

HS Earth: Pollution Detective

Students observe how ground water transports pollutants, and simulate ground water testing to discover the source of contamination.

Science

Str/std/bch	Performance Standard
I.I.I.	9-12.2. Design and conduct scientific investigations that include: <ul style="list-style-type: none"> • testable hypotheses • controls and variables • methods to collect, analyze, and interpret data • results that address hypotheses being investigated • predictions based on results • re-evaluation of hypotheses and additional experimentation as necessary
II.I.I.	9-12. 4. Identify and apply measurement techniques and consider possible effects of measurement errors.
II.III.II.	Geochemical Cycles 9-12. 9. Know that Earth’s system contains a fixed amount of natural resources that cycle among land, water, the atmosphere, and living things (e.g., carbon and nitrogen cycles, rock cycle, water cycle, ground water, aquifers).
II.III.II.	Geochemical Cycles 9-12. 12. Explain how the availability of ground water through aquifers can fluctuate based on multiple factors (i.e., rate of use, rate of replenishment, surface changes, and changes in temp).
III.I.I.	Science and Society 9-12. 9. Describe how scientific knowledge helps decision makers with local, national, and global challenges (e.g., Waste Isolation Pilot Project [WIPP], mining, drought, population growth, alternative energy, climate change).

Social Studies

Str/std/bch	Performance Standard
Hist.I.I-A.	9-12. 2. Analyze the geographic, economic, social, and political factors of New Mexico that impacted United States and world history, to include: <ul style="list-style-type: none"> • role of water issues as they relate to development of industry, population growth, historical issues, and current acequia systems/water organizations
Geog.II.II-D.	9-12.1 Analyze how the Earth’s physical processes are dynamic and interactive. 9-12.2 Analyze the importance of ecosystems in understanding environments. 9-12.3. Explain and analyze how water is a scarce resource in New Mexico, both in quantity and quality.
Geog.II.II-E.	9-12.1. Analyze the factors influencing economic activities (e.g., mining, ranching, agriculture, tribal gaming, tourism, high tech) that have resulted in New Mexico’s population growth.
Geog.II.II-F.	9-12.1 Compare the ways man-made and natural processes modify the environment and how these modifications impact resource allocations. 9-12.2 Analyze how environmental changes bring about and impact resources.

Extension – Read and discuss the article below. Ask students to draw an editorial cartoon about the article. To brainstorm, ask students to write nouns, adjectives, and verbs about drinking water. For those who are having trouble getting started, ask them to write nouns, adjectives, and verbs about jet fuel. Ask them to randomly pick a “drinking water” word and a “jet fuel” word. How can they use these two words in a cartoon?

Science

Str/std/bch	Performance Standard
III.1.1.	9-12.3. Evaluate the influences of technology on society (e.g., communications, petroleum, transportation, nuclear energy, computers, medicine, genetic engineering) including both desired and undesired effects, and including some historical examples .

Jet Fuel Leak Discovered at Kirtland

July 17, 2008

Albuquerque Journal

Yes, there is a large jet-fuel leak originating under Kirtland Air Force Base. And yes, it has reached the underground aquifer outside Kirtland grounds.

No, it won't affect drinking water supplies any time soon, according to state and Kirtland officials.

Estimates say that the jet fuel, sitting more than a foot deep on top of groundwater in some areas, will take more than 25 years to reach any wells that produce drinking water, said Baird Swanson, an environmental scientist with the New Mexico Environment Department.

"It's on the order of decades before migrating to drinking water supplies," he said.

Kirtland officials released the news to local media Friday, explaining that a leak they had been cleaning up since 1999 was larger than anyone had anticipated. The leak itself was revealed at the time.

The fuel has been leaking, Swanson estimates, since sometime in the 1970s. He said the amount of fuel that escaped the line over the years is impossible to know, but the leakage had to have been significant.

"(The fuel line) would have been releasing for a very long time in a large amount," Swanson said.

He said jet fuel can cause cancer if ingested.

Fuel cleanup project manager Mark Holmes said they expect to be able to clean up the fuel before it reaches drinking wells but would institute other -- and extremely expensive -- plans to remove the fuel if it creeps too close.

It is estimated to be about 1.5 miles from a drinking water well in Albuquerque's Ridgecrest neighborhood, which is the direction the leak is headed based on underground geography, Col. Robert E. Suminsby, Kirtland's base commander, said Wednesday.

The leak is closer to two wells inside the base, including 1,100 feet from one that serves the New Mexico Veterans Affairs Medical Center, but it is unlikely the plume would travel in that direction, Holmes said. Swanson said the fuel moving toward the hospital well would be akin to fluid moving across a flowing river instead of downstream.

The plan is to drill 11 more monitoring wells at a cost of \$2.8 million of Air Force funds to find the exact dimensions of the leak and any other information, and to continually update plans to remove the fuel as more data is available, Suminsby said.

And while the Air Force is moving as quickly as possible to properly clean up the leak, he said, no one will be in danger for quite some time.

"This is not an immediate cause for panic," Suminsby said.

Besides, the Air Force has already got two Ford V8 engines on the job 24-7, Holmes said.

The engines, attached to hoses that connect to various monitoring wells at different depths, suck up the jet fuel just like a normal car engine and burn the fuel to keep the engines running, he said.

That means the engines are powered by the same fuel they are cleaning up and can run constantly, with small pauses for oil and spark plug changes, Holmes said. Catalytic converters clean the emissions from the engine before they are released into the air, making it a fairly clean process, he said.

The engines have already sucked 130,000 gallons of the fuel from the ground.

Brent Wilson, base civil engineer director, said it was possible the engines could be used to power other devices and the Air Force was looking into the possibility of using the energy produced by the jet-fueled engine with other projects.

The engines have been in place since shortly after the leak was discovered in 1999, but the Air Force is looking into buying another twin engine machine to speed up the process now that the leak is known to be larger, Holmes said.

The Air Force drew immediate criticism from the Southwest Research and Information Center, an Albuquerque group that monitors groundwater contamination, for not notifying the public about the leak for several months.

Suminsby said Air Force officials immediately contacted the state Environment Department and kept both the city and the city-county Water Utility Authority in the loop about the leak once they discovered it had spread in February 2007.

The Air Force found out the leak had spread outside base grounds after new monitoring wells were completed in November 2007 and also shared that information with local and state governments, he said.

As for releasing the information to the media, Suminsby said they simply didn't know enough about the leak's spread.

"The natural inclination is everyone wants to know the problem ... But we won't know that until we drill the remainder of the monitoring wells," Suminsby said. "We didn't have enough answers."

<http://www.military.com/news/article/jet-fuel-leak-discovered-at-kirtland.html?ESRC=topstories.RSS>