

CURRENT ENVIRONMENTAL ISSUES
FACING OIL SHALE DEVELOPMENT

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ABSTRACT

Environmental regulation of the oil shale industry is shared in Colorado, Utah and Wyoming by EPA and the states. While much of the day-to-day administration of environmental programs is delegated by EPA to these states, Congress holds EPA accountable to carry out Congressional intent; thus EPA plans to maintain a strong presence in western oil shale environmental matters, characterized by "firmness, fairness, . . . with common sense."

Despite voluminous oil shale environmental studies during the past 20 years, many unknowns remain. Briefly discussed, these include air and water impacts of the large quantities of solid waste which will be produced by the industry, consumption of PSD air increments, potential for emissions trading, and acid deposition impacts on high elevation ecosystems.

INTRODUCTION

The purpose of this paper is two-fold: to present an update on the philosophy and approach of the Environmental Protection Agency to regulating development of the oil shale industry, and to present an overview of current environmental issues surrounding oil shale development.

PHILOSOPHY AND APPROACH

Under the present Administrator, EPA has pledged to enforce the Nation's environmental laws and regulations in a firm, fair, consistent, and predictable manner. Emphasis is on compliance with enforcement as a major tool to secure compliance. While Congress has directed EPA to delegate the day-to-day administration of most environmental programs to the states, it holds EPA accountable for carrying out congressional intent in all programs, delegated or not. Therefore, while many environmental matters affecting oil shale, such as the granting of permits, will often primarily involve interactions between the industry and the applicable states, EPA can be expected to maintain a strong presence in these matters. We will, however, attempt to use common sense and be reasonable in our actions.

Philosophically in EPA Region 8 (covering Colorado, Utah, Wyoming, Montana, North Dakota and South Dakota), we regard our overall task as helping the oil shale industry "do it right" from an environmental perspective. That is, it is our task to help the industry carry out its development plans in as environmentally benign a manner as possible. However, should a permit be applied for which

will cause unacceptable levels of environmental degradation or otherwise violate applicable laws and regulations, either the state or EPA, depending upon which has jurisdiction, will have no choice but to deny the permit .

To the extent EPA resources permit, we will provide technical assistance to oil shale companies, engineering firms and state agencies to promote good environmental management practices. We are mindful that Congressional policy calls for the development of oil shale as an alternate national energy resource, and thus EPA should contribute toward the accomplishment of this goal wherever possible and compatible with its mission.

In acting out this role, I believe EPA should be an advocate of environmental quality, just as other departments of the federal government are advocates for the special purposes they are chartered to serve. This means that we will take special measures to ensure that the viewpoints of environmental groups are presented and properly considered and that the public health and the environment are protected.

Having made these preliminary remarks let me hasten to add that I am aware of the many committees, reports, talks, and debates which have surrounded the subject of oil shale and the environment since the mid-1960's.¹ All I can do in this paper, is to bring some of this background up to date and highlight the major current concerns surrounding the subject which I believe are likely to be in the forefront during the next few years. Before proceeding, let me

lighten the subject by sharing an anecdote from the proceedings of the Seventh Oil Shale Symposium 10 years ago this month in a paper by H. Michael Spence. He used the story to illustrate that while we can all call ourselves environmentalists, we do not all agree on what the environmental solution should be.

. . .I heard an anecdote recently concerning a missionary traveling in the jungle and a lion which he encountered. The missionary was overcome with fear for his life as the lion appeared ready to devour him. The missionary decided his only salvation was in prayer which he began with some fervor. After several minutes - when he had not yet been eaten - the missionary looked up and to his surprise found the lion was also on his knees praying. "Oh," said the missionary with relief, "I see you are a Christian too." "Yes," said the lion, "but there is a difference between us. You are praying for salvation. I am saying Grace."²

Surely during the next 10 years we will still be playing missionary and lion in environmental matters. However, I strongly feel the interests of the industry, government and especially the public at large will be better served if we can approach environmental management of oil shale development in a cooperative, as opposed to a confrontational manner. There will be times when we will agree to disagree and have to settle our differences in court. However, to the

extent that we can reach agreement by sharing technical information, objective analyses and common sense negotiations, the cause of establishing an oil shale industry will certainly be advanced as will be the public interest, provided development complies with applicable laws and regulations.

CURRENT ENVIRONMENTAL ISSUES

To bring you up to date, I will focus on three broad categories of environmental issues: solid waste, water quality and air quality. Please remember that in the oil shale states of Colorado and Utah, EPA shares responsibility with the states in the water and air areas, and that we are in the process of delegating certain aspects of the hazardous waste programs to Colorado and Utah. Thus, I speak only for EPA and not the states.

As a preface to this overview, it should be emphasized that many of the environmental issues can not be addressed fully in the absence of an on-line commercial scale oil shale project. We need to know much more about the waste streams from both retorting and upgrading facilities at the commercial scale including the chemical composition of air, liquid and solid wastes. We need to know more about the behavior of retorted shale disposal piles including physical characteristics and stability. We also need to know more about water movement within and on retorted shale piles and the quantity and quality of potential leachate and runoff. The sampling and monitoring of a commercial scale facility should provide the opportunity to collect such data and to understand with greater certainty the environmental effects of oil shale development.

Over the past several years, EPA has assessed the potential environmental impact of oil shale development, particularly in the western regions of the United States.³ This work has been done in concert with the oil shale industry, state governments and the academic community. While we have learned much about several of the retorting technologies, we seem to know the least about the environmental effects of the Union Oil Company's Unishale B retorting technology. Several oil shale developers are looking at the Unishale B process for use at their respective projects. If this retorting technology or its apparent successor, Unishale C, develops as planned at the Union project, we may see the Union process used extensively throughout the western oil shale region.

Hence, it is important for us to understand in greater detail the potential effects of the Unishale B and/or C process and the effective alternative pollution control technologies. EPA is working directly with the Union Oil Company to collect and analyze samples from various waste streams and to test alternative control technologies on its Phase I shale oil project once it achieves steady-state operating status. EPA intends to continue this cooperative approach in answering many of the remaining environmental questions, especially those relating to solid waste, water quality, and air quality related issues.

Solid Waste Impacts and Control

Analysis of solid waste impacts and controls for an oil shale facility presents unique problems due to the very large volume of waste produced. A typical 50,000 bbl/day facility fed by

30 gal/ton shale will produce 25-30 million tons/year of spent shale alone, which over an operating life of 30 years, would cover an area of 3.5 square miles to a depth of 150 feet⁴. Hence, even though this waste may not be hazardous, it will require special handling and control to prevent significant impact upon the environment. Potential impacts or problems include:

Degradation of surface water quality by runoff.

Degradation of air quality by release of vapors or dust.

Siltation of surface streams by erosion.

Degradation of air quality from auto ignition.

Aesthetic impact.

Mass failure of disposal piles threatening life or property.

Degradation of surface and groundwater quality by leachates.

Another important reason for the actual sampling and monitoring of a commercial sized oil shale facility centers on the Resource Conservation and Recovery Act (RCRA) and the management of solid/hazardous wastes in the production of shale oil. Solid wastes generated from "the extraction, beneficiation and processing of ores and minerals" are specifically exempt temporarily, from being classified as hazardous wastes and from RCRA regulations by an amendment to the rule (40 CFR 261.4) published on 19 November

1980. A regulatory interpretive letter⁵ clarifies the RCRA mining waste exemption as applied to synfuel operations.

The preamble to the regulatory amendment (45 FR 76619) uses the words "hazardous wastes produced in and unique to, the exploration, mining, milling, smelting or refining of ores and minerals." The exemption can be viewed as extending to any unit operation including physical, chemical, or biological processes which process an ore or mineral in the dictionary sense of those terms. This includes the retorting of shale. It further extends to wastes produced from the process which may not become mixed with the spent shale or ash (e.g., sludges, condenser liquids, etc.) provided they are unique to the "ore processing operation." The exemption, however, does not extend to wastes resulting from the upgrading or refining of the crude oil extracted from shale, cleanup or enrichment of the gas, or other synfuels processes not associated with processing the shale. It also does not apply to hazardous wastes which are not unique to synfuels operations, like spent cleaning solvents, cooling tower blowdown, and ion exchange regeneration wastes.

The EPA is reviewing the breadth of this interpretation as well as the exemption itself, and in FY 1985, will issue a Report to Congress on this subject pursuant to Section 8002 of the RCRA. This Report will be used to evaluate the need and alternative approaches for management of oil shale related wastes. Our work with the Union Oil Company in sampling and analyzing waste streams will provide timely and important information for the Report to Congress.

Water Quality

The EPA has assessed the potential water quality impacts of oil shale development particularly in Colorado and Utah. Detailed development plans submitted by the prospective developers indicate that, in the semi-arid region in which the major development will take place, the industry will have to import water to satisfy its process needs and therefore will have no wastewater discharges ("zero discharge"). Because of the scarcity of water, these facilities will have to seek ways to reuse water and will have to optimize the "partial co-disposal treatments" of selective wastewater streams for their "next best use."

Developers have proposed that any "unusable" waste streams should be mixed with spent shale for moisturizing and ultimately be disposed with the retorted shale at disposal sites. Some of these aqueous waste streams may be hazardous as defined in the Resource Conservation and Recovery Act. RCRA also specifies that if a listed hazardous waste stream is combined or mixed with a non-hazardous waste stream then the combined wastes must be managed and regulated as hazardous wastes. This co-disposal issue raises several concerns, in addition to regulatory applicability, including the

wastewater treatment requirements for spent shale moistening and the volume and quality of runoff and leachate from retorted shale piles with "co-disposed" liquid hazardous wastes. Ultimately, however, we are concerned about the environmental effects of these wastes on surface and ground water resources.

These questions cannot be answered at this time. The EPA is investigating wastewater and treatment methods from various processing technologies (e.g., in-situ, modified in-situ, direct and indirect surface retorting) and will continue to sample wastewaters to further understand potential treatment problems and opportunities.

Air Quality Related Issues

The final issue category relates to air quality in the western oil shale region and the larger current debate over acid deposition.

The mining and processing of oil shale to produce a refined shale oil product can produce a variety of air pollutants, many of which may have adverse environmental impacts if not properly managed. These pollutants include those given in Table 1 which are emitted from various operations:

TABLE 1
POTENTIAL POLLUTANTS FROM OIL SHALE
MINING AND PROCESSING

<u>CRITERIA POLLUTANTS</u>	<u>HAZARDOUS POLLUTANTS</u>	<u>OTHER POLLUTANTS</u>
particulates	asbestos	ammonia
sulfur dioxide	arsenic	hydrogen sulfide
nitrogen oxides	beryllium	trace metals
carbon monoxide	polycyclic organics	reduced organic sulfides
lead	radionuclides	

fugitive emissions from mining, transportation, and materials handling; process emissions from materials preparation such as sizing for indirect fired retorting; process emissions from oil upgrading and storage facilities; fugitive emissions from waste handling and disposal; process emissions from utility generation; air emissions from application of process water to hot spent shale piles; and process and fugitive emissions from infrastructure development and secondary pollution sources.

Under the Clean Air Act (PL 95-95) shale developers must: (a) employ Best Available Control Technology (BACT), (b) insure that National Ambient Air Quality Standards (NAAQS) are not violated, (c) not violate the prevention of significant deterioration (PSD) ambient air quality increments, (d) not significantly degrade visibility in mandatory Class I areas and (e) obtain up to 1 year of baseline data before applying for a PSD permit to construct and operate.

Currently, the most significant aspect of the Clean Air Act to oil shale development is the PSD program. The energy rich oil shale region of Colorado, Utah and Wyoming enjoys some of the cleanest air in the United States. From an air quality standpoint, the total allowable oil shale development in Colorado may be limited by the concentration of sulfur dioxide, nitrogen dioxide and particulates resulting from that development. Already, we are beginning to see the potential conflict between oil shale development and maintenance of air quality in the region.

The Federal land managers of Class I areas have been given the affirmative responsibility by the Clean Air Act to protect the air quality related values of the lands they manage. Air quality related values (AQRV) include visibility, flora, fauna, soils and water. The PSD regulations require the impacts of PSD source emissions on the AQRV for Class I areas to be investigated and quantified. If a proposed oil shale source will exceed the available PSD air increments and/or cause adverse impacts on the AQRV of a Class I area, the PSD permit cannot be issued.

Presently there are a number of difficult problems for the oil shale industry in complying with PSD and Colorado state air quality regulations. The Colorado National Monument, near Grand Junction in Colorado is currently a Class II area within the PSD program. However, Colorado State air quality control regulations list the Colorado National Monument as Category I which establishes similar restrictions for SO₂ as Federal Class I areas. It appears that the State Category I standards at the Monument will be violated by the shale oil upgrading plant proposed by Chevron Shale Oil Company some fifteen miles away. It also appears that Class II increments for both sulfur dioxide (SO₂) and particulates are approaching levels of exceedence near Parachute Creek basin where several oil shale projects are planned. The Colony and Union projects alone appear to have consumed the air increments imposing a severe constraint on other oil shale developers in the area.

Finally, there appears to be an emerging problem with air quality related values (AQRV) at the Flat Tops Wilderness Area, (east of the oil shale deposits) a designated Class I PSD area. The federal land manager (US Forest Service) has indicated that certain PSD permit applicants would cause adverse impacts on the air quality related values of the Flat Tops area. Specifically, the effects relate to visibility impairment and the possible adverse effects of increased acid deposition on high elevation lakes and ecosystems. Based on these recent determinations, it appears that some oil shale related PSD permits may require further NO_x reduction or be denied until innovative and effective methods can be developed to reduce the impacts on these Class I and Class II areas.

EPA is working on these difficult problems. Clearly, there can be no further permits issued if violations of the Clean Air Act occur. However, there are ways of reducing emissions from existing sources to allow development of new projects while maintaining air quality. Such emissions trading offers considerable potential in managing air quality in an area approaching or exceeding air quality standards. Region VIII EPA is working with the State of Colorado an emissions trading program which we hope will provide an effective, yet more flexible, approach to air quality control. Obviously, this program may have great importance to oil shale development in the western U.S.

The western acid deposition issue should also be of great interest to the industry. I have already mentioned the

possible adverse effects of acid deposition on the Flat Tops Wilderness Area from proposed oil shale projects. Oil shale development will significantly increase the SO₂ and NO₂ loading in the region. These pollutants are basic ingredients in the formation of acid deposition. There is reason to believe that many sensitive receptors in the western oil shale region are highly susceptible to the effects of acid deposition.

Region VIII EPA has proposed a regional effort to understand with greater certainty the actual effects of acid deposition in the West and to identify means for controlling the problem while the effects are still preventable. This initiative attempts to consolidate understanding of research needs in the Rocky Mountain area for industry, the public, environmental groups, and state and federal agencies. EPA will not speak for these other organizations, but will facilitate the gathering of baseline data.

Two areas of study are being proposed to provide the detailed information needed: 1) in-depth prototype studies of sample wilderness Class I areas which will be affected by energy resource development and 2) local or mesoscale air transport model refinement and validation to provide adequate predictive techniques to State, local, and Federal decision makers. These proposed studies are designed to supplement EPA's National Surface Water Survey which will screen potentially sensitive lakes in the nation, including high altitude lakes.

The regulated and regulatory communities rarely have an opportunity to anticipate future problems and to devise solutions to those problems before they develop. This proposed research and development can provide the groundwork for solutions to many problems which occur as acid deposition becomes a major factor in the permitting of many energy sources in the western U.S.

CONCLUSION

Despite the fact that the environmental impacts of a future oil shale industry have probably been studied more than most developing industries, this paper indicates that much remains to be learned. The unknowns I have briefly discussed will provide much fodder for "missionary and lion" stories in the months and years to come. Hopefully, the opportunities provided by these Colorado School of Mines Oil Shale Symposia to exchange ideas and factual information will help many of these stories to have happy endings for the industry, the environment and the public.

REFERENCES

1. See, for example, Paul Ferraro and Paul Nazaryk, Assessment of the Cumulative Environmental Impacts of Energy Development in Northwestern Colorado, which includes an extensive bibliography of oil shale environmental studies on pp. 49 - 51.
2. H. Michael Spence, "The Environmental Story", Proceedings of the Seventh Oil Shale Symposium, April 18-19, 1974, Quarterly of the Colorado School of Mines, Volume 69, No. 2, April 1974, p. 80
3. Thoem T., Bates E., Dial C., Harris E., Princiotta F., "Status of EPA Regulatory and Research Activities Affecting Oil Shale Development" Proceedings of the 13th Oil Shale Symposium, Colorado School of Mines, 1980.
4. Bates E., Thoem T., Environmental Perspective on the Emerging Oil Shale Industry, USEPA 600/2-80-205a 1980.
5. Internal EPA Memorandum from Alfred W. Lindsey, EPA Headquarters, to Terry Thoem, Region 8 dated 1/22/81.

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