

## Injection Regulation

Underground injection of wastewaters has been the cornerstone of safe disposal of oil and gas wastewaters for over 80 years. It got started in the oilfield by engineers who understood the subsurface and the security the technology offered. In the 1950s, manufacturers and refiners began using the technology. Before the 1980s, regulation by the states was uneven and sometimes almost non-existent. Even then, impacts to groundwater were extremely rare.

### Five Myths about Underground Injection

**Underground injection is an old technology that regulators and generators are trying to get away from.**

USEPA's regulatory program is well established and has an excellent track record of protecting human health and the environment since federal rules were first implemented in 1980. In fact, the agency considers underground injection the preferred waste management method in many applications for a very good reason: it's the only technology that actually removes the contaminants from the biosphere, instead of simply rearranging them.

**Injection wells are a threat to groundwater.**

UIC rules require that wastewater gets introduced into specified porous strata within the subsurface and that those strata are overlain by an impermeable confinement layer that prevents the upward migration of waste. A UIC permit prescribes a maximum pressure limit that prevents fracturing of the confinement layer. If the

injection pressure approaches the permitted limit, the system shuts down automatically. Required, periodic electric wireline inspections as well as pump tests confirm that injection is occurring in accordance with the permit, and that the mechanical condition of the well is sound. No Class I well has ever failed to contain injectate in its confining zone since the advent of federal regulation in the 1980s.

**“The EPA has no reason but to conclude that existing Class I UIC regulatory controls are strong, adequately protective, and provide an extremely low-risk option in managing the wastewaters of concern.” – USEPA**

**Injection wells cause earthquakes.**

In the few places where they have, injection rates and/or pressures were very high. (These recent incidents involved wells regulated by the UIC Class II program.) Earthquake-prone areas are extensively documented and should be avoided in the initial site selection process. Ohio rules for Class I wells require gathering data from four seismic lines covering over 12 square miles around the proposed wellbore. An earth scientist interprets the data, looking for any faulting that might provide an upward pathway out of the injection zone. Any such faulting would render the site unacceptable. Ohio also requires an array of seismic sensors near the property for ongoing, continuous monitoring of the site to detect

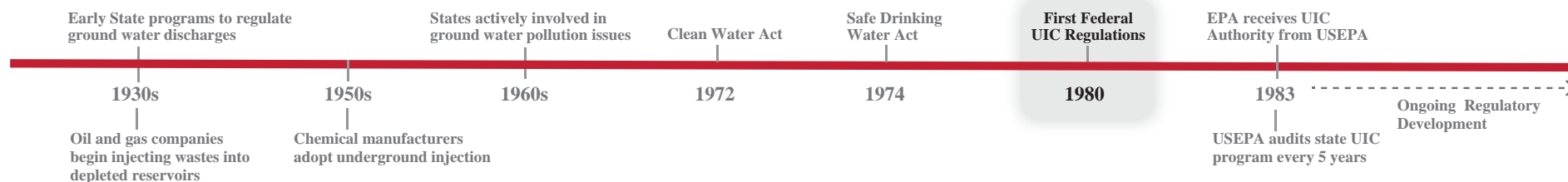
tremors in the area—whether or not they can be felt on the surface, whether or not they're associated with injection activity. Any such events are analyzed by an earth scientist and regularly reported to Ohio EPA. Taken altogether, Ohio's requirements provide a robust and effective impediment to induced seismic events. After over 975,000,000 gallons injected over almost ten years, we've never had a tremor.

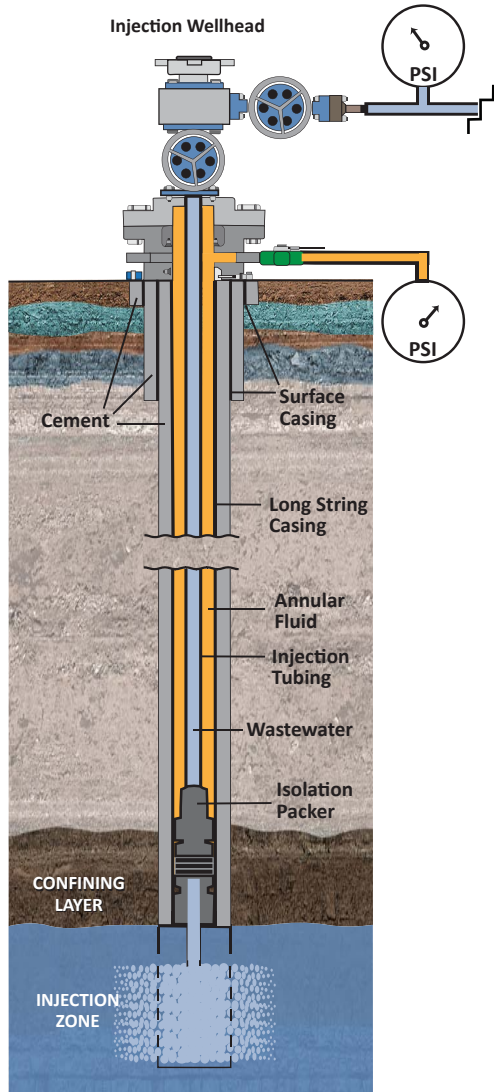
**You can't know where the wastewater is going once it's injected.**

Periodic tests and electric wireline logs provide an accurate picture of the exact depth where the wastewater enters the subsurface to assure that it goes into the permitted injection zone and nowhere else, and that it stays there. Finally, there's this: in its natural state, an injection zone contains saltwater. If the geologic setting had a pathway to fresh groundwater, the saltwater would have contaminated it tens of thousands of years ago.

**Injection wells expose a generator to cleanup liability if the well fails.**

In fact, since the advent of federal regulation, no Class I well has ever failed to contain wastes within its injection zone—let alone reached a drinking water formation much further uphole. Stories about UIC failures typically confuse poor housekeeping of the surface facility (which is not regulated by the UIC program) with a compliant UIC well on the same property. No Class I UIC well has ever gone through a cleanup action. You can't say that about landfills.





NOT TO SCALE

### Operational Safeguards

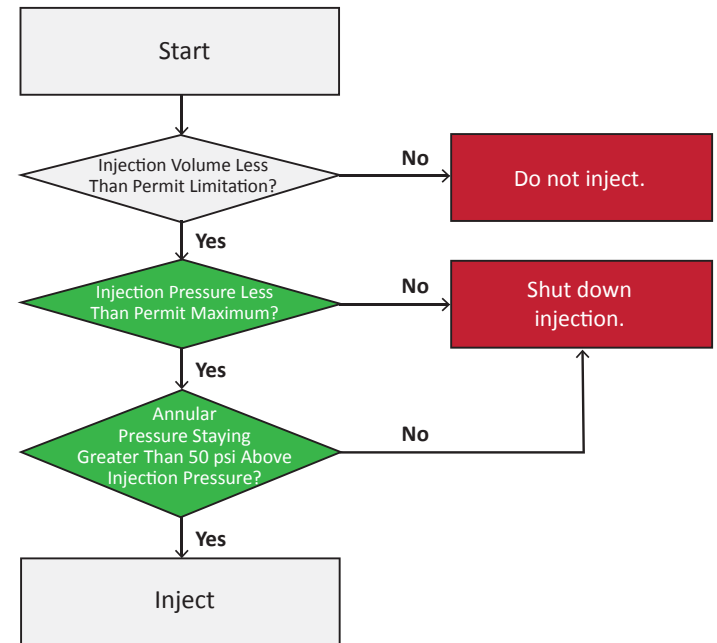
A focal point of UIC regulation is the injection pressure. A permit includes a maximum allowable injection pressure to prevent excessive injection pressure from fracturing the confining layer above the injection zone and create an upward pathway for the injectate.

Another cornerstone of UIC regulation is mechanical integrity. These rules require real-time monitoring of annular pressure. A change in pressure triggers an automatic shutdown, indicating a loss of the ability to monitor for a potential leak of waste out of the well, even though the injectate would still be safely contained in the well.

Finally, periodic wireline logging and pressure tests confirm that the injectate is entering only the injection zone and isn't migrating upward.

REQUIRED INSPECTION AND MONITORING	
Ohio Environmental Protection Agency	
Continuous, with automatic shut down	Annulus Pressure Monitored
Continuous	Injection Pressure Monitoring
	Seismic Monitoring
Monthly	Ohio EPA Reporting
Yearly Testing	Annulus Pressure Test
	Radiological Tracer Survey
	Formation Pressure Fall Off
Three-Year Testing	Differential Temperature Survey
Five-Year Testing	Casing Inspection Log

“...the probability of loss of waste confinement due to Class I injection has been demonstrated to be low” and “existing Class I regulatory controls are strong, adequately protective, and provide an **extremely low-risk option in managing the wastewaters of concern.**” – USEPA



The decision tree above sets forth simple, unambiguous operational rules for compliant injection.

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