
Chapter I

INTRODUCTION

1. The first part of the chapter discusses the importance of the introduction in a research paper. It emphasizes that the introduction should provide a clear and concise overview of the topic, state the research objectives, and outline the structure of the paper. The introduction should also highlight the significance of the research and its contribution to the field.

INTRODUCTION

U.S. industry is heavily dependent upon foreign sources for more than a dozen key materials, without which the economy could be severely jeopardized. The lack of manganese, for example, could bring a halt to steel production, with repercussions throughout the United States. Even for materials like petroleum on which the United States is not totally dependent, the loss of even part of the normal supply from abroad has resulted in serious economic disruptions. When drastic price increases by foreign suppliers become an additional element—as in the aftermath of the Organization of Petroleum Exporting Countries (OPEC) embargo—these disruptions are compounded,

U.S. experience with petroleum has dramatically emphasized the dangers of import dependence when political and economic motives are joined as they were in the OPEC embargo and price increases during the winter of 1973–74. These actions contributed not only to the inflationary problems already facing the United States, but they were also factors in the downturn in economic activity in the last half of 1974. For other industrialized countries, most of which are more heavily dependent on OPEC oil than the United States, the impact of the OPEC action was proportionately more serious and far reaching.

The concern over developments in materials supply and price has not been limited to petroleum, of course. A surge in worldwide demand for all types of materials in 1972 and 1973, augmented by a need to build inventories, resulted in tight supply situations in a number of commodities. The lack of productive capacity, plant closures stemming from environmental constraints, and the fact

that some raw-material-producing countries took advantage of the high demand situation by raising prices—all these factors contributed to worldwide materials problems.

Although the economic recession which began in late 1974 reduced the immediate pressure, the fundamental concern over the long-term adequacy of raw materials supply has continued unabated. Insofar as domestic supplies are concerned, the price mechanism should provide some corrective action under inadequate supply conditions by dampening demand, encouraging the exploitation of lower grade resources, and creating incentives to develop alternate or substitute materials. Further, long-term outlook for growth in demand should encourage investment in new mining and processing capacity. Technological progress in both production and usage should likewise be a positive factor. Nevertheless, there are limitations to each of these avenues, particularly where they involve declining or inaccessible resources.

The ultimate answer for some raw materials then is directly related to the degree of U.S. dependence on foreign sources for materials and the extent to which U.S. industry can cope with this dependence. The OPEC experience makes it abundantly clear that U.S. industry alone is unable to counteract the operations of foreign countries engaged in deliberate manipulations which affect the national economy. Not only OPEC, but the potential for cartel action in bauxite, the actions of the International Tin Council, the potential for price increases or political intervention in the platinum market by South Africa and Russia, worldwide industrial competition for materials supplies, as well as the shrinking

world supply of some material reserves—these are all situations which could have significant adverse effects throughout the U.S. economy.

Furthermore, it is not unreasonable to suggest that the U.S. policy of detente with the U. S. S. R., especially when coupled with the increasing demands expressed by the developing countries in the United Nations Conference on Trade and Development IV (UNCTAD IV) negotiations for more control of their natural resources, has had and will continue to have a significant effect on the U.S. and world economies. It likewise appears evident that since the U.S. strategic stockpile cannot, by law, be used to alleviate economic disruptions caused by cartels and unilateral political actions, analysis of the desirability of stockpiling for economic purposes involves considering a type of institution or capability quite different from the present strategic and supplemental stockpiles,

In addition to problems of foreign origin, several domestic trends and problems in materials supply raise the question as to

whether or not economic stockpiling would benefit the public welfare. The need to find new reserves, extract from leaner ores, and invest in new productive capacity require risk taking which might be minimized, or at least shared, by new public policies which might include economic stockpiling as a useful component. Also, the growing public awareness of environmental and social problems highlights such issues as recycling and the development of new technology to improve the overall conditions under which materials are extracted and produced.

Each of the materials problems discussed above—whether actual or potential—have significant impacts upon the U.S. economy, especially if more than one problem occurs simultaneously. Moreover, each of these problems may be reflected in shortages and hardships upon the American consumer, possibly severe enough to change his basic lifestyle. It is for these reasons that the United States should immediately and carefully reassess economic stockpiling as one component of a national materials strategy.

A. PAST AND CURRENT CONGRESSIONAL ACTIONS

1. Background

The need for an overall materials policy was recognized in 1952 when President Truman appointed a President's Materials Policy Commission (Paley Commission) which recommended that a Federal agency look at the materials problems as a whole, keeping abreast of the changing situations and the interrelation of policies and programs. The Paley report proposed that the materials agency concern itself with the entire energy and materials field and the relationship of separate programs such as coal, gas, and petroleum to one another; the dimensions of foreign production of materials and its relationship to domestic programs; and the development of a production plan to meet long-term materials requirements. These

recommendations were not implemented, and in recent years, materials problems have become widespread and acute.

President Nixon's Government reorganization plan called for the development of a Department of Natural Resources to include the present Interior and Agriculture Departments and related activities. This proposal was later changed to read that a Department of Energy and Natural Resources should be developed, and the Department of Agriculture's functions were omitted. Currently, there are a number of bills before the 94th Congress calling for the establishment of a "Department of Natural Resources and Environment" or a "Department of Social, Economic and Natural Resources Planning." So far, this legislation has not been acted upon.

Congress established the National Commission on Materials Policy in 1970 and charged it with making recommendations on the supply, use, recovery, and disposal of materials. The Commission's June 1973 report recommended that a comprehensive Cabinet-level agency be established for materials, energy, and the environment. It also called for the creation of a temporary high-level Natural Resources Coordinating Committee for materials policy and the organization of a computerized national minerals inventory system within the Department of the Interior until a new department was formed,

2. The National Commission on Supplies and Shortages

Congress already recognizes the need for coordinated materials planning, having passed in September 1974 Public Law 93-426 establishing the National Commission on Supplies and Shortages and charging it with drafting the "necessary legislative and administrative actions to develop a comprehensive strategic and economic stockpiling and inventories policy which facilitates the availability of essential resources." Specifically, Congress pinpointed five items in the act which underscore our materials vulnerability and suggest a possible direction of stockpiling policy development:

- a. The United States is increasingly dependent on the importation from foreign nations of certain natural resources vital to commerce and the national defense;
- b. Nations that export such resources can alone or in association with other nations arbitrarily raise the prices of such resources to levels which are unreasonable and disruptive of domestic and foreign economics;
- c. Shortages of resources and commodities are becoming increasingly frequent in the United States, and such shortages cause undue inconvenience and expense to consumers and a burden on interstate commerce and the Nation's economy;
- d Existing institutions do not adequately

identify and anticipate such shortages and do not adequately monitor, study, and analyze other market adversities involving specific industries and specific sectors of the economy; and

- e. Data with respect to such shortages and adversities is collected for various purposes, but is not systematically coordinated and disseminated to the appropriate agencies and to Congress.

3. The Energy Policy and Conservation Act of 1975

The Energy Policy and Conservation Act, Public Law 94-163, which was signed into law on December 22, 1975, has the following purposes:

- a. To grant specific standby authority to the President, subject to congressional review, to impose rationing, to reduce demand for energy through the implementation of energy conservation plans, and to fulfill obligations of the United States under the international energy program;
- b. To provide for the creation of a Strategic Petroleum Reserve capable of reducing the impact of severe energy supply interruptions;
- c. To increase the supply of fossil fuels in the United States, through price incentives and production requirements;
- d. To conserve energy supplies through energy conservation programs, and, where necessary, the regulation of certain energy uses;
- e. To provide for improved energy efficiency of motor vehicles, major appliances, and certain other consumer products;
- f. To reduce the demand for petroleum products and natural gas through programs designed to provide greater availability and use of this Nation's abundant coal resources; and
- g. To provide a means for verification of energy data to assure the reliability of energy data.

Each of these purposes is relevant to national stockpiling policy relating to energy materials.

Several of the purposes, together with the authority granted to implement those purposes, directly relate to legal and policy issues discussed in this assessment.

4. Status of Proposed Stockpile Legislation

Congress is presently considering proposed materials legislation for a broad variety of purposes. The issues related to national stockpile policy involve considerations of both military and economic security, as well as other social purposes. Military security has been the major purpose of the Strategic and Critical Stockpile, the Supplemental Stockpile, and the Defense Production Act Inventory. A future war might cause difficulties if it were coupled with concerted actions to cut off U.S. imports of

manganese, chromium, cobalt, platinum, and other critical materials. As a result, the strategic stockpile was analyzed to provide the background necessary to understand how it has been operated and the problems which have been encountered. However, no other specific assessment of the current strategic stockpile has been conducted in this study.

The analysis of strategic stockpiles and the current materials problems outlined in chapter II illustrate the fact that stockpiling may also be useful in accomplishing national economic policy. The issue of economic stockpiling is complex and probably should be addressed as a component of the evolving national materials strategy.

The status of bills relating to economic and strategic stockpiling, before the 94th Congress, is listed in table 1-1,

Table 1-1.—Review of pending stockpile-related legislation of the 94th Congress

Bill Identification	Identification No.		Sponsor	Date	(as of Feb 23 , 1976)
	House	Senate			
General					
To amend the Defense Production Act of 1950 to provide for national stockpiles to protect the economic security of the United States		S.1869	Williams	June 4, 1975	Referred to Senate Committee on Banking Housing and Urban Affairs June 4, 1975
To extend by 90 days (until Sept. 30, 1975) the expiration date of the Defense Production Act of 1950,		S.J. Res 94	Proxmire et al.	June 10, 1975	Passed both House and Senate signed by President June 28, 1975. Became law—P. L. 94-42 June 28, 1975,
To extend the Defense Production Act of 1950 until Mar. 31, 1976. (U.S. Congress. House Committee on Armed Services. Subcommittee on Seapower and Strategic and Critical Materials. Hearings on ship transfers, Navy programmings, and stockpiles.)	H.J. Res. 487		Rees	June 5, 1975	
Provides for a 1 -year moratorium on the sale, or other disposition from stockpiles of strategic and critical materials		S.2767	Domenici	Dec. 10, 1975	Pending in Senate Committee on Government Operations.

Table 1-1.—Review of pending stockpile-related legislation of the 94th Congress—continued

Bill Identification	Identification No.		Sponsor	Date	Status (as of Feb. 23, 1976)
	House	Senate			
Amends the Defense Production Act of 1950 to create a National Economic Stockpile Association that shall operate under rules promulgated by the Secretary of the Treasury to facilitate the availability of essential natural resources and to prevent disruption of the domestic economy.	H.R.9597		Rees	Sept. 15, 1975	Referred to House Committee on Banking, Currency and Housing, Oct. 15, 1975. Receiving executive comments.
Establishes a Strategic Energy Reserve Office in the Federal Energy Administration, and creates strategic energy reserves in storage capable of replacing energy imports for at least 90 days in order to minimize the impact of interruptions or reductions of energy imports. Passed the Senate on July 8, 1975, as amended. Text inserted in S. 622 (see above) on Sept. 26, 1975,		S.677	Jackson	Feb. 12, 1975	S. 622 passed in lieu of S.677 as P.L. 94-163, Dec. 22, 1975
Creates a National Strategic Petroleum Reserve of up to 1,300 million barrels of petroleum consisting of 300 million barrels in the military National Strategic Petroleum Reserve, and up to 1 billion barrels for the civilian National Strategic Petroleum Reserve (as authorized by this act), capable of reducing the impact of disruptions of oil imports.		s. 618	Jackson	Feb. 7, 1975	Referred to Senate Interior and Insular Affairs Committee, Feb. 7, 1975. 1st day Committee hearings, Mar. 11, 1975.
Amends the Strategic and Critical Materials Stockpiling Act in order to establish a fund that shall be used for the procurement of, and the carrying out of other functions related to, such materials.	H.R. 10526		Bennett	Nov. 4, 1975	Referred Armed Services Committee. Nov. 4, 1975,
Disposal of Specific Materials					
Authorizes the release of 1,553,500 pounds of cadmium from national stockpiles.	H.R.129 (H.R.3397)		Broomfield	Jan. 14, 1975	Referred to Subcommittee on Seapower and Strategic and Critical Materials, Mar. 6, 1975.

Table 1-1.—Review of pending stockpile-related legislation of the 94th Congress—continued

Bill Identification	Identification Number		Sponsor	Date	Status (as of Feb. 23, 1976)
	House	Senate			
A bill to authorize the disposal of silver from the national stockpiles.	H.R. 306		Conte	Jan. 14, 1975	Referred to Subcommittee on Seapower and Strategic and Critical Materials Mar. 6, 1975. 1st day of hearings, Mar. 25, 1975.
A bill to authorize the disposal of beryl ore from the national stockpiles and the supplemental stockpiles.	H.R. 400		Flood	Jan. 14, 1975	Referred to Subcommittee on SSCM* Mar. 6, 1975. 1st day of hearings 3/35/75
Authorizes the disposal by the U.S. Government of certain Sperm oil from the national stockpile and the subsequent regulated commercial disposal.	H.R. 3465		Mosher	Feb. 30, 1975	Referred to Subcommittee on Fisheries and Wildlife, Mar. 27, 1975. 1st day hearings, June 9, 1975.
Authorizes the disposal of tantalum materials from the national stockpile.	H.R. 1598		Drinan	Jan. 17, 1975	Subcommittee on SSCM*, Mar. 6, 1975.
Authorizes the disposal of approximately 100,000 tons of tin from the national and supplemental stockpiles.	H.R. 4535		Mollohan	Mar. 10, 1975	Subcommittee on SSCM, Mar. 21, 1975. 1st day hearings, Mar. 25, 1975.
Authorizes the disposal of approximately 241,600 tons of chemical-grade chromite from the national stockpile.	H.R. 4802		Rose		Subcommittee on SSCM*, Apr. 11, 1975.
Authorizes the release of 9,000 short tons of asbestos chrysotile from the national stockpile.	H.R. 5683 (H.R. 6663) (H.R. 7026) (H.R. 6910) (H.R. 7927)		Fenwick	Apr. 8, 1975	Subcommittee on SSCM*, Apr. 11, 1975. Favorable excommment from GSA, Aug. 11, 1975.

● Seapower and Strategic and Critical Materials.

B. ASSESSMENT SCOPE AND PURPOSE

While the basic objective of this assessment was to examine the attributes and consequences of economic stockpiling, another primary goal was to develop a generalized methodology which Congress, or any other organization, could use to investigate and provide input in the development of future stockpiling policy. It is in this context, and for this reason, that the step-by-step process used in the assessment is detailed as follows. Prior to describing this methodology, however, it is

appropriate to discuss briefly the nature and development of technology assessment, suggesting in that manner a perspective for understanding the nature, scope, and purpose of this assessment.

1. Definition of Economic Stockpiling

For purposes of this assessment, economic stockpiling is defined as the accumulation and storage of materials for the express intention

of being able to effect their distribution to accomplish public purposes other than the wartime emergency conditions stipulated in the Strategic Stockpile Act of 1946.¹ While a discussion of economic stockpiling might include an analysis of national, international, private, and public stockpiles, interest centers in this study on those purposes which the American market system does not adequately perform under the constraints, either foreign or domestic, which exist or may be imposed. For this reason, the stockpiling policies studied here concentrate primarily, though not exclusively, on the use of a public (i.e., Federal Government) economic stockpile to achieve various policy objectives. It is possible that an economic stockpile might best be achieved by U.S. participation in an internationally controlled stockpile, or through governmental cooperation with U.S. industry to operate privately held stockpiles. For that matter, how to implement an economic stockpile might be

¹The three definitions listed below reveal much about the evolution of the stockpiling concept in the United States over the past half century:

- (a) Webster's Unabridged—1922: No listing.
- (b) Webster's New Collegiate-1951: Stockpile, n. A storage pile; specifically, a reserve supply of an essential raw material, processed food, or the like accumulated within a country for use during a war-induced shortage.
- (c) Webster's Unabridged—1973: Stockpile, n. a reserve supply of something essential (as processed food or a raw material) accumulated within a country for use during a shortage caused by emergency conditions (as war).

The stockpiling of strategic materials to help meet wartime shortages was discussed in 1921, evidently not in time to make the 1922 edition of Webster.

The 1951 version is the essence of the language in the Stockpiling Act of 1946. Materials must be essential, i.e., critical or strategic, and releasable only to meet shortages generated by war conditions. Even the reference to food seems to be to the civil defense shelter stocking program rather than to the Department of Agriculture program (processed food; war-induced shortage).

The 1973 definition expands the war-induced shortage to one caused by emergency conditions as the reason for acquisition of materials above current needs. This definition covers most of the policy objectives included in the economic stockpiling concepts used in this study. It is interesting to note that the definition was written and adopted before the OPEC oil embargo of 1973/74.

viewed in the final analysis as a choice of the best management system—i.e., not whether or not, but to what extent, the Federal Government should become involved in the operation of the stockpile, Should the U.S. Government, for example, maintain total control of the stockpile, or should that control be shared with industry, with one or more foreign governments, or vested in a public-private corporation? Because of these considerations, an assessment is herein made of the benefits and costs to the United States of stockpiling materials for selected public purposes.

2. Materials Characteristics

An economic stockpile can be composed of raw materials, such as minerals and ores; semiprocessed materials, such as concentrates from mines or metal ingots; or finished materials, such as medicinal or fabricated products ready for use. Stockpiling can also involve food products, but these are specifically excluded from consideration in this assessment. It is recognized that each of the materials which might be stockpiled has special physical geographic, technological, economic, social, and political characteristics which define its modes of production, processing, transportation, marketing, consumption, conservation, storage, and disposal. Nevertheless, for this assessment, stockpiling is viewed initially in terms of a policy objective and only after that policy objective is defined and understood as a matter of national interest is attention given to the materials which might be stockpiled to achieve that policy. It should be noted that "objective" is defined as the goal, or intended use of a stockpiling policy, not the quantity of material to be included in a stockpile.

3. Definition of Technology Assessment

For the purpose of this assessment, technology assessment is defined as a "generalized process for the generation of reliable, comprehensive information about the chain of technical, social, economic, environmental, and political consequences of the substantial

use of a technology, to enable its effective social management by decisionmakers."²In the Working Glossary from which this definition was taken is also a discussion of the development and types of technology assessments. While the development of technology assessment is generally well known, it is important to mention here the four types of assessments, for they bear directly upon understanding the present assessment. The four types identified are:

- Assessments directed to the solution of identified problems of society which are usually amenable to systems analysis for their solution;
- Assessments to enable society to cope with the unfolding chain of cause-and-effect relationships stemming from a new technology;
- Assessments which are policy-oriented studies; and
- Assessments which are studies undertaken (usually in an academic environment) for the purpose of developing an assessment methodology, rather than as a input to decisionmaking.

Whether or not one agrees that all four, or only two, of the types identified above are really assessments, it is fundamental that the process of conducting a technology assessment—or for that matter, the assessment itself—not be equated with the policymaking process, but rather understood as being an input to that process. As the Working Glossary continues, the process of technology assessment is only one of three elements in society's management of technology:

The first is the process of science and technology, producing innovations as solutions to social problems and needs. These may be economically attractive, or may require public

funding; either way, they may become candidate claimants for political decisionmaking. The second element is the assessment of these technologies as solutions. The third element is the political process by which the social benefits and costs are finally judged and appropriate public action decided upon. Technology assessment, then, is the technological information input to the political decision process.

Because it is merely one of the inputs in the decisionmaking process, this assessment has not made any recommendations as to what, if any, policy Congress should consider implementing. It is also for this same reason that one of the primary goals of this assessment was to develop a generalized methodology which could be used in conducting similar policy assessments in the future.

a. Systems Approach to the Assessment of Economic Stockpiling.—The overall approach developed to manage and conduct the research in this assessment differs from the approaches used in the past materials stockpiling projects. The scope and purpose of past studies were limited to specific materials, classes of materials, or the macroeconomic effects of materials shortages on a particular industry or public sector. To date, no materials or stockpiling study has been found which uses a systems approach of first defining the policy objective to be achieved, then investigating materials stockpiling or alternatives to stockpiling as possible means of satisfying the requirements of that policy objective.

These past studies are understandable because the policy objective of stockpiling in the United States has been limited to providing materials for national emergencies. However, when related to the possibility of planned intervention in the United States and world marketplace, the broad spectrum of objectives which could be achieved by the implementation of a stockpiling policy defies consideration of a single material, a group of materials, or even one segment of U.S. society,

b. Definition of Systems Approach.—In general, systems analysis techniques were used to organize and manage this assessment,

²*Science Policy: A Working Glossary*, prepared for the Subcommittee on Science, Research, and Development of the Committee on Science and Astronautics, House of Representatives, U.S. Congress, July 1973. This document has served as the working glossary for this technology assessment.

As explained in the Working Glossary, systems analysis can be defined as an—

inquiry to aid a decisionmaker in choosing a course of action by systematically investigating his proper objectives, and risks associated with the alternative policies or strategies for achieving them, and formulating additional alternatives if those examined are found wanting. Systems analysis represents an approach to, or way of looking at, complex problems of choice under uncertainty . . . In such problems, objectives are usually multiple, and possibly conflicting, and analysis designed to assist the decision maker must necessarily involve a large element of judgment,

4. Seven Steps in the Generalized Assessment Methodology

Using the systems approach, it was possible to organize the assessment requirements into a series of sequential tasks. These seven steps are listed and discussed below. The exact methods to be used in completing each of the seven steps listed will vary as a function of the complexity of the stockpiling policy being assessed. However, certain tasks must be accomplished during each of these steps, as explained below.

Step 1: Identify the Major Issues Related to Economic Stockpiling.—The major issues related to economic stockpiling and associated materials problems which might require some national policy development were examined in a series of literature searches, interviews, case studies, and relevance trees. The major issues identified in this task, which formed the nucleus of information to be used as inputs to the impacts analysis, are discussed in chapter II.

Step 2: Develop Stockpiling Policies to Address the Major Issues.—The stockpiling policies developed here define the policy objectives which are designed to alleviate the national materials problems identified in step 1. In developing these policies, care was taken to insure, with one exception, that each one would achieve only one objective. Selection criteria were developed to identify which materials were directly related to the national materials issues. These materials are then used

as proxies in the impacts analysis. This task is discussed in chapter III.

Step 3: Assess the Impacts (Benefits and Costs) of Implementing the Stockpiling Policies.—The impacts related to implementing specific stockpiling policies are assessed in relation to the sectors of U.S. society which they could affect. As a minimum, consideration is given to the possible economic, political, and social impacts. These impacts are analyzed in chapters IV and V.

Economic stockpiling policies are considered in two categories: those relating to foreign actions and those relating to domestic actions. An example of the former would be one whose objective is to cushion temporary import disruptions, while an example of the latter would stabilize the long-term trend of fluctuating domestic materials prices. In either event, it is necessary to construct a probable future in which the stockpile would be operated. The complexity of the probable future could vary from the creation of a straightforward set of scenarios, based upon “what if” types of questions, to the extrapolation of the environment using sophisticated forecasting techniques. The nature of the future to be used should be determined as a function of the stockpiling objective and in anticipation of the impacts related to its implementation.

Step 4: Identify Alternatives to Economic Stockpiling.—A stockpiling policy may be only one of several means to satisfy the requirements of the national materials objectives. Accordingly, possible alternatives to economic stockpiling which may achieve the same or similar policy objectives have been identified. These alternatives are presented in chapter VII.

Step 5: Assess the Impacts (Benefits and Costs) of Implementing Alternatives to Economic Stockpiling.—In order to ascertain the true value of economic stockpiling policies, it is necessary to evaluate the impacts of alternatives in much the same way as was done for the stockpiling policies. It should be pointed out, however, that such a quantitative

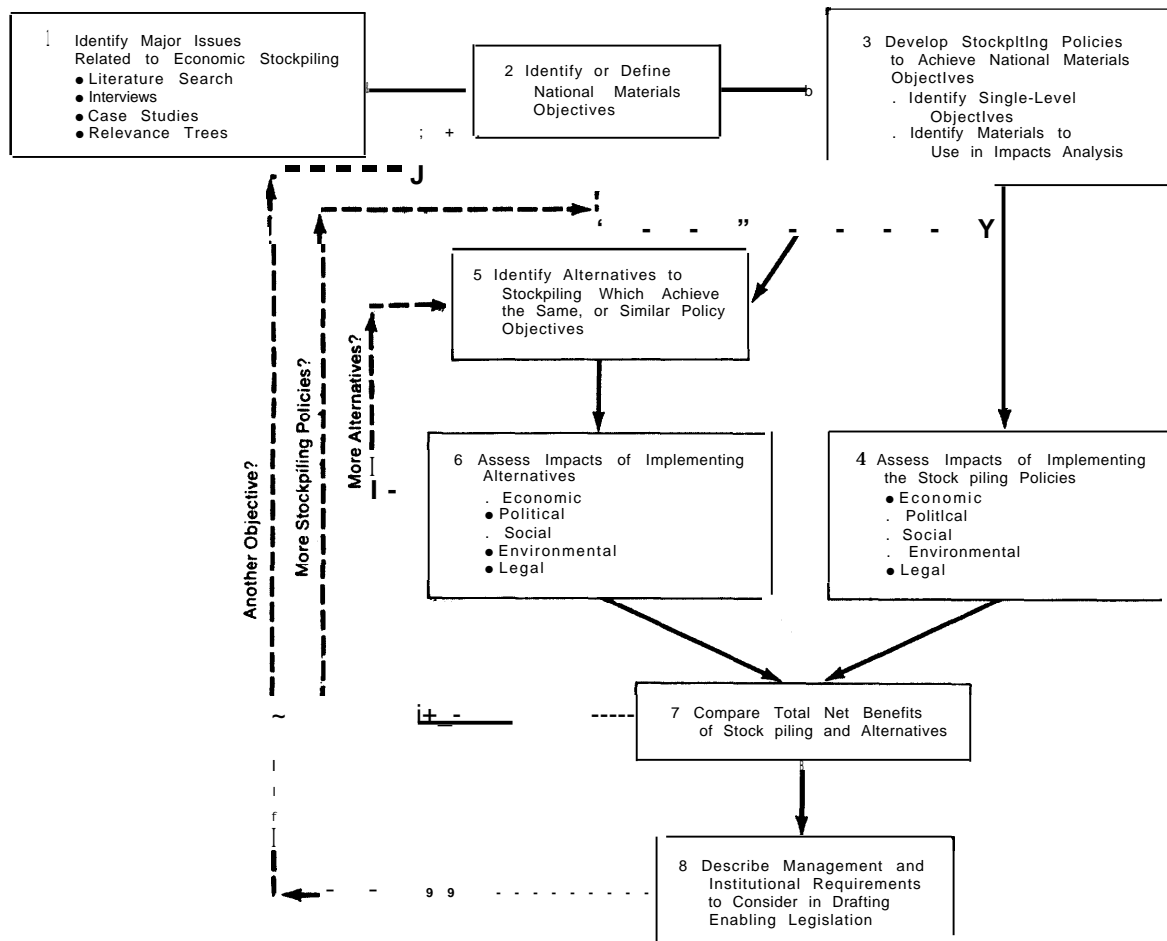
cost/benefit analysis was beyond the scope of this assessment and was therefore not performed. What was accomplished is a qualitative analysis of the alternatives in terms of their possible impacts, advantages, and disadvantages.

Step 6: Compare the Impacts (Benefits and Costs) of Economic Stockpiling With Those of Alternatives.-Once the information is collected and the analysis related to the first five steps has been completed, it should be possible to arrive at supportable conclusions regarding whether or not economic

stockpiling is sufficiently worthy for the Congress to consider in drafting enabling legislation. However, this detailed cost/benefit analysis was beyond the scope of this assessment and was not performed.

Step 7: Legislative Considerations
Regarding Economic Stockpiling.—Because no analysis other than qualitative judgments is offered regarding whether stockpiling offers greater net benefits than alternatives, and because no recommendation is offered regarding whether or not an economic stockpiling policy should be implemented, the final step of

Figure 1-1.
Functional Logic of Generalized Assessment of Methodology



this generalized methodology is to identify the possible legislative options and institutional arrangements which are available in considering possible legislation. These considerations are included in chapters VI and VIII.

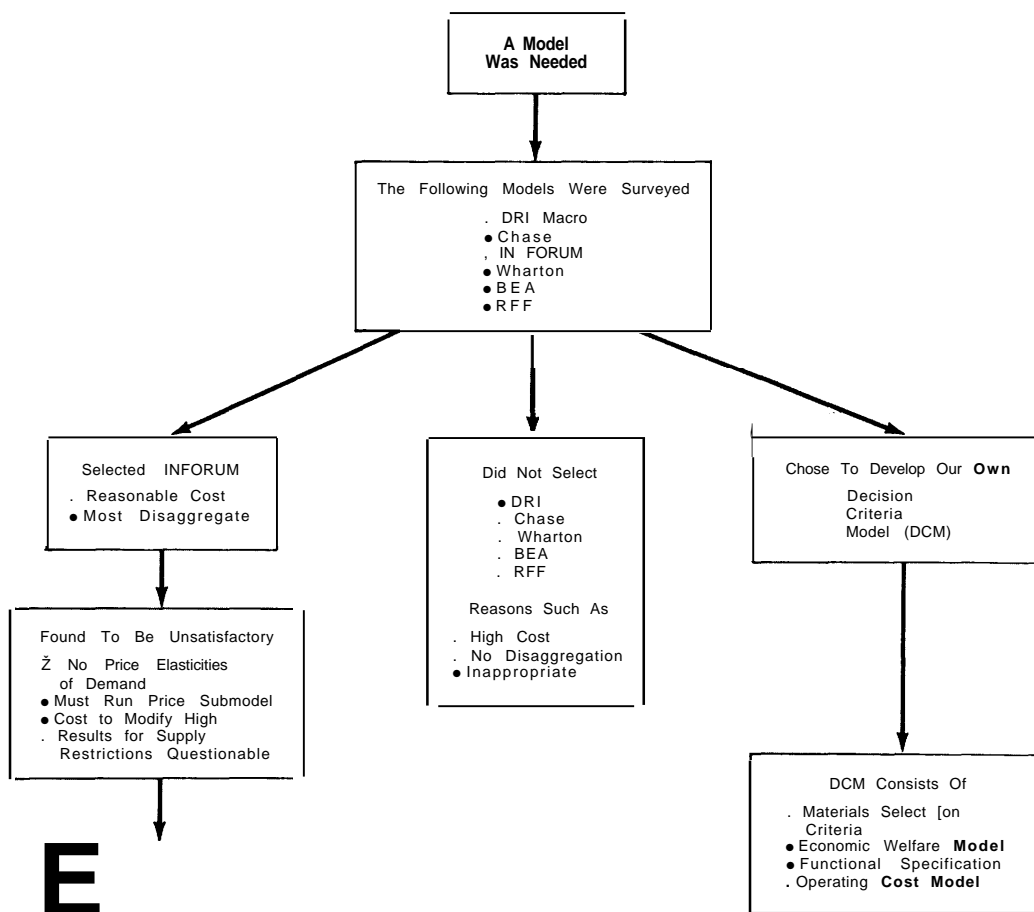
5. Functional Logic of Assessment Methodology

Figure 1-1 is a graphic display of the functional logic of the generalized methodology developed and generally used to assess economic stockpiling. While the steps in the methodology as outlined in the previous sec-

tion are presented as a sequential process, in actual practice the assessment process is iterative and requires a constant feedback of information from one task to another.

a. Discussion of Decision Criteria Model Development.—Figure I-2 is a display of the development of the decision and computer models surveyed and developed during this assessment. Several existing models were surveyed; one was selected, used, and found to be unsatisfactory. Therefore another model (Decision Criteria) was developed to assess the benefits and costs to society of implementing

Figure 1-2.
Decision Criteria Model Development



an economic stockpiling policy. It was with the four components of this Decision Criteria Model that the basic assessment was made and the findings were drawn.

b. Discussion of Decision Criteria Model.—The Decision Criteria Model, which is discussed in chapter III consists of four components:

- A Set of Materials Selection Criteria,

- . An Economic Welfare Model,
- A Functional Specification Checklist, and
- An Operating Cost Model.

The Economic Welfare Model and the Operating Cost Model were completely implemented for five stockpile policies using a computer program developed in the study.