APPENDIX G:

SOCIOECONOMIC AND ENVIRONMENTAL JUSTICE ANALYSIS METHODOLOGIES

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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);

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

G.1.1.1 Oil Shale Facilities

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

G.1.1.2 Tar Sands Facilities

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

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

[a] FTE = full-time equivalent.

Source: BLM (1984).

G.1.1.3 Power Plants and Coal Mines

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

G.1.2 Temporary Housing Construction Data

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

G.1.3 Economic Multipliers

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

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

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

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

G.2 SOCIAL IMPACTS

G.2.1 Population

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

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

G.2.2 Housing

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

G.2.3 Public Services

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

G.2.4 Social Disruption

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

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

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

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

G.2.5 Environmental Justice

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

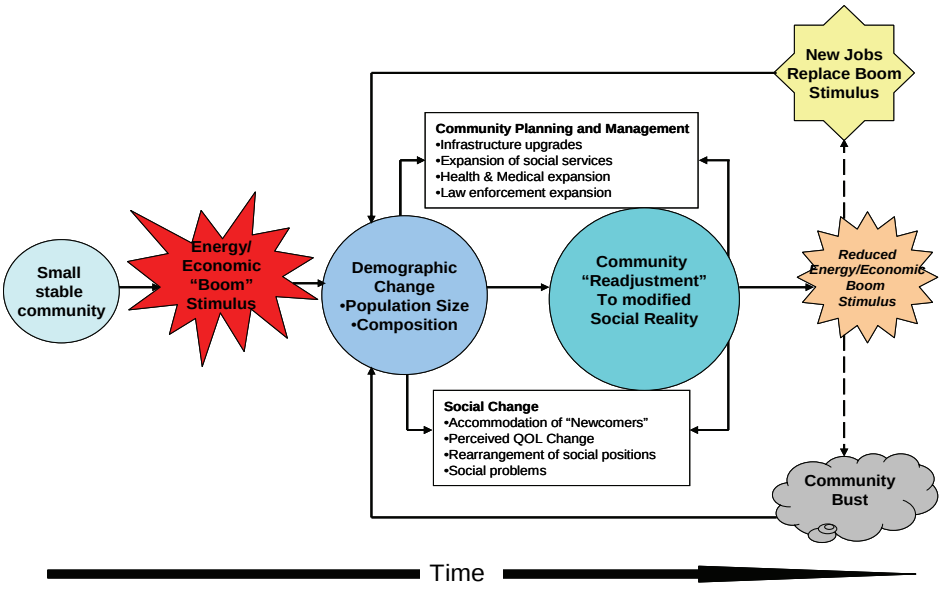

FIGURE G-1 The Cycle of Social Adjustment to "Boom" and "Bust"

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

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

G.3 REFERENCES

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

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