Center for
Western Priorities

1121 Grant Street
Suite CH-1B
Denver, CO 80203

Oil Shale

Key Facts:

- Oil Shale Industry Has Never Functioned At a Profitable Level, Would Likely Be Subsidized By the Federal Government.
- According to the Department of Energy Oil Shale Industry Would Require 31 Square Miles Per Million Gallons of Oil Production.
- Commercial Industry Operating to Produce an Average of 2.5 Million Barrels Per Day Would Involve Surface Mines Covering a Cumulative Area Roughly the Size of the City Of Boston.
- Oil Shale Would Require Massive Expansion of Existing Electricity Generation and Transmission Infrastructure.
- According to the Department of Energy, Oil Shale Is Concentrated In Area with Considerable Wildlife, Adjacent To Conservation and Wilderness Areas; Development Would Dwarf any Industrial Land Use Pursued In U.S. History.
- 200,000 Barrel a Day In Situ Plant Would Increase Electricity Consumption By 2,400 Megawatts – Requiring 135 Billion Cubic Feet of Natural Gas and Resulting in a Fuel Bill of $600 Million Per Year
- Shell Study Showed Greenhouse Emissions from ICP Research Site Generated 21 to 47 Percent More Emissions than Conventional Oil Production.
- Oil Shale Industry Will Produce Large Quantities Of Carbon Dioxide.
- Projected Water Use for Shale Development Exceeds Availability in Colorado Basin.

FACT SHEET

According to the Bureau of Land Management, "Oil shale is a fine-grained sedimentary rock that contains various amounts of organic matter. Oil in the shale is contained within a waxy, bituminous substance called kerogen. In order to

Center for
Western Priorities

1121 Grant Street
Suite CH-1B
Denver, CO 80203

release the oil from the kerogen, the rock must be heated to about 650 to 700 degrees Fahrenheit in an oxygen-free environment. An environmentally sound and profitable process of harvesting oil shale for commercial use has not yet been discovered, and some estimates say it could take thirty years to develop.

In order for oil shale production to be profitable, the industry must overcome technical, environmental, regulatory, and economic obstacles. The industry has never operated at a profitable level, and the sheer size of the potential industry would necessitate a rapid return on investment. The federal government would likely have to subsidize the industry. In addition, oil shale production poses environmental risks at times greater than conventional oil production. The Department of Energy stated that oil shale production would generate sulfur and nitrogen oxides, particulate matter and large quantities of carbon dioxide. A study by Shell oil showed that an in situ site generated 21 to 47 percent more emissions than conventional oil production. Additionally oil shale byproducts would require off site processing while some spent shale would be sent to landfills. Underground processing would also pose a water contamination risk.

Finally, the large scale of commercial oil shale cannot be supported by the existing infrastructure in the West. To process oil shale, new pipelines, water storage plants, and refineries would need to be constructed. The commercial oil shale industry could bring 50,000 new residents to sparsely populated areas of Colorado, Wyoming, and Utah stretching available housing stock and labor forces.

Oil Shale Development Would Be Challenging

An environmentally sound and profitable process of harvesting oil shale for commercial use has not yet been discovered, and some estimates say it could take thirty years to develop. Dubbed a miracle fuel, processes for developing commercial oil shale production are flawed, and the quest for its viability has been liked to cold-fusion.

BLM: "Environmentally And Economic Techniques To Extract Oil Shale Have Not Been Discovered." According to the Bureau of Land Management, "Economic and environmentally acceptable technologies to extract oil from oil shale have not yet been discovered." [Bureau of Land Management, Oil Shale Fact Sheet, February 2011]

Development Of Oil Shale Could Take 12 To 30 Years To Develop. According to the independent nonpartisan research group Headwaters Economics, "Reports typically put the time from the present stage of RD&D to full-scale commercial

Center for
Western Priorities

1121 Grant Street
Suite CH-1B
Denver, CO 80203

development (under the right hypothetical scenarios) at a minimum of 12 to 15 and as many as 20 to 30 years away. The change in administration may have an immediate impact on the timeline for commercial oil shale development. In contrast to his predecessor, Secretary of the Interior, Ken Salazar, advocates a go-slow approach, and recently stated that those who see oil shale as a 'panacea for America's energy needs have been living in fantasy land.' Another potential obstacle related to time is the assumption that oil shale will be viable after the next 10 to 15 years of significant investment in competing alternative energy sources." [Headwaters Economics, Oil Shale in the West: 14 Unanswered Questions, January 2010]

Most Methods Of Transforming Oil Shale Are Deeply Flawed, Dubbed Miracle Fuel "Perpetually Just Over The Horizon." According to an article in CNN Money, "Spanning some 17,000 square miles across parts of Colorado, Utah and Wyoming, this underground lakebed holds at least 800 billion barrels of recoverable oil. That's triple the reserves of Saudi Arabia. The reason you probably haven't heard about the Green River Formation is that most of the methods tried for turning oil shale into oil have been deeply flawed - economically, environmentally or usually both. Because there have been so many false starts, oil shale tends to get lumped with cold fusion, zero-point energy, and other 'miracle' fuels perpetually just over the horizon." [CNN Money, 11/1/07]

Oil Shale Extraction Methods Are Unproven

Since traditional mining options would be massively disruptive to the area, underground options called In-situ have been pursued. The commercial process of oil shale production is still in an experimental stage.

Oil Shale Must Be Extracted Vertically, Processed Above Ground; Below Ground Methods Have Not Be Pursued At Commercial Scale. According to the independent nonpartisan research group Headwaters Economics, "Because it is not free-flowing, oil shale necessitates a vertically-integrated production system, meaning that extraction, processing, and initial upgrading of the liquid product occur on the mine site, with further refining taking place at refineries. The method for heating oil shale in the absence of oxygen to extract liquid is called retorting, and can occur above ground in large kilns (surface retorting) or below ground. There are existing surface retorting oil shale operations in Brazil, Estonia, China, and possibly Russia. Below-ground retorting is called in situ processing and has yet to be pursued at a commercial-scale. If full-scale oil shale mining develops, it is likely that different mining and retorting technologies will be deployed based on the varying depth and concentration of the underground shale within the Green River

Center for
Western Priorities

1121 Grant Street
Suite CH-1B
Denver, CO 80203

Formation." [Headwaters Economics, Oil Shale in the West: 14 Unanswered Questions, January 2010]

Existing Retorting Technology Is Unproven; Current Operations Produce Only A Fraction Of DOE Projections. According to the independent nonpartisan research group Headwaters Economics, "Even existing oil shale retorting technology is far from proven. The RAND Corporation's 2005 research analysis found that conventional mining followed by surface retorting offered technically viable options for developing oil shale, but noted that existing operations elsewhere in the world are producing a small fraction of the total volume that industry and the Department of Energy project for a commercial-scale industry in the U.S. West." [Headwaters Economics, Oil Shale in the West: 14 Unanswered Questions, January 2010]

Underground In Situ Processing Only In Experimental Stage. According to the independent nonpartisan research group Headwaters Economics, "In situ processing can involve significantly less surface disturbance than would conventional mining with surface retorting and its advocates claim it may be more cost effective than above ground retorting. However, in situ processing is currently still at the experimental stage—five of the BLM's six current RD&D leases are focused on testing in situ options —and involves a staggering amount of energy to operate." [Headwaters Economics, Oil Shale in the West: 14 Unanswered Questions, January 2010]

Oil Shale Extraction Methods Are Expensive

The economics of Oil Shale extraction are an impediment to its commercial production. In order for oil shale production to be profitable, the industry must overcome technical, environmental, regulatory, and economic obstacles. The industry has never operated at a profitable level, and the sheer size of the potential industry would necessitate a rapid return on investment. The federal government would likely have to subsidize the industry.

Oil Shale Industry Has Never Functioned At A Profitable Level. According to the independent nonpartisan research group Headwaters Economics, "Neither existing production techniques nor new technologies that are in development have ever actually functioned at the scale that industry and government experts predict would be required to make Western oil shale financially viable." [Headwaters Economics, Oil Shale in the West: 14 Unanswered Questions, January 2010]

Center for
Western Priorities

1121 Grant Street
Suite CH-1B
Denver, CO 80203

Viability Of Oil Shale Dependent On Industry Ability To Overcome Challenges. According to the independent nonpartisan research group Headwaters Economics, "The development of a commercial-scale industry remains a tenuous proposition due to a number of technical, environmental, regulatory, and economic challenges. The viability of oil shale development relies on major assumptions regarding the industry's ability to overcome these and other obstacles." [Headwaters Economics, Oil Shale in the West: 14 Unanswered Questions, January 2010]

Scale Of Shale Development Would Require Rapid Return On Investment. According to the independent nonpartisan research group Headwaters Economics, "Under ideal scenarios, the pace and scale of oil shale development could be regulated in order to lessen the negative impacts and secure the greatest benefits of a new energy boom on local communities. However, the scale of the capital and investment required to bring new, first of a kind commercial oil shale facilities online puts energy companies under significant pressure to show a rapid return on investment. This suggests that if and when oil shale's 'moment' arrives, the pace of expansion and development is likely to be breakneck rather than measured. The viability of a commercial-scale industry from the perspective of local economic sustainability assumes major expansion of local capacity in terms of population, infrastructure, and governmental capacity. The recent experience of small, rural counties with rapid expansion of natural gas drilling in western Colorado suggests that increased tax revenue based on mineral extraction does not always keep pace with the impacts of mining activities." [Headwaters Economics, Oil Shale in the West: 14 Unanswered Questions, January 2010]

Oil Shale Would Likely Be Subsidized By The Federal Government. According to the independent nonpartisan research group Headwaters Economics, "Oil shale supporters within government would like to see the federal government heavily subsidize oil shale development. DOE's Office of Naval Petroleum and Oil Shale Reserves issued a 'Roadmap for Federal Decision Making' regarding oil shale in 2004 that was followed up by a 2007 U.S. Task Force on Strategic Unconventional Fuels that provided more specific suggestions for federal action. In the strategy advocated by these reports, the federal government assumes a large burden of the risk associated with oil shale development by funding a large share of demonstration projects and by offering a price guarantee and production tax credits." [Headwaters Economics, Oil Shale in the West: 14 Unanswered Questions, January 2010]

Shale Production Have Never Functioned At The Scale Industry Predicted To Make Western Shale Financially Viable. According to the independent

Center for
Western Priorities

1121 Grant Street
Suite CH-1B
Denver, CO 80203

nonpartisan research group Headwaters Economics, “Neither existing production techniques nor new technologies that are in development have ever actually functioned at the scale that industry and government experts predict would be required to make Western oil shale financially viable.” [Headwaters Economics, Oil Shale in the West: 14 Unanswered Questions, January 2010]

Cost-Effective Predictions On Shale Development Assume That Crude Oil Prices Will Continue To Rise And That Alternative Fuels Will Not Lessen Dependency On Oil. According to the independent nonpartisan research group Headwaters Economics, “Predictions of the cost-effectiveness of oil shale assume that crude oil prices will continue to rise and that investment in and development of alternative fuel and energy sources (as well as energy conservation) will not have an effect on fossil fuel dependency.” [Headwaters Economics, Oil Shale in the West: 14 Unanswered Questions, January 2010]

Oil Shale Extraction Is An Inefficient Way to Produce Energy

Oil shale processing requires heating rocks thousands of feet underground for months to produce a liquid similar to conventional oil. The production of 200,000 barrels a day from in situ processing would require 2,400 megawatts of electricity, requiring an expansion of current generation and transmission infrastructure. The operation of five in situ processing plants could require the construction of ten new power plants equal to the largest coal-fired plants currently operating in the state of Colorado.

Current In Situ Site Operated By Shell In Colorado Required Heating Shale Over Period Of Months To Produce Oil. According to the independent nonpartisan research group Headwaters Economics, “Shell’s trial in situ conversion processing (ICP) site near Parachute, Colorado ‘involves drilling holes up to 2,000-feet deep, inserting electrical resistance heaters, and heating the shale to 650-700˚ F over a period of months.’ The heated shale releases a liquid substance which can be tapped in a manner similar to a conventional oil well.” [Headwaters Economics, Oil Shale in the West: 14 Unanswered Questions, January 2010]

Oil Sale Has Low Energy Return On Energy Invested. According to the independent nonpartisan research group Headwaters Economics, “Compared to conventional fossil fuels, oil shale requires large investments of energy relative to energy it generates. This ratio is discussed in terms of Energy Returned on Energy Invested (EROI), which relates the unit of energy produced to the unit invested.” Adding, “The EROI of oil shale has been estimated to lie between less than one

Center for
Western Priorities

1121 Grant Street
Suite CH-1B
Denver, CO 80203

and 13, based on models and test runs of oil shale production. Shell claims that the ICP process (for oil shale) the company is currently testing has a ratio of 1:6 of energy used to energy produced. In defense of oil shale's viability, industry proponents note that oil shale's poor EROI is higher than that of tar sands, which is about 3." [Headwaters Economics, Oil Shale in the West: 14 Unanswered Questions, January 2010]

200,000 Barrel A Day Underground Processing Plant Would Require 2,400 More Megawatts Of Electricity. According to the independent nonpartisan research group Headwaters Economics, "Electricity to power retorting processes constitutes one of the major energy investments in oil shale extraction. In situ processing is especially expensive from an electricity standpoint: the BLM's PEIS used a working assumption that a single 200,000 barrel/day in situ plant would require 2,400 additional MW of electricity." [Headwaters Economics, Oil Shale in the West: 14 Unanswered Questions, January 2010]

- **Producing 2,400 MW of Electricity Costs About $600 Million a Year.** To produce 2,400 MW, a very efficient combined cycle gas power plant would require approximately 135 BILLION cubic feet of natural gas, or about 10% of Colorado's gas production. The fuel bill would be about $600 million per year. [Western Resource Advocates, undated]

Oil Shale Would Require Massive Expansion Of Existing Electricity Generation And Transmission Infrastructure. According to the independent nonpartisan research group Headwaters Economics, "An important assumption about a commercial oil shale industry is that the industry's significant power needs are achievable through a massive expansion of the existing electricity generation and transmission infrastructure. Such an expansion effort would trigger a number of significant regulatory hurdles." [Headwaters Economics, Oil Shale in the West: 14 Unanswered Questions, January 2010]

- **Operation Of Five Underground Processing Plants Could Require Construction Of Ten Power Plants Equivalent To The Largest Coal-Fired Plant Operating In Colorado**. According to the independent nonpartisan research group Headwaters Economics, "Operation of just the five in situ plants identified in the PEIS could require the construction of ten power plants the size of the largest coal-fired power plant currently operating in Colorado. (Craig Power Station has a nameplate capacity of 1,400 MW)" [Headwaters Economics, Oil Shale in the West: 14 Unanswered Questions, January 2010]

Center for
Western Priorities

1121 Grant Street
Suite CH-1B
Denver, CO 80203

Surface Processing Of Oil Shale Dirty And Inefficient. According to an article in CNN Money, "Problem was, the prevailing production process - known as surface retorting - was dirty and inefficient. Federal subsidies masked the problems, encouraging companies to build businesses they never would have created on shareholders' dimes. When oil prices collapsed, so did the economic rationale for shale oil. The day Exxon left town in 1982, turning some communities into ghost towns, is still remembered in northwestern Colorado as 'Black Sunday.'" [CNN Money, 11/1/07]

Oil Shale Extraction Would Require Immense Surface Mines

The scale of oil shale commercial production would be immense. Production of 2.5 million barrels a day would require surface mines covering a total area similar to the city limits of Boston, Massachusetts. The Department of Energy believes the impact of oil shale would be similar to the impact of oil and gas drilling.

Commercial Industry Operating To Produce An Average Of 2.5 Million Barrels Per Day Would Involve Surface Mines Covering A Cumulative Area Roughly The Size Of The City Of Boston. According to the independent nonpartisan research group Headwaters Economics, "Because of the depth and extent of the resource, oil shale extraction through surface mining would require mines that compare in size to the world's largest open-pit mines. The DOE has used a rule of thumb that allots 31 square miles of surface disturbance for every million barrels per day of oil shale produced. This means that a commercial industry operating to produce an average of 2.5 million barrels per day would involve surface mines covering a cumulative area roughly the size of the City of Boston—over 90 square miles—over a lifespan of 30 to 40 years. This estimate does not include surface disturbance related to the construction of supporting infrastructure such as roads, pipelines, refineries, and power plants." [Headwaters Economics, Oil Shale in the West: 14 Unanswered Questions, January 2010; Office of Naval Petroleum and Oil Shale Reserves, U.S. DOE, "Strategic Significance of America's Oil Shale Resource, Vol. II.," 24]

Impact Of In Situ Drilling Would Be Similar To Impact Of Oil And Gas Drilling. According to the Department of Energy Office of Petroleum Reserves, "In-situ production may involve limited mining to access the resource or drilling heater holes and production wells at very close spacing. Impacts will be similar to those experienced in oil and gas drilling operations. Heater holes and wells will likely require plugging and abandonment when heating and production operations cease." [Department of Energy Office of Petroleum Reserves, Fact Sheet: Oil Shale and the Environment, accessed 2/5/13]

Center for
Western Priorities

1121 Grant Street
Suite CH-1B
Denver, CO 80203

Oil Shale Extraction Would Overwhelm Current Public Infrastructure Out West

The large scale of commercial oil shale cannot be supported by the existing infrastructure in the West. To process oil shale, new pipelines, water storage plants, and refineries would need to be constructed. The commercial oil shale industry could bring 50,000 new residents to sparsely populated areas of Colorado, Wyoming, and Utah stretching available housing stock and labor forces.

Existing Infrastructure In The West Couldn't Support Commercial Oil Shale Industry. According to the independent nonpartisan research group Headwaters Economics, "The existing infrastructure in southwest Wyoming, northeast Utah, and northwest Colorado cannot accommodate a commercial-scale oil shale industry. Major adjustments and improvements would be required in terms of roads, bridges, pipelines, and refineries." [Headwaters Economics, Oil Shale in the West: 14 Unanswered Questions, January 2010]

Oil Shale Boom Would Add As Much As 50,000 Residents To Utah, Wyoming, And Western Colorado, Could Create Worker And Housing Shortage. According to the independent nonpartisan research group Headwaters Economics, "In addition, the region is ill-prepared for the structural socioeconomic change that is projected to accompany oil shale development, in part because it is already reeling from surges and contractions in oil and natural gas extraction. A 2008 report conducted for the Associated Governments of Northwest Colorado projected that a commercial-scale oil shale industry could add 50,000 residents (about one-quarter the number of the area's current population) and raises major issues in regards to shortages of skilled workers, housing availability and affordability. Regional leaders have stressed the importance of coordination with and support for local governments in the event of a move toward commercial-scale oil shale production." [Headwaters Economics, Oil Shale in the West: 14 Unanswered Questions, January 2010]

Shell Oil Would Have To Build Own Water Refinery To Process Oil Shale In Colorado. According to an article in CNN Money, "Water is another worry. ICP uses a lot of water, mainly to refine the oil and purify the natural gas. (Shell plans on building a refinery onsite, which is news in itself: It would be the first new refinery built in the U.S. in 30 years.) Shell appears to be on solid legal footing with its water plans, as it owns senior rights for local river water. And some of the water it intends to utilize will be salinated water pumped from deep aquifers that are not part of the conventional water supply. Nevertheless, the potential for political backlash remains high, given that this is a part of the country where water is

Center for
Western Priorities

1121 Grant Street
Suite CH-1B
Denver, CO 80203

scarce and fights over water rights get nasty. 'It will certainly be an issue,' says former Rifle mayor David Ling. 'There's an old expression around here: We talk over whiskey and fight over water." [CNN Money, 11/1/07]

New Water Pipelines, Treatment, And Storage Facilities Must Be Constructed To Sustain Oil Shale Industry. According to the National Oil Shale Association, "Water pipelines, storage and treatment facilities will be required to provide uninterrupted and reliable sources of water to commercial oil shale projects. Due to the arid nature of the west, storage of water during the snow melt period is required to assure a supply during the dry period of the year. These storage facilities will be on and/or off the site of the oil shale project." [National Oil Shale Association, Oil Shale and Water Fact Sheet, June 2012]

Hindered By Federal Obstacles

Because of the size and location of oil shale deposits in the West, commercial development would likely require modification of federal land management rules. Should that occur, the development of oil shale would dwarf any previous industrial land use pursued in U.S. History.

Surface Mines Needed For Oil Shale Development Unlikely To Gain Approval Without Modification Of Federal Land Management Rules. According to the independent nonpartisan research group Headwaters Economics, "Surface mines of the scale necessary for commercial development of oil shale would be unlikely to gain approval without significant modification of the suite of environmental and administrative statutes that currently guide federal land management. Thus, a critical assumption in projections of a viable oil shale industry is that extensive surface mines would pass administrative review of environmental impacts under NEPA." [Headwaters Economics, Oil Shale in the West: 14 Unanswered Questions, January 2010]

Oil Shale Development Would Dwarf An Industrial Land Use Pursued In U.S. History. According to the independent nonpartisan research group Headwaters Economics, "One of the most pressing questions about oil shale is scale. Predictions about the commercial viability of oil shale depend on developing an industry at a volume 50 times greater than the combined total of existing worldwide oil shale production. The scale of activities required to achieve such a production volume—and to make oil shale profitable, by distributing its significant costs across a vast economy of scale—would dwarf any industrial land use ever

Center for
Western Priorities

1121 Grant Street
Suite CH-1B
Denver, CO 80203

pursued in the United States." [Headwaters Economics, Oil Shale in the West: 14 Unanswered Questions, January 2010]

Oil Shale Extraction Requires Large Scale Land Use

According to an estimate by the Unites States Department of Energy, the oil shale industry would require 31 square miles for each million gallons of oil production. Much of that land is concentrated with wildlife and adjacent to wilderness and conservation areas.

Oil Shale Industry Would Require 31 Square Miles Per Million Gallons Of Oil Production. According to the Department of Energy Office of Petroleum Reserves, "In 1972, the Department of the Interior estimated the cumulative surface area impacted by a domestic oil shale industry – over a 40 year period – would be ~31 square miles per million barrels of daily shale oil production capacity (MM Bbl/d). This figure could increase if surface processes comprise a greater share of operations than assumed in the 1972 Prototype Leasing Program, or decrease if new in-situ processes comprise a greater share." [Department of Energy Office of Petroleum Reserves, Fact Sheet: Oil Shale and the Environment, accessed 2/5/13]

Oil Shale Is Concentrated In Area With Considerable Wildlife, Adjacent To Conservation And Wilderness Areas. According to the Department of Energy Office of Petroleum Reserves, "The area has considerable wildlife, including large mammals and migratory birds. Portions of the oil shale lands are in or adjacent to conservation and wilderness areas and scenic vistas." [Department of Energy Office of Petroleum Reserves, Fact Sheet: Oil Shale and the Environment, accessed 2/5/13]

Oil Shale Extraction Increases Pollution

Oil shale production poses environmental risks at times greater than conventional oil production. The Department of Energy stated that oil shale production would generate sulfur and nitrogen oxides, particulate matter and large quantities of carbon dioxide. A study by Shell oil showed that an in situ site generated 21 to 47 percent more emissions than conventional oil production. Additionally oil shale byproducts would require off site processing while some spent shale would be sent to landfills. Underground processing would also pose a water contamination risk.

Center for
Western Priorities

1121 Grant Street
Suite CH-1B
Denver, CO 80203

Oil Shale Development Would Involve Significant Emissions. According to the independent nonpartisan research group Headwaters Economics, "The OSTS PEIS notes that commercial-scale oil shale development will involve significant emissions that pose air quality concerns from the perspectives of visibility, deposition of particulate matter and the health of animal (including human) and plant populations. Review of the air quality impacts planned oil shale developments will trigger regulations under numerous state and federal statutes. Here again, scale is a critical issue: the level of air pollution will be directly related to the scale of extraction and development activities." [Headwaters Economics, Oil Shale in the West: 14 Unanswered Questions, January 2010]

Shell Study Showed Greenhouse Emissions From ICP Research Site Generated 21 To 47 Percent More Emissions Than Conventional Oil Production. According to the independent nonpartisan research group Headwaters Economics, "Shell recently reported that a test run of the ICP research site generated greenhouse gas emissions 21 to 47 percent greater than conventional oil production. Discussing the whole suite of synthetic fuels, an academic study in 2006 noted that greenhouse gas emissions of substitutes for conventional petroleum could be more than twice that of conventional oil per unit of fuel delivered. The viability of an oil shale industry assumes some exception for this fuel product in any future regulations regarding greenhouse gas emissions." [Headwaters Economics, Oil Shale in the West: 14 Unanswered Questions, January 2010]

Heating Of Oil Shale Would Generate Sulfur And Nitrogen Oxides, Particulate Matter, And CO2. According to the Department of Energy Office of Petroleum Reserves, "Most western oil shale ore is a carbonate-based, kerogen-bearing marlstone. Heating carbonate rock to 450 to 500 degrees centigrade generates not only kerogen oil and hydrocarbon gases but also a slate of other gases, including: (1) oxides of sulfur and nitrogen, (2) carbon dioxide, (3) particulate matter, and (4) water vapor. Fugitive dust and fine particulates may also pose concern." [Department of Energy Office of Petroleum Reserves, Fact Sheet: Oil Shale and the Environment, accessed 2/5/13]

- **DOE: Stack Gas Clean-Up Technologies Could Be Applied To Oil Shale To Control Emissions**. According to the Department of Energy Office of Petroleum Reserves, "Commercially available stack gas clean-up technologies, currently in use in electric power generation and petroleum refining facilities, have improved over the years and should be effective in controlling oxides and particulates emissions." [Department of Energy

Center for
Western Priorities

1121 Grant Street
Suite CH-1B
Denver, CO 80203

Office of Petroleum Reserves, Fact Sheet: Oil Shale and the Environment, accessed 2/5/13]

DOE: Oil Shale Industry Will Produce Large Quantities Of Carbon Dioxide. According to the Department of Energy Office of Petroleum Reserves, "Oil shale industry will produce large quantities of Carbon Dioxide. Carbon dioxide (CO2) will be produced in large quantities and may need to be captured, used in other commercial applications (such as improved oil recovery or coalbed methane operations), or otherwise sequestered. Depleted oil and gas reservoirs in the local area may provide effective sequestration targets." [Department of Energy Office of Petroleum Reserves, Fact Sheet: Oil Shale and the Environment, accessed 2/5/13]

Surface Processing Produced Toxic Byproducts, Would Require Further Refining At A Second Site. According to an article in CNN Money, "The basic problem with surface retorting was that shale had to be mined, transported, crushed and then cooked at 1,000 degrees Fahrenheit. Not only were there toxic waste byproducts, but the oil thus produced had to be purified and infused with hydrogen before it could be refined into gasoline and other products." [CNN Money, 11/1/07]

Some Spent Shale From Oil Shale Processing Would Go To Landfills. According to the Department of Energy Office of Petroleum Reserves, "Surface retorts generate quantities of spent shale. Retort technology has improved to reduce residual carbon, making spent shale better suited for landfill. Backfilling will be employed in underground and surface mines. Some spent shale will be used to make commercial building materials, or landfilled. Satisfactory disposal and reclamation has been achieved in later-generation oil shale operations." [Department of Energy Office of Petroleum Reserves, Fact Sheet: Oil Shale and the Environment, accessed 2/5/13]

Underground Processing Posed Risk To Groundwater Contamination. According to the independent nonpartisan research group Headwaters Economics, "In situ processing poses considerable risk to groundwater contamination. One of Shell's experiments on a BLM RD&D lease involves freezing the perimeter of the extraction zone through massive below-ground refrigeration systems. Freeze-wall technology is a proven technique for managing contamination from construction and other surface disturbances, but its use for such large-scale operations and its ability to protect against leakage once the site is abandoned is not well-established." [Headwaters Economics, Oil Shale in the West: 14 Unanswered Questions, January 2010]

Center for
Western Priorities

1121 Grant Street
Suite CH-1B
Denver, CO 80203

Oil Shale Extraction Drastically Increases Water Use

Projected Water Use For Shale Development Exceed Availability In Colorado Basin. According to the independent nonpartisan research group Headwaters Economics, "The projected water usage demands of oil shale development—hundreds of thousands of acre-feet per year—greatly exceed water availability in the Colorado River Basin, an already over-adjudicated water source of which municipalities as well as agricultural users from across the West are fiercely protective." [Headwaters Economics, Oil Shale in the West: 14 Unanswered Questions, January 2010]

Oil Shale Development Would Require Large Volume Of Water. According to the independent nonpartisan research group Headwaters Economics, "In addition to the risk of groundwater contamination, the volume of water necessary to facilitate mining operations has long been known to pose a roadblock to oil shale development. In 2004, the Department of Energy published statistics suggesting that a full-scale commercial oil shale industry could create a total new water demand of .18 to .42 million acre-feet per year and notes that 'for a mature industry, substantial water storage and water transfers may be required over time.'" [Headwaters Economics, Oil Shale in the West: 14 Unanswered Questions, January 2010]

- **Development Would Require Adjustments To Colorado River Compact**. According to the independent nonpartisan research group Headwaters Economics, "Development of the industry, therefore, assumes major adjustments to the administration of the already-strained Colorado River Compact. Municipal and industrial consumers seeking to protect their access to Colorado River water could be a major constraint on the scale of oil shale development." [Headwaters Economics, Oil Shale in the West: 14 Unanswered Questions, January 2010]

GAO: Oil Shale Development Could Have Significant Impacts On The Quality And Quantity Of Water Resources. According to the a report by the Government Accountability Office, "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." [Government Accountability Office, A Better and Coordinated Understanding of Water Resources Could Help Mitigate the Impacts of Potential Oil Shale Development, October 2010]

Center for
Western Priorities

1121 Grant Street
Suite CH-1B
Denver, CO 80203

Surface Mining Would Involve Significant Disturbance; Could Impact Water Quality. According to the Department of Energy Office of Petroleum Reserves, "Open-Pit (surface) mining involves significant surface disturbance and can impact surface-water runoff patterns, subsurface water quality, flora, and fauna. Experience in coal mining and other mining industries has demonstrated that impacted lands can be very effectively reclaimed with minimal longterm effect." [Department of Energy Office of Petroleum Reserves, Fact Sheet: Oil Shale and the Environment, accessed 2/5/13]

DOE: Runoff From Mining And Retorting Operations Could Impact Surface And Groundwater. According to the Department of Energy Office of Petroleum Reserves, "Runoff from mining and retorting operations can impact surface and groundwater. In-situ operations pose greater risks to groundwater quality. Controls will be required to protect surface and groundwater." [Department of Energy Office of Petroleum Reserves, Fact Sheet: Oil Shale and the Environment, accessed 2/5/13]