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## A P P E N D I X E S

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## APPENDIX A, EXHIBIT 1

### TECHNOLOGY ASSESSMENT-BELATED ACTIVITIES OF THE BUREAU OF MINES

Technology assessment, as the term is most often used in the Bureau of Mines (BOM), consists of predicting and simulating alternate futures based on contingencies assumed for technological, economic, social, environmental, and other relevant influences. The contingencies and the assumptions for these are identified, quantified, and analyzed through scenarios. These techniques used for the preparation of the scenarios may be described as eclectic because there is considerable flexibility in the use of judgment, experience, and intuition in the forecasting procedure. This method may avoid many of the rigidities of projection by trend extrapolation, such as mechanical curve fitting, or the uncertainties of trend correlation, or econometric procedures where determining or influential variables cannot be precisely identified, quantified, and forecast within a mathematical framework. However, any or all of these techniques may be utilized in developing a specific assessment.

The Bureau has been involved with technology evaluation in one form or another since its establishment in 1910. Proper performance of the Bureau's programs has required that researchers be fully aware of the present state-of-the-art in their technical specialty areas, the directions in which research is advancing, and the needs and impacts of future research. Similarly, each commodity specialist has to be fully informed about the technologies affecting his commodity including exploration technologies for finding it, mining technologies for extracting it, and mineral processing and metallurgical technologies for putting it to use.

The first major assessment effort in modern Bureau history was the Paley Commission study in 1952. This study made a comprehensive effort to forecast supply and demand for mineral commodities. From this base the Bureau developed its publication "Mineral Facts and Problems," which presents a comprehensive assessment data base for 88 mineral commodities. This document, which was first published in 1955, is updated and relined every five years. The most recent edition in 1970, not only presented a thorough assessment of supply-demand factors affecting the commodities through 2000 but also made further refinements of the assessment methodologies. The 1875 edition currently being prepared for publication is about 75 percent complete. The new edition will include forecasts for both 1985 and 2000, and will make predictions of mine production for the first time. There will also be a greater refinement in the probable ranges of supply and demand based on both quantitative and qualitative factors.

Bureau efforts have delineated the current status of worldwide technologies in mining, metallurgy, ceramics, fuels and minerals utilization, minerals recovery and recycling, reclamation of mined lands, and alternate transportation methods for minerals. Other Bureau efforts have forecasted future developments in these technologies and their impact on the mineral economy into the 21st Century to guide government and industry research, legislative and regulatory measures, and national resource development. Still other Bureau efforts have involved assessments of the mineral potential of wilderness, river basin, Indian, park and forest lands, and various special studies. The Bureau's expertise and capability to conduct these assessments represents a unique national resource, and is widely recognized, both in and out of Government.

Some of the studies recently provided to Congress or to other government agencies include:

1. Coal Task Force Study for Project Independence;
2. Petroleum Task Force Study for Project Independence;
3. Critical Minerals Studies for the Council on International Economic Policy;
4. Department of the Interior Minerals Analysis Policy System;
5. Studies on Aluminum, Chromium, Cobalt, Manganese, Iron Ore, Tin, Platinum, Uranium, and Zinc;
6. Mineral evaluations to support implementation of the Eastern Railway System Improvement Plan (ConRail) ;

7. Impact assessment of State Air Quality Requirements on coal supplies; and
8. Impact of proposed Federal Surface Reclamation Legislation on coal and energy supplies.

These and other studies have had considerable impact on the development and implementation of public policy in these areas.

An example of an assessment recently conducted by the BOM is the Critical Minerals Study conducted for the Council on International Economic Policy. The oil embargo initiated in 1973 by the OPEC nations focused high level government attention on the fact that the United States was also dependent on imports for scarce and critical commodities—among these being aluminum, chromium, cobalt, and manganese. After National Security Council attention to the problem, a list of these critical minerals was developed by the Council on International Economic Policy. The Bureau then undertook an assessment of the impact of an embargo or cartel action by nations producing these minerals on the United States economy.

The Bureau's assessment examined the domestic demand and supply for these materials, the possibility of substitution and recycling to meet the demand, and developed supply and demand curves. The impact of new technologies to meet the demands—for example, ocean mining of manganese, or development of the Bureau's process for producing alumina from abundant low grade domestic sources—on these supply and curves was then assessed. The economic impact of various contingencies was estimated, and various policy options were developed along with their costs and benefits. Recommendations for policies with implications outside the Bureau's area of responsibility were made, and the Bureau's internal research priorities were realigned to assure proper attention to the most critical problems.

TA can be a major tool for the management, provision, and assurance of future minerals needs through its use in planning, programming, and decision making. Man is to an increasing degree able to control and determine his environment. With certain limitations, needed technology can be literally programmed and managed into existence. A major portion of the BOM efforts is devoted to precisely this goal. For example, Bureau researchers foreseeing the depletion of the rich iron ore deposits in the Mesabi Range, developed technology for the beneficiating and processing of non-magnetic taconite into useful iron ore. This added substantially to the Nation's reserves of this vital commodity. Other Bureau research has been instrumental in the development of the titanium and zirconium metal industries in which these metals were made into useable products to meet emerging needs. Still other Bureau research has developed processes to remove sulfur from coal prior to combustion and to remove sulfur dioxide from stack gas, allowing abundant high sulfur coal to remain an important energy source without undesirable emission of air pollution. There are many additional examples of the contribution of research at the Bureau of Mines to the solution of problems.

Recognizing that the results of TA could be made even more useful in planning the Bureau's internal programs, the Bureau has recently created the Office of Program Development and Evaluation and its Division of Planning and Evaluation to develop and implement a systematic approach to strategic and tactical planning for the BOM. The Division has already developed a draft strategic and tactical plan for programs at the BOM in the 1978-1981 period. It is also developing a program planning system design to integrate the Bureau's ongoing planning and programming systems into a Bureau-wide, long-range system to better assure that the major problems confronting the Bureau and the Nation's mineral industries are effectively being addressed.

The planning methodology being developed will utilize the concepts of technology forecasting to identify and define the problems confronting the BOM, set objectives for solving those problems, develop alternative strategies for reaching the objectives, analyze the strategies in terms of their costs, risks, and benefits, set priorities, and select the most promising strategies for implementation. Programs will then be developed for implementing the selected strategies, and tactical plans involving all Bureau organizations will be developed. The Bureau's budget request will be a natural product of the planning process, and decisions made by the Department of the Interior, the Office of Management and Budget, and the Congress, will be factored into the planning process as constraints. Ongoing programs of the Bureau will be evaluated for their effectiveness and efficiency in achieving the objectives specified by the strategic and tactical plan, and appropriate modifications to the funding, staffing, organiza-

tion, and emphasis of the programs will be made. The results of these evaluations will be factored back into the system to guide future planning.

The Strategic and Tactical Plan will be updated annually to reflect changing conditions, progress, and problems. It should significantly improve the Bureau's capabilities to effectively, efficiently, and creatively address the difficult problems confronting the Nation's minerals-producing and consuming industries in future years.

Although the Bureau has yet to produce a study with technology assessment in its title, the Bureau has demonstrated its capacity to conduct such studies. It appears likely that the Bureau will participate in TAs conducted by other agencies such as the Congressional Office of Technology Assessment. Our participation in these studies would be to furnish both the crucial analytical data and the experts needed to interpret and to present the results of these studies. The Bureau is looking forward to such participation.

#### TECHNOLOGY ASSESSMENT-RELATED ACTIVITIES OF THE U.S. GEOLOGICAL SURVEY

The U.S. Geological Survey (USGS) gathers and interprets earth science and cartographic information supporting a broad range of technical resource planning and development activities in the United States and throughout the world. These information products form a necessary basis and a data source for technology assessment (TA).

The study and location of minerals and fuels to support the Nation's technology is the Geological Survey's special responsibility. Resource analysis and the development of geological data banks permit the storage, retrieval, and processing of large amounts of information to model the complex interactions of geology and economics, and their impacts on mineral and fuel supply and demand. One product of the information systems provided the Office of Technology Assessment (OTA) all of the background material for the mineral assessment of Federal lands. The Survey's Geologic Division also provides geologic information describing the geologic benefits and hazards involved in the siting of major or special structures such as nuclear reactors, pipelines, buildings, or entire communities. Planning, siting, and building activities utilize topographic maps, orthophotomaps, and other cartographic tools principally developed and published by the Topographic Division.

The Water Resources Division studies and assesses the Nation's water resources for the purpose of planning, policy, and decisionmaking. Assessments made of the quantity and quality of water in the Nation's streams provide information on water development and hazards, and a data base for the design of water supply and control systems. Special assessments are made that relate to specific national issues such as environment, energy, food and fiber, and floods.

The Conservation Division, in support of its mineral lease development activity on public lands, classifies and evaluates the land for its mineral and water-power potential, provides mineral evaluations of lands offered for leasing, and supervises the activities of industry on Federal leases in order to protect the public interest in these lands.

The Land Information and Analysis (LIA) Office provides scientific and engineering data developed by the USGS and the Department of the Interior (DOI). It is appropriate and readily understandable language and supports land use, land resources, and related environmental planning and decision-making at all levels of government and in the private sector. This is part of the TA of those activities of man that are related to natural and earth science. The major functions of LIA provide support for land resources planning and management through: (1) development and application of natural science and geographic technology; (2) mapping current land use; (3) collecting, processing, and distributing remotely sensed data, and applying other aspects of space technology; and (4) activities in the preparation of environmental impact statements (EIS) in accomplishing USGS responsibilities directly related to the requirements of the National Environmental Policy Act (NEPA). The environmental impact statements provide essential inputs to decisions by the Secretary of the Interior on leasing, mineral exploration and development, and plant construction directly related to energy and critical minerals.

The preparation of environmental impact statements by the USGS, and assistance to other agencies in their preparation, is under the direction of the Environmental Impact Analysis Program of LIA. These activities draw upon the

expertise in the various fields of science of all of the Divisions of the USGS as well as from other bureaus of the DOI and from other Federal agencies.

The table below lists activity in environmental impact statement preparation in the 1976 fiscal year, where the USGS was either the lead Bureau or shared the lead with another DOI bureau.

*Fiscal Year 1976* **131fl Preparation (Survey-Lead or Joint-Lead)**

COMPLETED EIS

1. Oil and gas development in the Santa Barbara Channel Outer Continental Shelf (OCS), off California. Final environmental statement filed with the Council on Environmental Quality (CEQ), March 1976.

2. Proposed plan of mining and reclamation, Belle Ayr South coal mine, Amax Coal Company, Wyoming. Final environmental statement (FES) filed with CEQ November 1975. This FES was a basis for the Secretary's decision (November 11, 1975) to continue surface mining.

3. Proposed surface management of federally owned coal resources (43 CFR, Part 3041) and coal-mining operating regulations (30CFR, Part 211). Final environmental statement filed with CEQ March 1976 (joint lead with the Bureau of Labor Management (BLM)).

4. Proposed development of phosphate resources in Southeastern Idaho. Draft environmental statement filed with CEQ April 1976.

5. Proposed plan of mining and reclamation, Cordero coal mine, Sun Oil Company, Wyoming. Final environmental statement filed with CEQ April 1976.

6. Geological and geophysical regulations on the OCS. Final environmental statement filed with CEQ April 1976.

CURRENTLY ACTIVE EIS

*Draft Environmental Impact Statements (DEIS)*

1. Proposed plan of mining and reclamation, Bear Creek uranium mine, Rocky Mountain Energy Company, Wyoming. (Joint lead with the Nuclear Regulatory Commission (NRC) and Forest Service (FS).)

2. Proposed plan of mining and reclamation, Coal Creek mine, Atlantic Richfield Company (ARCO), Wyoming.

3. Proposed plan of mining and reclamation, Caballo coal mine, Carter Oil Company, Wyoming.

4. Proposed plan of mining and reclamation, Decker coal mine, Decker Coal Company, Montana. (Joint EIS with State of Montana.)

5. Proposed plan of mining and reclamation, East Gillette coal mine, Kerr-McGee Coal Company, Wyoming.

6. Proposed plan of mining and reclamation, North Gillette mine, Amax Coal Company, Wyoming.

7. Proposed plan of mining and reclamation, Rochelle coal mine, Peabody Coal Company, Wyoming.

8. Proposed plan of mining and reclamation, Westmoreland coal mine, Shell Oil Company, Crow Indian Reservation, Montana. (Joint EIS with the Bureau of Indian Affairs (BIA).)

DEFERRED EIS

1 Glen Canyon (Fireflood project ), Glen Canyon National Recreation Area. Utah. Awaiting DOI decision on legality and status of project.

2. Proposed plan of mining and reclamation, Youngs Creek coal mine, Crow Indians-Shell joint venture, Montana. Awaiting resolution of Crow Indian lawsuit.

IMMINENT EIS

1. Proposed Federal coal leasing, and proposed plans of mining and reclamation, Regional Environmental Statement, Central Utah.

2. Proposed Federal coal leasing, and proposed plans of mining and reclamation, Regional Environmental Statement, Powder River coal basin, Montana.

3. Proposed Federal coal leasing, and proposed plans of mining and reclamation, Regional Environmental Statement, Hanna basin, Carbon County, Wyoming.

## DRAFT ENVIRONMENTAL IMPACT STATEMENT ON IDAHO PHOSPHATE MINING

Preparation of environmental impact statements is the major technology assessment activity of the USGS. The recently released Draft Environmental Impact Statement on the Development of Phosphate Resources in Southeastern Idaho, is an example of current activities. The draft statement was prepared by a Federal interagency task force under the leadership of the USGS with major inputs from the U.S. Forest Service and the Bureau of Land Management. Other Federal agencies providing consultation and/or contribution to the preparation of this statement include the following:

- U.S. Fish and Wildlife Service.
- Bureau of Outdoor Recreation.
- Bureau of Mines.
- Environmental Protection Agency.
- National Oceanic and Atmospheric Administration.
- Mining Enforcement and Safety Administration.

Data, information, and/or other assistance were obtained from the following State agencies:

- Idaho Department of Health and Welfare, Division of Environment.
- Idaho Fish and Game Department.
- Idaho Department of Water Resources.
- Idaho Bureau of Mines and Geology.
- Idaho Department of Transportation, Division of Highways.
- Idaho Department of Agriculture.
- Idaho Department of Parks and Recreation.
- Idaho Department of Lands.
- Idaho Bureau of State Planning and Community Affairs.
- Idaho Water Administration Board.
- Idaho State Archeologist.
- Idaho State Historic Preservation Officer.

Additional participation and assistance were obtained from many sources. The eight companies proposing mining provided data and information on their proposed activities. The Union Pacific Railroad provided, for task-force consideration, much assistance on transportation facilities for ore haulage; the Utah Power and Light Company and the Idaho Power Company did likewise on utility systems. Officials and employees of local and county governments and the Southeastern Idaho Council of Governments also provided data and assistance. Comments of residents of the area, environmentalists, and others were also helpful to the task force in the preparation of the statement. Input to the draft statement in areas where expertise within government was limited, was provided by contract: study of air quality impact was made by North American Weather Consultants, Inc.; Socio-economic impact studies were made by the Southeastern Idaho Council of State Governments; and a study of the archeologic impacts was made by Professor Butler, Idaho State University.

The regional analysis covers potential operations on proposed and potential mining and processing of Federally-owned phosphate deposits in six counties in southeastern Idaho. The phosphate deposits represent 35 percent of total U.S. reserves which are 14 percent of world reserves.

The draft statement provides analyses of the broad cumulative impacts of existing and proposed phosphate resource development—including both mines and processing plants as well as related facilities. The description includes the proposed activities that require Federal action; the environmental impacts, mitigating measures, unavoidable adverse environmental effects, short-term use versus long-term productivity, and commitment of alternatives such as denying, modifying, or postponing development of the Federal phosphate resources.

The summary of the environmental impacts listed in the statement are:

1. Land surface will be altered by pits and dumps, soils and vegetation will be removed from the mining and associated areas, wildlife habitat and populations reduced, and water quality lowered.
2. Ambient air quality will be lowered, particularly in the vicinity of processing plants.
3. Livestock forage will be reduced during mining operations, and productivity of the mining area will be reduced even after reclamation.

4. Population and employment in the region will increase and the socioeconomic infrastructure will be under stress.

5. Recreational resources will be reduced, unknown archeologic values may be destroyed, and esthetic aspects will change.

#### TECHNOLOGY ASSESSMENT RELATED ACTIVITIES

##### OFFICE OF BIOLOGICAL SERVICES

The Fish and Wildlife Service has a broad range of activities related to TA. A prime example of these activities is the Office of Biological Services (OBS) with major projects concentrating on the assessment of energy resource development technology with respect to its impact on fish and wildlife habitat. Biological Services projects involved in this effort are in the areas of coal conversion and extraction, oil shale development, western water allocation, geothermal development, outer continental shelf and coastal ecosystems development, and stream alterations and power plant siting.

Continuing technology assessment (TA) of energy development methods is essential to obtain the best scientific information on resultant environmental impact. Relevant information must then be incorporated in planning and decisionmaking processes so that damaging ecological effects of mining, oil production, stream and coastal alterations, urban development and other major changes to the landscape can be minimized.

Elements of TA are involved in the following OBS projects.

1. Coal Project: In this project, research effort is focused on the impact on fish and wildlife habitats of surface mining operations in the Great Plains, Southwest and Appalachian regions. TA of coal extraction and conversion processes is inherent in research on methodologies for surveying and characterizing ecosystems by key variables so that important habitat areas can be readily identified and protected under Federal leases.

2. Oil Shale Project: A mature oil shale industry would affect the environment substantially by the generation of millions of tons of waste shale in the mining process. Consequently the project's emphasis is being placed on evaluating the environmental costs of oil shale development based on present prototype operations. TA is required for methods of dealing effectively with the residues, including contouring, compacting and revegetating to rehabilitate fish and wildlife habitats.

3. Western Water Allocation Project: Water use requirements and waste water disposal for future coal and oil shale operations will greatly tax limited supplies of water in the western United States. This project is assessing and developing scientific information related to stream flow requirements for maintaining fish and wildlife resources. Input is needed for decisionmaking on water allocation and disposal at State and Federal levels.

4. Geothermal Projects: This project involves the assessment of the ecological impact of geothermal electric generating plants to be located on Federal and private lands in the West. The information obtained is being incorporated into lease stipulations and management plans in order to protect specific fish and wildlife habitats.

5. Coastal Ecosystems and Outer Continental Shelf Development Projects: The activities of these two projects are closely related by virtue of the growing importance of accelerated offshore oil and gas development and its effect on the nation's coastal systems. Methods for characterization of coastal areas will be utilized for protection of fish and wildlife resources from the impact of oil and gas development and other forms of coastal alterations. Participation with the Bureau of Land Management in an environmental baseline data program aids in the selection of new offshore leasing sites. The full range of coastal impacts including exploration, drilling, transportation, storage, processing, and facilities support must be considered. TA throughout this range is required to determine what protective measures are needed for marine and estuarine biotic resources.

6. Power Plants Project: Approximately 350 major electric power plants are expected to be built in the United States during the next decade. This project's research efforts are concentrated on minimizing losses of aquatic life in streams, lakes and other water bodies used for cooling purposes in steam electric plants. Means of locating transmission corridors in order to minimize habitat disturbance are also being studied. TA of methods for accomplishing these objectives is required.

7. Stream Alteration Project: The effort in this project involves the environmental impacts of stream and river alterations associated with land and water development activities. Various studies are being conducted to assess the effects of channelization and dredging on different types of fish and wildlife habitats and to develop mitigation procedures. A major research study is a TA devoted to determining the ecological effects of the large-scale removal of gravel from streams for the Alaska pipeline bed and associated roadbeds.

#### TECHNOLOGY ASSESSMENT RELATED ACTIVITIES

##### BUREAU OF LAND MANAGEMENT

The Bureau of Land Management's daily management activities and permitting and leasing functions require that it use technology assessment (TA) techniques in order to properly protect the public lands from undue or unacceptable harm, and to make decisions which are in the public interest. This need is being met on a day-to-day basis through the Bureau's land-use planning system and environmental review procedures. The land-use planning system utilizes procedures that identify and generally evaluate the impacts, both beneficial and detrimental, of potential uses of given areas of the public lands. This evaluation is used to determine how to optimize the values present. Once the determination is made, the land-use planning process allows for constant updating through TA along with other studies and evaluations to ensure that this use or combination of uses is still the most appropriate.

Some specific examples of the use of TA in Bureau of Land Management programs are:

1. Energy Minerals Activity Recommendation System (EMARS) : This system was developed to determine where, when, and how much coal should be offered to meet the Nation's need for energy development. It allows the Bureau to evaluate the effects that energy mineral leasing will have on the environment in the area of such development. It uses the land-use planning system and input from industry, State and local governments, and the general public in the TA of an energy mineral development. When all of the impacts have been examined, a proper decision on whether Federal coal should be leased can be then made.

2. Outer Continental Shelf Leasing Program : The TA function of the Bureau of Land Management's Outer Continental Shelf (OCS) mineral leasing program involves analysis of environmental impacts associated with offshore oil and gas operations. This analysis is, to a large extent, based on an understanding of the technical state-of-the-art for conducting such operations, including exploration, development, production, and transportation.

Each OCS environmental impact statement contains in a separate appendix, a description of offshore oil and gas operations and includes a discussion of state-of-the-art technology. One of the basic assumptions regarding the causes of offshore environmental impacts from oil and gas operations relates to impacts resulting from day-to-day operations under existing operating practices, regulations, economics and technology in all phases of the operation. These basic assumptions are followed by a discussion of specific impacts so that in effect, the state-of-the-art technology forms a base from which specific impacts can be assessed.

In addition to offshore oil and gas operations, the Bureau of Land Management has prepared proposed operating and leasing regulations, and published a draft environmental impact statement for hard-mineral leasing on the OCS. The draft environmental impact statement contains a discussion of state-of-the-art technology for OCS mining, including exploration, mining, transportation, and processing.

3. National System of Transportation and Utility Corridors Study : This study made an assessment of the necessity and desirability of establishing a national system of transportation and utility corridors. Five major systems were examined. The study and the TA inherent in it revealed that in order to minimize ecological and environmental impacts and the proliferation of rights-of-way on Federal lands, while at the same time developing and distributing much-needed new energy sources, a certain degree of flexibility will be needed when planning for corridors. Conclusions were based on a variety of considerations and impacts including, among others, safety and reliability, social and economic impacts, and land use and environmental impacts.



# TECHNOLOGY ASSESSMENT - RELATED ACTIVITIES OF THE BUREAU OF RECLAMATION

The Bureau of Reclamation (BOR) has been involved in the technology of water and related resources development in the Western United States for over 70 years. The technology employed in this development includes the planning, construction and operation of dams, canals, tunnels, pipelines, powerhouses, pumping plants, transmission lines, and other related activities.

In 1974 (the last year of accumulated record) projects of the Bureau of Reclamation included 301 storage dams and dikes capable of storing 138 million acre-feet of water, 361 canals having a total length of almost 7,000 miles, 164 tunnels totaling over 220 miles in length, 795 miles of pipelines, 139 diversion dams, 50 powerplants with an installed capacity of over 8 million kilowatts, 127 pumping plants capable of over 2 million horsepower of lift, and 16,230 miles of transmission lines.

The impacts on the physical, social, environmental and economic setting of the United States in general and of the Western United States in particular resulting from these BOR accomplishments have been significant. One only has to visualize the Central Valley of California or the Columbia Basin Project area of Washington without dependable water supplies to realize the impact of such projects. To be sure, there have been trade-offs in terms of adverse and beneficial effects, but where services to meet the needs of people are concerned, the positive accomplishments and impacts have been momentous. Reclamation projects now produce enough food to satisfy the needs of nearly 33 million people.

The planning, construction, and operational phases of water and related land resources development are based on a technology and expertise that has changed with time in terms of sophistication and changing emphasis in meeting current needs. Generally, the project developed entails an evaluation, selection and justification process that addresses in great detail, during the project-by-project investigation stages, estimates of physical, socio-economic, and environmental impacts both beneficial and detrimental and including direct and indirect effects. Congress then authorizes such projects individually for construction and operation. While not formally technology assessments, our evaluations incorporate many elements of such assessments.

The following summary sheets concern a potential water resources development project, the Uintah Unit of the Central Utah Project, located in the Upper Colorado River Basin. This is currently in the process of being reported on to the Congress following detailed feasibility investigations. It is presented here as an example of a TA of a typical multipurpose public works water and related land resource development project. It is typical of those projects that over the years have produced the technological accomplishments previously enumerated for 1974. This project proposal currently awaits Congressional action regarding its authorization for construction. The summary is supported by a detailed feasibility report and associated appendixes. The final environmental impact statement is scheduled for September 1977, while the draft is scheduled for January 1977.

## SUMMARY SHEETS

### UINTAH UNIT, CENTRAL UTAH PROJECT (RECOMMENDED PLAN)

#### LOCATION

Duchesne and Uintah Counties, northeastern Utah, in the Uinta Basin of the Upper Colorado River Basin.

#### PLAN

The Uintah Unit would develop flows of the Uinta and Whiterocks Rivers for the irrigation of Indian and non-Indian land, municipal and industrial use, recreation, and fish and wildlife purposes. Flood control also would be provided.

Irrigation water would be made available from the storage regulation of surplus flows of the Uinta and Whiterocks Rivers, the saving of excessive seepage losses through rehabilitation of existing canals, and the increased use of return flows. Storage regulation would be provided in the Uinta Reservoir on the Uinta River within the Uintah and Ouray Indian Reservations, and in the Whiterocks Reservoir on the Whiterocks River within the Ashley National Forest. Irrigation supplies would be released from both reservoirs to the stream ,

channels below and distributed through new and existing canal systems. Municipal and industrial water would be made available from the project storage for use in the vicinity of Roosevelt, Utah. Treatment and distribution of the water would be the responsibility of the water users.

Part of the storage in the Uinta and Whiterocks Reservoirs would replace the irrigation storage presently provided in 13 upstream mountain reservoirs within the Ashley National Forest. Twelve of the reservoirs would be rehabilitated and stabilized as fishery lakes and part of the capacity of the other reservoir would be maintained as an inactive fishery pool. Minimum pools for fish would be provided in the project's Uinta and Whiterocks Reservoirs and minimum flows for fish would be provided in the rivers below the project reservoirs and in the Powerhouse Canal. Some range lands in the Uintah and Ouray Indian Reservations would be rehabilitated to mitigate losses to big game resulting from inundation by the Uinta Reservoir. Recreational facilities would be provided at the Uinta and Whiterocks Reservoirs and at the upstream reservoirs.

#### *Water Supply (average annual acre-feet)*

Project water supply :

Irrigation water at canal heads:

Storage supply -----	42,700
Savings of canal losses -----	4,700
Usable return flow -----	4,600

Total -----	52,000
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Municipal and industrial water ----- 1,000

Effects on Colorado River:

Stream depletion ----- 30,300

Increase in salinity concentration at Imperial Dam (mg/l) :

From pickup of salt load -----	1.5
From stream depletion -----	3.1

#### IRRIGATION SERVICE AREA (ACRES)

	Water right acreage	Land owner- ships
Supplemental service lands:		
Indian -----	34,152	25,152
Non-Indian -----	11,000	20,000
Subtotal -----	45,152	45,152
Full service lands: Indian -----	7,818	7,818
Total -----	52,970	52,970

<sup>1</sup> Land ownerships differ from water-rights acreages because of ownership transfers after water-rights were granted.

#### PROJECT FEATURES

	Uinta	Whiterocks
Reservoirs:		
Capacity (acre-feet):		
Active -----	35,030	26,020
Inactive and dead -----	12,000	6,000
Total -----	47,030	32,020
Surcharge -----	10,220	3,460
Normal water surface area (acres) -----	736	400
Dams:		
Height (feet) -----	226	218
Crest length (feet) -----	3,550	1,550
Volume (cubic yards) -----	7,100,000	6,160,000

*Project costs (January 1975 prices)*

<b>Construction costs:</b>	
Uinta Dam and Reservoir .....	\$36,505,000
Whiterocks Dam and Reservoir .....	33,807,000
Canal rehabilitation .....	3,258,000
Laterals .....	1,932,000
Operating facility* .....	18,000
Other project costs .....	80,000
Recreational facilities .....	2,487,000
Modification of upstream reservoirs .....	170,000
Powerhouse Canal modifications .....	55,000
Treatment of big game range .....	10,000
<b>Total .....</b>	<b>78,322,000</b>
<b>Average annual operation, maintenance, and replacement costs (1972-74 prices) .....</b>	<b>38,000</b>

## BENEFIT-COST ANALYSIS

(100-yr period at 3.25-percent interest)

	Direct benefits	Indirect and public benefits	Total benefits
<b>Average annual benefits:</b>			
Irrigation .....	\$1,892,000	\$458,000	\$2,350,000
Municipal and industrial water .....	150,000		150,000
Recreation .....	1,113,000		1,113,000
Fish and wildlife .....	234,200		234,200
Flood control .....	33,000		33,000
Employment opportunities for Ute Indians .....	60,000		60,000
<b>Total .....</b>	<b>3,482,200</b>	<b>458,000</b>	<b>3,940,200</b>
<b>Average annual equivalent costs .....</b>			<b>2,954,000</b>
<b>Benefit-cost ratio .....</b>			<b>1.3:</b>

## COST ALLOCATIONS AND REPAYMENT

(Unit-\$1,000)

	Construction Costs	Annual operation, maintenance, and replace- ment costs
<b>Cost allocations:</b>		
<b>Reimbursable costs:</b>		
Irrigation .....	58,784	35
Municipal and industrial water .....	1,165	1
<b>Subtotal .....</b>	<b>59,949</b>	<b>36</b>
<b>Nonreimbursable costs:</b>		
Recreation .....	8,437	
Fish and wildlife:		
Enhancement .....	6,328	
Mitigation .....	2,877	
Flood control .....		2
<b>Subtotal .....</b>	<b>18,373</b>	<b>2</b>
<b>Total .....</b>	<b>78,322</b>	<b>38</b>
<b>Repayment of reimbursable costs:</b>		
Irrigation (50-yr period):		
Prepayment 1 .....	245	
Irrigators:		
Indians <sup>1</sup> .....	5,856	24
Non-Indians .....	2,194	11
Apportioned revenues of Colorado River storage project .....	49,838	
<b>Subtotal .....</b>	<b>58,784</b>	<b>35</b>
Municipal and industrial water (40-yr period--4.371 percent):		
Prepayment 1 .....	5	1
Water users .....	1,160	
<b>Subtotal .....</b>	<b>1,165</b>	<b>1</b>
<b>Total .....</b>	<b>59,949</b>	<b>36</b>

<sup>1</sup> Expenditures for investigations from nonreimbursable Colorado River development fund.<sup>2</sup> Indians' payments toward construction costs would be deferred as long as lands remain in Indian ownership.<sup>3</sup> In addition to costs shown, municipal and industrial water users would pay \$156,000 in interest during construction on the basis of 4.371-percent interest rate.

APPENDIX A-EXHIBIT 2

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**PROCEEDINGS  
OF THE SYMPOSIUM**

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**ENVIRONMENTAL  
IMPACT OF  
NITRILE BARRIER CONTAINERS**

**LOPAC®:**  
A case study

July 19, 1973

**Sponsored by Monsanto Company  
with the cooperation of the  
University Research Institute of Connecticut  
at the Seminar Hall of  
Rensselaer polytechnic Institute  
at Hartford, Connecticut**

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## APPENDIX A - EXHIBIT 3

## A CASE STUDY OF TECHNOLOGY ASSESSMENT IN INDUSTRY\*

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&

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## ABSTRACT

Technology Assessment techniques were employed to identify environmental, legislative and consumerism issues that might result as a consequence of the introduction of a polymeric beverage container. The assessment followed classical lines involving cross-impact and Delphi procedures. Additionally, panels of individuals chosen for their sensitivity to the issues involved were employed to identify specific events of possible concern. The events so identified became part of the cross-impact matrix.

As a consequence of these exercises, environmental and consumer safety criteria were established and meeting these became an integral part of the development program for the container. Internal studies were augmented by fifty investigations conducted at independent research institutions and by academicians.

The possibility of adverse legislation or administrative action by regulatory bodies was identified and a program was devised to communicate the environmental and consumer safety advantages of the Lopac® container to selected individuals who could be involved in such actions.

This presentation details the Technology Assessment techniques employed, discusses the studies undertaken as a consequence of the assessment and enumerates some of the actions taken to meet the criteria which were established as a result of the Technology Assessment. The program devised to externalize these efforts and their results, with emphasis on communication with legislators and environmental organizations, will be discussed.

## INTRODUCTION

Ted Mock is credited with the profound observation that "Technology Assessment may be the answer to Murphy's Law--that whatever can go wrong, will go wrong." He further defined Technology Assessment as "the systematic study of the effects on society that may occur when a technology is introduced, extended or modified, with special emphasis on impacts that were unintended or delayed."

This description accurately describes the case history I will present today. A new technology was under development -- a polymeric beverage bottle. A significant amount of corporate resources, both capital and personnel were devoted to this effort. Technical success

• Presented at the International Conference on Technology Assessment, Monaco, October 27, 1975.

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APPENDIX A – EXHIBIT 4

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A PRACTICAL METHOD FOR TECHNOLOGY ASSESSMENT

PRESENTED AT THE  
FIRST INTERNATIONAL CONGRESS ON TECHNOLOGY ASSESSMENT

MAY 27    JUNE 2, 1973  
THE HAGUE, THE NETHERLANDS

By

J, KENNETH CRAVER  
MONSANTO COMPANY  
ST, LOUIS, MISSOURI

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