

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18

**APPENDIX G:
SOCIOECONOMIC AND ENVIRONMENTAL JUSTICE
ANALYSIS METHODOLOGIES**

1
2
3
4
5
6
7
8
9
10
11
12
13
14
15

This page intentionally left blank.

APPENDIX G:**SOCIOECONOMIC AND ENVIRONMENTAL JUSTICE
ANALYSIS METHODOLOGIES**

The analysis of the socioeconomic impacts of oil shale and tar sands development in Colorado, Utah, and Wyoming consists of two interdependent parts. The analysis of *economic impacts* estimates the impacts of construction and operation of oil shale and tar sands facilities and associated power plants, coal mines, and temporary housing on local employment and income. Because of the relative economic importance of oil shale and tar sands development in small rural economies and the consequent incapacity of local labor markets to provide sufficient workers in the appropriate occupations required for development, construction, and operation in sufficient numbers, oil shale and tar sands development is likely to result in a large influx of temporary population. Given these considerations, the analysis of *social impacts* assesses the potential impacts of oil shale and tar sands development on population, housing, local public service employment and expenditures, crime, alcoholism, illicit drug use, divorce rates, and mental illness. Also covered is social disruption; since it may occur with rapid population growth and the “boom and bust” economic development associated with oil shale and tar sands facilities, a review of the literature on social disruption is included. Finally, under social impacts, the analysis covers environmental justice impacts on minority and low-income populations.

The analysis assesses the impacts of oil shale and tar sands development and the associated power plants, coal mines, and temporary housing in a region of influence (ROI) in each state. The ROIs consists of the counties and communities most likely to be impacted by oil shale and tar sands development (see Section 3.10.1 of this programmatic environmental impact statement [PEIS]). Selection of these counties was based on counties used in the *Final Environmental Statement for the Prototype Oil Shale Leasing Program* (DOI 1973).

G.1 ECONOMIC IMPACTS ON LOCAL EMPLOYMENT AND INCOME

The analysis of socioeconomic impacts of oil shale and tar sands development, power plants, coal mines, and temporary housing on regional employment and income were assessed for the PEIS by using direct employment data in association with regional economic multipliers.

G.1.1 Direct Employment Data

To provide appropriate direct employment estimates for the analysis, a review of a number of relevant documents was undertaken, including *Final Environmental Statement for the Prototype Oil Shale Leasing Program* (DOI 1973); *Final Environmental Impact Statement, Proposed Development of Oil Shale Resources by The Colony Development Operation in Colorado* (BLM 1977); *Final Programmatic Environmental Impact Statement, Development Policy Options for the Naval Oil Shale Reserves in Colorado* (DOE 1982); *Final Supplemental Environmental Impact Statement for the Prototype Oil Shale Leasing Program* (BLM 1983a);

1 *Final Environmental Impact Statement, Uintah Basin Synfuels Development* (BLM 1983b); and
 2 *Utah Combined Hydrocarbon Leasing Regional Final Environmental Impact Statement*
 3 (BLM 1984). Following this review, direct employment data were taken from a number of
 4 different sources.

7 **G.1.1.1 Oil Shale Facilities**

9 Direct employment data for the construction and operation of surface and underground
 10 mine facilities with surface retorting for the development of oil shale resources were based on
 11 data taken from the *Final Environmental Statement for the Prototype Oil Shale Leasing Program*
 12 (DOI 1973). Data on oil shale developments using in situ processing under Alternatives B and C
 13 were available from Thompson (2006a). For Alternative A (No Action Alternative), data were
 14 based upon numbers presented in the four environmental assessments prepared by the companies
 15 conducting oil shale research, development, and demonstration projects (BLM 2006a–c; 2007).
 16 Employment numbers for oil shale facilities are presented in Section 4.11.3.

19 **G.1.1.2 Tar Sands Facilities**

21 Construction and operations direct employment data for tar sands facilities were available
 22 in the *Utah Combined Hydrocarbon Leasing Regional Final Environmental Impact Statement*
 23 (BLM 1984), but only for two technologies (surface mining and in situ processing) and only for
 24 two production levels (190,000 bbl/day and 175,000 bbl/day, respectively). These values were
 25 converted to direct employment values per 1,000 bbl/day, as shown in Table G-1.

27 For the socioeconomic assessment, direct employment was estimated as an average of all
 28 the assessed tar sands development technologies on the basis of a 20,000-bbl/day production
 29 level. To estimate per facility direct employment values, a general assumption of 40,000 bbl/day
 30 per facility was used as representative of a typical commercial tar sands project. The per facility
 31 values were then estimated as direct or total
 32 values times the ratio of the per facility
 33 production to the total production.

TABLE G-1 Input Data for Tar Sands Direct Employment Estimates

Action	Direct Employment (FTE/1,000 bbl/day) ^a
Surface mining, construction	50.5
Surface mining, operations	34.6
In situ, construction	68.9
In situ, operations	12.8

36 **G.1.1.3 Power Plants and Coal Mines**

38 Power plant construction and operations
 39 direct employment data were taken from
 40 Thompson (2006b,c), which described a
 41 1,500-MW plant proposed for Ely, Nevada.
 42 Employment data for coal mines were from
 43 U.S. Department of Energy (DOE) (2007a,b,c)
 44 and industry sources (Hill and Associates 2007).

^a FTE = full-time equivalent.

Source: BLM (1984).

1 **G.1.2 Temporary Housing Construction Data**

2
3 The impacts of the construction of temporary housing were assessed by using estimates
4 of the number of in-migrating direct and indirect workers and accompanying family members,
5 with updated construction labor cost factors taken from the *Final Environmental Statement for*
6 *the Prototype Oil Shale Leasing Program* (DOI 1973).
7

8 9 **G.1.3 Economic Multipliers**

10
11 Economic multipliers captured the indirect (off-site) effects of construction and operation
12 of oil shale and tar sands facilities and associated power plants and housing developments.
13 Multipliers for each ROI were derived from IMPLAN[®] input-output economic accounts for each
14 ROI (Minnesota IMPLAN Group, Inc. 2007). These accounts show the flow of commodities to
15 industries from producers and institutional consumers, consumption activities carried out by
16 workers and owners of capital, and imports from outside the region. Each IMPLAN model
17 contains 528 sectors representing industries in agriculture, mining, construction, manufacturing,
18 wholesale and retail trade, utilities, finance, insurance and real estate, and consumer and business
19 services. Each model also includes information for each sector on employee compensation;
20 proprietary and property income; personal consumption expenditures; federal, state, and local
21 expenditures; inventory and capital formation; imports; and exports.
22

23 IMPLAN multipliers for 2004 for oil and gas extraction, coal mining, new residential
24 construction, power generation and supply, manufacturing and industrial buildings, and personal
25 consumption expenditure were used to estimate the indirect impacts of OSTs and ancillary
26 project development and temporary housing in each state ROI.
27

28 Assumptions that were made in the analysis about the expected pattern of procurement
29 within the ROI for the various materials and equipment and the extent of local wage and salary
30 spending by oil shale and tar sands facility and power plant workers and temporary housing
31 construction workers are described in Section 4.11 of this PEIS.
32

33 Impacts on ROI employment are described in terms of the total number of jobs (direct
34 plus indirect) created in the region in the peak year of construction and in the first year of
35 operation of oil shale and tar sands facilities and the associated power plants and temporary
36 housing construction. Impacts on ROI income are described in terms of total income generated
37 by direct and indirect construction and operations activities. The relative impact of the increase
38 in employment in the ROI was calculated by comparing total oil shale and tar sands development
39 construction employment over the period in which construction is expected to occur with
40 baseline ROI employment forecasts over the same period. Forecasts were based on data provided
41 by the U.S. Department of Commerce (2007).
42
43
44

1 **G.2 SOCIAL IMPACTS**

4 **G.2.1 Population**

6 An important consideration in the assessment of impacts of oil shale and tar sands
7 development is the number of workers, families, and children that would migrate into the ROI,
8 either temporarily or permanently, with the construction and operation of oil shale and tar sands
9 facilities, power plants, and temporary housing. The capacity of regional labor markets to
10 provide workers in the appropriate occupations required for oil shale and tar sands development
11 construction and operation in sufficient numbers is closely related to the occupational profile of
12 the ROI and occupational unemployment rates. Assumptions made about the number of
13 in-migrating oil shale and tar sands facility, power plant, temporary housing construction, and
14 indirect workers required to produce goods and services resulting from increased local demand
15 associated with oil shale and tar sands facility, power plant, and temporary housing worker wage
16 and salary spending are described in Section 4.11, together with the number of workers bringing
17 family members into each ROI. The residential location of in-migrating workers was estimated
18 by using a gravity model to assign workers to communities based on population size and distance
19 from potential oil shale and tar sands projects (see Section 4.11). The national average household
20 size was used to calculate the number of additional family members accompanying direct and
21 indirect in-migrating workers.

23 Impacts on population are described in terms of the total number of in-migrants arriving
24 in the region in the peak year of construction. The relative impact of the increase in population in
25 the ROI was calculated by comparing total oil shale and tar sands development construction
26 in-migration over the period in which construction is projected with baseline ROI population
27 forecasts over the same period. Forecasts were based on data provided by the three states
28 (Colorado State Demography Office 2007; Utah Governor's Office of Planning and
29 Budget 2007; Wyoming Department of Administration and Information 2006).

32 **G.2.2 Housing**

34 The in-migration of workers occurring during construction and operation associated with
35 oil shale and tar sands facility and power plant development would substantially affect the
36 housing market in the ROI in the absence of temporary housing developments. The analysis
37 considered these impacts by estimating the increase in demand for vacant housing units in the
38 peak year of construction resulting from the in-migration of direct oil shale and tar sands facility,
39 power plant, and indirect workers into each ROI. The relative impact on existing housing in the
40 ROI was estimated by calculating the impact of oil shale and tar sands-related housing demand
41 on the forecasted number of vacant housing units in the peak year of construction. Forecasts
42 were based on data provided by the three states (Colorado State Demography Office 2007; Utah
43 Governor's Office of Planning and Budget 2006; Wyoming Department of Administration and
44 Information 2006).

1 **G.2.3 Public Services**

2
3 Population in-migration associated with construction and operation of oil shale and tar
4 sands facilities and the associated power plants and temporary housing construction workers
5 would translate into increased demand for educational services and for public services (police,
6 fire protection, health services, etc.) in each ROI. The impacts of in-migration associated with oil
7 shale and tar sands and power generation facilities on county, city, and school district revenues
8 and expenditures were based on per capita expenditure data provided in the jurisdictions' annual
9 comprehensive financial reports (see Section 3.11). Impacts on public service employment were
10 calculated by using the existing levels of service (the number of employees per 1,000 people
11 required to provide each community service) to estimate the number of new police officers,
12 firefighters, and general government employees required in the peak year of construction and
13 first year of operations. Similarly, the number of teachers in each school district required to
14 maintain existing teacher-student ratios across all student age groups was estimated. Impacts on
15 health care employment were estimated by calculating the number of physicians in each county
16 required to maintain the existing level of service, based on the existing number of physicians per
17 1,000 population, and the number of required additional staffed hospital beds to maintain the
18 existing level of service, based on the existing number of staffed beds per 1,000 population.
19 Information on existing employment and levels of service was collected from the individual
20 jurisdictions providing each service (see Section 3.11).

21 22 23 **G.2.4 Social Disruption**

24
25 The relative economic importance of oil shale and tar sands facilities and associated
26 power plant and temporary housing developments is likely to create a large influx of temporary
27 population both during construction and at the start of the operation phases of each project.
28 Because population increases are likely to be rapid, and in the absence of adequate planning
29 measures, local communities may be unable to quickly cope with the large number of new
30 residents; social disruption and changes in social organization are likely to occur. Community
31 disruption can also lead to increases in social distress; in particular, increases in drug use,
32 alcoholism, divorce, juvenile delinquency, and deterioration in mental health and perceived
33 quality of life. Changes in cultural values may also occur as the resident population is exposed
34 to, and may be required to at least partially adapt to, the cultural values of the in-migrant
35 population.

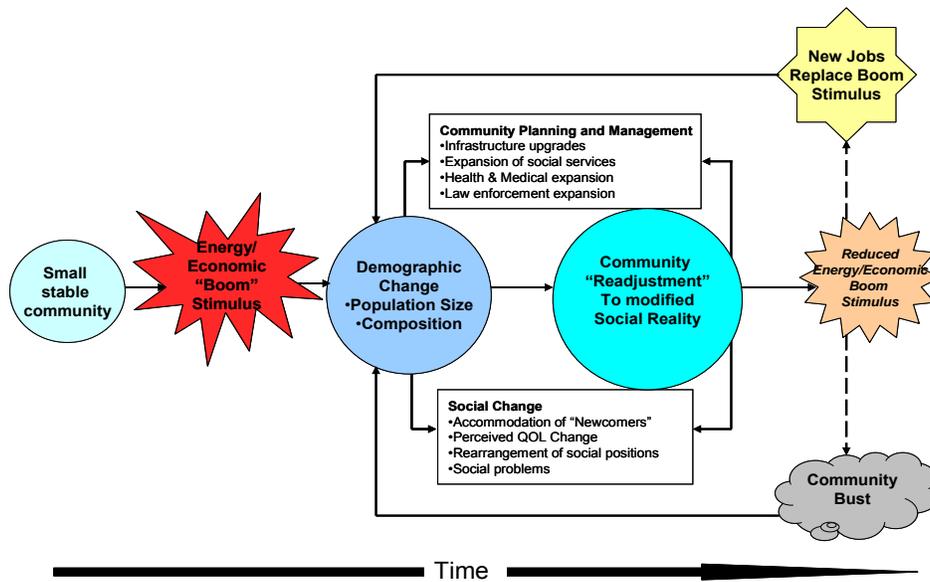
36
37 The assessment of the impacts of oil shale and tar sands development on social disruption
38 was based on a literature review drawing on past experience of social change associated with
39 resource development projects in rural areas, particularly developments that have led to "boom
40 and bust" economic development in communities in the western United States, where rapid
41 in- and out-migration and the associated community upheaval occurred both during and after
42 resource extraction. Extensive literature in sociology (in the journals *Rural Sociology*, *Pacific
43 Sociological Review*, and *Sociological Perspectives*, among others) is available on the problems
44 of community adjustment. The review included the social impacts of a wide range of energy
45 developments, including coal mining, oil and gas development, and power generation in the
46 western states, in addition to the social impacts that have occurred with past oil shale and tar

1 sands development. The review also included studies of the social impacts of oil shale and tar
 2 sands development in Colorado, Utah, and Wyoming identified in the *Final Environmental*
 3 *Statement for the Prototype Oil Shale Leasing Program* (DOI 1973) and in five EISs—Colony
 4 Oil Shale Final EIS (BLM 1977), Naval Oil Shale Reserves Final Programmatic EIS
 5 (DOE 1982), Prototype Oil Shale Leasing Program Final Supplemental EIS (BLM 1983a),
 6 Uintah Basin Synfuels Development Final EIS (BLM 1983b), and Utah Combined Hydrocarbon
 7 Leasing Regional Final EIS (BLM 1984).

8
 9 Social disruption and the resulting community adjustment that may occur in small,
 10 relatively self-contained communities arising from “boom and bust” surges in population size
 11 may have a number of components (Figure G-1). A “boom” stimulus provides new jobs that
 12 bring growth in population size and change the demographic composition of the community.
 13 Social change resulting from the need to accommodate new residents changes the perceived
 14 quality of life and leads to changes in social relations. Social problems, such as divorce,
 15 substance abuse, and crime, can occur. Social problems may be mitigated by community
 16 planning and management of growth, allowing the community to more easily adjust to new
 17 residents. After some period of time, employment associated with the boom may decrease,
 18 whereby the community may replace the jobs afforded by the initial economic stimulus or, as is
 19 more likely, employment is reduced in size by a “bust,” whereby the cycle of adjustment is
 20 repeated, mitigated to a greater or lesser degree by community planning efforts.

21
 22
 23 **G.2.5 Environmental Justice**

24
 25 Executive Order 12898 (U.S. President 1994) formally requires federal agencies to
 26 incorporate environmental justice as part of their missions. Specifically, it directs agencies to
 27 address, as appropriate, any disproportionately high and adverse human health or environmental
 28



29
 30 **FIGURE G-1 The Cycle of Social Adjustment to “Boom” and “Bust”**

1 effects of their actions, programs, or policies on minority and low-income populations. The
2 analysis of the impacts of oil shale and tar sands development on environmental justice issues
3 follows guidelines described in the Council on Environmental Quality's *Environmental Justice*
4 *Guidance under the National Environmental Policy Act* (CEQ 1997).

5
6 The analysis method has three parts: (1) a description of the geographic distribution of
7 low-income and minority populations in the affected area; (2) an assessment of whether the
8 impacts of construction and operation would produce impacts that are high and adverse; and
9 (3) a determination about whether these impacts disproportionately impact minority and
10 low-income populations. The description of the geographic distribution of minority and
11 low-income groups is based on demographic data from the 2000 Census. To fully evaluate the
12 potential environmental justice impacts of the oil shale and tar sands development, the
13 distribution of minority and low-income populations is described at the census block level. On
14 the basis of data at the individual block level, the minority and low-income population within a
15 50-mi buffer zone around each oil shale and tar sands resource location was analyzed.

16 17 18 **G.3 REFERENCES**

19
20 *Note to Reader:* This list of references identifies Web pages and associated URLs where
21 reference data were obtained. It is likely that at the time of publication of this PEIS, some of
22 these Web pages may no longer be available or their URL addresses may have changed.

23
24 BLM (Bureau of Land Management), 1977, *Final Environmental Impact Statement, Proposed*
25 *Development of Oil Shale Resources by The Colony Development Operation in Colorado*, Vols. I
26 and II, U.S. Department of the Interior.

27
28 BLM, 1983a, *Final Supplemental Environmental Impact Statement for the Prototype Oil Shale*
29 *Leasing Program*, Colorado State Office, Denver, Colo., Jan.

30
31 BLM, 1983b, *Final Environmental Impact Statement, Uintah Basin Synfuels Development*,
32 Vol. 1, U.S. Department of the Interior, Feb.

33
34 BLM, 1984, *Utah Combined Hydrocarbon Leasing Regional Final EIS, Volume I: Regional*
35 *Analyses*, Utah State Office, Salt Lake City, Utah, June.

36
37 BLM, 2006a, *Environmental Assessment, Chevron Oil Shale Research, Development &*
38 *Demonstration*, CO-110-2006-120-EA, White River Field Office, Meeker, Colo., Nov.

39
40 BLM, 2006b, *Environmental Assessment, EGL Resources, Inc., Oil Shale Research,*
41 *Development & Demonstration Tract*, CO-110-2006-118-EA, White River Field Office, Meeker,
42 Colo., Oct.

43
44 BLM, 2006c, *Environmental Assessment, Shell Oil Shale Research, Development and*
45 *Demonstration Projects, Rio Blanco, Colorado*, CO-110-2006-117-EA, White River Field
46 Office, Meeker, Colo., Nov.

47

- 1 BLM, 2007, *Environmental Assessment, Oil Shale Research Development and Demonstration*
2 *Project, White River Mine, Uintah County, Utah*, UT-080-06-280, Vernal Field Office, Vernal,
3 Utah, April.
4
- 5 CEQ (Council on Environmental Quality), 1997, *Environmental Justice Guidance under the*
6 *National Environmental Policy Act*, Executive Office of the President, Washington, D.C.
7 Available at <http://www.whitehouse.gov/CEQ/>. Accessed July 2006.
8
- 9 Colorado State Demography Office, 2007, *State Demography Office*. Available at
10 <http://www.dola.state.co.us/demog/>. Accessed March 2007.
11
- 12 DOE (U.S. Department of Energy), 1982, *Final Programmatic Environmental Impact Statement,*
13 *Development Policy Options for the Naval Oil Shale Reserves in Colorado*, Assistant Secretary,
14 Environmental Protection, Safety and Emergency Preparedness, Office of Naval Petroleum and
15 Oil Shale Reserves, Aug.
16
- 17 DOE, 2007a, Energy Information Administration, *Coal Production and Number of Mines by*
18 *State and Mine Type*. Available at <http://www.eia.doe.gov/cneaf/coal/page/acr/table1.html>.
19 Accessed Oct. 5, 2007.
20
- 21 DOE, 2007b, Energy Information Administration, *Average Number of Employees by State and*
22 *Mine Type*. Available at <http://www.eia.doe.gov/cneaf/coal/page/acr/table18.html>. Accessed
23 Oct. 5, 2007.
24
- 25 DOE, 2007c, Energy Information Administration, *Electric Power Annual 2005—State Data*
26 *Tables*. Available at http://www.eia.doe.gov/cneaf/electricity/epa/epa_sprdshts.html. Accessed
27 Oct. 5, 2007.
28
- 29 DOI (U.S. Department of the Interior), 1973, *Final Environmental Statement for the Prototype*
30 *Oil Shale Leasing Program, Volume IV of VI, Consultation and Coordination with Others*,
31 Washington, D.C.
32
- 33 Hill and Assoc. (Hill and Associates, Inc.), 2007, *Economic Benefits of a Coal-Fueled*
34 *Power Plant Compared to Natural Gas*, prepared for Peabody Energy. Available at
35 <http://coalcandothat.com/pdfs/EconBeneCoalFuel.pdf>. Accessed Oct. 8, 2007.
36
- 37 Minnesota IMPLAN Group, Inc., 2007, *IMPLAN Data Files*, Stillwater, Minn.
38
- 39 Thompson, S., 2006a, personal communication from Thompson (U.S. Bureau of Land
40 Management, Washington, D.C., Office) to K. Smith (Argonne National Laboratory, Lakewood,
41 Colo.), Nov. 30.
42
- 43 Thompson, S., 2006b, personal communication from Thompson (U.S. Bureau of Land
44 Management, Washington, D.C., Office) to K. Smith (Argonne National Laboratory, Lakewood,
45 Colo.), Dec. 6.
46

- 1 Thompson, S., 2006c, personal communication from Thompson (U.S. Bureau of Land
2 Management, Washington, D.C., Office) to K. Smith (Argonne National Laboratory, Lakewood,
3 Colo.), Dec. 13.
4
- 5 U.S. Department of Commerce, 2007, *Regional Economic Accounts*. Available at
6 <http://www.bea.gov/bea/regional/reis/default.cfm?catable=CA04>. Accessed Jan. 2007.
7
- 8 U.S. President, 1994, "Federal Actions to Address Environmental Justice in Minority
9 Populations and Low-Income Populations," Executive Order 12898, *Federal Register* 59:7629,
10 Feb. 6.
11
- 12 Utah Governor's Office of Planning and Budget, 2006, *Population Projections by County and*
13 *District*. Available at <http://www.governor.utah.gov/DEA/Projections/06ProjCountyand>
14 [District.pdf](http://www.governor.utah.gov/DEA/Projections/06ProjCountyand). Accessed July 2006.
15
- 16 Utah Governor's Office of Planning and Budget, 2007, *2002 Baseline Projections UPED Model*
17 *System*. Available at <http://www.governor.utah.gov/dea/LongTermProjections.html>. Accessed
18 March 2007.
19
- 20 Wyoming Department of Administration and Information, 2006, *Population for Wyoming,*
21 *Counties, Cities, and Towns: 2000 to 2020*. Available at <http://eadiv.state.wy.us/pop/>
22 [wyc&sc20.htm](http://eadiv.state.wy.us/pop/wyc&sc20.htm). Accessed March 2007.
23
24

1
2
3
4
5
6
7
8
9
10
11
12
13

This page intentionally left blank.