

Acronyms, Abbreviations, and Glossary

Acronyms and Abbreviations

acre-ft	—acre-feet	FLPMA	—Federal Land Policy and Management Act of 1976
acre-ft/yr	—acre-feet per year	FmHA	—Farmers Home Administration
AGR	—aboveground retorting	FMSHA	—Federal Mine Safety and Health Amendments of 1977
API	—American Petroleum Institute	FRC	—Federal Regional Council
AQCR	—Air Quality Control Regions	ft	—feet
ARCO	—Atlantic Richfield Co.	ft ²	—square feet
BACT	—best available control technology	ft ³	—cubic feet
BaP	—benzo(a)pyrene	FUND	—Foundation for Urban and Neighborhood Development
BAT	—best available technology	FWPCA	—Federal Water Pollution Control Act of 1972
bbl	—barrel(s)	gal	—gallon
bbl/d	—barrels per day	gal/rein	—gallons per minute
BLM	—Bureau of Land Management, Department of the Interior	gal/ton	—gallons per ton
BOD	—biochemical oxygen demand	GOREDCO	—Gulf Oil Real Estate Development C00
BPT	—best practicable control technology currently available	HC	—hydrocarbons
Btu	—British thermal unit	HEW	—Department of Health, Education, and Welfare
cm	—centimeter	H ₂ S	—hydrogen sulfide
cm/h	—centimeters per hour	IFS	—Institute Francais du Petrol
CO	—carbon monoxide	JBC	—Joint Budget Committee of the General Assembly (Colorado)
CO ₂	—carbon dioxide	mg/l	—milligrams per liter
CO ₂ S	—carbonyl sulfide	mg/m ³	—micrograms per cubic meter
CRS	—Congressional Research Service	mi ²	—square miles
CRSP	—Colorado River Storage Project Act of 1956	MIS	—modified in situ
CRSS	—Colorado River System Simulation Model	mm	—millimeters
CS ₂	—carbon disulfide	mmho/cm	—milliohms per centimeter (conductivity)
CWACOG	—Colorado West Area Council of Governments	MSHA	—Mine Safety and Health Administration
CZMA	—Coastal Zone Management Act	MW	—megawatt
DDP	—detailed development plan	μg	—microgram
DEI	—Development Engineering, Inc.	μg/m ³	—micrograms per cubic meter
DLA	—Department of Local Affairs (Colorado)	NAAQS	—National Ambient Air Quality Standards
DNR	—Department of Natural Resources (Colorado)	NAS	—National Academy of Sciences
DOD	—Department of Defense	NEPA	—National Environmental Policy Act of 1969
DOE	—Department of Energy	NH ₃	—ammonia
DOI	—Department of the Interior	NIOSH	—National Institute for Occupational Safety and Health
DRI	—Denver Research Institute	NO _x	—nitrogen oxides
EIS	—environmental impact statement	NOSR	—Naval Oil Shale Reserve
EPA	—Environmental Protection Agency		
ERDA	—Energy Research and Development Administration		
FAPRS	—Federal Assistance Program Retrieval Systems		

NPC	—National Petroleum Council	RISE	—rubble in situ extraction
NPDES	—National Pollutant Discharge Elimination System	scf	—standard cubic foot
NSPS	—New Source Performance Standards	SCOT	—Shell Claus Offgas Treating process
NTU	—Nevada, Texas, and Utah	SEIO	—Governor's Socio-Economic Impact Office (Colorado)
O₃	—ozone	SIP	—State implementation plan
OCS	—Outer Continental Shelf	SMCRA	—Surface Mining Control and Reclamation Act of 1977
OMB	—Office of Management and Budget	SMR	—standardized mortality ratio
OSEAP	—Oil Shale Environmental Advisory Panel	SO₂	—sulfur dioxide
OSHA	—Occupational Safety and Health Administration	SOHIO	—Standard Oil Co. of Ohio
Oxy	—Occidental Petroleum	SRI	—Stanford Research Institute
PADD 2	—The Petroleum Administration for Defense District 2	TDS	—total dissolved solids
PAHs	—polycyclic aromatic hydrocarbons	TIS	—true in situ
Pb	—lead	ton/d	—tons per day
p/m	—parts per million	Tosco	—The Oil Shale Corp.
POM	—polycyclic organic matter	TSCA	—Toxic Substances Control Act of 1976
PSD	—prevention of significant deterioration	UBCOG	—Uintah Basin Council of Governments
QDA	—Quality Development Associates	USBM	—U.S. Bureau of Mines
Quad	—1 quadrillion = 10 ¹⁵ Btu	USBR	—U.S. Bureau of Reclamation
RARE II	—Roadless Area Review and Evaluation (Forest Service)	USFWS	—U.S. Fish and Wildlife Service
RCRA	—Resource Conservation and Recovery Act of 1970	USGS	—U.S. Geological Survey
R&D	—research and development	USPHS	—U.S. Public Health Service
		WPA	—Water Purification Associates
		WPRS	—Water and Power Resources Service

Glossary

Adit: A nearly horizontal opening to a mine.

Aquifer: An underground formation containing water.

Aromatic hydrocarbon: A compound of carbon and hydrogen characterized by a ring of six carbon atoms, e.g., benzene.

Best available control technology (BACT): The most advanced control technology that can be used for new sources of pollution. Required for nonattainment regions (where air pollution presents a danger to the public health) by the Clean Air Act as amended in 1977.

Biochemical oxygen demand: A chemical measure of the power of an effluent to deoxygenate water.

Bitumen: The smaller (about 10 percent) soluble, organic component of oil shale.

Breakeven price: The constant price at which shale oil syncrude would just earn its minimum rate of return.

Calcite: The mineral calcium carbonate, found in nature in the form of limestone, marble, or chalk.

Catalytic cracking: A process of breaking down petroleum hydrocarbons by heating them in the presence of a catalyst. The products are hydrocarbons of lower molecular weight, having lower boiling points, e.g., gasoline.

Coking: One of the processes used to upgrade shale oil and improve its transportation properties. The oil is thermally decomposed at high temperatures (900° to 980° F or 480° to 525° C) forming coke as a solid product.

Criteria pollutants: Under the Clean Air Act, the reduction and prevention of air pollution is regulated by measuring five criteria pollutants: particulate, sulfur oxides, carbon monoxide, nitrogen dioxide, and photochemical oxidants. National Ambient Air Quality Standards were developed for six pollutants associated with the

criteria pollutants. Sulfur oxides are measured by sulfur dioxide and photochemical oxidants are measured by ozone and hydrocarbons.

Crude short: The condition when a company has limited or inadequate access to crude petroleum.

Dawsonite: The mineral, dihydroxy sodium aluminum carbonate. It is a potential source of alumina, which can be converted to aluminum.

Deposit: A natural accumulation, e.g., of coal, iron ore, or oil shale.

Deposit dewatering: The removal of ground water from an oil shale deposit.

Distillates: The liquid products condensed from vapor during distillation (as of petroleum).

Light distillates contain the lowest boiling constituents of the petroleum, from which gasoline is produced.

Middle distillates contain higher concentrations of the high boiling constituents, from which diesel and jet fuels are produced.

Heavy distillates contain higher concentrations of the high boiling constituents, from which lubricating and residual oils are produced.

Distillation: A separation process in which a substance is vaporized, and the vapor collected after condensation as a liquid.

Diversion: A channel constructed to divert water from one source or body of water to another.

Interbasin diversion—Moving water from one major hydrologic basin to another.

Intrabasin diversion—The redistribution of water within a major hydrologic basin.

Dolomite rock: Similar to limestone but composed mainly of the mineral, calcium magnesium carbonate ($\text{Ca Mg}(\text{CO}_3)_2$).

Electrostatic precipitator: A device that uses an induced electrical charge to recover fine particles from a flowing gas stream.

Environmental impact statement (EIS): The National Policy Act of 1969 requires that an environmental impact statement be prepared for "major Federal actions significantly affecting the quality of the human environment."

Fischer assay: Small samples of crushed oil shale are heated to 932° F (500° C) under carefully controlled conditions. The oil yield by this method is the standard measure of oil shale quality.

Fracturing: Breaking up a deposit by means of chemical explosives, electricity, or injecting high-pressure air and water to increase its permeability to fluid flow.

Fugitive dust: Particulate matter discharged to the atmosphere in an unconfined flow stream.

Gas oil: A liquid petroleum distillate with a viscosity and boiling range between kerosene and lubricating oil (450° to 500° F or 230° to 260° C).

Ground water aquifer: Water contained underground in the interstices of soil and rock, obtainable through wells or springs.

Halite: The natural mineral form of sodium chloride (NaCl).

High-Btu gas: Gas with a high heating value, e.g., pure butane has a heating value of $3,200\text{ Btu/ft}^3$.

Hydrocarbons: Organic compounds containing only carbon and hydrogen.

Hydrocracking: The breaking apart of relatively heavy petroleum hydrocarbons into smaller, lighter molecules by means of heat in the presence of hydrogen and using special catalysts.

Hydrologic basin: The entire area of land drained by a river and its tributaries.

Hydrotreating: The hydrogenation of crude shale oil to convert it to -synthetic crude oil (syn-crude).

Kerogen: The organic oil-yielding material present in oil shales. It is not a definite compound but a complex mixture varying from one shale to another, and is only slightly soluble in ordinary organic solvents.

Low-Btu gas: Gas with a relatively low heating value (about 100 Btu/ft^3), e.g., producer gas.

Locatable minerals: Minerals on public land that can be transferred to private ownership by the process of staking claims and filing for patents.

Marlstone: A hardened mixture of dolomite and calcium carbonate.

Middle distillate cracking and reforming: Breaking down and converting straight chain petroleum hydrocarbons into cyclic and aromatic hydrocarbons, by means of heat, pressure, and catalysts (usually in the presence of hydrogen). Used to produce fuels with high octane rating from lower grade products.

Mining:

Block caving—Sections of the area being mined are undercut and then allowed to cave in, thus crushing the material being mined.

Continuous—A machine cuts and loads ore from a mine face in a continuous operation, without the use of drills and explosives.

Long-wall—The ore seam is removed in one operation along a working face that maybe several hundred yards long. The mine roof col-

lapses as the working face advances through the ore body. The technique is commonly used for coal mining, especially in Great Britain.

Open pit—The overburden is drilled and blasted loose over a large area and removed to expose the oil shale beds. These are then drilled and blasted.

Room-and-pillar—Some shale is removed to form large rooms, and some is left in place, as pillars, to support the mine roof.

Solution—The injection of fluids into the formation to dissolve soluble salts from among the oil shale layers, thereby creating a honeycomb pattern of voids.

Strip—The overburden and deposit are removed with a dragline—a massive type of scraper shovel.

Subsidence—The mine roof is allowed to collapse into the working area after the ore is removed.

Mining bench: A shelf or ledge made in a mine tunnel or working when an upper section is cut back.

Modular retort: The smallest unit that would be used in commercial practice. Its capacity varies with the developer.

Molecular weights: The relative mass of a molecule as compared with that of an atom of hydrogen. It is calculated by adding up the weights of the molecule's constituent atoms.

Mucking: Removal material broken up in the mining process.

Nahcolite: A mineral chemically identical to commercial baking soda (sodium bicarbonate).

New Source Performance Standards (NSPS): The Clean Air Act requires that the Environmental Protection Agency set standards of performance for major new potential sources of pollution, and that such facilities use the most advanced technology available for pollution control.

Nonattainment area: The air in the region does not satisfy the National Ambient Air Quality Standards as established under the requirements of the Clean Air Act.

Nondegradation area: The air in the region is cleaner than that required by the National Ambient Air Quality Standards.

Nonmethane hydrocarbons: All the organic compounds of carbon and hydrogen that are not straight chain, saturated (no more hydrogen can be added) molecules in which the carbon atoms are joined to each other by single bonds.

Nonpoint source: A site from which there is un-

collected runoff, e.g., a mining operation, construction site, or agricultural area.

Olefin hydrocarbons: Unsaturated (lower ratio of hydrogen to carbon) compounds of carbon and hydrogen having at least one double bond.

Onstream factor: The fraction of the time that a plant could be expected to operate at design capacity.

Organic compounds: The compounds of carbon. These fall roughly into two classes: compounds containing only carbon and hydrogen (hydrocarbons), and compounds in which one or more hydrogen atoms have been replaced by other elements or groups of elements (heteroatomic compounds).

Overburden: The material overlying a deposit that must be removed before surface mining.

Paraffin hydrocarbons: Saturated compounds of carbon and hydrogen having only single bonds.

Particulate: Minute separate airborne particles, one of the criteria pollutants under the Clean Air Act.

Perfection of water right decree: Meeting all the requirements under applicable law to establish legal rights to the water—implies not only ownership but also actual use.

pH: A means of expressing the acidity or alkalinity of a solution. At normal temperatures, pure water has a pH of about 7 (neutral); the pH of a strong acid is about 1 and that of a strong base about 14.

Photochemical reactions: Chemical reactions induced in the atmosphere by ultraviolet radiation from the Sun.

Phreatophyte: A deep-rooted plant that obtains water from the water table or the layer of soil just above it.

Placer deposit: A deposit of alluvial material found along and in riverbanks, streambanks, and in beach sands.

Polycyclic organic compounds: A compound whose molecular structure contains two or more rings (usually fused) that are mostly constructed of carbon atoms (e.g., anthracene).

Pour point: The lowest temperature at which a liquid will flow.

Prevention of significant deterioration (PSD): A statutory program of the Clean Air Act aimed at preserving the existing high air quality in those areas having the cleanest air (nondegradation regions).

Pyrolysis: The breaking down of complex materials into simpler units by means of heat.

Radionuclide: A radioactive atom.

RARE II: The Roadless Area Review and Evaluation process being undertaken by the Forest Service for all potential wilderness areas in the national forest system.

Refluxing: Distillation in which the liquid is condensed with the rising vapor in a fractionating column.

Reserve: A resource that can be extracted from the deposit and processed to yield products that can be marketed at a profit.

Resource: A naturally occurring substance with properties that can be put to use.

Retort: The vessel or container in which the oil shale is pyrolyzed to recover the shale oil.

Retort plant:

Commercial scale—A commercial-size oil shale facility would use several modular retorts in parallel to obtain the desired production rate,

Pilot-plant scale—About one-hundredth of the capacity of a commercial scale module.

Pioneer commercial scale—Would contain several commercial-size modules.

Semiworks scale—About one-tenth of the capacity of commercial-size.

Retorting: The raw oil shale is heated to pyrolysis temperatures (about 1,000° F (540° C)) to obtain crude shale oil.

Above-ground (AGR)—In this process, the retorting vessels are essentially large, steel cylindrical or cone-shaped containers lined with refractory brick. The retorting systems, which differ widely with respect to technical and operating characteristics, fall into four classes based on the mode of transferring heat through the oil shale: 1) by conduction through the retort wall, 2) by flowing gases generated from the carbonaceous material and hot gases created in the retort, 3) by gases heated outside the retort, and 4) by mixing hot solid particles with the oil shale.

Modified in situ (MIS)—In this process, a portion of the shale deposit is mined out, and the rest is fractured with explosives or by other means to create a highly permeable zone through which hot fluids can be circulated.

True in situ (TIS)—In this process, the shale is left underground and is heated by injecting hot fluids.

Rubbling: Shattering by explosives of a portion of an oil shale deposit so that it can be retorted underground. A modified in situ process.

Sedimentary rocks: These are derived from the disintegration and weathering of older rocks,

and deposited in layers by water, wind, or ice (e.g., sandstone, limestone, shale.)

Shale oil syncrude: A synthetic crude oil produced by adding hydrogen to crude shale oil, comparable with the best grades of conventional crude.

Spent shale: The retorted residual material after the oil and gas products are removed. Its properties vary with the type of retorting procedure used; indirectly heated retorts produce a carbonaceous spent shale, while directly heated retorts produce a material essentially stripped of carbon.

Spot market price: The nonposted price for a barrel of oil,

Syncrude: Synthetic crude oil, produced from any source other than conventional petroleum.

Trona: A hydrated mixture of sodium carbonate and sodium bicarbonate. It is a source of soda ash for glass production.

Upgrading: The treatment of crude shale oil to improve it to a transportable refinery feedstock, e.g., hydrotreating.

Virgin flow: The flow of a river that would occur in the absence of human-related activities. In this assessment most of the analysis of water availability refers to the average flow between 1930-74, because of its common use in other water resources analyses.

Viscosity: A measure of a liquid's resistance to flow.

Water rights:

Absolute—The right created when a holder of a conditional right perfects that right by actually diverting the water and applying it to a beneficial use.

Conditional—The right obtained by filing for a conditional decree from the State water courts, and then proceeding diligently towards the actual use of the water,

Diversion—Permits the diversion of water from a stream followed by its immediate application.

Junior—The prior appropriation doctrine for water rights is based on the principle "first-in-time, first-in-right." In times of shortages, rights that are junior in terms of the initiation date are curtailed to assure water supplies to users with more senior rights.

Senior—The more senior (older) the water right, the higher its priority for the use of limited resources.

Storage—Permits the impoundment of water for later application.