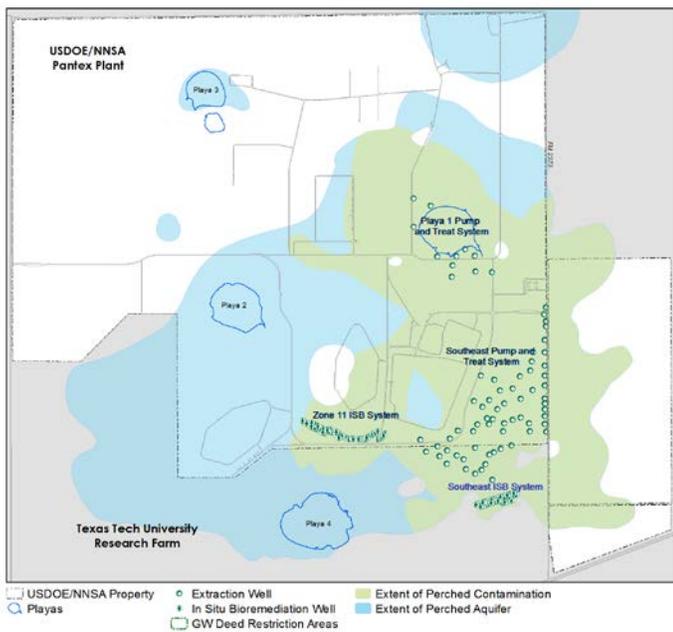
Based on the rate of perched groundwater flow and estimated amendment longevity, injections are necessary about every 18-36 months. Injection frequencies/volumes are expected to change over time at this system as the Pump and Treat Systems continue to operate and remove water that could move south through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

The 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 amendment longevity, injections are necessary every 12-24 months.

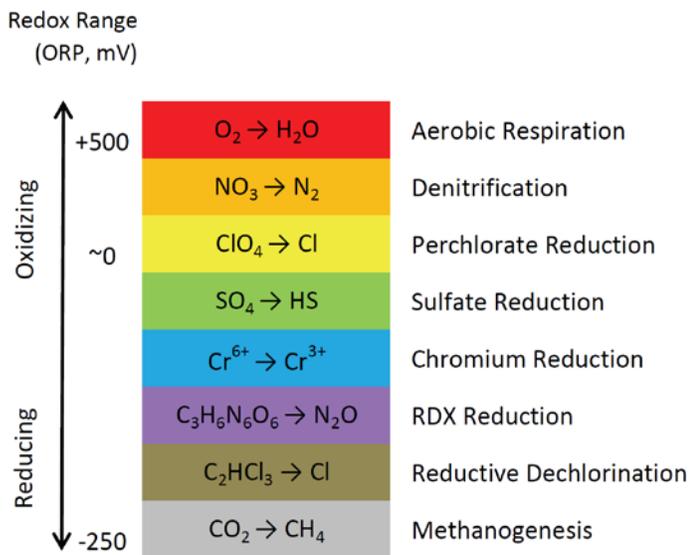
The Southeast ISB primarily treats the high explosive RDX and hexavalent chromium. This system has successfully treated high explosives and hexavalent chromium below safe levels at most downgradient wells. One downgradient well on the southwest end of the system does not demonstrate treatment. Pantex is investigating whether this well is hydraulically connected to the system or if treatment has not been effective in a portion of the system. Treatment options will be evaluated with time as wells are drilled and more information becomes available.

The Zone 11 ISB primarily treats the organic solvent trichloroethene (TCE) and perchlorate. This system has successfully treated perchlorate to safe levels and TCE has been greatly reduced and is expected to meet safe levels in a short time. While TCE levels are declining, the breakdown product of TCE are showing signs of incomplete treatment. Because of this incomplete treatment, bioaugmentation with a necessary bacteria, *Dehalococcoides*, was implemented in 2015. It is expected that the bacteria will completely treat TCE and its breakdown products to safe drinking levels.

The ISB Systems must achieve deep reducing conditions for treatment of RDX and TCE. The figure below demonstrates the reducing conditions that are required to breakdown various contaminants. The ISB must achieve reducing conditions for perchlorate, chromium, RDX, and reductive dechlorination (TCE). Pantex monitors the treatment zone to evaluate the health of the zone and to adjust injection frequencies or volume of amendment as needed. Pantex also monitors the downgradient wells to evaluate the effectiveness of treatment of the contaminants in each area.



**Plume Boundary and Groundwater Remedies**



It is expected to take several years of treatment to allow the contaminant plumes to move through the treatment zones. Pantex will continue to operate this action and provide results in progress reports that can be found at [pantex.energy.gov](http://pantex.energy.gov). This action is one of several positive steps Pantex is taking to protect the public and Ogallala Aquifer.

