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DEVELOPMENT AND APPLICATION OF A PERMIT INFORMATION SYSTEM FOR SHALE OIL
(PERMISSO)

FINAL REPORT FOR THE PERIOD
June 1978 - May 1979

July 1979

Work performed under Contract 31-109-38-3764; WO 79-007

Science Applications, Inc.
1546 Cole Boulevard, Suite 210
Golden, CO 80401

Deputy Under Secretary for Commercialization
Assistant Secretary for Energy Technology/Division of Fossil Fuel Extraction
Laramie Energy Technology Center

MASTER

TECHNICAL INFORMATION CENTER
UNITED STATES DEPARTMENT OF ENERGY

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SCIENCE APPLICATIONS, INC.
1546 COLE BLVD., SUITE 210
GOLDEN, CO 80401

JULY 1979

PREPARED AT THE REQUEST OF
JACKSON S. GOURAUD, THE DEPUTY UNDER SECRETARY FOR COMMERCIALIZATION, DOE
AND SPONSORED BY THE DIVISION OF FOSSIL FUEL EXTRACTION/
LARAMIE ENERGY TECHNOLOGY CENTER
UNDER CONTRACT 31-109-38-3764, W.O. 79-007

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PREFACE

This report covers the first phase of a program to develop an information system capable of describing and assessing the federal, state, and county permitting process for oil shale development. The program is an outgrowth of widespread confusion and dissatisfaction regarding the existing permitting process for oil shale. The problems posed by the present requirements were a main topic of concern at a recent meeting of the Rocky Mountain Oil and Gas Association (RMOGA). Mr. Jackson Gouraud, the Deputy Under Secretary for Commercialization, U.S. Department of Energy (DOE), participated in the meeting as a specially invited guest. The RMOGA meeting served as a forum in which government and industry could enumerate and analyze the problems which have been instrumental in preventing oil shale from approaching its potential to alleviate our nation's energy problems.

Mr. Gouraud and his associates within DOE recognized the possibility that prospects for commercialization of oil shale could be enhanced through improvements in the permitting process. Consequently, the Department of Energy, Division of Fossil Fuel Extraction (LETC), agreed to sponsor a Phase I study designed to (1) establish a manual permit information system applicable to every location in which oil shale development is likely to occur, and (2) demonstrate the potential benefits obtainable through system automation. Dr. Andrew Decora, Director of the Laramie Energy Technology Center, provided valuable guidance as technical project officer for the study. The program has also benefited from the continuing interest and encouragement of Mr. Richard H. Hertzberg, Director, Division of Fossil Fuel Extraction, DOE.

Definition of the permitting system has required considerable research and analysis. Above all else, the program has required the cooperation and assistance of many people. The authors of this report have received valuable assistance and encouragement from over 200 people, all of whom are involved in a regulatory, advisory or developmental aspect of oil shale. Most of them have recognized the importance of this program, and have taken time to provide in-depth analyses of one or more significant elements of the pertinent regulations.

Space limitations preclude the listing of these individual contributors and their special contributions. However, the authors would like to express gratitude to the following organizations whose representatives have been most helpful:

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Claremont Engineers, Inc.

Rio Blanco Oil Shale Co.

The Carter Oil Co.

U-a Project

The Superior Oil Co.

U-b Project

Paraho Project

Rocky Mountain Energy

Talley Energy Systems

- . County Planning Commissions of Delta, Garfield, Mesa, Moffat, and Rio Blanco counties, Colorado; Carbon, Daggett, Duchesne, Summit, and Uintah counties, Utah; and Carbon, Lincoln, Sublette, Sweetwater, and Uinta counties, Wyoming.
- . State of Colorado: Departments of Health, Local Affairs, and Natural Resources.
- . State of Utah: Board of State Lands; Divisions of Oil, Gas, and Mining, Water Rights, and Water Resources; Industrial Commission.
- . State of Wyoming: Department of Environmental Quality; Industrial Siting Commission; Planning Coordinator.
- . U.S. Department of the Interior: Bureau of Mines; Bureau of Land Management; Department of Indian Affairs; Geological Survey, Area Oil Shale Office; Oil Shale Environmental Advisory Panel.
- . U.S. Department of Labor
- . U.S. Environmental Protection Agency, Region VIII
- . U.S. Navy, Casper office

More than 20 people at Science Applications, Inc. and the firm of Holland and Hart have been involved in data acquisition, analysis, and reduction. The authors would like to express their collective thanks and appreciation to all who have contributed their special talents and insights to this program.

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EXECUTIVE SUMMARY

Under LETC Purchase Order #PL 82391 for the U.S. Department of Energy, Science Applications, Inc. has completed Phase I of the development and application of a Permit Information System for Shale Oil (PERMISSO). The objectives of Phase I were to:

1. Compile and evaluate pertinent oil shale permitting data, and organize these data into a meaningful and logical manual information system.
2. Evaluate the benefits obtainable from a planned Phase II effort, which would comprise automation, validation, and use of a permit information system.

The Phase I study was accomplished through: (1) a systematic evaluation of likely oil shale development processes and locations; (2) a legal search and analysis of federal, state, and local statutes and regulations which could reasonably be expected to apply to these potential development alternatives; (3) field trips to, and coordination with federal, state, and local regulatory bodies to gather pertinent data; (4) interviews with representatives of industrial groups interested in oil shale development, to gather information on current problems and practices; (5) classification of data, preparation of a generic flow chart of the permitting process, and preparation of data summaries of permits and approvals considered significant to the permitting system.

It was found that:

1. The permitting system is in a constant state of change, and is growing in complexity.
2. There are potential direct savings of several millions of dollars obtainable through development and use of an automated permitting system data base.
3. The probability that shale oil will contribute to the solution of our nation's energy problems would be increased by the creation of an information system which (a) makes the existing oil shale permitting system more accessible and intelligible to the policy maker and oil shale developer; (b) can be easily maintained and updated to conform with changing requirements; (c) provides sufficient visibility into permit requirements to enable the developer to avoid redundant effort and order his responses so as to minimize delay; (d) minimizes the amount of effort required to satisfy existing permit require-

ments; and (e) can be used in the development of an optimized or improved oil shale permitting process.

4. The automated system (PERMISSO) should contain an organized compilation of the permits, approvals, licenses, and key procedures through which federal, state, and county regulatory bodies ensure that on-site activities related to oil shale development conform with legal requirements. In response to a set of input specifications of the nature, size, and location of one or more oil shale projects, PERMISSO should produce (a) summaries and flow chart representations of a systematic procedure for satisfying the pertinent permitting requirements, and (b) a summary of the data requirements associated with each pertinent permit or approval. Several options should be available to the user in controlling the presentation of outputs.

5. There is interest in Colorado, Utah, and Wyoming in improving the permitting system for the development of energy-related minerals. Preliminary discussions have shown that PERMISSO could play a central role in such efforts.

The manual permit information system developed during the Phase I study is described in the main body of this report, which also contains summaries of the potential uses and limitations of the system. The permit information summaries are contained in the Appendix to this report (under separate cover).

SECTION 1

INTRODUCTION

The development of a Permit Information System for Shale Oil (PERMISSO) is an attempt at examining public laws, regulations, and resulting requirements regarding permits required in projects involving the development and extraction of oil from oil shale. This study includes only the western oil shale deposits located in Colorado, Wyoming, and Utah.

1.1 Background

The PERMISSO study is an outgrowth of widespread confusion and dissatisfaction regarding the existing permitting process for oil shale. At a recent meeting of the Rocky Mountain Oil and Gas Association (RMOGA), representatives of industry expressed concern that the permitting system was so complicated and confusing as to impose serious, perhaps unnecessary obstacles to the development of a viable oil shale industry.

Three major, interrelated problems surfaced at the RMOGA meeting: technical problems, economic problems, and problems with the oil shale permitting process. Of the three, the permitting problem appeared to be the most amenable to study through systems-analysis methods. Improvement in the permitting process, or at least improvement in industry's interface with the process, would not only allow industry to concentrate upon the technical and economic problems involved in oil shale, but would have a favorable impact upon the economic problem itself.

It was generally recognized that, in erecting the permitting system, government was attempting to protect values (natural resources, environmental quality, cultural assets, aesthetics, etc.) that are important, often irreplaceable, and endangered. The allegations were that the system erected to protect these values was unnecessarily cumbersome and variable.

Conceptually, many of the problems associated with the oil shale permitting process could be solved through compilation, analysis, and automation of the system. Consequently, the Department of Energy agreed to sponsor a study designed to (1) establish a manual permit information system applicable to every location in which oil shale development is likely to occur, and (2) demonstrate the potential benefits obtainable through system automation.

1.2 Results

A manual permitting data bank has been created. As anticipated, the data bank is voluminous. Representative samples of the summary sheets included in the data folders are shown in par. 4.3.2. Also included in the folders are:

- A copy of the basic authority (Public Law___)
- A copy of the regulations
- Where applicable, a copy of blank permit forms
- Other data pertinent to the requirement.

The main body of the permit summary sheets is contained in the Appendix to this report. From the data points (each permit), categorization, structuring, and ordering led to the development of the flow charts contained throughout the report and more specifically in the Generic Flow Chart for PERMISSO (fold out inside back cover).

The value of this effort is further identified in terms of a "snap shot" of requirements as they exist at a point in time. This snap shot forms an information baseline and a tool for analysis for related DOE projects as indicated in Figure 1. As implied by the illustration, PERMISSO can serve as a tool for combining the results of various investigations into a unified plan for improving our regulatory system.

Coordination and cross fertilization of several DOE funded efforts are now beginning to have the effect of narrowing and focusing regulatory requirements while meeting the environmental concerns of major energy developments. DOE Region VIII personnel, departments in the State of Colorado, and projects involved are cooperating in this process. Both Wyoming and Utah have shown interest in a similar concept.

Figure 1. Potential Role of PERMISSO in the Colorado Requirements Coordination

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Section 2

CONCLUSIONS AND RECOMMENDATIONS

Listings of the main conclusions and recommendations resulting from the Phase I study are given below. See Section 5 for a discussion of the potential benefits arising from the implementation of the study recommendations.

2.1 Conclusions

1. A logical system can be developed to relate federal, state, and local permitting requirements to the classes and locations of likely oil shale development activities.
2. More than 400 permits, licenses, and approvals have been found to be pertinent to oil shale development. These permitting elements have been classified, analyzed, and linked in a manual information system described in this report.
3. The permitting system is characterized by the diversity of governmental agencies involved in its operation, the high rate of change in permitting requirements, and the high degree of redundancy in the data required of the developer.
4. The permitting system could be simplified and made more responsive without sacrificing its effectiveness.
5. Automation of the permitting system is technically feasible and economically desirable.
6. Automation of the permitting system would facilitate any future attempts to improve the usefulness and efficiency of the permitting process.

2.2 Recommendations

It is recommended that:

1. The manual oil shale permitting system developed during this study be automated, validated, and maintained,
2. Development and validation of the automated system be coordinated with permitting improvement programs underway or contemplated at the state level,
3. The oil shale permitting system at all levels be subjected to quantitative analysis, and an action plan developed for system improvement, and
4. The potential for extension of the system to include other energy systems be evaluated.

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SECTION 3

OBJECTIVES AND REQUIREMENTS

This part of the report describes the objectives of the oil shale permitting system study and the major assumptions that were made in defining the system objectives, or that proved to be essential to the development of the manual information system. Major decisions which followed from the objectives and assumptions included: the domain of the information system; the level of detail to be included in the system; the choice between legally defined requirements and local custom or opinion; and the treatment of "gray areas" such as secondary growth, water rights, proposed regulations, and apparent inconsistencies in the permitting system.

3.1 System Objectives

The objectives of the Permit Information System for Shale Oil (PERMISSO) are to: (1) make the existing permitting structure and requirements known and intelligible to the developer and policy maker; (2) provide a mechanism for efficient updating to conform to changes in the permitting process; (3) provide sufficient visibility to enable the developer to avoid redundant effort, and to order his responses to minimize delay; (4) minimize the amount of effort required to conform to existing regulations; and (5) illuminate possibilities for subsequent improvements in the permitting process.

These objectives were established in response to a number of present or potential problems cited by oil shale developers and members of regulatory agencies. The existing permit process for oil shale development is widely perceived as being overly difficult, time-consuming, and costly. Difficulties are thought to arise because:

- a) Numerous federal, state, and local agencies are involved.
- b) Statutes and regulations change with time, and their implementation and interpretation vary with time and place.
- c) There is a substantial amount of redundancy in the information required by the various monitoring and enforcement agencies, and there is a lack of standardization among similar requirements as to quality and quantity of data.
- d) Many statutes, regulations and requirements are vague, and their interpretation is variable at the individual's level.

Figure 2 shows the general role of PERMISSO in converting problems to solutions. A set of perceived problems in the regulatory process led to a set of objective for PERMISSO. If the regulatory system were left unchanged, the user of PERMISSO (e.g., a developer or planner) could reap benefits (1) through (4) on a case-by-case basis. If there were sufficient motivation to change the regulatory process to reach one or more of the conditions listed under "FUTURE POSSIBILITIES", attainment of PERMISSO Objective (5) would create a tool for determining how the goal might be reached.

It should be emphasized that the existence of PERMISSO will not eliminate the need for qualified, individual interpretation of regulations. However, PERMISSO's outputs may assist the developer and the regulatory agency in establishing a logical framework for interpretation.

3.2 Permitting System Definition

Many definitions of the "permitting system" are possible, and several alternative definitions were considered. Detailed consideration of the system objectives resulted in the following working definition:

The oil shale permitting system is an organized compilation of the permits, approvals, licenses, and key procedures through which federal, state (Colorado, Utah, and Wyoming), and county regulatory bodies ensure that on-site activities of oil shale developments conform to legal requirements.

Key terms in this definition include:

- a. Organized compilation: Mere listings of components do not define a system; the logical linkage of components must be exhibited.
- b. Permits, approvals, licenses (except licenses that exist only for revenue purposes), and key procedures: Again, the emphasis is upon finding and linking the data elements necessary to a successful set of interactions between the developer and the regulatory structure, with certain restrictions as outlined in the following discussion.
- c. Federal, state, and county: Municipalities are excluded, as are all agencies in regions outside a 14-county area where oil shale developments are considered most likely.
- d. On-site activities: Secondary impacts such as induced growth, new towns, etc., are excluded unless legal requirements imposed upon the oil shale developers force the developers to obtain permits for such impacts.

Figure 2. Relationship of PERMISSO Objectives to Solving of Identified Problems

e. Legal requirements: The developer may provide data or services beyond those legally required, either as a public service or because of local practice, but such actions are excluded.

3.2.1 Establishment of Limits of Coverage

There are specific data requirements and certifications, sometimes appearing in pre-printed blank forms, which must be properly completed by a would-be developer and reviewed and approved by one or more government agencies before certain specific actions relative to exploration, design, construction, operation, or abandonment of an oil shale project may take place. Permit applications are often accompanied by payment of a fee or performance bond. Federal, state, and local governments are involved in this process. A strictly defined permit system would be one which includes only the formally defined mechanisms (blank forms with control or identification numbers) for obtaining express approvals to commence, continue, or cease operations.

However, such a restrictive definition would not lead to a system which could satisfy objectives (1) and (3) from Figure 2. The permitting problem cannot be understood without considering the sequence of assessments, hearings, reviews, and approvals which constitute the interface between the developer and the public or its elected or appointed representatives.

A different, more complex permitting system can be defined by including the sum of environmental, land use and other controls at all levels of government which impinge upon the development process. This might include such items as obtaining zoning variances or changes for the secondary growth which usually will have a significant impact upon the sparsely populated oil shale region, and without which a mature oil shale industry could hardly be established. This would extend the range of government agencies involved to the municipality level, and extend the geographical domain far beyond the limits of the oil shale property itself. It would also involve many permits and requirements which are not unique to oil shale, and which are considered to be well understood by organizations interested in land development. It is difficult to place consistent bounds upon such a system, and it would tend to defeat objective (2) if such a volume of largely extraneous data were included.

3.2.2 Exclusion of Feedback Loops

Procedures for appealing the initial decisions of regulatory agencies often direct the parties to the courts after administrative remedies are exhausted. The possibilities of waivers, return loops, alternate paths, etc., that are introduced to the permitting system by the existence of the appellate process add immeasurably to the potential complexity of the permitting system. Any attempt to incorporate such possibilities would almost surely preclude attainment of objective (2), and would certainly hinder attainment of objective (1).

3.2.3 Inclusion of Permit Sequencing

The oil shale permitting system definition calls for definition of the logical linkage of permitting system elements. This brings up the question of permit sequencing. Three types of precedence occur: (1) statutory or regulatory, e.g., a legal stipulation that a particular permit cannot be granted until some other permit has been obtained or some regulatory action or developmental activity has been completed; (2) technical, e.g., there may be insufficient data on which to prepare or review a given application until some milestone in the development process has been reached; and (3) practical, e.g., under normal conditions it is considered most efficient to secure a particular permit in advance of some other permit. It seems obvious that the information system should exhibit statutory and technical precedences, but it is debatable whether logical precedences should be exhibited. On the positive side, such inclusion may be helpful to the general user, in that he can begin with a completed "road map" and adapt it to his circumstances. On the negative side, inclusion of practical precedences implies a set of rules for which there is no legal or technical basis, and thus might be deceptive to the user unless carefully qualified. Objectives (1), (3), and (4) appear to favor inclusion of all types of precedence.

3.2.4 Multiple Levels of Output

Visibility is enhanced by graphical presentation, and sequencing provides an important efficiency in helping to illuminate possibilities for system improvement (objective 5). However, there is a need for presentation of more detail than can conveniently be shown in flow diagrams.

These considerations led to a plan for three levels of system output, as depicted in Figure 3. At the top and mid levels, the regulatory process will be illustrated, to the level of detail necessary to place formal permits in their proper context. At the lowest (detailed) level, the focus will be upon individual permits and cumulative data requirements.

3.2.5 Geographical Coverage

Given local variations in the regulatory process, it is necessary to consider the number and diversity of locations in which oil shale development could conceivably take place during the intended lifetime of the information system. Low grade, shallow deposits of oil shale underlie large parts of the eastern and central states and northern Alaska. However, the largest deposits of the resource are located in the Green River Formation underlying nearly 20,000 square miles of Colorado, Utah, and Wyoming. This region contains most of the U.S. shale oil considered economically recoverable under present conditions. Assuming a useful life of 15 to 20 years for the permit information system, it thus seems reasonable to restrict the coverage of the system (insofar as its state and county facets are concerned) to the Green River Formation of Colorado, Utah, and Wyoming. This simplification favors objective (2) without seriously affecting the attainment of the other objectives.

The PERMISSO system concentrates on requirements likely to be imposed on a project inside the property boundaries of that project, i.e., upon the site and the process likely to be encountered there. In developing oil shale resources, the developers will help cause major changes in the regions in which the development occurs. Small, existing communities will face growth decisions, and in some cases entirely new communities will be established. A whole range of permits and approvals, incident to growth and development but in no way unique to the oil shale industry, will pertain to and regulate these activities. Because they are not unique to oil shale activities, and because their location, nature, and context are unpredictable in the absence of detailed development plans, they are not considered suitable for detailed treatment by PERMISSO.

Present plans and technical/economic considerations indicate that the shale oil would travel (probably by pipeline or truck) to distant oil refineries, where it would be refined to produce conventional petroleum products. There may be on-site processing such as heater treaters or more complex

Figure 3
LEVELS OF OUTPUT

1. Top Level	-- Summary Display of Agencies Involved, Expected Time Delays, Number of Permits/Approvals by Type
2. Mid Level	-- Path-by-Path Detail at Permit Level Shows Logical Sequence, Permit Name, Cognizant Agency, Governing Regulation, Expected Turnaround Time
3. Detailed Level	-- Data Requirements Associated with Each Applicable Permit
Lists of Redundant Requirements
Indication of Most Stringent Requirements

NOTE: Growth potential exists for interactive completion of some set of permits or permit data items.

treaters to make the shale oil suitable for such transport. The permit system should cover the degree of treatment or upgrading presently considered likely to occur at the site, and be kept current with technological changes. However, except for rights-of-way or construction permits required at the site and permits needed to deliver the shale oil to some existing transport facility, off-site processes and permits have been excluded.

3.2.6 Exclusion of Water Rights

Water poses special problems for the system definition, primarily because of the arid nature of the oil shale region. Issues related to acquisition of water rights have been excluded, except as they relate to questions of legal commitments for runoff, points of diversion, etc.

3.2.7 Summary

Thus restricted, the outputs of the permit information system do not constitute a general sourcebook or thesaurus of the broad set of environmental and land use controls which affect the development process. For example, if an item stands clearly in the path of obtaining a specific permit, that item will appear at the flow chart level because the permitting process could not be understood without it (objective (1)), but the item will not be described or documented in any detail beyond that necessary to clarify the permitting sequence. On the other hand, each individual permit relating directly to the life cycle of an oil shale development will be documented in terms of its domain or applicability, its most logical position in the development sequence, and its associated data requirements.

SECTION 4

OIL SHALE PERMITTING SYSTEM

The U.S. oil shale permitting structure could be defined as the set of federal, state, and local regulations, approval mechanisms, and guidelines which control oil shale operations at any given location in the United States. Such a definition would be too broad for PERMISSO. The PERMISSO model of the system (like all models of any system) is a simplified representation of reality designed to be useful but not definitive in every real-world case. The degree of aggregation and simplification is discussed in par. 3.0.

There is a further distinction between the manual model, which is simply a collection of manual files with sufficient identifying information to enable a user to assemble that set of permits considered most appropriate in his case, and the planned, automated system. To preserve these distinctions, the following terms are used:

- . Permitting structure, i.e., the total real-world regulatory structure.
- . Manual system, i.e., the Phase I set of files.
- . Automated system, i.e., the computerized, validated system (PERMISSO) planned for Phase II.

The manual information system consists of several file drawers of data, organized in accordance with the "applicability" of each piece of data. The organizational concept is illustrated in Figure 4. The user of the file, knowing the type of mining operation in question, the type of retorting operation, the type of off-site and auxiliary operations, the location, and the land use conditions, can scan the files, extract each permit folder containing data applicable to his particular interest, and, from the data contained in each folder, assemble and correlate the set of data pertinent to his problem.

In addition, a card catalog has been established to aid the user of the data. In the card catalog, individual permits are listed by title, filed by key words, and cross-referenced to the data files.

It is essential that users of the manual information system, and future users of the eventual automated system, understand the proper use and limitations of each version of the system. These uses and limitations can be summarized as follows:

1. The manual system, while developed with as much thoroughness and care as possible within the limits of the Phase I contract, has not undergone a systematic validation process, a process reserved for Phase II, and to be

FIGURE 4
DATA ORGANIZATION / FILING GUIDELINES

A MINING:	B UNDERGROUND PERSONNEL:	C RETORTING:	D RETORT TYPE:	E HEAT SYSTEM:	F AUXILIARY SYSTEM:	G LOCATIONS:	H LANDS:
Solution 1	Yes 1	Underground 1	Vertical 1	In-Situ Combust 1	All 0	All 0	All 0
Surface 2	No 2	Surface 2	Oblique 2	In-Situ Combust With Steam 2	New Roads 1	All Colorado 10	Private/Fee Lands 1
Underground 3		Both 3	Horizontal 3	In-Situ Combustion With Recycle Gas 3	Dams 2	All Utah 20	Patented Claims 2
True In - Situ 4		None 4	None 4	Hot Inert Gas 4	Airports, Railroads 3	All Wyoming 30	Federal (BLM) 3
				Combustion Above-Ground 5	On-Site Upgrading 4	Delta Co. 11	Federal (Navy) 4
				Solid Heat Carrier 6	Oil Pipeline 5	Garfield Co. 12	Federal (Undesignated) 5
				None 7	New Power Transmission Facilities 6	Mesa Co. 13	State 6
					On-site Power Generation Systems 7	Moffatt Co. 14	Indian Reservations 7
					Multimineral Processing 8	Rio Blanco Co. 15	
					Communication 9	Carbon UT 21	
						Dagget UT 22	
						Duchesne UT 23	
						Summit UT 24	
						Uintah UT 25	
						Carbon WY 31	
						Lincoln WY 32	
						Sublette WY 33	
						Sweetwater WY 34	
						Uinta WY 35	

Applicability:

1. Period separates items A, B, C, etc.
2. Comma separates items within a category (multiple but not universal applicability)
3. Zero denotes universal applicability within a category; trailing blanks are equivalent to zero's.

EXAMPLES:

1. 0. (permit applicable to all oil shale operations).
2. 0.0.0.0.0.10.0.0 (permit applicable to all Colorado oil shale operations)
3. 3.1.1.1.1.1.2,5.0.0 (permit applicable to underground mining, personnel working underground, underground retorting, vertical retort type, in-situ combustion, where new roads and dams and pipelines are required, all locations, all land uses)

undertaken in conjunction with the automation and checkout of the system.

2. Neither the manual nor the subsequent automated system will produce outputs that can be guaranteed to be precisely accurate for any given case. The many potential variations in oil shale operations, the uncertainties inherent in the appellate process, and the discretionary latitude given to the various regulatory bodies are among the factors which preclude any such guarantee. With the passage of time, statistics can be gathered which can be used to derive reliability estimates for the system. The validation process itself will contain provisions for evaluating the completeness and accuracy of the system when measured under special test conditions. However, the permitting process is so flexible, variable, and subject to interpretation that it is presently impossible to specify the degree of reliability of any given output of the system.

3. Both manual and automated outputs should be viewed as planning aids. The data bank is designed to provide sufficient information to help the user determine whether any given permit applies to his particular case, and whom he should contact for guidance or further information. Such contact is especially recommended in the case of the manual system, which is not being updated and has not been subjected to the validation process planned for Phase II. However, regulatory bodies are almost unanimous in recommending that prospective oil shale developers establish communications with regulatory bodies as early as possible, in order to facilitate and expedite the permitting process.

4. The automated system will be designed for use by oil shale developers and public and private decision-makers at all levels in evaluating potential projects and policy alternatives; the manual system is intended only to serve as the basis for the automated or "production" system. Thus, the automated system will be continuously updated, and there will be an effective date associated with each output. The manual system has no uniform, effective date, in that it represents the situation encountered during the period June-October, 1978 when each cognizant agency was interviewed. Theoretically, the manual information system could be validated and maintained; however, a main conclusion of the cost/benefit analysis outlined in par. 5.1 was that such a process would be overly costly and cumbersome compared with the automation alternative.

The major factors which constrain the use of the manual permitting system (and, to a lesser extent, the future automated system) appear to be a logical

outgrowth of the checks and balances which permeate our national structure. To some extent, they may also be an outgrowth of the rather haphazard process by which laws are passed and regulatory agencies are created and given ill-defined or overlapping responsibilities. This section begins with a presentation of the generic model for the manual system (par. 3.1.1), and continues with a presentation of a somewhat typical, specific case (par. 3.1.2). The essential data elements of the manual information system are quite extensive; they are contained in the Appendix to this report. The information contained in the Appendix is designed to enable interested readers to assemble any or all of the approximately 3,000 networks which, taken together, represent the permitting spectrum as a function of the situation parameters outlined in Figure 4. Finally, in par. 3.2, two sample summary sheets from the manual system are presented and discussed.

4.1 Development of Manual System

The problem of ensuring that the proposed information system is complete and accurate has been attacked in the manner shown in Figure 5. Certain assumptions were made regarding the existing permitting system. These assumptions were tested, verified, and employed as described in the following paragraphs.

First, it was assumed that a permit system, peculiar to each locale and each type of proposed oil shale development, exists or can be developed. The total system was assumed to be scattered, partially undefined, and characterized by redundancy and inconsistency, but nonetheless subject to system analysis. Therefore, a systems analysis approach was selected and applied.

Second, conventional data gathering methods (e.g., letters to known regulatory agencies, followed by field visits, followed by permit tabulation and correlation) would not ensure that the product was either comprehensive, correct, or maintainable. However, each permit requirement should logically spring either from a piece of federal or state legislation, or from a regulation established by a commission or local governing body, which in turn may have been established and given legal powers by some form of enabling legislation. Because legislation is published and available in the archives, the framework for the permit system could best be established through definition of enabling legislation. An information system built around the framework of legislation would be relatively easy to maintain, because potential changes to the system could be identified, to a large extent, by monitoring pertinent legislative actions. The system would be credible and authoritative, because all or most of its outputs could be associated with the appropriate legislation or regulations. Thus, following project initiation (Task 1), a systematic effort was begun to define enabling legislation and existing regulations (Task 2).

However, the possibility was recognized that some permits or permit requirements might not be traceable to legislation or regulations; conversely, it was assumed that the permits in some locations would be deficient or inconsistent with respect to one or more pieces of legislation. Also, pertinent legislation, regulations, and requirements are continually changing. Thus, the goal of ensuring that the system is both

FIGURE 5. SUMMARY OF SYSTEM DEFINITION TASKS FOR PHASE I

comprehensive and correct required that the effort of defining permitting legislation and requirements be coordinated with, and supported by, a directed search for permits.

The general sequence for the permit evaluation process was as follows: (1) define the federal permit system, applicable to all states; (2) define the state permit system, applicable to all locales within the state; and (3) define the local requirements. This involved field visits preceded by correspondence with identified agencies at all three levels.

The methodology is further illustrated by Figures 6 and 7. Objectives and the means of their attainment are given in the upper portion of Figure 6. General responsibilities of SAI and the law firm of Holland and Hart of Denver are outlined in the lower portion of the illustration. Mining and recovery methods were analyzed: those considered viable with respect to regulatory analysis in oil shale are shown in Figure 7. These methods, in conjunction with the feasible locations (14 counties - four in Colorado, and five each in Utah and Wyoming) and land ownership categories (eight), constitute one axis for a parameterized "permit" matrix. The form of the system/location axis for the manual information system is indicated by Figure 8. The other axis is composed of all the statutes and regulations at federal, state, and county levels which apply to any of the system-location-land use combinations to be evaluated. The object was to link each item in the matrix with the essential approvals and procedural requirements, in order to form an efficient plan for each system-location-land use combination. The resulting matrix is very large; its form is illustrated by Figure 9.

Not all combinations implied by Figure 4 are compatible (e.g., "surface" mining in Category A with "personnel underground" in Category B). In the manual system, "applicability" numbers were assigned to each data folder (par 4.3) as a guide to the establishment of practical flow networks.

Development of a generic flow chart (par 4.2) and permit data summaries (par 4.3) completed the technical effort. A simple cost-effectiveness analysis (par 5.1) was then performed.

Figure 6

METHODS AND PROCEDURES

PHASE I OVERVIEW

OBJECTIVES

- Reliability of Product through Multiple Search Paths
 - "Top-down" Legal Search
 - "Bottom-up" Permit Search
 - Federal, state, county agencies
 - Companies involved in oil shale
 - Correlation of Results
 - Iteration
 - Verification with Cognizant Agencies
- Maintainability
 - Data identification within "visible" laws and regulations
 - Cross-reference files and index
 - Tickler system with federal, state, and local agencies

PARTICIPANTS

- SAI
 - System Definition
 - "Bottom-up" Permit Search
 - Technical Analysis
 - Project Management
- Holland and Hart
 - "Top-down" Legal Search (Statutes and Regulations)
 - Legal Interpretations

FIGURE 7
METHODS AND PROCEDURES - SUMMARY OF SYSTEM MODELS

HORIZONTAL AXIS FOR PERMIT MATRIX
FIG. 8

DUE TO SPACE LIMITATIONS,
ONLY THE LEFT-MOST, VIABLE
PATHS ARE SHOWN.

Figure 9. CONCEPTUAL VIEW OF PERMIT MATRIX

	All	Private	Patent. Claims	Fed. (BLM)	Fed. (Navy)	Fed.	State	Indian	All	Private	Patent. Claims	BLM
ENABLING LEGISLATION	1	2	3	4	5	6	7	8	9	10	11	12
33 USC 1344 33 CFR 323, 325 (DREDGE & FILL)	X	X	X	X	X	X	X	X	X	X	X	X
CRS 1973 25-8-501,503 (NPDES)									X	X	X	X
25 USC 396 (Mineral Leasing or Indian Land)								X				

These column headings correspond directly to the bottom line of Fig. 8.

Examples:

33 USC 1344 Applies in all cases

CRS 1975 25-8-501,503 Applies to all Colorado cases.

25 USC 396 Applies only to Indian lands. (X's would also appear under the Indian lands category for each state.)

4.2 Flow Chart Level Description

Almost all of the regulatory mechanisms mentioned in the following discussion were developed without particular reference to oil shale. Thus, the application of these mechanisms to oil shale, which is an infant industry quite unlike "conventional" mining industries, has been attended by uncertainty and debate. Generally speaking, there are no federal standards (ambient or emission) directed specifically toward oil shale production. However, various agencies have established provisions or policies for dealing with problems that are characteristic of oil shale but uncommon in conventional mining activities.

4.2.1 General Description

Figure 10 (in flap at back of report) is the general flow diagram of the existing oil shale permitting system. Although the general flow diagram is too voluminous and complicated to permit ready comprehension, it is presented in order to suggest the degree of complexity of the system, and the general patterns implicit in the system.

The segmentation of the permitting system was directed by custom and convenience. The typical oil shale operation is considered to pass through the following six phases:

1. Designation. This phase comprises such activities as land acquisition (if any), formal expression of interest from an industrial standpoint, in-house investigation and stipulation of development sites by the federal government, and, in the case of public land, competitive bidding and selection of the developer.

2. Exploration. These are activities undertaken by the proponent to delineate the mining potential. Exploration comprises activities such as aerial and ground surveys; sinking shafts; drilling core and bore holes to extract samples prior to commencement of development or production; and the building of roads, accessways, and other facilities related to such work. Other surveys, such as those required for the EIS, are omitted from exploration, and included in design.

3. Design. This phase comprises the design activities from conceptual design through detailed planning. The design phase includes various environmental surveys, development of waste disposal plans, planning and design of the mining and retorting operations, and the design of all facilities.

4. Construction. The construction phase is considered to include development of the site, including start-up operations. The construction of all roads,

pipelines, utility systems, waste storage and disposal facilities, along with the construction of the actual mine and processing facilities, constitute the construction phase.

5. Operation. The operation phase is the period of commercial production of oil from the site. The procedures for continual production and transportation of oil including mining, retorting, trucking or piping, and waste disposal are the major activities of the operation phase.

6. Post Operation. Project shut-down and reclamation activities constitute the post operation phase. These activities include tearing down the facilities, closing the mine, and redressing the land as required by the reclamation plan.

The development stages form the columns of the generic flow chart, and elements of the permitting system are assigned to stages in which their completion is considered most likely to occur. The generic flow chart also associates permits by type of objective or concern which the permits were designed to address. The classes of permits are:

1. Air quality, encompassing system elements designed generally to protect and enhance the ambient atmospheric environment. Typically, EPA and state health departments administer most of the air quality elements of the system.

2. Waste disposal and rehabilitation, including plans, procedures, and facilities for the safe treatment and disposal of both hazardous and benign solid wastes. Generally, county and state agencies regulate these activities.

3. Water quality and availability, dealing primarily with the avoidance or minimization of pollution of streams and underground water sources. EPA and state health departments have major responsibilities for these concerns, but local governments and state engineers also play important roles.

4. Fish and wildlife values, concerning the protection, and possibly the enhancement of plants and animals affected by the oil shale project. Both federal and state agencies control these permits.

5. Health and safety, encompassing the elements most closely related to mining and the miner's physical environment. Much of this is controlled through periodic inspections, which do not fit into the flow-chart framework and, strictly speaking, are outside the permitting system. Major responsibilities for elements included in the flow chart are vested in MSHA, and state mining boards.

6. Cultural values, consisting of the identification and preservation of historic and archeological sites. Which agencies protect these sites depends on the ownership of the land. The Department of the Interior and the states register all sites and issue permits for the examination and excavation of those sites within their jurisdiction.

7. Multipurpose and other, encompassing miscellaneous elements and permits designed to affect two or more of the above classes. Typically, elements in this category relate to structures, communications and transportation facilities, and various types of rights-of-way.

The classification of elements is shown by means of irregular-shaped longitudinal areas in the generic flow chart. The sequencing of elements within the classes, though arbitrary, is justified by the assumptions of par. 3.0.

Apart from the basic framework of segmentation by development stage and class of element, the other major characteristics of the flow chart are (1) the manner and degree of simplification employed in the construction of the chart, and (2) the manner in which the chart is built around six major events in the permitting process. A discussion of these two subjects follows.

The flow chart is a simplification of reality in several ways. First, it does not contain the loops or repetitive activities that sometimes occur in real operations. In this respect, the generic flow chart approximates a situation in which all permit applications are properly completed and successful. Second, the flow chart omits the multiple occurrences of the same permit, e.g., an emissions notice would be needed for each point source, and separate emission permits might be needed for exploration, construction, and operation. Third, only the major events associated with a given permit are shown.

To appreciate the degree of simplification in the generic chart, consider Figure 11, which refers to a hypothetical permit needed by a hypothetical Wyoming oil shale project. The upper left hand box illustrates the fact that, at each step in the development process, the developer, working in cooperation with regulatory agencies, faces a decision with respect to the applicability of a given permit application, the possible discontinuance or modification of the project so as to nullify the need for the permit, etc. Multiple involvement in the permit review process is typical of major permits.

If a negative decision is returned on the permit application, several courses are possible. It may be possible to amend the application, or it may

FIGURE II
EXPANDED VIEW OF A HYPOTHETICAL MAJOR PERMIT ACTION

be appropriate to appeal the decision.

If the permit is obtained, it may be accompanied by a number of conditions. The illustration suggests a situation in which agencies at all levels of government monitor compliance throughout the life of the project and, in one instance, into the post-operations stage.

The bottom portion of Figure 11 illustrates some of the major variables which influence the applicability, preparation, and consideration of the hypothetical permit.

The key elements in the generic flow chart (Figure 10) are:

1. The mineral lease, especially as pertaining to public lands
2. The state environmental pre-design conference
3. The Detailed Development Plan (DDP) for leases on public lands
4. The mining plan
5. The mining reclamation plan
6. The environmental impact statement (EIS)

The oil shale operations being developed on public lands are controlled by lease agreements between the developer (lessee) and the Bureau of Land Management (BLM). The typical BLM oil lease agreement requires (1) that the lessee file and obtain approval of a DDP before any work other than exploratory is performed, and (2) that operations conducted under the lease be "in compliance with all applicable federal, state, and local water pollution control, water quality, air pollution control, air quality, noise control, and land reclamation statutes, regulations, and standards." In addition, the oil shale lease includes specific environmental stipulations which require that the lessee: avoid removing or damaging objects of historical or scientific value; minimize damage to fish and wildlife habitat; incorporate the means to insure the health and safety of their workers and personnel; minimize air, water and noise pollution; and preserve the scenic and functional aspects of the land. The lease requires that all lands disturbed by the development be returned "to a usable and productive condition consistent with or equal to pre-existing land uses in the area and compatible with existing, adjacent undisturbed natural areas."

The state environmental pre-design conference (area 2G in Figure 10) is one of the key elements in the oil shale permitting process. This conference is intended to serve as the means for developing a coordinated set of requirements for all state environmental permits and approvals. The conference should

be requested as soon as the oil shale proponent has developed his conceptual design to the point at which he can give a general description of the location, mining process, auxiliary processes (transportation, communications, access routes, etc.), expected size, and general schedule for his intended oil shale activities. Usually, the state agency (health department) will arrange to have specialists in each environmental area (e.g., air and water quality, solid waste, epidemiology, sanitation, and radiological health) present at the conference.

The proponent should make an informal presentation of his conceptual design, after which the state agency will develop environmental monitoring, modelling, and permitting guidelines for the project. These guidelines should be fully discussed, issues should be resolved, and an action plan should be developed and circulated to all concerned. Most representatives of state agencies believe that the permitting process will be expedited if the pre-design conference is held early in the development process and all state personnel are kept fully informed of the plans for, and progress of, the project.

Detailed Development Plans presently are required in federal oil shale lease agreements. The DDP contains: (1) a schedule of the planning, exploratory, development, production, processing and reclamation activities to be conducted under this lease; (2) a detailed description pursuant to the applicable Codes of Federal Regulations of the procedures to be followed to conform to the environmental criteria and controls in the lease; and (3) a requirement that the lessee will use all "due diligence" in the orderly development of the leased deposits to attain, as early as is consistent with compliance with the provisions of the lease, a production rate at least equal to the minimum royalty rate. No operations can be conducted on the lease except pursuant to an approved plan, and provision is made for revision of approved plans.

DDP's are administered by the USGS Area Oil Shale Office (AOSO), based upon a final outline prepared and distributed by that office. It is not intended that all plans conform exactly to the form of the outline. The basic principles incorporated in the outline in addition to lease requirements are:

1. The plan should give an overall picture from commencement of operations to final reclamation.
2. The level of detail would vary with time -- early actions can be detailed; long range actions would, of necessity, be conceptual.

3. A most probable path should be traced through available alternatives for the life of the lease.

4. Alternatives are to be discussed for major actions where there are alternatives.

5. Environmental impacts and mitigating measures are to be succinctly described.

6. Approved plans can be revised or modified to reflect knowledge gained under the terms of the lease.

Though the mining plan approval and the reclamation plan approval are separate necessities, they are reviewed concurrently by the same state agency.

The mining plan is a state-required element of the permitting system. Together with the mined land reclamation plan, the mining plan is a major tool used by the state mining authority in determining whether a state permit to mine should be issued.

The following information from Colorado mining regulations serves to illustrate the requirements of the mining permit application, which are common to the three states.

"EXHIBIT D - Mining Plan

The mining plan shall supply the following information, correlated with the affected lands, map(s) and timetables:

- a. Description of the method(s) of mining to be employed in each stage of the operation as related to any surface disturbance on affected land;
- b. Earthmoving;
- c. All water diversion and impoundment; and
- d. The size of area(s) to be worked at any one time. Where applicable, disturbances associated with these area may be classified as:
 - (i) Major disturbance - that area of a mining operation which includes excavations, overburden spoils, and topsoil stockpiles.
 - (ii) Moderate disturbance - that area of a mining operation which is a result of backfilling of an open cut, stabilization of waste dumps, the leveling of overburden spoils, the smooth grading and the distribution of topsoil or other suitable approved plant growth medium. Also includes, within the affected area, on-site private ways, roads, railroads, evaporation or settling ponds, leaching dumps, work, parking, storage or waste discharge areas and areas in which

structures, facilities, equipment, machines, tools or other materials or property which result from or are used in the mining operation are situated.

- (iii) Minor disturbance - that area of a mining operation which is undergoing preparation immediately prior to planting or seeding, is being planted or seeded, or has been planted or seeded and has not been released from bond upon full completion of all reclamation requirements as set forth in the permit.

e. A timetable shall be required to help describe the mining operation in terms of:

- (i) An estimate of the periods of time which will be required for the various stages or phases of the operation.
- (ii) A description of the size and location of each area to be worked during each phase.
- (iii) Outlining the sequence in which each stage or phase of the operation will be carried out.

(Timetables need not be separate and distinct from the mining plan, but may be incorporated therein.)

A map (in Exhibit C) may be used along with a narrative to present the following information:

- (i) Nature, depth and thickness of the ore body or deposit to be mined and the thickness and type of overburden to be removed (may be marked "CONFIDENTIAL", as per Section 1.33).
- (ii) Nature of the stratum immediately beneath the material to be mined in sedimentary deposits."

The mined land reclamation plan is a state-administered contract covering actions performed during or after mining operations to shape, stabilize, revegetate, or otherwise treat the land affected in order to achieve a safe, stable ecological condition and use which will be consistent with local environmental conditions (Utah definition, but consistent with that of other states). The following set of requirements from Utah illustrates the nature of the mined land reclamation plan.

Mined Land Reclamation Plan

- "(a) A statement of known prior and current uses to which the land was put including estimates of current surface resources and its capabilities to support a variety of uses or potential uses.
- (b) The possible uses for the land following termination of mining operations.
- (c) The manner in which the overburden, topsoil, tailings, waste, and rejected materials will be deposited.
- (1) Where conditions permit, the manner in which the plant supporting materials will be conserved and restored. If no such material exists, an explanation of said conditions shall be given.
- (2) An explanation of how toxic or otherwise undesirable materials will be segregated and disposed of.
- (d) Where grading, backfilling, compaction, etc. of the soil or fill is desirable, the manner and extent of how such will be accomplished shall be explained.
- (e) A planting program as best calculated to revegetate the land affected. Where there is no original protective cover, an alternate practical procedure should be proposed to minimize or control erosion or siltation.
- When applicable, the objective in revegetation should be to stabilize the land as quickly as possible after it has been disturbed in order to achieve permanent and protective vegetative cover. Non-noxious native plants that will give a quick, permanent, protective cover and enrich the soil shall be given priority..
- (f) A timetable for the accomplishment of each major step in the reclamation plan."

The EIS occupies a key role in the manual model because of the following facts and assumptions:

1. It is assumed that a single, comprehensive EIS will be prepared for a given project (in addition to a preliminary environmental assessment or prototype EIS in the case of public lands).
2. The EIS will synthesize the environmental monitoring and modeling results obtained during the early stages of the project, and will serve as the vehicle for demonstrating overall environmental impacts.
3. Preparation of the EIS will entail gathering data on ecological, socio-

economic, historical, and archaeological factors that will tend to determine and shape the permits required relative to those factors.

4. Permits for federal actions that significantly affect the quality of the human environment cannot be obtained until the NEPA requirements for an EIS have been satisfied. An action is "federal" when federal monies support it and federal responsibilities control it. One definition states that an EIS would be required for:

"...agency projects and activities that may be directly acted upon by the agency; or that are supported (even partially) with federal contracts, grants, subsidies, loans, or other funding assistance; or that are part of a federal lease, permit, license, certificate or other entitlement for use;..."

Thus, we conclude that, for the generic case, an EIS will be required; if so, it would be in the developer's and the public interest to have a single, comprehensive EIS prepared and used as the primary tool for defining likely environmental impacts.

4.2.1.1 Air Quality

At the general flow chart level (upper portion of Figure 10), the air quality portion of the manual system is straightforward. However, in practice, the situation is more complicated than can be shown on a single flow chart. This is true of all classes of permits. We have chosen to elaborate upon a single area -- the ramifications of the 1977 amendments to the Clean Air Act -- to illustrate the detailed process.

Two aspects of the Clean Air Act underwent significant revision in the 1977 amendments. These are the programs for the prevention of significant deterioration (PSD) of air quality and for achieving national ambient air quality standards (NAAQS) in non-attainment areas. For purposes of administering the program, all areas of the United States have been divided into four categories: (1) Does not meet Primary Standard; (2) Does not meet Secondary Standard; (3) Cannot be classified; and (4) Better than the National Standard. Any area that falls into the first two categories is considered as a non-attainment area, while any area that falls into the last two categories is considered a PSD area. Therefore, any new source of air pollution that meets certain qualifications will be forced to undergo analysis under one or the other program depicted in the PSD Clean Air Act Amendments. The following analysis illustrates the air quality problems that a would-be oil shale developer will

have to face. Reference in this discussion is made to Figure 12.

4.2.1.1.1 Summary of PSD/Non-Attainment Permitting Process

The Clean Air Act Amendments of 1977, along with implementing regulations, require any potential developer to obtain a PSD permit for the development of an oil shale project in an attainment area. The categories of sources for which EPA requires a permit were expanded to 28 (as opposed to the previous 19 categories). In addition, the 1977 amendments included a "catch-all" phrase which states that any project which has the "potential to emit" more than 250 tons per year of any criteria pollutant would be required to be reviewed by the U.S. EPA.

In the June 19, 1978 Federal Register, EPA published its final regulations relating to the PSD program. In this publication, EPA spelled out the procedural methodology for determining the exact permitting process for projects that would require the PSD/non-attainment review.

Because of the definition given to potential emissions, almost any oil shale development would require a PSD permit. There are very few projects that can show potential emissions of less than the limit of 250 tons per year. (EPA defines potential emissions solely on the basis of what a source might emit without control. The final regulations define "potential to emit" as the "capability at maximum capacity to emit a pollutant in the absence of air pollution control equipment.")

The calculation of the 250 ton per year limit will not allow credit for any control devices such as baghouses, road watering, precipitators, or scrubbers. In addition, fugitive dust sources may be included in determining this limit. This would include such items as dust from haul roads, blasting, crushers, and shovel operations.

However, EPA recognized that a full PSD review of all such sources would be more costly and time-consuming than would be justified by the results obtained. Therefore, it has adopted a second "tier" of review, in order to determine whether a particular source may be granted a PSD permit without undertaking costly monitoring, air quality analysis and the like. If the "allowable" emissions (after controls) from such a facility are less than 50 tons per year, 1000 tons per day, or 100 pounds per hour, a PSD permit can be obtained using an abbreviated procedure.

The format for the preparation of the PSD application has been somewhat

(Including PL 95-150)

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defined by EPA, and a process has been determined to be acceptable. Oil shale projects in Utah, Wyoming, or Colorado fall under the jurisdiction of EPA Region VIII, headquartered in Denver.

The organization of a full permit application will include six major sections. The first section will include a project description. This will define the proposed mining plan, the process description, the location of the project, the proximity of the project to any Class I or non-attainment areas, and a time frame for completing the proposed development. The purpose of this section is to put into perspective and describe the proposed project so that EPA would be informed relative to program details.

The next section of the application includes a description of the baseline conditions that existed at the proposed project site as well as the regional baseline. The baseline meteorology, climatology, and air quality for the proposed project are described in this section. An evaluation of the basic climate of the area, a general dispersion climatology, evaluation of mixing heights and stability, air movement patterns, typical and worst case conditions, etc., are included in this section.

The third section involves an analysis of the potential emissions from the site. This includes an inventory of all potential sources such as disturbed land acreage, tailings area, haul roads, primary and secondary crushers, emissions due to blasting, shovels and front loaders, ore storage areas, and stack emissions. After a complete inventory of all potential emissions is assembled for each criterion pollutant (e.g., SO_2 , TSP), calculations relating to the uncontrolled emissions from each of these potential sources are required. All such calculations are then summed individually for each pollutant and compared with the potential 250 tons per year limit as defined in the Clean Air Act Amendments of 1977. If the summation of each of these potential emissions is less than 250, the review is concluded and no further analysis is required.

However, if the pollutant emissions exceed 250 tons per year, the review continues to the second tier analyses.

The fourth section of the permit involves the second tier analysis of the PSD review. This section, dealing only with those pollutants greater than 250 tons/year, selects only the stationary sources that would be required for review, and their controlled emissions would be evaluated. Such stationary sources would include the primary and secondary crushers, driers, the heating

units, etc. Credit would be given for any controls placed on these devices such as baghouses, scrubbers, and precipitators. Once a listing of all these stationary sources is completed, each source is described in detail, with emissions calculated, and a description of the control process is provided. Specifically, any manufacturer's guarantees would have to be defined. If the applicant has not settled upon a vendor for control equipment by the time the application was submitted, typical equipment and guarantees would have to be submitted with the stipulation that no vendor had been selected, but that these controls were typical of those being reviewed by the applicant. Since credit is given for the control devices on the emitting sources, EPA requires that they be described in detail so that EPA is convinced that the credit taken is justified relative to the proposed control device.

The fifth section relates to the impact analyses necessary for the proposed project for comparison to the PSD increments as well as to the National Ambient Air Quality Standards (NAAQS). The results of the Phase I analysis relating to the screening model level of effort would be presented at this time, showing the site-specific modeling as well as regional modeling for the proposed project. This section includes a description of the model or models used, a detailed evaluation of the emissions as input to the model, the meteorological parameters used, and a presentation and discussion of the results. The site-specific modeling is done for each major stationary source while the regional modeling would include any surrounding sources that would add to the impact that this facility might project. This section would also discuss any unique problems that might occur relating to this project. Any proposed project that undergoes a detailed second tier review also has to address (1) the possible impairment to visibility, soils and vegetation that would occur as a result of the source or modification, and (2) general commercial, residential, industrial and other growth associated with the source or modification.

The last section of the PSD permit includes a detailed listing of the computer codes used for the modeling analysis, the emissions and meteorological input as well as detailed listings of all computer outputs. EPA requires modeling analysis details used in the evaluation of the projected impacts. It also requires that any models used for evaluating impacts for a PSD permit be EPA-approved models.

The above formatting for the PSD permit applications is based upon current requirements by EPA. The requirements should change slightly after the new rules and regulations are further interpreted. In addition, more radical changes may result from lawsuits which have been filed challenging various aspects of the PSD regulations.

The non-attainment provisions of the Clean Air Act establish procedures for obtaining permits that will differ somewhat from the PSD process. The individual states that contain non-attainment areas are in the process of revising their State Implementation Plans to achieve compliance with the NAAQS. Only if they submit valid, enforceable plan revisions to EPA by January 1, 1979, and EPA approves the plans by July 1, 1979, can new stationary sources locate in non-attainment areas after the latter date. The detailed permit process that an applicant must follow will be instituted by the particular state.

It should be noted that the question of whether a PSD or a non-attainment permit will be required may not be an either-or proposition. Several areas of the country, including some in the oil shale area, have been designated non-attainment for one or more pollutants. However, there may well be PSD areas nearby, or other pollutants for which PSD standards apply. In such a case, a source might be forced to obtain both a PSD and non-attainment permit, or at least to satisfy requirements under both programs.

Interrelated to the PSD requirements, each state has standards that must be addressed by PERMISSO in an integrated manner.

4.2.1.1.2 State of Wyoming Air Quality Permit Application

The State of Wyoming has updated its Air Quality Standards and Regulations in the 1978 version (Wyoming Division of Air Quality, 1978). The latest standards differ only slightly from the 1975 regulation with the exception of the appendices which list emission regulations, reference methods, performance specifications for continuous monitors, determination of emission rate change, and emission inventory requirements. The review of such an application is conducted in the Department of Environmental Quality, Division of Air Quality. Figure 13 is a permit flow diagram for the State of Wyoming.

The State of Wyoming has forms which must be completed as part of the application. A complete inventory of all sources from the proposed project, as well as a calculation of the emissions from each of these sources, is required. The calculation of these emissions is on the basis of controlled emissions, and credit is given for abatement devices and procedures proposed

by the applicant. Thus, the watering of roads and chemical stabilization of roads, scrubbers, and baghouses would be included in the calculation of the emissions from these sources. The State of Wyoming requires that all sources, both fugitive and emissions, be included in the calculation of the probable impact on ambient air quality. This differs considerably from the calculational approach required for the PSD permit under EPA.

In order to become compatible with the Clean Air Act Amendments of 1977, Wyoming has indicated a shift in its modeling analysis to use allowable emissions instead of controlled (or actual) emissions.

The calculation of potential impact is required by the State of Wyoming, as are a description of the program, meteorological and emission inputs, and copies of all of the output from these calculations.

In addition, the state requires a baseline and ambient air quality study that describes the climatic and air quality conditions both at the site and of a regional nature. This is prepared as part of the permit application for the construction permit.

The applicant has to provide a description of the processing plant and associated facilities as well as a mining plan including a mine layout, sequence of mining, etc., as part of the application permit which describes the proposed project to the state. This is required as part of the permit application.

Any special studies, such as a wind flow analysis, are included with the permit application in order to assist the state in their evaluations. The detail with which the studies need to be conducted is usually determined and negotiated in discussions with the state.

4.2.1.1.3 State of Colorado Air Quality Permit Application

The State of Colorado requires an emissions permit prior to the construction of any emitting source. This includes oil shale development. The State of Colorado also has air monitoring requirements and has specified their ambient air monitoring requirements in a document issued by the state in February, 1978 and outlined in a flow diagram shown herein as Figure 14.

The review of such an application is conducted in the Colorado Department of Health, Air Pollution Control Division. State forms must be completed as a part of the application. In addition, a complete inventory of all emission sources for the proposed project is required. In somewhat the same manner as Wyoming, impact analysis is determined on a case-by-case basis.

FIGURE 13
AIR QUALITY PERMIT FLOW DIAGRAM
STATE OF WYOMING

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FIGURE 14
PERMIT FLOW DIAGRAM FOR DIRECT SOURCES
STATE OF COLORADO

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Colorado requires planning meetings prior to the submittal of an application for a direct source emission permit. The Division states that the planning meeting should take place prior to detailed planning by the applicant. The purpose of the planning meeting is to exchange information between the applicant and the Division and to decide upon information that should be in the application. Such information should include air quality and meteorological data and modeling information so that it can be determined whether or not ambient air quality standards can be met. The applicant should provide equipment information, plans, descriptions, specifications, drawings, and additional information as the Air Pollution Division deems necessary to determine if the requirements of this regulation will be met.

The submittal of the application is determined at this planning meeting, and the various depths of analysis are outlined. It would be anticipated that, for an air quality assessment for an oil shale development, detailed modeling and regional impact analysis would be required. When the state modifies its state implementation plan, this may require up to a year's worth of data prior to submittal of the application. Any additional studies that the state might require would be discussed and delineated in this planning meeting prior to submittal of the application.

4.2.1.1.4 State of Utah Air Quality Permit Application

The State of Utah has a program similar to Colorado in that pre-planning meetings are scheduled. The State of Utah is currently revising its air conservation regulations and hopes within the next few months to have these regulations modified.

Utah requires construction permits prior to the commencement of any activities by a proposed applicant. A detailed review of the Utah permit procedure is provided in Figure 15. Generally, it involves the same permitting process as required in Colorado and Wyoming.

4.2.1.2 Water Quality and Availability

Figures 16 and 17 illustrate the general water quality and water availability process for the oil shale region. In the general case, the oil shale developer will have the option to use:

1. Ground water, i.e., any water not visible on the surface of the ground under normal conditions.
2. Surface water.
3. Both ground water and surface water.

Permits and approvals governing the availability of water are usually administered by state (e.g., state engineer, supported by water commissions) and local authorities. Permits and approvals governing water quality are generally federal responsibilities (e.g., U.S. EPA), which may be delegated to states. However, states also have regulations which prohibit pollution of water resources.

The generic flow chart (Figure 10) assumes that the acquisition of water rights has already taken place, or at least is outside the scope of the oil shale permitting system. The acquisition of water rights is in itself a complex subject, and is treated in oversimplified fashion in Figure 16.

The water rights process in the oil shale region follows the doctrine of prior appropriation. Priorities vary, but generally place domestic and agricultural uses ahead of mining. In practice, the water doctrine gives water rights to the earliest qualified applicants. The figure illustrates the major possibilities: acquire water appropriated for industrial use, acquire water appropriated for agricultural use and change the water use in accordance with beneficial-use principles, or obtain appropriations of previously unappropriated water.

In the case of surface waters, an appropriation is accomplished by the actual diversion of water from a natural stream, followed within a reasonable time by an application of such water to a beneficial use. Appropriation of ground water is accomplished by removing water from its natural location, or controlling water in its natural course or location, and applying these waters to a beneficial use.

Although the water quality and availability practices differ in detail from state to state, the general procedures are very similar. Following is a brief summary of the permitting system following the acquisition stage.

The permits to construct the works and apply water to beneficial use carry time limitations, although extensions of time may be granted upon proper showing of diligence or reasonable cause for delay. Within a fixed period of time, the developer must furnish proof of appropriation or proof of permanent change. Proof generally consists of sworn statements of the nature of the works constructed, quantity of water appropriated, and the methods of applying the water to beneficial use.

Oil shale projects offer several possibilities for waste water treatment and disposal. The basic water quality control strategy is to prevent any

FIGURE 15
AIR QUALITY PERMIT FLOW DIAGRAM
STATE OF UTAH

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FIGURE 16
SUMMARY OF PROCEDURE FOR
ACQUISITION OF RIGHTS TO DIRECT AND USE WATER

FIGURE 17

SUMMARY OF PROCEDURE FOR APPROVAL
OF SURPLUS WATER DISPOSAL AND CREATION OF UNDERGROUND WASTE

surface or subsurface flow of contaminated water from leaving the shale processing site. EPA has established national effluent limitations on what a point source can discharge into the water. Depending upon the pollutant, an effluent limitation may permit some level of pollutant discharge, or may prohibit any discharge of the pollutant. To ensure that all effluent limitations and other requirements are met, the states issue discharge or disposal permits for all point sources of pollution.

In some cases, the states apply even more stringent controls to regulate water pollutants. Eventually, the purity of the receiving waters will serve as a standard for controlling pollution. That is, if effluent limitations do not serve to bring the quality of a particular waterway up to standard, industry will be compelled to comply with even tighter controls on their effluents.

As indicated by Figure 17, underground wastes (e.g., spent oil shale retorts) are a cause for concern because of potential water contamination. Permits for creating underground waste, based upon an approved plan for prevention of contamination of waters, are required.

Waste water disposal may be some combination of surface disposal and subsurface disposal. In either case, discharges which may be expected to reach navigable waters are subject to compliance under several programs. Foremost among these are the National Pollutant Discharge Elimination System (NPDES) and the Areawide Waste Treatment Management Plan.

NPDES permits contain specific "schedules of compliance" which prescribe an enforceable sequence of actions leading to compliance with effluent limitations, prohibitions, or standards. Responsibility for enforcing the program rests jointly with EPA and the states. Two alternatives exist:

- (1) A federal permit program, under which EPA issues permits after certification from the state,

- (2) A state permit program, under which the state issues permits following approval of the state program by EPA. However, EPA monitors the state program and retains veto authority over the issuance of individual permits.

The Clean Water Act provides for a reasoned, areawide approach to the abatement of water pollution through Section 208. For areas in which an areawide water quality management plan has been developed under Section 208, it is

necessary for the areawide 208 agency to review plans for significant developments to ensure that they are consistent with the comprehensive plan. Most oil shale projects are expected to occur in future Section 208 planning areas.

4.2.1.3 Solid Waste Disposal and Reclamation

The air and water quality elements of the permitting system (par. 4.2.1.1 and 4.2.1.2, respectively) are aimed at prevention or minimization of direct contamination of air and water. The solid waste disposal and reclamation elements of the system have the purposes of protecting air and water quality from indirect or delayed pollution, maintaining the aesthetic qualities and productivity of the oil shale area, and avoiding adverse long term ecological effects.

Spent shale disposal, including catalysts, etc., involved in shale operations, requires adequate advance planning and post operations monitoring of air and water quality. Problems associated with the spent shale and associated wastes include percolation in relatively impervious dumps or piles, dust problems, water consumption, surface runoff, runoff after abandonment, and levels of salinity. The two dominant requirements that have been identified for surface disposal of retorted shale are aspects of headwater diversion and drainage impoundment.

Engineering and good management techniques are required in the regulations. These are normally in the form of reclamation plans addressed in mining permits by the various agencies. Specific solid waste disposal guidelines and regulations are being developed in a general manner.

Problems specific to oil shale that have been identified are both site-specific and process-specific, and include high and low temperature retorted shale, raw shale, catalysts, and chemical sludges. Process and site-specific characteristics will affect permeability, leaching characteristics, dust and erosion control, and disposal management techniques.

4.2.1.4 Fish and Wildlife Values

The permitting subsystem which seeks to protect fish and wildlife values is keyed to the protection of endangered, rare, and historically symbolic species. In the flow-chart representation of the manual system, the focal point for fish and wildlife values is the environmental impact statement (EIS). It is considered that the EIS will be the vehicle for a thorough, systematic study of the potential effects of development on species, habitats, and ecosystems. Among the questions addressed by an oil shale EIS are the following:

. With the removal of natural feeding sites, is the animal life of the area likely to be adversely affected?

. Do the effluents of the proposed project indicate likely impairment to aquatic life?

. Would the proposed action result in the destruction of habitats of rare and endangered species?

. Would project-induced population shifts threaten important biological communities?

. Could needed soil communities be destroyed by leachate at or below waste disposal sites?

Once these questions are answered through the medium of the EIS, it should be a relatively straightforward matter to satisfy permit application requirements involving fish and wildlife values. However, the comments regarding timeliness of permit applications (par. 4.1) must be heeded. Whereas some permit sequences (e.g., air and water quality, health and safety) are relatively well established, those relating to fish and wildlife are not. An intensive exploration effort, for example, could result in a shift of many permit requirements into the designation and exploration stages of the project. Also, the number and types of permits required may vary greatly from site to site, primarily because the fish and wildlife communities vary and there are many permits and regulations that are specific to a single plant or animal category.

4.2.1.5 Health and Safety

The health and safety elements of the permitting system can be classified as follows:

<u>Health</u>	<u>Safety</u>
. Industrial hygiene	. Fire and explosives
. Noise	. Ground control
. Radiation	. Other process-specific hazards
. Respirable dust	
. Ventilation	

These are a primary concern of the traditional mining laws, and many of the traditional mining permits and approvals are included in this category, which is outlined in in the generic flow diagram (Figure 10).

Industrial hygiene includes permits for food service establishments and health care facilities. Both permits are issued by state health authorities upon approval of the facility's compliance with regulations.

Fire and explosives are regulated by several permits. The U.S. Treasury issues two: the Explosives Manufacturing Permit for manufacturing (or formulating on-site), transportation, and use of explosives; and the Explosives Users Permit for users who neither transport nor manufacture. Some states and counties issue permits covering the same activities, and in addition, control explosives storage by permits. Besides various mining regulations, a permit in Colorado for the approval of LPG storage helps maintain fire safety.

Colorado also requires the possessor of radioactive materials to obtain a license from the Department of Health.

The other process-specific hazards category mainly includes permits resulting from the approval of specific facilities. The FAA maintains oversight of airports by four permits and notifications. It also approves all towers higher than 200 feet. Inspection of boilers, trenches, electrical systems, underground diesels, and medical certification of hoistmen all lead to permits and are handled by the state.

Noise, respirable dust, ventilation, and ground control are maintained within safe standards not by permits as such, but by mining regulations and inspections.

The depiction of the health and safety subsystem may be deceptively simple. Periodic health and safety inspections are excluded from the permitting system. Some of the permits and approvals shown in the generic flow chart require periodic renewal, but renewal requirements are not depicted on the flow chart. As with elements in other categories, a number of permits of a given type may be needed during the life cycle of an operation, but such permits usually appear only once on the generic flow chart.

The mining plan and mined land reclamation plan, which are major components of this permitting subsystem, are discussed in the introduction to par. 4.2.

4.2.1.6 Cultural Values

The development of oil shale resources requires a number of activities which result in alteration of the land surface. Activities such as the drilling of test holes, the construction of roads, pipelines, and power transmission facilities, leveling of land for processing facilities, and actual mining operations might result in the destruction of valuable historical and archaeological sites, or objects of historic or scientific interest. It is the policy of federal and state governments to protect such cultural values. Sites that are deemed important, and which would be destroyed by construction, must be

excavated by a qualified archaeologist. Sites which may be avoided by construction may be fenced or otherwise protected from vandalism. Sites of national significance will be nominated for the National Registry of Historic Places.

The permits and approvals pertinent to cultural values are outlined in in the generic flow diagram (Figure 10). The issuance of such permits is shown to follow preparation of the EIS as a matter of practical convenience. Pertinent quotations from the National Environmental Policy Act of 1969 follow.

"It is the continuing policy of the Federal Government, in cooperation with State and local governments, and other concerned public and private organizations to use all practicable means and measures, including financial and technical assistance, in a manner calculated to foster and promote the general welfare, to create and maintain conditions under which man and nature can exist in productive harmony and fulfill the social, economic, and other requirements of present and future generations of Americans."

"...it is the continuing responsibility of the Federal Government to...preserve important historic, cultural and natural aspects of our national heritage..."

"...all agencies of the Federal Government shall...include in every recommendation or report on proposals for legislation and other major Federal actions significantly affecting the quality of the human environment, a detailed statement by the responsible official on - (i) the environmental impact of the proposed action, (ii) any adverse environmental effects which cannot be avoided should the proposal be implemented, (iii) alternatives to the proposed action, (iv) the relationship between local short-term use of man's environment and the maintenance and enhancement of long-term productivity, and (v) any irreversible and irretrievable commitments of resources which would be involved in the proposed action should it be implemented."

Thus, preparation of the EIS will necessarily involve activities which should include the discovery, evaluation, and preservation of items of cultural value. Plans and provisions for the protection of such values, as cited in the EIS, can serve as inputs to the permit applications.

However, it is once again necessary to stress the possible exceptions to the sequence outlined in the flow chart. Whenever there is encountered evidence of cultural values which could reasonably be construed to be protected under the Federal Antiquities Act of 1906, the Historic Sites Act of 1935, the Historic Preservation Act of 1966, the Reservoir Salvage Act of 1960 (as amended), etc., or by state statutes or regulations, the pertinent elements of the permitting system must be implemented.

4.2.1.7 Multipurpose and Other

This category includes all of the permitting elements not otherwise classified in Figure 10, the generic flow chart: "Multipurpose and Other" elements predominate during the designation phase of the potential oil shale venture, because the permitting system during the earliest stages is concerned primarily with overall impact of the venture. As the venture progresses, the permits become more detailed and specific, but some multipurpose and other elements are scattered throughout the latter stages of the operation.

Two of the key items in this category, i.e., the DDP and the EIS, are described in the introductory portion of par. 4.2. Right-of-way permits are a major component of this category. These permits are required for roadways or rights of ingress and egress, pipelines, and related activities which require the traversing of property or tracts of land. Right-of-way permits are obtained from the agency with jurisdiction over the property of concern. For example, in the case of public or Indian land, the agency might be:

- . Bureau of Land Management (BLM), which has jurisdiction over much of the land rich in oil shale;
- . U.S. Forest Service, which has jurisdiction over national forest lands;
- . U.S. National Park Service, which issues rights-of-way on all land which it administers;
- . Bureau of Indian Affairs (BIA), which issues rights-of-way and clearance for all Indian lands;
- . U.S. Fish and Wildlife Service (FWS), primarily with respect to lands of the National Wildlife Refuge System and areas with FWS waterfall management rights.

Placement of rights-of-way permits on the generic flow chart is governed by the following factors:

- 1) A period of time (usually 2-5 years) from the date of approval is allowed for construction activities. The permit approval should not be

obtained so early that it must be renewed before it is used.

- 2) An environmental assessment of impact statement may be required before a permit is issued. Thus, the permits should be timed to coincide with the comprehensive EIS, insofar as practicable.
- 3) Usually, no formal application form exists, but the applicant must provide justification for the permit (i.e., satisfactory evidence that the right-of-way is essential), and appropriate information with regard to the use and mapping of the activity. Thus, the application must be made late enough in the process to enable all needed information to be available, but early enough to ensure that project operations are not delayed for want of required permits.

4.2.2 Illustrative Example

As part of the evaluation of the manual system developed during Phase I, a site-specific approach from the overall generic flow chart is shown in Figure 18 (second foldout). Figure 18 is based on permits required for a specific project in Sweetwater County, Wyoming. The generic chart was followed with a set of assumptions at each decision point (Table I) and verified with data obtained from an actual project.

The in-situ oil shale recovery site subject project is located in southwest Wyoming on leased-private land. The project has leased all of a section, but the permit area applied for contains only 20 acres (800' x 1090') in the southwest $\frac{1}{4}$ of the southwest $\frac{1}{4}$ of the Section. Subject project location is shown on Figures 19 and 20.

The project operation is divided into two stages which will span 2 $\frac{1}{2}$ years. Despite the small relative size of this operation, there are several regulatory requirements which must be met on the federal, state, and local levels. These requirements and the steps needed to meet them are described below.

4.2.2.1 Air Regulations

The site is regulated by the Clean Air Act of 1977 since it involves the emission of several criteria pollutants. Wyoming's State Implementation Plan (SIP) has shown that the whole state meets National Ambient Air Quality Standards, and as a result the attainment, or prevention of significant deterioration (PSD), regulations apply. One area in the state, the Trona Industrial Area (TIA), is non-attainment for particulate emissions (TSP). The project is outside the geographic zone of TIA and is therefore governed by PSD.

Table I

DECISION CRITERIA FOR DEVELOPING ILLUSTRATIVE PERMITTING FLOW CHART

Forty-two questions were used to determine which permits on the generic flow chart would apply to a specific project in Sweetwater County. Besides being an explanation for the inclusion of any particular permit on the Sweetwater County flow chart, the list of questions serves as a description of the Sweetwater County project.

QUESTION	RESPONSE
SIZE OF THE PROJECT	
Will the project exceed a cost of 5 million dollars or 50,000 barrels of produced oil during the designation or exploration periods?	No
Will the project exceed a cost of five million dollars or fifty thousand barrels of produced oil after the exploration period?	Yes
Will a food service facility be built?	Yes
Is the project small enough to receive a negative declaration for environmental impact?	No
Will an airport be built?	No
DESIGN OF THE PROJECT	
Will the project use surface or groundwater or both?	Groundwater
Will the project require a variance from MSHA regulations?	No
Could the project eventually require a temporary transfer of water to supply extra needs?	Yes
Could the project affect navigable waters by spilling oil?	Yes
Could the project discharge any toxic substances?	Yes
Could the project discharge any waste into waters at temperatures that harm life in those waters?	No
Could the project dispose of hazardous materials?	Yes
Could the project require underground injection of surplus or waste water?	Yes
Will the project drill water wells on public land?	No

FIGURE 10
GENERIC FLOW CHART FOR THE WESTERN OIL SHALE
PERMITTING PROCESS

NOTES

1. THIS FLOW CHART HAS NOT BEEN APPROVED BY THE AGENCIES INVOLVED IN THE OIL SHALE PERMITTING PROCESS. IT IS A PRELIMINARY CHART, DESIGNED TO PROVIDE A GENERAL OVERVIEW OF THE EXISTING PERMITTING SYSTEM FOR THE STATES OF COLORADO, UTAH AND WYOMING. SEE THE DISCUSSION IN PAR. 3.2 OF THE PERMISSO FINAL REPORT, SAI-78-03 GLN, SCIENCE APPLICATIONS, INC., FOR GUIDELINES IN THE PROPER INTERPRETATION AND USE OF THIS FLOW CHART. SEE TABLE 1 OF THE APPENDIX TO SAI-78-034 GLN FOR A GUIDE TO EXPANDED DESCRIPTIONS OF INDIVIDUAL PERMITS AND APPROVALS.

2. THESE ELEMENTS REPRESENT TRANSITIONAL OR UNCERTAIN ITEMS, I.E., PERMITS OR APPROVALS WHOSE APPLICABILITY TO OIL SHALE IS IN DOUBT. THESE ELEMENTS WILL BE COMPLETED OR ELIMINATED FROM FUTURE EDITIONS OF THE FLOW CHART.

3. THESE ELEMENTS NOT YET APPLICABLE TO OIL SHALE, BUT LANGUAGE OF LEGISLATION LEAVES THEIR APPLICABILITY OPEN. INCLUDED IN THIS VERSION OF FLOW CHART FOR COMPLETENESS.

FIGURE 18 MAJOR PERMITS REQUIRED FOR A PERMIT IN SWEETWATER COUNTY, WYOMING (HYPOTHETICAL CASE)

Table I (cont'd)

QUESTION	RESPONSE
Will the project require new telephone or telegraph lines across federal land?	Yes
Will the project require radio or television rights-of-way?	Yes
Will the project require a railroad?	Yes
Will the project require a railroad across federal land?	Yes
Will the project require oil pipelines across federal lands?	Yes
Will the project require power transmission lines across federal lands?	Yes
Will the project require a new road across federal land?	No
Will the project require disposal of solid waste during the exploration period?	Yes
Will the project require treatment of waste water during the exploration period?	Yes
LOCATION OF THE PROJECT	
Is site on Federal Land?	No
Is site in Colorado?	No
Is the site in Utah?	No
Is the site in Wyoming?	Yes
Is the project in Sweetwater County?	Yes
Is the site on or adjacent to public lands other than forest service land?	Yes
Is the site in an area zoned by the county for agricultural use or for resource conservation use?	Yes
Do historic or archaeological sites exist on the site of the project?	No
Is the site in an air quality non-attainment area?	No
Has the site previously been designated unsuitable for surface mining by the Department of the Interior?	No

Table I (cont'd)

QUESTION	RESPONSE
Will a lease be required for either the surface or mineral rights?	Yes
Is the ownership of a mine being changed?	No
PROJECT'S EFFECT ON INDIGENOUS LIFE	
Could the project threaten any plants enough to require their enhancement?	Yes
Could the project threaten wildlife enough to require enhancement of wildlife?	Yes
Could some endangered species require enhancement due to the effects of the project?	Yes
Could birds depredate the project?	Yes
Could the project harm migratory birds?	Yes
MANAGEMENT DECISION	
Could the project purchase explosives from non-contiguous states?	Yes

Figure 19
SITE LOCATION

Figure 20. SITE DRAWING (IN LIEU OF SITE MAP)

Since the project emissions are going to be well below NAAQS, the EPA has indicated that only a short review will be necessary. It will want a project description, description of baseline conditions, and an analysis of the potential emissions. This will satisfy EPA review. EPA has changed its PSD regulations, but the new requirements will not apply to the project once operations have commenced.

The Wyoming Department of Environmental Quality (DEQ) Air Division regulations require two permits prior to the approval of a mineral extraction operation. The first is a permit to construct. DEQ also requires a permit to operate; however, this regulation only applies to operations which exceed a 120-day "start-up" period. The project is exempted from this permit in Stage I since operations are expected to last only 90 days. An appropriate permit will be filed prior to Stage II.

It should be noted that the DEQ Air Division Regulations Standards are measured in concentration levels (e.g., ppm and $\mu\text{g}/\text{m}^3$) rather than emission rates (e.g., tons/year) as in the EPA regulations. A similar emission rate at sea level and at 7000' (approx. project elevation) would produce different ppm concentrations.

4.2.2.2 Land Regulations

The project is regulated by federal land laws despite the fact that it is located on leased-private land. One of the most stringent requirements is that any activity which affects the environment must complete an environmental impact statement under the National Environmental Policy Act (NEPA) [42 U.S.C. §4321 et. seq. (1975)]. For operations which present only minor environmental hazards, an environmental impact assessment (EIA) is used.

An operation which is near a navigable water must address possible impacts pursuant to the Rivers & Harbors, Flood Control Act, of 1970 [33 U.S.C. §401 et. seq.; Publ. L. No. 91-611]. Bitter Creek runs just south of the project and Green River is about ten miles away. The Act forbids any interference or obstruction with the navigability of the nation's waters. Since Bitter Creek is not navigable, the Act only applies to Green River. The only possible impact on Green River would be erosion caused by retort water run-off. The law, therefore, does not apply since the project's retort waters will be ponded with no run-off anticipated.

The Surface Mining Control & Reclamation Act [30 U.S.C. 1201 (1977)] applies to surface mining operations which result in disturbances of surface

areas. The Act probably does not apply to the subject project except for the prohibition against surface disturbance and the requirement for reclamation of lands. Even if the Act did apply, it is mainly a policy statement which requires approval of state land use regulations by the Office of Surface Mining, Reclamation and Enforcement. Wyoming's DEQ land use regulations have been approved and are used to govern intrastate activity.

The Federal Mine Safety and Health Act of 1969 (30 U.S.C. §801) (MHSa) requires a statement that the project will not involve any labor to be performed underground.

Wyoming's DEQ Land Regulations require a mining permit and a license to mine. Of particular importance to DEQ-Land Division is the reclamation plan which must accompany the mining permit, especially because of the vicarious approval by the U.S. Office of Surface Mining, Reclamation and Enforcement. The DEQ license to mine is required in order to show intended compliance with the reclamation plan.

Legal arguments that in-situ oil shale recovery is not regulated by DEQ Land Regulations have been silenced by a precedent set by other in-situ operators. As a practical matter, DEQ Land Quality Division has indicated that any extraction other than oil is included in these regulations.

Plans in Stage I call for an evaporation pond to hold the retort waters. The project must submit to the Wyoming State Engineer approved plans which delineate proper lining to prevent leaching, and leak detectors.

The Wyoming Industrial Siting Act requires a separate permitting procedure but exempts the project since the value of this operation is less than \$50 million cut-off, and less than 50,000 bpd output planned. Only a Certificate of Insufficient Jurisdiction is required.

DEQ Solid Waste Management requires a permit for an operation dealing with solid waste facilities. They have indicated that their permit procedure will apply when the project covers up the evaporation pond, either at the end of Stage II, or if it is successful, at the end of the commercialization process.

The project will also be subject to local land use or zoning ordinances. The Sweetwater County Planning Commission has zoned the permit area I-2 (industrial). The Sweetwater County Zoning Resolution allows mineral extractions in an I-2 zone, thereby eliminating the need for the project to apply for a variance.

Access to the project from public roads must be approved by the Federal

Bureau of Land Management (BLM).

4.2.2.3 Water Regulations

There are two primary uses of water in the project's oil recovery process. Water is used for the hydraulic fracture state and contains fracture-gel and potassium chloride (KCl) as additives. It is also used to wash out wells prior to final retorting. Because of the lack of surface water supply and the unsuitability of the groundwater aquifers, the project receives water from the public utilities in both Rock Springs and Green River. Access to the site is equidistant between the two cities. There is no impact, therefore, on surface water supplies.

The Federal Water Pollution and Control Act Amendments of 1972 (33 U.S.C. 1251 et. seq.), as amended by the Clean Water Act of 1977 (Pub. L. No. 95-217), prohibits any discharge into navigable waters and all toxic discharges without a permit. This will not present a problem because retort waters will be ponded. The National Pollution Discharge Elimination System (NPDES) is delegated to the State of Wyoming.

DEQ-Water Quality Division Regulations have several impacts. Waste discharges are required to be managed by best available practices under the Wyoming NPDES. Best management practice is used in designing an evaporation pond to hold retort waters. As a result, the project may not have to apply for a waste discharge permit under Wyoming's NPDES, nor will it have to apply for a discharge permit pursuant to the production of oil and gas (a separate chapter under DEQ-Water). Wyoming has no zero-discharge permit requirement, unlike some other state water regulations. The project will require a drilling permit from the State Engineer's office since one well for water will be drilled.

The project must also apply for a permit for a water evaporating pond, and a permit for exploration by dozing in constructing the pond after approval of the plans by the State Engineer. An evaporation pond is a waste water facility within the meaning of the DEQ-Water Regulations which also requires a permit to construct.

4.2.2.4 Miscellaneous Regulations

The Endangered Species Act of 1973 (Pub. L. No. 93-205) was enacted for the purpose of protecting the lives and habitats of selected endangered and threatened species. The latest list published by the Secretary of Commerce (32 F.R. 34479, August 4, 1978) shows no species that are in the permit area.

The Wyoming Fish & Game Department maintains its own list of rare species.

These are ranked according to priority, with the highest priority belonging to those species not listed under the Federal Act. The Bluehead Sucker, found in Bitter Creek, is such a species. According to a Fish & Game official, a high priority species under Wyoming laws is not as "safe" from environmental injury as a federally listed one. Hence, rare species are indirectly regulated on the state level by other applicable laws. In the case of the Bluehead Sucker, DEQ water laws protect its environment; but as mentioned, the project will not impact local waters because of the design of the evaporation pond. The reclamation plan in the mining permit will insure the safety of any prairie pigeon hawks in the area.

The project is also subject to certain noise laws which may impact the operation. OSHA's employee noise standards must be met. Although some activities in Stage I will exceed OSHA limits, it is anticipated that the relatively short duration (e.g., explosion) will not defeat project compliance.

Sweetwater County has no ambient noise regulations. The relative remoteness of the site would insulate both Green River and Rock Springs from any dangerous noise emissions.

The respective agencies have indicated that there are no archaeological, paleontological, or historical resources in the area which demand protection under federal legislation. (This would still be subject to an independent check as part of EIS preparation.)

Identification of requirements starting with the manual flow chart (Figure 10), followed by use of the data base developed during Phase I, has allowed identification of project regulatory requirements in a very short period. An outside estimated time requirement for this identification was on the order of two months. This indicates the usefulness of the Phase I effort. Data automation (Phase II) in greater detail has great potential in reliability and time reduction. The overall goal of the automated data base is applicability and usefulness to any user, at any level. The methodology used in developing the data base and the resultant files, library and other materials leading to the site-specific flow chart has shown:

1. Automation is possible
2. Automation is desirable
3. Maintenance is required
4. Better understanding can be gained
5. Regulatory redundancies can be addressed

4.3 Detailed-Level Description

4.3.1 Introduction

The detailed oil shale permitting system is characterized by a large number of data items which must be furnished by the proponent or developer. Often, the same data element appears on a number of permits, and is furnished to a number of regulatory agencies. The proliferation of regulations and regulatory agencies, and the redundancy in data requirements, are the most noticeable features of the oil shale regulatory system.

In assembling the Phase I manual data bank, SAI has followed a procedure of establishing and cross-referencing folders for each permit and each significant approval pertinent to the oil shale permitting system. The most significant data in each folder were then reduced to a standard format. The resulting summaries, called permit information summaries, contain the data which will be included at the detailed data level in the Phase II automated capability.

The permit information summaries have been retained in a retrievable manner for ease of maintenance. These summaries appear in the Appendix to this report. Most of the over 400 summaries represent actual permits, while a few describe events or activities (approvals, hearings, decision points, etc.) which are essential to an understanding of the permitting process.

4.3.2 Illustrative Examples

The permit information summaries, which constitute the bulk of the oil shale permitting system as it has emerged during the Phase I study, are contained in the Appendix to this report. However, two representative summaries are included in this section for purposes of explanation of the manual system. These two ordinary permits, the Dredge-and-Fill Permit and the Permit to Construct a Private Driveway, serve as examples of the information collected in the system and contained in the Appendix. All of the permits are summarized with the same ten point outline form used for these permits.

File number: This five-digit number serves as a means of indexing the permit summaries and the back-up source material. The first two digits specify the authority. 01 is federal, 02 is Colorado, 03 is Utah, 04 is Wyoming, and so on through all of the counties. The last three digits have no particular meaning except that similar permits from different authorities will have approximately the same last three digits. To discover whether Utah administers a State Certification for the Dredge-and-Fill Permit, or has its own

permit similar to the Dredge-and-Fill Permit, one should search the files around number 03030.

A. Name of Permit. The names given on the summary sheets are either the names actually given on the permit, or are descriptive names for the permit. The Permit to Construct a Private Driveway is formally titled Driveway Permit. The descriptive name was used because it conveys more information than the real name.

B. Applicability/Description. Each permit is given an eight-digit applicability number from the Applicability Chart (Figure 4). The Dredge-and-Fill Permit is likely to be required of all projects described by the Applicability Chart, but the Permit to Construct a Private Driveway would be required only for projects which build new roads in Colorado. Occasionally, a brief written description of the project appears in Section B.

C. Agency. The name of the agency that issues the permit is given here. In the case of the Dredge-and-Fill Permit, and many other federal permits, the state may administer the federal program.

D. Authority. The statutory authority, if any, is cited here.

E. Applicable Regulations and Standards. Frequently the permitting agency follows specific regulations or standards which define what activities are permissible. These regulations are cited and occasionally described in this section.

F. Precedent Permits/Events. Any other permit legally required or logically necessary prior to obtaining this permit is listed or described here. Often, as in the case of the Permit to Construct a Private Driveway, there is no particular precedent permit required. In such cases, the precedent will be entry into the development stage (par. 4.1) to which the permit logically belongs.

G. Application and Prerequisite Requirements. Information or instructions useful in applying for the permit are described in this section.

H. Processing Requirements. These are details that the applicant can expect concerning how the agency will process the application. The staff review time, if known, and the fee or bond required will be mentioned here.

I. Nature of Approval. Here the conditions of the permits and the type of notification from the agency are mentioned.

J. Other. This section contains additional pertinent information which did not fit in other sections.

- A. NAME OF PERMIT: Dredge-and-Fill Permit
- B. APPLICABILITY/DESCRIPTION: 0.0.0.0.0.0.0
- C. AGENCY: U.S. Army Corp. of Engineers or State
- D. AUTHORITY: Clean Water Act, 33 U.S.C. § 1344 (§ 404)
- E. APPLICABLE REGULATIONS/STANDARDS: 33 C.F.R. Part 323 and Instructions in Engineers Pamphlet 1145-2-1

The Army Corp. of Engineers regulations are set forth at 33 C.F.R. Part 323. The procedural requirements are set forth at 33 C.F.R. Part 325. A definition of the term "navigable waters" is set forth at 33 C.F.R. Part 329.

Instructions in Engineers Pamphlet 1145-2-1 (a Guide for Applicants), is used to prepare the permit of NEG Form 4345.

- F. PRECEDENT PERMITS/EVENTS: State certification pursuant to § 401 of the Clean Water Act.
- G. APPLICATION AND PREREQUISITE REQUIREMENTS: A state may take over control of § 404 permit requirements. If the Corp. of Engineers retains authority, an environmental impact statement (EIS) pursuant to the National Environmental Policy Act of 1969 (NEPA) is required pursuant to 33 C.F.R. § 325.4. The EIS must be prepared unless the District Engineer determines that the proposed project will not significantly affect the quality of the human environment. In that case, an environmental assessment is required pursuant to § 325.4(b)(2).
- H. PROCESSING REQUIREMENTS:
 - 1. Number of Forms: One, plus original and two copies of detailed facility plans.
 - 2. Staff Review Time: 120 days, nominally.
 - 3. Hearing Requirements/Notice: See § 325.3.
 - 4. Fee Schedule/Bond: For commercial projects, a fee of \$100 is charged (§ 325.1(f)).

I. NATURE OF APPROVAL:

1. Form of Approval: Section 325.5 sets forth the form, the basic format to follow ENG Form 1721 (Appendix A of 33 C.F.R. Part 325).
2. Duration of Permit: Section 325.6 indicates that authorizations continue in effect until automatically expiring, or modified, suspended or revoked. Section 325.7 details modification, suspension or revocation procedures.
4. Reviews/Monitoring: Section 325.9 sets forth requirements for supervision.

- A. NAME OF PERMIT: Permit to Construct a Private Driveway
- B. APPLICABILITY/DESCRIPTION: 0.0.0.0.0.1.10.0
- C. AGENCY: District Maintenance Superintendent, Department of Highways, State of Colorado
- D. AUTHORITY: To secure a permit to construct a private driveway or to revise an existing driveway connecting to a state highway the applicant should make application in writing.
- E. APPLICABLE REGULATIONS/STANDARDS: 2 C.C.R. 601-1
- G. APPLICATION AND PREREQUISITE REQUIREMENTS: The written application must include the location, what the access will be used for, width of driveway desired, and address and phone number of applicant.
- I. NATURE OF APPROVAL:
 - 3. Conditions: As listed under "General Provisions" in 2 C.C.R. 601-1, p. 4.

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SECTION 5

SYSTEM APPLICATIONS

The PERMISSO development, validation, and application project was designed for two distinct phases. Phase I -- System Definition -- had two main purposes: (1) to compile, evaluate, and organize pertinent permit data into a meaningful and logical manual information system; and (2) to determine how best to validate and implement a maintainable permit information system. The two-phase process allows the results of the system definition to be examined before the decision on automation is made.

This section of the report summarizes the results of the experience gained in the Phase I study, and extends these findings into a discussion of recommended guidelines for automating, validating, and using the information system. Par. 5.1 contains the results of a simple cost-effectiveness analysis which confirmed the potential benefits of the automated system and led to a conceptual design for PERMISSO. Methods and requirements for validating the information system are outlined in par. 5.2. Par. 5.3 summarizes the possible mechanisms for the maintenance and use of the automated system. Finally, par. 5.4 discusses means of using the PERMISSO in a program designed to streamline or "optimize" the permitting system.

5.1 System Automation

The Phase I study has confirmed previous estimates of the complexity and dynamic nature of the oil shale regulatory processes. It has been found that about 3,000 distinct permit networks or flow charts would be needed to describe all possible paths open to oil shale developers in Colorado, Utah, and Wyoming. The total excludes other possible combinations arising from the appellate process, design modifications, etc. On the average, about 200 events may be needed to depict a given network in sufficient detail to serve as a planning guide. Over 50 data elements are needed for some of the more complicated permits or licenses in the process.

The permitting requirements have changed frequently over the past 10 years. Opinions differ regarding the rate of change for the future. However, recent experience indicates that a rate of change of 10 percent per year may be conservative. That is, over a 10-year period there may be as many changes or additions to data requirements as there are data elements in the present system.

Thus, the Phase I study has confirmed the original assumption that the

permitting system is so complex and dynamic that it should be automated if it is to be maintained in a manner that is intelligible to the policy maker and the developer. A simple study was made to develop guidelines for the automated system, and to derive an estimate of the relative cost-effectiveness of such a system.

5.1.1 Rationale

As agents for the general public, all levels of government are interested in helping to solve our energy problems, while simultaneously helping to ensure that other facets of the quality of our national life are maintained or enhanced. To help attain stated goals related to quality of life, an elaborate permitting system has been erected at various levels to govern the manner in which energy development is conducted. To ensure that the permitting system does not unduly hinder the solution of our energy problems, government has the responsibility to make compliance with permitting requirements as simple as possible consistent with the goals for which the system was established. If automation of the permitting system would help the government fulfill its objectives, then automation is a legitimate objective for the government.

For purposes of this analysis, it is assumed that (1) energy needs have a high priority; (2) the key role of the permitting process in relation to our energy needs is understood; and (3) of the three basic options open to government -- (a) do nothing to alleviate the problem, (b) automate the permitting process, and (c) maintain a manual system roughly equivalent in capability to the automated system -- the most cost-effective option is the one that should be selected.

Unfortunately, the cost-effectiveness ratio of option (a) as opposed to options (b) and (c) is extremely difficult to establish, as the following paragraphs attempt to demonstrate. Thus, a qualitative argument, based on the foregoing assumptions (1) and (2), is used to eliminate option (a). Then, a further set of assumptions is employed to serve as the framework for a quantitative comparison of options (b) and (c) (par. 5.1.2).

Ideally, the decision regarding option (a) (the do-nothing or null case) could be based upon quantitative cost-effectiveness data. For this to be a solid basis for decision, it would be necessary to:

- (1) Define the "system" affected by such a decision;
- (2) Define the spectrum of alternatives, including each type of automation and each alternative to automation;

(3) Define the costs and benefits associated with each alternative. In our viewpoint, this cannot be done properly. First, it is clear that the permitting process can have international repercussions, that is, the "affected system" is the world. A permitting system which adds something to the cost of development of a resource, something to the delay in reaching operational capability, and something to the cost of operation of a facility, may have the cumulative undesired impact of foreclosing the possibility of a development that otherwise might have occurred. If an entire energy-related industry is involved, the consequences of such an unforeseen event can be extremely far-reaching and difficult to quantify with any degree of certainty. Conversely, if streamlining the permitting process lowers costs and reduces delays enough to make an otherwise infeasible development feasible, the results can be equally far-reaching and difficult to quantify. The hidden, second-order costs of an inefficient or counter-productive system would perhaps dwarf the traceable, first-order costs. Second-order costs might accrue to the government through needless duplication and confusion, to the would-be developer for the same causes, and ultimately, to the energy-using public in the form of unnecessarily high taxes and prices. In any case, there is little merit in making cost/benefit comparisons based upon precise estimates of some very uncertain fraction of total cost or total benefit.

Thus, the most significant criterion for the do-nothing alternative is not measurable dollar cost: it is the unacceptable risk involved in any attempt to maintain the status quo. This risk is that oil shale development will be set back unnecessarily for an extended period of time, so that the potential contribution of shale oil will be delayed beyond the critical period expected to occur a decade or two in the future. In its field interviews, SAI has consistently sought the opinions of both industry and government on the relative importance of the permitting problem to the total development problem. We have no sure way to determine the extent to which the expressed opinions are realistic, but there is an impressive amount of agreement that avoidable difficulties with the permitting system could, under certain circumstances, be the decisive factor in decisions to discontinue or postpone the developmental activities that are required if oil shale is ever to become a viable source of energy.

Assuming that the risk inherent in the do-nothing case is unacceptable, it remains to be seen whether the automation alternative is superior to a manual alternative. To do this, we note that there are two basic, simple conceptual approaches to cost-benefit analysis:

1. Fixed-effectiveness approach. For a specified level of effectiveness to be attained in the accomplishment of a given objective, determine which alternative is likely to achieve the specified level of effectiveness at the lowest economic cost.

2. Fixed-cost approach. For a specified cost level to be used in the attainment of a given objective, determine which alternative is likely to produce the highest effectiveness.

The fixed-effectiveness approach was selected for this study, on the assumption that a certain level of performance is required if the permitting problem is to be solved; thus, if a manual system is to be considered as an alternative, the manual system must have at least roughly equivalent capability to that postulated for the automated system. The specified capabilities are:

1. Multiple levels of output: summary flow charts, detailed flow charts, and detailed data levels are needed to fulfill the system objectives (Figure 3).

2. Outputs available within minutes at the flow-chart level, to permit numerous development or system alternatives to be explored and compared before detailed outputs are ordered.

3. Detailed-level outputs available within two days under normal conditions.

4. Permitting changes to be incorporated into the information system within 30 days under normal conditions, i.e., outputs to reflect the permitting situation as it existed no more than 30 days before the outputs were requested.

5.1.2 Cost/Effectiveness Analysis

The general nature of an automated system capable of fulfilling the above requirements is illustrated by Figure 21. The input module would be an interactive (conversational) component designed to (1) help insure that the user obtains the most appropriate outputs from the data base, and (2) provide quick response to user queries.

FIGURE 21

STRUCTURE OF THE PERMIT INFORMATION SYSTEM FOR OIL SHALE

1. Input Module -- Functions: (1) Guide the user through a process which elicits sufficient information to identify the applicable permit set; (2) Transmit the results to the process module.
2. Process Module -- Functions: Based upon permit set and descriptive data obtained from input module, access the data base to obtain the most stringent (in terms of (a) standards and (b) nominal lead times) set of permit requirements, the set of duplicate requirements, and the total requirement set.
3. Output Module -- Displays and/or prints the permit forms required, with most-stringent and duplicate items annotated.
4. Data Base Module -- Contains permit requirements.
5. Update Module -- Controls the content and procedures of the other system modules.

Figure 22 illustrates the operational concept of the conversational module. An operator would ask the user a series of questions regarding the oil shale project. A list of acceptable responses to each question (a "menu") would be presented to the user upon request. If none of the acceptable responses precisely matched the user's needs, the user would be required to give the response that most nearly suited his case.

The exact number and nature of the questions and permissible responses will be determined early in Phase II -- System Implementation and Validation. Their general nature is evident from Figures 4 and 22. The type of mining and retorting process, the location, the size of the proposed operation, the nature of the auxiliary systems (e.g., transportation, communication), and the land use/ownership category are significant factors which the user would be expected to know.

(As seen from the discussion in paragraph 4.3.2, there are other questions which determine whether certain permits are required; however, in many cases, answers to these questions will not be known until late in the development stage of the project. The system will be conservative, i.e., it will list doubtful permits for such cases.)

Once the essential information has been entered into the system, the user can await a graphic display (flow chart) at the terminal. He will have the option to change his specification or enter new sets of specifications (new cases) for processing by the system.

Several options will be available for the graphic displays. These options follow from the variations in lead times for the items in the flow chart. That is, the flow charts will be plotted against time lines (e.g., nominal or average, maximum, or minimum), and the user will be able to visualize how the time line varies as a function of the situation uncertainties.

On the basis of inspection of the summary displays, the user will be expected to select one or more cases as being of sufficient interest to merit detailed analysis. The data requirements associated with the selected case or cases will be voluminous. In the normal operating mode, these detailed outputs, in the form of computer printouts or hardcopy, will be delivered to the user a day or two after the interactive session.

Many variations of the above sequence are possible. However, for purposes of the cost-effectiveness analysis, it is evident that a manual

FIGURE 22
INTERACTIVE CLASSIFICATION
OF PROJECT

system of roughly equivalent capability would have the following characteristics:

1. The information center would have stores of continually updated summary flow charts, detailed flow charts such as the foldout at the back of the report, permit data summaries such as those included in paragraph 4.3.2 and the Appendix, and indexes of data redundancies and relative stringencies for each flow chart.

2. The user would be guided through a problem-definition sequence similar to that of the automated case. He would then be shown the flow charts pertinent to his case. He would make a selection from these, and he would then be sent or given the permit data summaries and tabulations pertinent to his request.

A survey of project team members was taken to estimate the range and mean of the expected frequency of use of the system. The manual data base was reviewed to determine an estimated range and mean rate of change of data base elements. These estimates, together with extrapolations from experience in Phase I and in developing and maintaining information systems similar to PERMISSO, were used to develop a simple cost model for the present case. Details of the numerical and procedural assumptions employed with the model are given in the Technical Notes at the end of this volume. However, to place the quantitative results in perspective, the following qualifications are included here:

1. The costs are estimated in terms of constant 1978 dollars.
2. Typical rates for SAI personnel and computer services were used in making the estimates.
3. A high level of competence was assumed for all operating and maintenance personnel. No costs incident to training or turnover of personnel were included.
4. No costs incident to possible consulting services for special situations were included. Costs were restricted to those estimated for routine operations.
5. Life cycle cost sensitivity to uncertainties in cost factors was not tested.

The results of the cost-effectiveness review are summarized in Table II and Figures 23 and 24. Table II shows the estimated cost increments for

developing, providing routine annual maintenance for, updating, and using each system.

Figures 23 and 24 show that the estimated cost of the automated system is significantly lower than that of a manual system of roughly equivalent capability throughout the entire range of anticipated usage and update frequencies. The cost differential increases with the volume of activity (number of requests for PERMISSO outputs). The differential increases even more rapidly with the rate at which the permitting system changes. This pattern is to be expected, because a primary reason for automating an information system is to handle high volumes of use and a high rate of change in the information base.

TABLE II
SUMMARY OF ESTIMATED INCREMENTAL COSTS
PERMISSO VERSUS EQUIVALENT MANUAL SYSTEM

OPTION	INVESTMENT ¹	ANNUAL OPERATING ²		
		Fixed Costs ³	Cost Per Permitting System Element Change ⁴	Cost Per System Response to User Inquiry ⁵
MANUAL	\$330,000	\$88,000	\$1,072	\$90
AUTOMATED	\$353,000	\$85,000	\$ 126	\$35

Notes:

1. Estimated cost of developing, documenting, and validating the system.
2. For Figures 8 and 9, it is assumed that, after 15 years, cumulative changes in technology and in the permitting system would cause the system to be discarded and replaced with a new system. Thus, for either option, life cycle cost = investment + 15 x (annual fixed cost + (number of element changes/year x cost per change) + (number of system responses/year x cost per response))
3. Annual cost of equipment rentals, system bookkeeping, other costs independent of volume of system use and rate of change of data base.
4. Unit cost associated with an average change to the permitting data base (e.g., replacement of one permit with another).
5. Unit cost associated with one response to a typical inquiry, as described in the text accompanying this Table.

FIGURE 23
TOTAL ESTIMATED SYSTEM COST
vs. RATE OF CHANGE OF PERMITTING SYSTEM
(450 SYSTEM RESPONSES / YEAR)

FIGURE 24
TOTAL ESTIMATED SYSTEM COST
AS A FUNCTION OF SYSTEM RESPONSES / YEAR
(10 PERCENT RATE OF CHANGE OF PERMITTING SYSTEM)

5.2 System Validation

Validation of PERMISSO refers to a procedure for ensuring that the automated system operates properly throughout its domain, i.e., consistently produces the desired results. Validation has a one-time component, which is designed to ensure that the initial operating version of the system meets predetermined standards, and a subsequent continual or periodic component, designed to ensure that the system continues to meet performance standards as changes to the data base occur.

A general plan for validation of the system has evolved. However, it is not the intent of this paragraph to provide a validation plan. Rather, this discussion is intended to emphasize the need for validation and the general mechanisms involved in ensuring that the system's outputs are valid in a broad sense, i.e., founded on fact, and capable of being supported or defended.

The manual data base assembled during this study must be reviewed by all agencies involved in oil shale permitting over the western oil shale region. This is a selective process in that the system developers would use the automated capabilities of PERMISSO to find and display all information associated with a given agency, and would then review those outputs with designated representatives of that agency. This is a give-and-take procedure which ends in mutual agreement that the system's representation of the agency's procedures is adequate. The results of these individual conferences must then be re-assembled, and the combined representation must then be analyzed by oil shale and legal specialists to ensure that the entire representation is consistent. Apparent defects encountered in this analysis may need to be resolved through iteration with the pertinent agencies. Once the system is found to be logical, internally consistent, and complete within the restrictions outlined in Section 3, it can then be subjected to performance tests.

Considering the number of output paths involved and the large number of data elements in the system, validation of a manual system would be much more difficult than validation of an automated system. This is true for both the initial validation process and the periodic component, which is considered to be an element of system maintenance in the cost-benefit analysis (par. 5.1).

As discussed in Section 4, the system outputs can only be considered to be general guidelines. System validation cannot alter this situation. However, for the system to retain credibility and achieve maximum acceptance, systematic validation procedures must be followed.

5.3 System Maintenance

There are many possible mechanisms for the maintenance and use of PERMISSO. The principal conclusion regarding system application is that the oil shale permitting system is still evolving, and is subject to continuous modification. The principal recommendations following from this conclusion are that (1) the system be automated, as described in par. 5.1; (2) care be used in selecting the proper organization or organizations to maintain the system; and (3) methods be devised to amortize the costs of maintenance and use on an equitable basis.

A related problem is that of ensuring that the outputs of the PERMISSO are used to best advantage. Because this problem has potential implications for recommendations (2) and (3), it is discussed first.

As noted in previous sections of this report, oil shale permitting is an individual process, in that regulatory bodies have considerable operational flexibility in determining permitting requirements for individual operations. This flexibility means that it is impossible to predict with certainty the permitting pattern for any given operation. Other factors add to the uncertainty, e.g., oil shale projects require years to complete and the permitting system may change in the midst of the project activities, and projects may evolve from demonstrative to commercial, or from one type of mining to another, and thus be faced with a changing set of permitting requirements.

The ability of the automated system to highlight the impact of changes in requirements as a function of regulatory or technological options or changes is one of the major reasons for automating the system. However, the existence of PERMISSO cannot obviate the need for legal advice, or for close cooperation with regulatory bodies; ideally, it will enhance such cooperation and assistance, not hamper or replace it. It will be essential that the PERMISSO service group ensure that all outputs are properly qualified, and that each user is made aware of the proper use of PERMISSO as a general guideline and planning tool.

Successful maintenance of PERMISSO is contingent upon several factors: systems analysis and data processing capabilities and facilities, an understanding of oil shale technology, legal expertise in the subject area, and, above all, the cooperation of the various regulatory bodies. It appears that it would be improper to segment the system and delegate its maintenance to local governments. At the other extreme, it may be that federal entities are

too far removed from local regulatory bodies to manage the system efficiently. If these assumptions are correct, state agencies should be considered as potential custodians and operators of the system. Some form of cooperative arrangement could be considered to avoid redundancy in the analysis and maintenance of the federal elements of the system.

Another question, raised by several of the contributors to the Phase I effort, was the possibility of using PERMISSO's outputs for projects other than oil shale, or failing that, the possibility of expanding PERMISSO to apply to energy sources other than oil shale. These possibilities should be considered in the selection of custodian and operator. Obviously, there is considerable commonality between the oil shale permitting system and that in effect for other mining activities in the same geographical region. Expansion to include other forms of energy development would require only that specific requirements not applicable to oil shale be researched and analyzed. Common requirements would require little additional effort.

The problem of amortizing the cost of maintenance and use of PERMISSO is interesting because of the variety of potential users and uses of the system, and the potentially large volume of requests for system outputs. The users may range from potential oil shale developers through citizen participation groups to regulatory personnel to high-level policy makers. The extent to which these groups use the system will be determined by factors such as the reliability of the system, its flexibility and timeliness, cost per output, ease of access to the system, and the degree to which the system is publicized. In summary, a comprehensive plan is needed to help ensure that PERMISSO is properly maintained and employed.

5.4 System Modification

Once the automated system has been prepared and validated, a number of options for improving the oil shale permitting system can be considered. These options could be classified as follows:

1. Streamlining
 - a. Total system
 - b. State-by-state
2. "Optimizing"
 - a. Total System
 - b. State-by-state

It should be emphasized that both streamlining and optimization, while conceptually straightforward from a technical standpoint, may be difficult or impossible to achieve from a practical standpoint. The difficulty lies in the need to preserve the individual prerogatives (and facilitate achievement of the diverse objectives) of the many governmental entities involved in the permitting system. As a practical matter, it is not only necessary to develop a design which could achieve these goals: it is also necessary to convince the many policy-making and regulatory bodies that the recommended system would indeed lead to attainment of the permitting system's goals.

The following conclusions and recommendations are based on the assumption that it is worthwhile to define potential improvements to the system, even though it is uncertain whether or when these improvements will be adopted in toto. It may be that considerations outside the scope of the analysis will predominate in some instances; nevertheless, it is presumably best if all major options can be identified, weighted in an objective sense, and presented to the policy makers. At any rate, there is known to be interest in at least two of the oil shale states in a systematic effort to review and improve the state and local permitting system, and the following conclusions and recommendations are relevant to that interest.

The process designated as streamlining is relatively straightforward, once the automated system has been developed and validated. The postulated objective of such an effort is the elimination of redundancy in the burden imposed upon developers and regulatory bodies. For each given set of parameters (Figure 4), PERMISSO will print out the total expected data requirements, will list and identify all redundant requirements (i.e., all permits or approvals which require a particular item of information), and, wherever appropriate, will list the most stringent requirement (i.e., which is the most severe or restrictive requirement if the same general information is required for several permits or approvals). Ideally, the developer should be constrained to provide such data only once, and the system should take care of the dissemination of the data, and should note whether, when, and by whom each data item has been reviewed, authenticated, or otherwise processed. The existing oil shale permitting system would remain in place, but some portion of the burden on both the developer and the various regulatory agencies would be lightened. The extent of the benefit would be influenced by the degree of willingness to

accept the prior user's authentication or review, to standardize forms or questions which have the same basic intent, and so forth.

The "optimization" process is more time-consuming and difficult, but could prove to be more useful than the streamlining process. Essentially, the process would include:

1. Determination of the goals of the entire permitting process, i.e., making an objective assessment of what the system is designed to accomplish.

2. Developing a representative set of oil shale development models, i.e., making an objective assessment of the processes, schedules, and cost relationships which are likely to result from the development of a commercial oil shale industry.

3. Developing and applying a heuristic procedure for defining, for each class of oil shale development, that permitting subsystem which satisfies the goals of the permitting process at the least total cost to the developer and the government.

4. Translating the results of Step 3 into an action plan for federal, state, and local government.

Variations of the foregoing procedure could readily be identified. However, the essential differences between the streamlining and optimization procedures should be noted. Streamlining leaves the present system intact, but more easily maintained. Optimization pre-supposes that basic changes in the system may be needed, and that improvements would be made if shown to be desirable. It is recommended that serious consideration be given to the use of PERMISSO as a vehicle for permitting system analysis and improvement, using objective procedures similar to those outlined.

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TECHNICAL NOTES
COST-EFFECTIVENESS FACTORS AND ASSUMPTIONS

Paragraph 5.1 of this report describes the rationale, method, and results of a simple cost-effectiveness analysis of an automated oil shale permit information system. These technical notes are appended to the report to provide added detail for readers who may be interested in the numerical assumptions made in comparing the costs of an automated system (PERMISSO) with those of a manual information system of roughly equivalent capability. As given in the footnotes to Table II (paragraph 5.1), the following expression is used:

$$TC = I + EL (AFC + (CSR \times NSR) + (CEC \times NEC))$$

where TC = total life cycle cost, dollars

EL = expected life of the system, years

AFC = annual fixed cost, dollars

CSR = cost per system response to user inquiry, dollars

NSR = number of system responses to user inquiry/year

CEC = cost per flow-chart-element-level changes/year

NEC = number of flow-chart-element-level changes/year

The following notes address the cost elements given in the above expression, beginning with general assumptions developed through a review of the Phase I manual system.

DATA BASE CONTENTS

Number of Permit records	~350
Number of approvals, hearings, etc.	~450
. Total major data element records	<u>~800</u>
. Number of Requirement items	~1500
Characters/major data element	~2500
Characters/requirement element	~500
Total information characters	2.75 megabytes
Overhead/linkage characters (30%)	.825 megabytes
Total data base size	<u>3.6</u> megabytes

Nominal Response Profile

Total distinct permits/hearings/approvals	~280
Total requirements identified	~525
Charts/graphs produced	~8
Printout (redundancy/stringency/summary data)	~25 pages
Frequency 100 → 1000; nominal =	450/year

Nominal Data Base Update Profile

Frequency of changes: 10 → 160; nominal	80/year
Permits/hearings/approvals affected by single change 1 → 100, nominal	~3
Requirement elements affected by single change 1 → 50, nominal	5
Data Entry Requirements: 100 → 10000 characters nominal	~500 characters

Validation that change made correctly:

Simple case: printout of relevant information

Complicated case: processing of appropriate test case
(see nominal response profile)

. Expected computer processing time:

Nominally	30 - 120 cpu seconds
	5 - 30 connect minutes
	10 pages verification printout

. Expected computer charges (nominal): \$5.00

Estimates of computer processing times are based upon execution speeds of a PRIME 400 minicomputer with an 80 megabyte storage module. Execution times of an existing data base manager used by stock brokers to manage customer portfolios were the basis of the above estimates.^a This data base manager performs functions similar to those necessary for the PERMISSO system. The portfolio manager was written in FORTRAN and is operational on a PRIME 400 minicomputer. The portfolio manager is somewhat simpler in structure than the PERMISSO, and execution times are adjusted accordingly.

Total expected charges for automated update of data base: Nominal range \$103-\$149, which averages to a nominal value of \$126.

a

User Instructions, Broker Services Portfolio Management System,
Science Applications, Inc., 1 May 1978

WORKING NOTES

Work involved per data base element change (Manual Case)

Information base: 100 detail and 20 summary flowcharts (combined from 3000 total), 1200 information folders (summary sheets)

Individuals/level of effort per element change:

Manager/consultant	--occassionally, less than $\frac{1}{2}$ hour
Legal specialist	--occassionally, less than 1 hour
Oil shale Analyst	--every change, less than 4 hours
Librarian	--every change, less than $1\frac{1}{2}$ hours
Data Analyst	--every change, less than 4 hours
Technical Illustrator	--every change, less than 25 hours
Clerk/typist	--every change, less than $3\frac{1}{2}$ hours

Categorization of Tasks to be Accomplished/Personnel

Identify scope and direction of change--

Oil shale engineer/data analyst/manager/legal specialist

Make corrections on existing flow charts (estimate 50-75% need to be corrected for each change)--

oil shale analyst/data analyst/clerk

Touchup/redraw flowcharts to reflect indicated changes--

Technical illustrator

Identify and make corrections to existing data folders--

Oil shale engineer/data analyst/clerk

Verify correctness of all changes--

Oil shale analyst/data analyst

The above estimates assume the existence of a fairly extensive indexing, cross categorization scheme for flowcharts and data folders so that retrieval will be simplified and accurate.

Total expected cost (less reproduction expense): Range: 950-1200

Nominal: \$1072

ANNUAL FIXED CHARGE (AUTOMATED CASE)

Individuals/Level of Effort (approximate man days)

Manager/consultant	22
Legal Specialist	34
Oil Shale Analyst	45
Data Base Administrator	22
Programmer	45
Data Analyst	45
Clerk Typist/Keypunch	34

Task Descriptions/Routine Procedures

Office Manager: Provide customer interface, insure smooth handling of permit inquiries, handle complaints, adjust procedures where necessary, give promotional briefings, review performance reports.

Legal Specialist: Keep abreast of current events, with regard to government regulations in relevant areas; suggest areas for improvements in permitting procedures to eliminate duplicity and inefficiencies.

Oil Shale Analyst: Answer inquiries concerning system capabilities; organize/provide informational brochures; conduct spot checks of system performance; identify and suggest modifications for problem areas in the system; study feasibility of extending concepts to associated data bases; write performance reports on system operation.

Data Base Administrator: Monitor contents of data base and file organization procedures. Suggest improvements in software design and hardware requirements.

Programmer: Make corrections to the system as directed by the Oil Shale Analyst and Data Base Administrator; to include data handling as well as human interfacing, new correction/update methods, etc.

Data Analyst: Provide assistance to Data Base Administrator and Oil Shale Engineer in the performance of their indicated duties.

Clerk Typist/Keypunch: Type, mail out standard correspondence/informational promotional brochures. Enter programming/data base corrections at the request of the Programmer or Data Analyst.

Total estimated annual cost.....\$85,000.

ANNUAL FIXED CHARGE (MANUAL CASE)

Individuals/Level of Effort (approximate man days)

Manager/consultant	22
Legal Specialist	34
Oil Shale Analyst	72
Librarian	45
Data Analyst	45
Technical Illustrator	15
Clerk/typist	45

Task Descriptions/Routine Procedures

Office Manager: Provide customer interface, insure smooth handling of permit inquiries, handle complaints, adjust procedures where necessary, give promotional briefings, review performance reports.

Legal Specialist: Keep abreast of current events with regard to government regulations in relevant areas; suggest areas for improvements in permitting procedures to eliminate duplicity and inefficiencies.

Oil Shale Analyst: Answer inquiries concerning system capabilities; organize/provide informational brochures; conduct spot checks of system performance; identify and suggest modifications for system problems. Review librarian suggestions on data reorganization; write performance reports; research possible improvements/extensions of the system; provide routine correspondence; respond to customer suggestions on system inefficiencies.

Librarian: Review current methods in data organization; monitor effectiveness of current operational procedures; suggest improvements, modifications, incomplete areas in current data scheme; remain expert in data base contents/organization.

Data Analyst: Work at the direction of the Oil Shale Analyst and Librarian to implement their suggestions.

Technical Illustrator: Make corrections/modifications to existing flow charts; provide technical assistance in brochure design and creation.

Clerk/typist: Type routine correspondence, reports and do office filing work. Make corrections/modifications to data folders.

Total estimated annual cost.....\$88,000.

PER FLOW CHART ELEMENT CHANGE (AUTOMATED CASE)

Types of Activities:

1. Analyze change for import/impact
2. Reduce data for inclusion in data base
3. Enter/process/validate changes

Manpower Requirements:

- . Personnel Involvement (specific activities)
 - . Manager/consultant (1,2) Only occasional involvement
 - . Legal Specialist (1,2) Only occasional involvement
 - . Oil Shale Engineer/analyst (1,2,3)
 - . Data Analyst (1,2,3)
 - . Data Entry Clerk (3)
- . Time Requirement Range--30 minutes to 4 hours

The upper limit would be incurred infrequently, e.g., a major revision in a law had far reaching impact on the wording and requirements of various permits.

- . Expected Personnel Costs (nominal): \$60

Data Processing Requirements:

- . A medium scale minicomputer capable of directly accessing various data records stored in a mass storage medium such as a disk.
- . A multilinked file structure capable of quickly identifying the desired record(s) by use of a user supplied set of "keys," e.g., an availability identifier.
- . Nominal update to access 1 permit record, 3 requirements records, modify each substantially, relink properly with

SYSTEM RESPONSE/USER INQUIRY (AUTOMATED CASE)

Individuals/Level of Effort

- . Manager/Consultant --only rarely, less than ½ hour
- . Legal Specialist --only rarely, less than 1 hour
- . Oil Shale Analyst --occasionally, less than 1 hour
- . Data Analyst --every request, less than 1 hour
- . Clerk/Typist --every request, less than ½ hour

Categorization of Tasks to be accomplished/personnel

Information gathering--

Data Analyst/oil shale engineer

Computer Interface--

data analyst/clerk

Explanation of Outputs (display/harcopy)--

data analyst/oil shale engineer

Followup (customer problems/questions)--

oil shale engineer/manager/legal specialist

Miscellaneous clerical tasks--

clerk

Computer Requirements

CRT display terminal, preferably with graphics and hardcopy
reproduction capability

Line printer--standard with computer forms

Random access mass storage medium

Central Processing time--less than 3 minutes of CPU on a reason-

ably fast (IBM equivalent: 370/145) minicomputer or mainframe

Total Expected Cost: Expected (including computer related charges)

\$30-\$40; Nominal: \$35.00

SYSTEM RESPONSE/USER INQUIRY (MANUAL CASE)

Types of Activity:

1. Determine specific case
2. Retrieve specified chart
3. Explain/absorb chart contents
4. Identify and retrieve detailed data
5. Follow up response to questions/problems

Manpower Requirements

- . Personnel Involvement (specific activities)
 - . Manager/Consultant (5) only occasional involvement
 - . Legal Specialist (5) only occasional involvement
 - . Oil Shale Engineer/Analyst (1,3,5)
 - . Librarian/Information Specialist (1,2,3,4,5)
 - . Clerk (2,4)
- . Time Requirement Range: 2-8 hours

The upper limit would occur infrequently--e.g., a case involving detailed explanation of all outputs as well as several difficult questions posed by the requester in follow up interviews.

- . Total expected Costs (nominal): \$90.00.

INVESTMENT

The sequence for the manual and automated case is outlined below

<u>MANUAL</u>	<u>AUTOMATED</u>
1. Design manual data structures, flow charts	Design computerized data base
2. Design manual data retrieval processes	Design application modules
3. --	Code de-bug application modules
4. Build manual data bank, prepare flow charts and summaries	Build data base
5. Validate system	Validate system
6. Document system	Document system
7. Establish up-date system	Establish up-date system
8. Prepare permitting handbook	Prepare permitting handbook
9. Prepare final report	Prepare final report

The total estimated man-hours for the two cases follows:

	<u>MANUAL</u>	<u>AUTOMATED</u>
Manager/Consultant	830	808
Legal Specialist	780	752
Oil Shale Analyst	1900	1840
Data Base Administrator	--	1180
Librarian, Professional	1480	--
Librarian, Assistant	--	180
Programmer	--	900
Data Analyst	1220	1380
Technical Illustrator	1120	100
Technical Typist/Keypunch	1020	960

Total estimated cost: manual system, \$330,000; automated system, \$353,000

FIGURE 10
GENERIC FLOW CHART FOR THE WESTERN OIL SHALE
PERMITTING PROCESS

NOTES

1. THIS FLOW CHART HAS NOT BEEN APPROVED BY THE AGENCIES INVOLVED IN THE OIL SHALE PERMITTING PROCESS. IT IS A PRELIMINARY CHART, DESIGNED TO PROVIDE A GENERAL OVERVIEW OF THE EXISTING PERMITTING SYSTEM FOR THE STATES OF COLORADO, UTAH AND WYOMING. SEE THE DISCUSSION IN PAR. 3.2 OF THE PERMISSIO FINAL REPORT, SAI-78-03 GLN, SCIENCE APPLICATIONS, INC., FOR GUIDELINES IN THE PROPER INTERPRETATION AND USE OF THIS FLOW CHART. SEE TABLE I OF THE APPENDIX TO SAI-78-03 GLN FOR A GUIDE TO EXPANDED DESCRIPTIONS OF INDIVIDUAL PERMITS AND APPROVALS.

2. THESE ELEMENTS REPRESENT TRANSITIONAL OR UNCERTAIN ITEMS, I.E., PERMITS OR APPROVALS WHOSE APPLICABILITY TO OIL SHALE IS IN DOUBT. THESE ELEMENTS WILL BE COMPLETED OR ELIMINATED FROM FUTURE EDITIONS OF THE FLOW CHART.

3. THESE ELEMENTS NOT YET APPLICABLE TO OIL SHALE, BUT LANGUAGE OF LEGAL AUTHORITY LEAVES THEIR APPLICABILITY OPEN. INCLUDED IN THIS VERSION OF FLOW CHART FOR COMPLETENESS.

FIGURE 18 MAJOR PERMITS REQUIRED FOR A PERMIT IN SWEETWATER COUNTY, WYOMING (HYPOTHETICAL CASE)