In the first year, key sites will be core drilled. Analyses of cores and samples from these coreholes will be used in directing additional coring and sampling work that will be needed to complete the delineation and mapping of the deep-lying Piceance Basin deposits. In subsequent years the work will be extended to include the Uinto Basin of Utah and the Green River and other basins of Wyoming and Sand Wash Basin, Colorado.

RESOURCES DEVELOPMENT PLANNING

Objective

The objective of this program part is to provide comprehensive plans for development of the publicly-owned resources in the oil shale areas. Comprehensive planning will provide:

1. Evaluation of best mining or extraction methods for the various oil shale areas in terms of mineral conservation, prevention of pollution and aesthetic damage, safety, and economic operations.
2. An estimated schedule of oil shale development by area.
3. An evaluation of all the resources involved in the region and the opportunities for multiple-use of selected areas.
4. An evaluation of water, electric power and other utility needs and transportation and communication needs.
5. Urban planning for an oil shale industry.
6. Economic analysis of conflicting and complementary resource use, alternatives in leasing, incentives, and allocation of receipts.
7. An overall plan for development of the various oil shale basins and the portions thereof. Tentative identification of basins into various multiple-resource units for various types of mining or extraction, and for solution of possible pollution problems.

A 10-year program costing $4,350,000 is contemplated.

Program

A. *Evaluating of mining and extraction methods:*

1. Mine site and type.—Studies will be made of different methods for mining oil shale, including the data from mining research proposed elsewhere. Each method will be identified and analyzed to set up selection criteria of systems and sites based on such factors as topography, water supply, delivery of shale to plant sites and spent-shale disposal as related to industrial applications.

The methods fall into three main categories: 1. Open-pit mining, 2. Underground mining, 3. In situ retorting.

Factors to be investigated in evaluating different techniques include pit- or underground-mine design with respect to physical setting, optimum size of operation, allowable cost of shale delivered to processing plants, and safety.

Data from in situ retorting research proposed elsewhere in this program will be studied with respect to choice of methods for preparing shale beds for retorting, initiating and maintaining a retorting process, and recovering the shale oil produced. The techniques to be considered for preparing the shale beds include use of nuclear energy, chemical high-explosives fracturing, electrical fracturing, and hydraulic fracturing.

2. Mine design and economics.—Design of a mining operation will consider tonnage and grade requirements, safety and health aspects, and optimum extraction of the material. The design will incorporate current conventional methods, as well as adaptation of new concepts resulting from the research program on extraction and transportation methods. Estimated costs for each mining method—that is, surface, underground, and in situ—will be considered at various tonnage levels.

3. Safety considerations.—Safety is a primary consideration in the planning and design of any minig system, whether it be underground or on the surface. The type and degree of protection that can and must be provided for both men and equipment may well determine the technical and economic feasibility of any large oil-shale development. Most design factors based on the strength and character of the rock, such as the size and shape of underground openings or the depth and slope of surface pits, must be considered in relation to their effects on production workers and expensive equipment. Actual production operations, such as breaking and handling of rock, are more flexible but also must be planned for maximum safety. Environmental health of workmen is another important consideration, particularly in the design of ventilating systems to control dust, temperature and humidity.