

Why GAO Did This Study

Oil shale deposits in Colorado, Utah, and Wyoming are estimated to contain up to 3 trillion barrels of oil—or an amount equal to the world’s proven oil reserves. About 72 percent of this oil shale is located beneath federal lands, making the federal government a key player in its potential development. Extracting this oil is expected to require substantial amounts of water and could impact groundwater and surface water. GAO was asked to report on (1) what is known about the potential impacts of oil shale development on surface water and groundwater, (2) what is known about the amount of water that may be needed for commercial oil shale development, (3) the extent to which water will likely be available for commercial oil shale development and its source, and (4) federal research efforts to address impacts to water resources from commercial oil shale development. GAO examined environmental impacts and water needs studies and talked to Department of Energy (DOE), Department of the Interior (Interior), and industry officials.

What GAO Recommends

GAO recommends that Interior establish comprehensive baseline conditions for water resources in oil shale regions of Colorado and Utah, model regional groundwater movement, and coordinate on water-related research with DOE and state agencies involved in water regulation. Interior generally concurred with GAO’s recommendations.

View [GAO-11-35](#) or key components. For more information, contact Mark Gaffigan or Anu Mittal at (202) 512-3841 or gaffiganm@gao.gov or mittala@gao.gov.

ENERGY-WATER NEXUS

A Better and Coordinated Understanding of Water Resources Could Help Mitigate the Impacts of Potential Oil Shale Development

What GAO Found

Oil shale development could have significant impacts on the quality and quantity of water resources, but the magnitude of these impacts is unknown because technologies are years from being commercially proven, the size of a future oil shale industry is uncertain, and knowledge of current water conditions and groundwater flow is limited. In the absence of effective mitigation measures, water resources could be impacted from ground disturbances caused by the construction of roads and production facilities; withdrawing water from streams and aquifers for oil shale operations, underground mining and extraction; and discharging waters produced from or used in operations.

Estimates vary widely for the amount of water needed to commercially produce oil shale primarily because of the unproven nature of some technologies and because the various ways of generating power for operations use differing quantities of water. GAO’s review of available studies indicated that the expected total water needs for the entire life cycle of oil shale production ranges from about 1 barrel (or 42 gallons) to 12 barrels of water per barrel of oil produced from in-situ (underground heating) operations, with an average of about 5 barrels, and from about 2 to 4 barrels of water per barrel of oil produced from mining operations with surface heating.

Water is likely to be available for the initial development of an oil shale industry, but the size of an industry in Colorado or Utah may eventually be limited by water availability. Water limitations may arise from increases in water demand from municipal and industrial users, the potential of reduced water supplies from a warming climate, fulfilling obligations under interstate water compacts, and the need to provide additional water to protect threatened and endangered fishes.

The federal government sponsors research on the impacts of oil shale on water resources through DOE and Interior. DOE manages 13 projects whose water-related costs total about \$4.3 million, and Interior sponsored two water-related projects, totaling about \$500,000. Despite this research, nearly all of the officials and experts that GAO contacted said that there are insufficient data to understand baseline conditions of water resources in the oil shale regions of Colorado and Utah and that additional research is needed to understand the movement of groundwater and its interaction with surface water. Federal agency officials also said they seldom coordinate water-related oil shale research among themselves or with state agencies that regulate water. Most officials noted that agencies could benefit from such coordination.