Chapter VI

MANAGEMENT AND INSTITUTIONAL CONSIDERATIONS FOR IMPLEMENTING AND OPERATING AN ECONOMIC STOCKPILE

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The decision regarding whether or not to implement an economic stockpile as a national policy is an exceedingly complex process which includes both domestic and international issues covering the full range of economic, social, legal, and political variables. While the United States does maintain stockpiles for strategic purposes, it is important to recognize that there is no direct experience in the United States with economic stockpiling, particularly as to what impact such governmental intervention may have on the marketplace or various public sectors. For these reasons, consideration has been given in this assessment to the entire decisionmaking process related to developing, implementing, and operating an economic stockpile.

The decisionmaking process developed here (termed "Decision Criteria Model") provides a conceptual model for accomplishing four requirements: (a) how to assess whether or not to stockpile certain materials for economic purposes, (b) how to identify candidate materials and estimate the optimal quantity of those materials to be stocked, as well as the timing of their acquisition and disposal, (c) how to specify the functional nature of the stockpiled materials, and (d) how to estimate the annual and projected budget costs required to operate the stockpile.

This chapter is a discussion of the pertinent considerations related to implementing and operating an economic stockpile, with particular attention to the management and institutional options which should be analyzed in the development of stockpiling policies. The following sections are included:

- Decision criteria—a model for making decisions regarding an economic stockpile;
- Information requirements of an economic stockpile;
- Organizational options of an economic stockpile;
- Interrelationships of an economic stockpile with existing US. and foreign stockpiles and with other U.S. materials policies; and
- Budget implications of an economic stockpile.

A. DECISION CRITERIA MODEL FOR DEVELOPING AND IMPLEMENTING ECONOMIC STOCKPILE POLICY

1. Components of Decision Criteria Model

As discussed in chapter III, the Decision Criteria Model is composed of four components: (a) Materials Selection Criteria, (b) Economic Welfare Model, (c) Specification of Functional Nature of Stockpile, and (d) Operating Cost Model. The nature and purpose of the first two of these components are developed and discussed in chapter IV; therefore, it only remains to explain their value from a management point of view. The last two components, however, are presented in detail in subsequent sections of this chapter.

The Materials Selection Criteria provide the guidelines with which decisions can be made as to which materials ought to be considered for an economic stockpile. These decisions would be made after a particular stockpiling policy has been selected for implementation. In turn, after the specific material or materials have been identified, the Economic Welfare Model provides the method by which the integral parts of a stockpile--optimal quantities and timing of acquisition or disposal--an be estimated by the management agency.

2. Specification of Functional Nature of Stockpile

Having determined the manner in which materials are selected for an economic stockpile and the method by which decisions are made as to the quantity and timing of acquisitions (or disposals) of those materials, there is a need to consider the third component of an economic stockpile—the Specification of Its Functional Nature. A distinction is made here between the management operations and the specification of a particular stockpile. The basic agency organization might not vary from one stockpile to another and could be easily adapted for administering two or more stockpiles simultaneously. In contrast, the functional nature of a stockpile could vary greatly, depending upon the nature of the policy objective and the particular characteristics of the materials involved.

Aside from the economic impacts, there are certain political and social impacts which may help determine the nature of an economic stockpile. These may be either domestic or international, or both. The extent to which the nature of a stockpile may affect such matters as employment, the environment, materials conservation, foreign policy, and foreign trade should be considered, and consultation with industry and with interested Government agencies should be held accordingly.

Four major categories of requirements need to be considered to specify the functional nature of an economic stockpile:

- Acquisition and disposal,
- Time factors,
- Form of material, and
- Location and storage.

Some of these considerations relate to the type of material stockpiled and the rate of acquisition or disposal, but they may be stated in general terms in order to encompass various contingencies. To a considerable extent, the four categories are similar to those which have been analyzed with respect to a defense-oriented stockpile, although the scope and ramifications of an economic stockpile may be broader and more involved. The history and experience of the strategic stockpile can nevertheless provide considerable insight as to the direction of an economic stockpile and are drawn upon in the following discussion.

a. Acquisition and Disposal.—Materials acquisition may be from domestic or foreign sources. For those stockpiles in which support of domestic production or other domestic activity is not a factor, acquisition can be

achieved either through purchase or through transfer of materials from the strategic/critical materials stockpile, or by exchange for other materials such as surplus agricultural commodities. For those stockpiles in which domestic support is involved, acquisition would have to be made through domestic purchase. In order to do so, however, information required about the sources would include such items as size, location, accessibility, types of productive facilities, degree of nationalization (of foreign sources), possibilities and probabilities of import disruptions of any kind, and quantities available in excess of normal requirements of the sources. The kinds of transportation facilities normally used, their adequacy, alternative routes, and vulnerability to disruptions by strikes are also factors for consideration. Among domestic sources, there may be questions of equitability among suppliers of various sizes, including small businesses, as well as among suppliers in various geographical locations. Seasonal variations in supply, substitutability of other materials, and technological changes in production and consumption should also be taken into account in specifying acquisitions and disposals.

Some of the factors mentioned above with respect to acquisitions would apply also to disposals, e.g., location of recipients, availability of transportation facilities, and equitability. Those stockpiling policies aimed at solving problems of indefinite duration, such as import/price disruptions or a scarcity of domestic materials, would tend to involve less-frequent disposals than those aimed at such problems of limited or intermittent duration, as nonpolitical import disruptions, temporary surpluses/shortages, or instability in international markets. It is presumed that, if required, stockpiles would be created in anticipation of the problems and therefore far enough in advance of problem events like temporary surpluses/shortages to provide the quantities required in overcoming the difficulties. On that basis acquisitions would tend to follow domestic supply/import patterns and normal transportation routes. Nevertheless, problems could arise. For example, members of a potential cartel (bauxite, perhaps) could conceivably withhold supplies in order to defeat the purposes of an anticartel stockpile. In that case, shifts to other sources, including whatever domestic sources may be available, would probably be difficult if not impossible,

Disposals would involve equitability of allocations to domestic consumers, a potential matter of concern for the agency administering the stockpile. The allocation programs enacted by the Federal Energy Administration demonstrate the public sensitivity to equitable distribution of supplies and the difficulties in obtaining adequate solutions.

Acquisitions and disposals may also be affected by how such time factors as the duration of an emergency situation or the time required to obtain certain materials impact on various stockpiles. This subject is discussed in the following section.

b. Time Factors. Time factors which must be considered prior to materials acquisitions and disposals include: the duration of the materials to be stored, the time to acquire materials, and the time to make materials available to consumers. The duration of the materials problem—i.e., whether it is temporary or of indefinite extent—will influence the need for and the timing of acquisitions, as well as the total life of the stockpile. A short-term supply disruption may, for example, require consideration of seasonal and regional variations. The duration of the materials problem is related to the probability of its occurring within certain time limits. The latter is in turn a factor in the decision criteria governing the quantity and timing of stockpile actions.

The time needed to acquire materials may depend on the availability of unused productive facilities in the United States and in foreign supplying countries. This factor emphasizes the importance of forward planning within the terms of normal production cycles, The time needed to make materials

77-119 0-76-11

available to consumers during stockpile disposals may vary with the type of stockpile specified. Such short-term problems as nonpolitical supply disruptions would involve more rapid movement to the usage site than such long-term problems as cartel actions.

c. Form of Material.—In general, the form of material specified should be at that stage of processing which permits the widest application in end uses and which in effect stockpiles significant inputs of time, labor, transportation, and energy. In the case of metals, the basic refinery shape meets these criteria. The stockpiling of metals in earlier stages, such as ores or concentrates, would require further processing in domestic plants before the material can be used and could result in lost time, especially in the case of short-term supply disruptions. Exceptions to this general standard may occur, as in the case of ferroalloying materials. For these it may be desirable to stockpile not only certain ferroalloys but also ores/concentrates to provide some flexibility in the ferroalloys produced domestically. At the other end of the production line, stockpiling of special alloys or of mill shapes would demand a multitude of forms whose characteristics vary as requirements patterns change. In any event, technological developments in production or consumption could result in changes in the basic forms stockpiled, such as through upgrading or through exchanges.

Whether in metals or nonmetals, the type of stockpile specified may dictate variations from the standards described above. A short-term stockpile may suggest more readily usable forms than a long-term stockpile. In all cases, the availability of U.S. processing facilities—metal processors, petroleum refineries, etc.—to convert materials into the forms needed by consumers must be taken into account in the specification of material forms.

d. Locations and Storage.—Location and storage are also functions of the stockpiling policy objective. For short-term supply disruptions, the location should be closer to normal supply lines and to consumers' plants than that required to meet long-term problems. Since stockpiles for any consumers could involve a large number of relatively small stockpiles and a large number of storage warehouses, tanks, etc., the practical alternatives may be locations close to transportation facilities which would be accessible to several users.

The method of storage specified will depend upon the characteristics of the material involved, particularly its perishability. Protection against climatic elements may be desirable for some materials; protective packaging, for others. The choice of warehouses, tanks, or natural cavities will depend on the type of material and on the availability and relative costs of storage. Maintenance of the quality of those materials with potential deterioration must likewise be considered. This could require periodic review of materials status and possible rotation, i.e., disposal prior to deterioration and acquisition of an equivalent amount of "fresh" materials.

B. INFORMATION REQUIREMENTS FOR AN ECONOMIC STOCKPILE

The Decision Criteria Model sets the realistic and practical boundaries on how much, and what kind of data and information are required for economic stockpiling. Each of the four components of the Decision Criteria Model requires pertinent information which must be refined through a combination of manual and automated mechanisms from the general mass of domestic and foreign data and information. The second and fourth components are economic models which involve simulation of specifically quantifiable conditions. The first and third components are largely judgmental functions involving selec-

tive decisionmaking by materials experts; however, they are supported by automatic mechanisms which manipulate huge quantities of data to produce the relevant and highly organized information subsets required by the machine functions.

This section is a discussion of the information required to support the four components of the Decision Criteria Model discussed above; therefore, it contains data elements of three levels: (1) general information to support the methodology of any stockpiling policy, (2) unique or specific data elements applicable to a particular policy, and (3) unique data elements applicable to a particular material under consideration for a given policy.

1. General Information Requirements

Once a policy objective is defined, analysis must be conducted as to what materials to stockpile and the economic benefits of doing so. The Materials Selection Criteria are guidelines which materials experts can use to scrutinize the data and information available to them and identify those materials most directly relevant to the problems which an economic stockpile could alleviate. Calculations are then made to estimate the net economic benefits of stockpiling these Problem-Related Materials.

Two operations are needed to support these materials experts: (1) a technical information center where all hardcopy documentation relevant to stockpiling can be analyzed, classified, and then grouped into materials categories; and (2) a computer-support facility where a large number of automated data bases may be scanned.

a. Materials Selection Criteria.—The materials selection criteria utilized to select a group of materials to satisfy a particular stockpile policy consists of two or more questions applicable to each material, Table VI-1 is a matrix which contains five rows corresponding to the five stockpiling policies. The 12 columns contain the selection criteria which should be asked to determine whether or not a material is related to the problem which the policy is designed to solve. The marked intersections on the matrix indicate the questions which are applied to any material for that stockpiling policy.

Any of the 12 indicated questions as applied to a material and a specific stockpiling policy is highly subjective and requires considerable information to support the decision process. From the point of view of information requirements, the sum total of information available from literature, interviews, relevance trees, and human experience is required to determine whether or not a specific material passes the initial selection test for a particular policy and should therefore be analyzed with the economic welfare model.

For example, in “high degree of import dependence, ” how high must the import dependence be for a material to be selected, how is that number quantified, and what information is required to derive the number? Similar questions can be asked of each selection criteria. In each case, if the quantified number is increased (or decreased), additional materials will be rejected (or accepted) from the list for any policy. Of course, some of these materials may be rejected later through application of the cost/benefit functions in the economic welfare model.

It should be possible to establish a quantifiable relationship between data concerning activities related to a selected material and the materials selection criteria related to a particular stockpiling policy. However, care must be taken to assure that the number of subjective assumptions necessary to quantify that relationship does not produce an answer of less validity than a direct subjective estimate made by experts.

b. Economic Welfare Model .—The economic welfare model is based on determining the costs and benefits of stocking specific materials to achieve a policy objective. Since cost and benefit functions can be specified in a quantitative form, it is logical to assume that data items (numbers) can be assigned to each

Table VI-1 —Materials selection criteria applied to selected stockpile policies

Selected Stockpile Policies	Materials selection criteria: Economically and Technologically significant	High degree of import dependence	High potential for political control and price	High degree of concentration of supply	Growing scarcity occasioned by increasingly lower grade resources	Significant volatility of domestic prices	Wide fluctuations in domestic supply/demand	High degree of international trade	Significant volatility of international prices	Wide fluctuations in international supply/demand	Potential for international commodity agreements	Potential for foreign policy benefits
1. Discourage/counteract cartel/unilateral political actions affecting price or supply.	x	x	x									
2. Cushion the impact of nonpolitical import disruptions.	x	x		x								
3. Assist in international materials market stabilization.	x				x							
4. Maintain minimum supply of scarce domestic materials.	x					x	x					
5. Provide a market for temporarv surpluses and ease temporary shortages.	x							x	x	x	x	x

element in the cost/benefit functions. These items may not be easily derived, however, and may require the development of some quantitative data through subjective reasoning.

The cost function has been defined to consist of the external cost (EC), the holding cost (HC), and the loss in domestic consumer surplus (LCS). The significant data items which are required for computation of the cost function (dollars versus quantity) can be listed as follows.

- Storage and administrative cost in $/unit
- Rate of stock loss in units/time
- Interest rate in percent per annum (or other)
- Unit cost of stocks in $
- Fixed costs for initialization of the stockpile in $
- Stockpile size in units
- U.S. supply at price P
- Supply elasticity
- U.S. demand at price P
- Demand elasticity
- Equilibrium price (world) in $
- World price elasticity
- Damage and spoilage storage costs in $/unit or $/time
- Loss in consumer surplus costs in $
- Indirect cost in $

These cost items can be established for each stockpiling policy, and they are different for each material, Time also causes a change in the costs and must be taken into account.

The benefit functions are unique to each stockpiling policy and consist of summations of quantified benefits arrived at through solution of individual benefit equations. These equations, in turn, consist of elements for which quantitative data must be determined,

c. Specification of Functional Nature of Stockpile.—The nature of a stockpile has been discussed as consisting of seven main categories: administration and control, acquisition, disposal, form, location, storage, and rotation.

The administration and control of all stockpiles will be similar and can be considered as general to all policies. The information required for administration and control will include detailed and timely data to allow analysis, policy decision, operations, and monitoring,

Table VI–Z contains the seven categories of information and indicates the required information element for each. These information elements are general and should be determined for each stockpiling policy and specific material.

2. Unique Information Requirements

As discussed in an earlier section, the data requirements for the materials selection criteria, the functional nature, and the cost functions of the decision criteria are fairly general and apply to all stockpiling policies. The information elements for developing the benefit functions are specific to each stockpiling policy and will be discussed here.

Table VI–3 contains a summary matrix of the specific data items which are required (for each material) in order to calculate the benefit functions for each stockpiling policy. This table illustrates the similarity of data items for SP-1, –2, –3, -4, and –5. Further discussion of these data items can be found in chapter V.

3. Requirements for a Materials Information System

The required Materials Information System (MIS) consists of a manual and an automated segment.

The manual segment of the MIS consists of a physical library or “hardcopy” data base and manually applied formulae, procedures, and methodology. The data base is developed through the information gathering and

Table VI–2.—Information elements required for specifications categories

Information elements	Administration and control	Acquisition	Disposal	Form	Location	Storage	Rotation
User location	....	....	....	....	x	....	....
Financing costs	×	....	....	....	....	....	....
Operating costs	×	....	....	....	....	....	....
Materials pricing	×	x	....	....	....	....	....
Distribution costs	×	....	x	....	....	....	....
Storage costs	×	....	....	....	....	x	....
Import/export regulations	×	x	....	....	....	....	....
Storage locations	×	....	....	....	x	....	....
Storage forms	×	x	....	×	....	x	....
Storage quantities	×	x	....	....	....	x	....
Storage life	×	....	....	×	....	x	x
Material sources	×	x	....	....	....	....	....
Material users	×	....	x	....	....	....	....
Supply lines/distribution	×	x	x	....	x	....	....
Local and national laws	×	....	....	....	....	....	....
Other stockpiles (transfers)	×	x	x	....	....	....	....
Quantities available	×	x	x	....	....	....	....
Potential supply disruptions	×	x	x	....	....	....	....
Seasonal supply variations	×	x	x	....	....	....	....
Time to acquire	×	x	....	....	....	....	....
Imported suppliers	×	x	....	....	....	....	....
Domestic suppliers	×	x	....	....	....	....	....
Transportation vulnerability	×	x	x	....	x	....	....
Availability timing	....	....	x	×	....	....	x
User demand fluctuation	....	....	....	....	....	....	x
Stockpile duration	×	....	x	....	....	....	....
User equitability	....	....	x	....	....	....	x

Table VI–3.—Specific data items required for stockpile policies

Stockpile policy					Specific data items
1	2	3	4	5	
x	×	....	....	....	r =Risk aversion faCtOr
x	....	....	....	....	D=Damage of the action without stockpiling
x	....	....	....	....	D'=Damage counteracted with the stockpile
x	....	....	....	....	P =Probability of the action without stockpiling
x	....	....	....	....	P'=Probability of the action when a stockpile exists
x	x	x	....	....	i =The % import disruption
x	x	....	....	....	k =The duration of the disruption in months
x	x	....	....	....	S'ik =Supply when the action occurs without stockpiling
x	x	....	....	....	S_{ijk} =Producer supply with disposal of the stockpile

Table VI–3 Specific data items required for stockpile policies—continued

Stockpile policy					Specific data items
1	2	3	4	5	
x	x				p'ik 'price when the action occurs without stockpiling
x	x				p'i,k 'price With disposal of the stockpile
x	x				d'ik =Demand when the action occurs without stockpiling
x	x				d'ijk =Demand with disposal of the stockpile
x	x				EDijk =External costs saved by the disposal of the stockpile
	x				D'ijk =Damage offset by stockpile j
	x				P_ik =Probability of the interruption occurring
			x		P_o =Price in current time period without stockpile acquisition
			x		P~$_j$ =Price in current time period with acquisition of stockpile j
			x		P_t =Price in future time period without stockpile disposal
			x		P'tj =Price in future time period with disposal of stockpile j
		x		x	t =Portion of surplus-shortage cycle occurring in the coming time period
			x		t_f =Time horizon; years between current time and future time
			x		Q_{oj} =Size of stockpile j accumulated in current time period
			x		Q_{tj} =Size of stockpile j disposed in future time period
			x		ED_{tj} =External damages saved in future time period with disposal of stockpile j
		x		x	CS_j =Increase in consumer surplus
		x		x	AC_j =Decrease in average production
		x		x	ED_j =External damage-external costs saved
		x		x	cp_j =Unit cost of production saved by stabilization due to stockpiling
		x		x	S_a =Domestic production of material over the entire cycle
		x		x	g =Fraction reflecting distribution of prices over fluctuation range
		x		x	ph =High price without stockpile
		x		x	phj =High price with disposal of stockpile j
		x		x	pi =Low price without stockpile
		x		x	pl_j =Low price with acquisition of stockpile j
		x		x	dh =High demand without stockpile
		x		x	d'h_j =High demand with disposal of stockpile j
		x		x	d_l =Low demand without stockpile
		x		x	d'l_j =Low demand with acquisition of stockpile j
		x			PBj =Political benefits
		x			f =Fraction of stockpile costs obligated by the U.S.
		x			cj =Cost of stockpile j obligated by the U.S.

cataloging of (1) literature, (2) interviews, (3) relevance trees, and (4) bibliography. The automated segment of the MIS consists of an automated data base, storage and retrieval capability, automated analysis, and report generation,

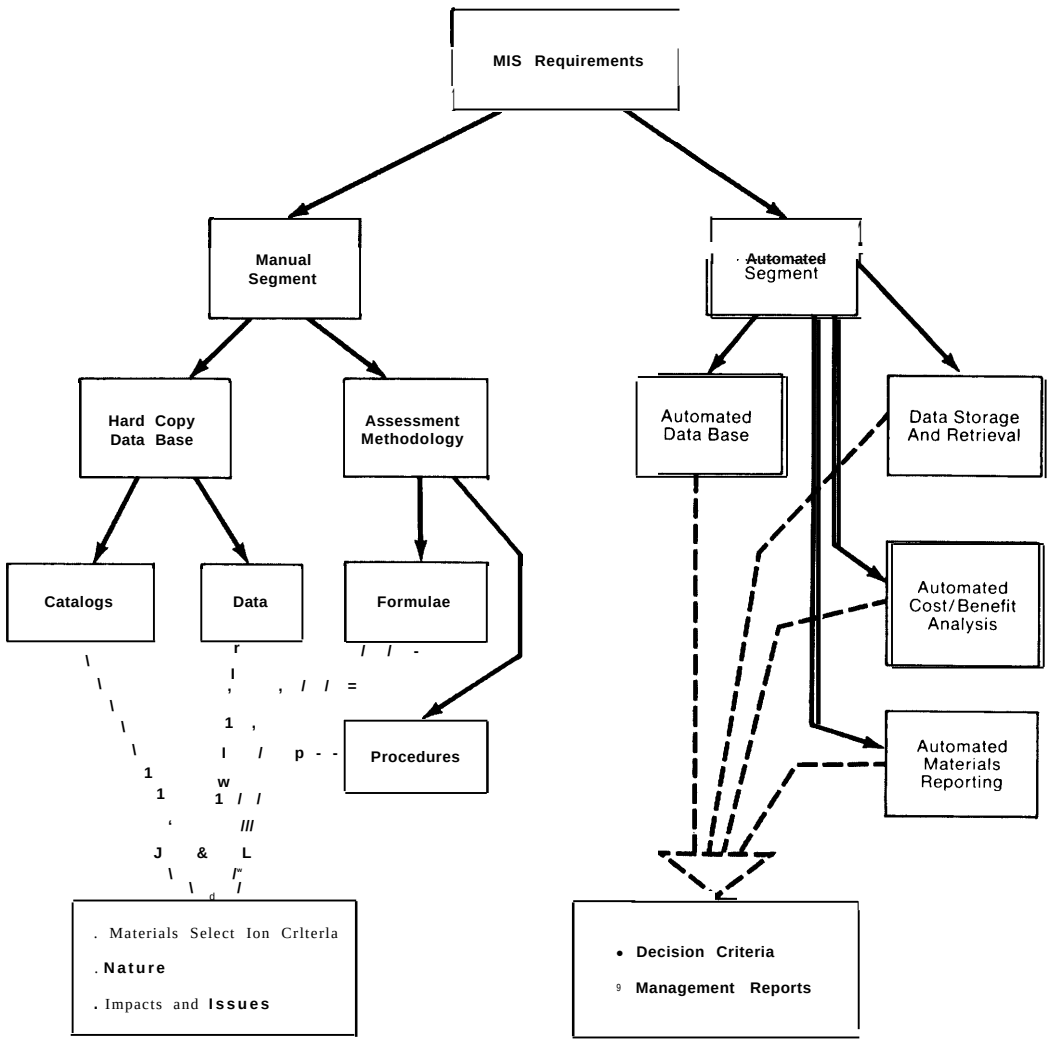
a. Manual Segment.—The "hardcopy" data base can be utilized in conjunction with manual techniques to perform the analysis of stockpiling policies through application of the Materials Selection Criteria, description of the nature of the stockpiles, assessment of the impacts and issues, and development of the final stockpile specification,

b. Automated Segment.—The automated data base, MIS storage and retrieval capability, automated analysis, and report generation capabilities can be used for

- Modeling and futures analysis,
- Automated cost/benefit analysis, and
- Automated materials stockpile management reporting.

Figure VI–1 illustrates the Materials Information System.

Figure VI-I.
Materials Information System



c. MIS Implementation.—The implementation of the automated segment of the Materials Information System is illustrated in figure VI–2,

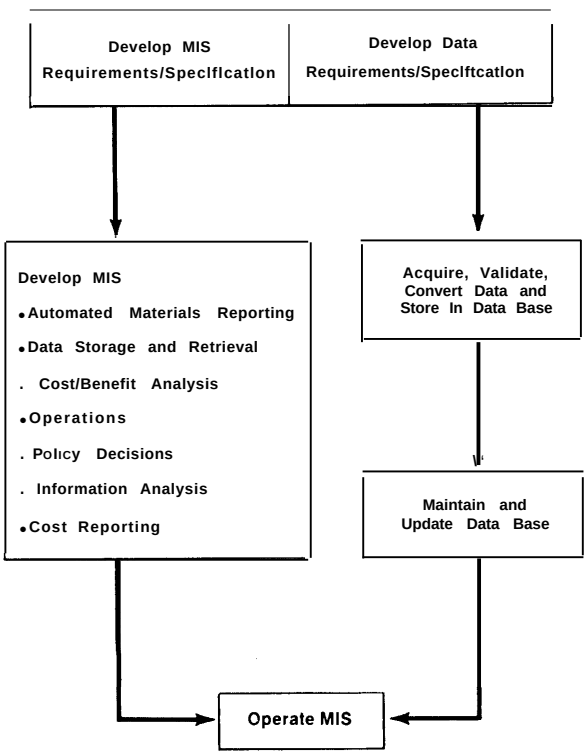
Once the MIS requirements and data requirements have been developed, the next step is to develop the Detailed MIS specification, to include

- Hardware,
- Software, and
- System capabilities.

The detailed data specification must be developed to include

- Specific data items,
- Source, and
- Update frequency.

Figure VI-2.
Automated MIS Implementation



The MIS system must be implemented to include

- Automated materials reporting,
- Data storage and retrieval,
- Cost/benefit analysis,
- Operations status reporting,
- Policy Decision Reporting,
- Information analysis, and
- Cost reporting.

The data base can be implemented by acquisition, validation, conversion, storage of data, and update and maintenance of the data.

4. Conclusions Regarding Information Requirements

In terms of any given material being considered for stockpiling action, specific information is required for each of the special physical, geographic, technological, economic, social, political, historical, and forecasting characteristics of modes of production, processing, transportation, marketing, consumption, conservation, storage, disposal, and cyclic reutilization.

The detailed materials information system should include: (1) a system specification and (2) data specification. An effort should be begun to acquire, validate, and catalog all required data elements to support an economic stockpile if and when it is implemented. In the act establishing the National Commission on Supplies and Shortages, the Congress listed two items which pinpoint explicit inabilities of the United States to coordinate, transfer, and manage data and information. To identify these specific information elements is a task which has not yet been done; however, the Office of Technology Assessment is currently conducting an assessment of Materials Information Systems.

C. ORGANIZATIONAL OPTIONS FOR ESTABLISHING AN ECONOMIC STOCKPILE

The success of an economic stockpiling program could depend in large part on the type of organization established to administer it, especially its ability to operate independently in the national interest, free of influence by special groups, whether inside or outside Government. To a considerable extent, the history of the strategic stockpile has been one of diverse pressures imposed from several directions—the executive branch, legislative branch, producing industries, and consuming industries. Not uncommonly, the interests of the latter two groups were reflected in those of the first two, and there is no reason to expect that an economic stockpile might fare differently, unless there is a concerted effort to avoid such situations.

1. Safeguards Against Stockpile Abuse

A primary concern is the need to establish safeguards which would minimize if not eliminate politically based decisions. A stockpile authority independent of both the executive and legislative branches of the Government may be desirable for this purpose. The stockpile authority should be flexible enough to manage any type of stockpile or combination of stockpiles with a minimum of adjustments. Depending upon its legislative mandate, for example, an economic stockpile could be in any of the several institutional arrangements discussed in chapter VIII.

2. Control of Economic Stockpile

Regardless of how it is organized, the matter of how an economic stockpile will be controlled is a factor which could determine its success or failure as a national policy. Stockpile control is important for several reasons, among which are maintaining an accurate inventory status, preventing theft or other types of stockpile losses, and insuring that the stockpile is specified in the most suitable manner in terms of material acquisition and disposal,

The principal decision regarding stockpile control is whether or not Congress should regularly approve stockpiling actions or leave those day-to-day operations to the stockpile agency (wherever it is located) and exercise control through annual or semiannual oversight, Regardless of whether Congress opts for direct, operational control or general oversight, an economic stockpile will have to be carefully coordinated within the Federal Government so as not to work at cross-purposes with other national or international programs, Moreover, some decision will have to be made regarding whether or not, how, and to what degree stockpiling operations need to be insulated from the political uses of the stockpile to serve special-interest groups, As pointed out in chapter II, the ramifications of a national economic stockpile are so enormous and so attractive that one can expect great pressure to be exerted on the agency responsible for material acquisition and disposal,

Obviously, responsibility for the broad policy direction and oversight is lodged with Congress and, as indicated in chapter VIII, should be incorporated into basic legislation establishing the economic stockpile. It is noteworthy that the Stockpiling Act of 1946 made Congress a key part of the operational procedure with absolute veto power over disposals, On the other hand, the legislation is silent about the policy decisions or judgments which led to the calculation of surpluses which could then be disposed, Such an omission could be fatal to any proposed legislation establishing an economic stockpile. Congressional power over appropriations eliminates any parallel problems with respect to acquisition programs.

Another lesson to be learned from the strategic stockpile experience is the need for

more expeditious action by Congress with respect to agency disposal plans. Delays of weeks, even months, in completing hearings and taking action regarding the strategic stockpile were not uncommon, While this may be the normal and expected procedure, it should be realized that an economic stockpile will have to react much faster than the strategic stockpile in meeting supply disruptions and price increases, With prices and market conditions changing at an increasingly rapid pace, an extension in stockpiling action could well obviate the mandated purpose of the stockpile. Economic stockpiling is a temporary solution to certain materials problems, thus the ability to act swiftly in overcoming these problems is a factor which should not be overlooked or minimized.

3. Organizational Capabilities

The structure of an administering agency designed to achieve the goals described above could have three organizational capabilities, These capabilities are as follows:

a. A central agency responsible for overall direction of the program, policy formulation, and congressional relations;

b, An organization possessing computer resources; and

c. An organization responsible for day to day operations such as acquisition, disposal, storage, etc.

In addition, there could be professional and support staff in each of the Government agencies with responsibilities related to or affected by the economic stockpile program.

The experience of the strategic stockpile program in the above activities under the Office of Emergency Preparedness (OEP) is enlightening.[1] The first activity was performed for the strategic stockpile program by OEP itself. Since that agency was responsible for a large number of different programs, a substantial number of staff members devoted time to more than one program. However, that agency did have a stockpile policy division which was almost exclusively concerned with the strategic stockpile, Additionally, considerable attention was paid to stockpile matters by members of the Director's Office, the Assistant Director's Office with his assignment, and the planning staff. Together, it is estimated that perhaps 20 man-years per annum were devoted to the stockpile program in OEP proper.

In addition to regular professional staff, OEP, through the Assistant Director for Resource Analysis, provided direction and control over the Mathematics Computation Laboratory (MCL) of the Corps of Engineers, This group had a staff of about 110 persons, including programmers, systems analysts, economists, etc. The unit possessed a Univac 1108 and a full complement of peripheral equipment. Perhaps 20 to 25 percent of the total effort was expended to support the stockpile program in a continuing effort to update data banks, improve analytic techniques, keep stockpile objectives current, and the like,

Work on the stockpile program was also performed in the Federal agencies with responsibilities affected by the program. OEP transferred almost $2 million a years to other agencies for work on defense planning. Almost one-half was transferred to the Business and Defense Services Administration (now Bureau of Domestic Commerce) of the Department of Commerce, which played a large role in developing material supply estimates and requirements for the civilian (including industrial) economy. With the major contribution coming from Interior and Commerce (State and Defense to a lesser degree), it is estimated that 30 man-years were invested in the stockpile program by Federal agencies other than OEP.

[1] OEP became OP (Office of Preparedness) in 1973. Its functions were transferred to the General Services Administration in 1973; and it is now known as the Federal Preparedness Agency (FPA).

[2] 1965–70 conditions in terms of salaries, etc.

D. INTERRELATIONSHIP OF AN ECONOMIC STOCKPILE WITH OTHER MATERIALS POLICIES

An economic stockpile cannot be operated in a vacuum without reference to the environment in which it exists. That environment includes the following real or potential factors: (I) implementing one or more stockpiling policies simultaneously; (2) existing U.S. national stockpiles, including the strategic stockpile; (3) foreign national stockpiles; (4) international stockpiles; (5) other U.S. materials policies; and the entire fabric of foreign economic policy. In the context of implementing and operating an economic stockpile, the managing agency should consider the complex interrelationships with these various factors and their effects on such things as benefits, costs, materials availability, the American consumer, and foreign relations.

1. Implementing Multiple Stockpiling Policies

The analysis of the five stockpiling policies has been conducted as though each policy were totally independent of the other four; however, as a practical matter this independence probably would not exist. It is quite possible that a stockpile dealing with import disruptions resulting from cartel and cartel-like actions (SP–1) would be implemented simultaneously with a stockpile dealing with temporary, nonpolitical import disruptions (SP-2). Moreover, a stockpile designed to achieve domestic market stability (SP-5) could be implemented along with one designed to achieve international market stability. For that matter, any combination of two or more of the five stockpiles could be simultaneously implemented as appropriate to meet the various policy objectives.

The problems of instituting or operating two or more stockpiles simultaneously would not necessarily be additive in scope or difficulty. Depending upon specific policies involved, there may be a considerable degree of commonality in various aspects of the specified stockpiles, e.g., the form of the materials. Furthermore, the net result of acquisition or disposal decisions and actions could preclude the necessity for several such independent actions for the same material.

Interrelationships in the simultaneous operation of multiple economic stockpiling policies will be briefly discussed in the following categories:

- Administration,
- Materials and Budget Costs,
- Economic Welfare Model,
- Stockpile Nature, and
- Information Requirements.

a. Administration.—The administrative aspects of an economic stockpile probably provide the greatest degree of commonality among a combination of stockpiles. A single agency, with increments of personnel as needed, should be able to manage any number of stockpiles. The creation of a single administrative agency which is established to acquire, hold, and release materials in response to specific stockpiling policies under a strict set of regulations may be required to preclude impacts on the U.S. economy which outweigh the benefits of economic stockpiling.

b. Materials and Budget Costs.—As indicated above, the same materials may be stockpiled for more than one policy objective. For example, out of the total of 33 materials being considered for 1 or more stockpiles, 16 are involved in at least 2 stockpiles (2 in 4 different stockpiles, 4 in 3 stockpiles, and 10 in 2 stockpiles). See chapter III, table 111-4, for a display of these materials.

Acquisition costs and other costs of two or more stockpiles operated simultaneously will vary by material and the quantities needed. Where a certain quantity of a particular material serves more than one stockpiling ob-

jective, the acquisition costs and related costs are reduced in proportion. Savings in administrative and management costs will be limited by the degree of overlapping of function.

c. Economic Welfare Model.—Because each Economic Welfare Model applies to a specific stockpiling policy, individual determinations based on these models must be made separately, However, all policy development should consider the most efficient method of arriving at the net effect of several simultaneous, or nearly simultaneous, actions, taking into account the interrelationships of their economic, social, political, and legal impacts.

d. Stockpile Nature.—The form in which a specific material should be stockpiled, the method of acquisition (by purchase, transfer, or exchange), the method of disposal, the timing of acquisitions and disposals, the method of storage, the location, and the degree of rotation may or may not differ among stockpiling policies. A high degree of commonality of these elements would, of course, limit the problems in specifying multiple stockpiling policies.

e. Information Requirements.—Information requirements will tend to be similar for more than one stockpile, In fact, some information needs may be common to all of the five policies.

f. Summary.—The potential is large for achieving the objectives of two or more economic stockpiling policies simultaneously with a minimum of duplicate effort and duplicate burden on the economy. Arriving at the most effective and most efficient stockpile wouId have to be the responsibility of an administrative agency operating within established ground rules, taking into account all relevant factors and the net effects of several simultaneous or nearly simultaneous actions.

2. Existing U.S. National Stockpiles

The United States maintains several stockpiles for strategic purposes, each acquired under a different legislative authority, One is the national stockpile acquired in the open market, under the authority of the Stockpiling Act of 1946. The second is the Defense Production Act inventory which, under the Defense Production Act of 1950, was accumulated through the acquisition of generally premium-priced materials purchased as an incentive to expand production. As permitted by the Defense Production Act, these materials can be released by the Director of OEP at any time without legislative approval, but they cannot be sold at less than market price. The third stockpile is the Supplemental Stockpile, consisting of an inventory of materials acquired as the result of barter of agricultural surpluses for strategic materials, under the authority of the Agricultural Trade Development and Assistance Act of 1954. By statute, the release and disposal of these materials is governed by the provisions of the Stockpiling Act.

Notwithstanding the fact that materials have been acquired under three separate authorities, and placed in three separate inventories, all materials of specification grade are credited to the strategic stockpile objectives. Furthermore, they are all drawn upon as necessary in developing a strategic distribution of the materials in storage areas adjacent to points of consumption but out of target areas. Material reserves in the strategic stockpile are based upon the defined length of a possible war. In 1944, this was defined to be 5 years; in 1958, it was reduced to 3 years; and in 1959 the “Six-Month Rule” was adopted under which the maximum objective was to be not less than 6 months use by U.S. industry during periods of active demand. Until 1962, the inventories and objectives of these stockpiles were classified and were closely guarded secrets. In addition to these, there are special stockpiles such as the Energy Research and Development Administration (ERDA) stockpiles and the Naval Petroleum Reserves.

The analysis in this assessment has shown that whether or not it was intended, the strategic stockpile has created effects beyond its intended purpose and its legislative mandate. Furthermore, in periods of high industrial demand the strategic stockpile has increasingly been subjected to demands from industry for release of materials in short supply. The redefining of the length of the war has continually resulted in materials being declared surplus and available for disposal. For material to be sold from the strategic stockpile, it must be both declared surplus and approved by Congress. The revenue from the materials sales reverts to the Treasury for general use.

The strategic stockpile has been the subject of various governmental studies, including those by the Federal Preparedness Agency and the General Accounting Office. The National Security Council is currently conducting an interagency study on the operation of the strategic and critical materials stockpiles. While the content of this study has not been released, it may result in a directive to revise the guidelines and objectives governing the strategic stockpile program. Possible changes could include a better resolution of the problem of meeting stockpile objectives in a timely fashion without significantly affecting domestic or international markets. Another possible change is an extension of the definition of national emergencies to include periods of severe supply disruptions, whether or not they are related to wartime conditions. The feasibility of combining one or more economic stockpiles with existing stockpiles must be weighed against the advantages and disadvantages of entirely separate systems, taking into account their various goals and ramifications.

3. Foreign National Stockpiles

The same threats of supply disruptions of foreign source materials which could seriously affect the United States can also damage the economies of other nations. Many countries are more foreign source material dependent than the United States and have planned and/or initiated economic stockpiles or variations thereof as a form of self-protection. The U.S. Government must consider the implications of such developments in foreign countries in arriving at an economic stockpiling policy for this country. A detailed analysis of economic stockpiling in selected countries is presented in appendix c.

4. International Stockpiles

International stockpiles may have more significant impacts on U.S. policy than would individual foreign stockpiles. International stockpiles would likely be related to international commodity agreements, and the number of countries and materials would probably be larger than for foreign national stockpiles.

The international tin buffer stocks, as part of the International Tin Agreement (which the United States has recently signed and submitted to the U.S. Senate for advice and consent to ratification), is an existing example of an international stockpile. This agreement is described in detail in chapter VII.

The possibilities of economic cooperation and of market and price stabilization (or manipulation) among producers, consumers, or combinations of both in the application of international stockpiles could be extensive in scope and effect. In this assessment, such a stockpile is considered an alternative arrangement to a national stockpile. U.S. participation in the management of such a stockpile would be but one consideration of the economic, legal, and political aspects of international stockpiles.

5. Other U.S. Materials Policies

National materials policy encompasses the total range of public and private decisions which impinge on the supply and demand of all types of materials. Materials policy has been the subject of many discussions and studies, including that by the National Commission on Materials Policy, whose report was published in June 1973. It has also been a sub-

ject of concern by Congress as discussed in chapter I.

One significant aspect of national materials policy was set forth in the Mining and Minerals Policy Act of 1970, The act states that it is the continuing policy of the Federal Government in the national interest to foster and encourage private enterprise in (1) the development of economically sound and stable domestic mining, minerals, metal, and mineral reclamation industries; (z) the orderly and economic development of domestic mineral resources, reserves, and reclamation of metals and minerals to help assure satisfaction of industrial, security, and environmental needs; **(3)** mining, mineral, and metallurgical research, including the natural and reclaimable mineral resources; and (4) the study and development of methods for the disposal, control, and reclamation of minerals waste products and mined land, in order to lessen any adverse impact of mineral extraction and processing upon the physical environment which may result from mining or mineral activities,

Economic stockpiling policy development should be considered as part of a national strategy for combating materials supply and price problems, and such development should be coordinated among the responsible governmental, industrial, and public agencies,

E. BUDGET IMPLICATIONS OF AN ECONOMIC STOCKPILE

As one component of the Decision Criteria, the Economic Welfare Model takes into account the overall economic benefits and costs-both gross and net—applicable to a specific economic stockpiling policy. Some of the cost elements in this model are likewise components of the Operating Cost Model. However, the latter is used not to help arrive at a measure of the net economic benefits to society, but rather to estimate the out-of-pocket costs which, as budget outlays, are of concern to the stockpile operator, namely, the Federal Government. One fundamental difference between the Economic Welfare Model and the Operating Cost Model is the inclusion in the latter of the capital required for the acquisition of material for a stockpile. The Economic Welfare Model, on the other hand, neutralizes this cost as offset by the value of the stockpiled material.

Budget costs are incurred during each operational phase of an economic stockpile: the acquisition, holding, and disposal phases. Such costs for a particular stockpile might be as large or even larger than the economic costs of the stockpile. The exact size of such operations will depend on the precise objectives and timing of implementations in relation to the existing U.S. and world situation,

1. Method of Financing an Economic Stockpile

Acquisition and disposal transactions can be dealt with in several ways in the fiscal system, Congress can authorize the outlays for acquisition, either open ended or up to some predetermined limit, permitting it to be financed by borrowings from the Treasury to be repaid from appropriations after the fact. Or an independent corporation might be set up with nominal capitalization and authority to borrow for its current needs. Either of these methods essentially bypasses the budget-appropriations process and may allow the stockpile managers limited or unlimited freedom to roll over the funds in selling and buying, with little or no fiscal control. There are ample precedents for both.

An alternative is to keep the acquisition/disposal financing within the normal budget-appropriation process, appropriating funds each year against budget estimates or prospective acquisitions and disposals. In this way the stockpile operation can be kept within

budget limitations and be subject to congressional and executive fiscal control. Admittedly, this alternative presents problems of anticipation and flexibility which the other alternatives avoid by more open-ended arrangements. It requires that stockpile managers, acting pursuant to authorizations under stockpiling legislation for specified purposes (as represented by the several stockpiling policies), present to the Office of Management and Budget (OMB) annual estimates of their prospective budgetary requirements for acquisition and disposal to be included in the budget and subject to appropriations legislation. Thus stockpile managers will be required to account for their activities, past and prospective, in defining their budget requests both to OMB and Congress. The necessary flexibility might be achieved by an appropriation of an uncommitted revolving fund which, in combination with multiyear appropriations, would enable the stockpile managers to respond quickly to contingencies or market situations. The revolving fund could be restored after the fact by regular or, if necessary, supplemental appropriations. On the other hand, proceeds from stockpile disposals, except perhaps those generated by price stabilization actions, would not be available for a revolving fund. These would be treated as offsets in determining amounts to be budgeted and appropriated.

2. Discussion of Operating Cost Model

This section describes the Operating Cost Model which can be used to estimate the operating costs for an economic stockpile. Following a discussion of the model, illustrative calculations are made for each of the five stockpiling policies, using the same materials previously used in the impacts analysis to specify the functional nature of the stockpiles for each of the stockpiling policies, For illustrative purposes, it is assumed that each of these stockpiles would be implemented separately.

a. Operating Cost Equation.—The basic operating cost equation consists of adding the initialization cost, the acquisition cost, the holding cost, and the disposal cost, then subtracting from that the capital gains so that

$$OC = IC + AC + HC + DC - CG \quad (26)$$

where

IC (Initialization Cost) = $C_f + C_iQ =$ Fixed cost of initialization + (variable unit cost of initialization x stockpile size)

AC (Acquisition Cost) = C_UQ = Unit cost X size of acquisition =

HC (Holding Cost) $(S + dc_u + ic_u) Q$ [Storage and administrative cost per unit + (rate of stock loss X unit cost) + (interest rate X unit cost] x stockpile size

DC (Disposal Cost) = $C_dQ_{d_1} =$ Unit cost of disposal X size of disposal

CG (Capital Gain) = $Q_{d_p}] - Qa_p2 =$ (Size of disposal X unit price of disposal) - (size of acquisition X unit price of acquisition)

Each element in equation will vary from policy to policy and from material to material. In addition to the quantities of materials and the timing involved in acquisition and disposal which are determined using the Economic Welfare Model, the operating cost model includes the following considerations:

- Acquisition sources,
- Form of material,
- Location,

. Storage, and

. Rotation,

For a detailed discussion of the above considerations, see section A(z) of this chapter.

b. Administrative Costs.—These will be virtually the same regardless of how many materials are included in the stockpile. The administrative organization should be so structured as to include the following elements: information gathering, information analysis, policy decisions, and operations. It is estimated that annual administrative costs for an economic stockpile would be $500,000.

3. Estimation **of Operating Costs**

This section describes the factors in the Operating Cost Model and presents calculations for each of the stockpiling policies. The quantity of material used and the options selected for each of the factors in the calculations used to specify the stockpile nature were selected by materials experts as being reasonable approaches. These calculations should not be taken as definitive, but rather as illustrative of the method of calculating the operating costs of an economic stockpile.

a. SP–1: Discourage or Counteract Cartel or Unilateral Political Actions Affecting Price or Supply.

(1) Stockpile of l/z billion barrels Of petroleum.

(2) Acquisition sources.—Although there has been some discussion about bartering wheat or other surplus agricultural products for petroleum, it is assumed that acquisition would be by direct purchase, partly from foreign sources and partly from domestic sources.

(3) Form of material.—This stockpile may consist wholly of crude oil, wholly of petroleum products, or of a combination of the two. In turn, petroleum products may be entirely of one specific type, for example, gasoline of a certain octane rating or of a mixture of many products in innumerable combinations. For the purpose of this stockpile it is assumed that only crude petroleum would be inventoried, as the basic refinery feed stock from which all petroleum products could be derived for specific applications. Assuming a mixture of both foreign and domestic crude, it would be such as to pose an average acquisition price of $10.30 per barrel, including an increase of 30 cents per barrel resulting from the stockpile acquisition.

(4) Location.—To provide the maximum inhibiting effect of a crude oil stockpile on cartel or cartel-like actions, it would be desirable to locate this material close to consumers (refineries), thus limiting transportation costs and time to availability when needed.

(5) Storage.—Five options for storing petroleum have been suggested as follows: shut-in oil wells, conventional steel tanks, onshore salt domes, offshore salt domes, and offshore nuclear-created rock caverns. On the basis of availability, leadtime, and costs, onshore salt domes are selected as the most feasible method. The one-time acquisition cost for salt dome storage facilities is estimated at $5 per barrel. Annual cost estimates range from $0.60 to $1 per barrel; the high figure is chosen for the purposes of this assessment.

(6) Rotation.—The absence of loss by deterioration of crude oil precludes the need for inventory rotation.

(7) Summary of operating costs,—Taking into account the factors described above, operating costs for this stockpile are estimated as follows, for the first 2 years of its operation:

77-119 0-76-12

First year

	$ billion
OC = IC = Cf + C i Q = $0.5 million+ ($5)X500 million barrels	= 2,5
+AC = C_UQ = $10.30 (500 million barrels)	‘5.2
+HC = (s+dc_u+icu)Q = [$1+0 +0.08 ($10.30)]1.5 billion barrels	=0,9
+DC	=O.O
-CG	=0.0
	8.6

Second year
OC-CiQ-AC = $912.5

b. SP–2: Cushion the Impact of Nonpolitical Import Disruption

(1) Stockpile of 100,000 short tons of zinc.

(2) Acquisition sources.—The acquisition of zinc could involve purchase, transfer from the strategic/critical material stockpile, or barter for surplus agricultural commodities. It is assumed that the zinc from this stockpile would be purchased, from both domestic and foreign sources.

(3) Form of material.—To achieve maximum flexibility in the use of this material, when it is disposed of, it should be in the form of slab zinc,

(4) Location .—Proximity of the stockpile to using plants is more significant than is nearness to producing plants, The former would facilitate the flow of zinc to using plants in temporary shortage situations. While the stockpile is being accumulated, time would be available to move material from producing plants to the stockpile site.

(5) Storage.—Zinc could be stored as slabs stacked in the open on Government-owned land.

(6) Rotation.—Zinc slabs do not deteriorate in quality from exposure to the elements and a rotation program is not necessary.

(7) Summary of operating costs.—Taking into account the factors described above, the first year's operating costs for this stockpile are estimated as follows:

	$ million
OC = IC = Cf+CiQ = $0.5 million+ (0) 100,000 tons	= 0 . 5
+AC = C_UQ = $720(100,000 tons)	= 72.0
+HC = (S+dcu+.icu)Q = [$0.10+0+0.08($720)] 100,000 tons	= 5.8
+DC	= 0.0
-CG	= 0.0
	78.3

C. SP–3: Assist in International Materials Market Stabilization.

(1) Stockpile of 20,000 long tons of tin.

(2) Acquisition sources.—The acquisition of tin could involve purchase, transfer from the strategic/critical material stockpile, or barter for surplus agricultural commodities. It is assumed that tin for this stockpile would be purchased entirely from foreign sources; production of tin from domestic resources is negligible.

(3) Form of material.—Tin would be stockpiled in the form of pig tin, allowing flexibility in its end uses.

(4) Location.--Since this material would be purchased from abroad, the stockpile location would be significant only with respect to proximity to consumers.

(5) Storage.—Pig tin would be stacked in the open on Government-owned land.

(6) Rotation.—Although there could be some quality deterioration in pig tin, it would not be significant and rotation would be minimal.

(7) Summary of operating costs.—Taking into account the factors described above, the first year's operating costs for this stockpile are estimated as follows:

	$ million
OC = IC = Cf+ CiQ = $0.5+ (0)20,000 tons	= 0.5
+AC = C_UQ = $7,588(20,000 tons)	= 152.0

(1) Stockpile of 1,000 short tons of contained tungsten trioxide in ores and concentrates.

(2) Acquisition sources.—Tungsten would be purchased from domestic sources only. This stockpile is designed to assure that tungsten is both produced and consumed at a rate which differs from that which results from a market not thus influenced by Government intervention.

(3) Form of material.—Tungsten would be stockpiled in the form of ores and concentrates, permitting flexibility in its conversion to various forms of tungsten intermediate and end products.

(4) Location.—In view of the relatively long period of time involved in the life of this stockpile, its location is not important in relation to proximity to producers or users.

(5) Storage.—Tungsten ores and concentrates would be stored in cans placed in Government-owned warehouses.

(6) Rotation.—Tungsten ores and concentrates stored in cans in enclosed warehouses do not deteriorate and require no rotation.

(7) Summary of operating costs.—Taking into account the factors described above, the first year's operating costs for this stockpile are estimated as follows:

	$ million
OC = IC = $C_f + C_i Q$ = $0.5 million + (0) 1,000 tons	= 0.5
+ AC = $C_u Q$ = $9,011 (1,000 tons)	= 9.0
+ HC = $(s + dc_u + ic_u) Q$ = [$2.50 + 0.08($9,011)] 1,000 tons	= 0.7
+ DC	= 0.0
- CG	= 0.0
	10.2

e. SP–5: Provide a Market for Temporary Surpluses and Ease Temporary Shortages.

(1) Stockpile of 500,000 short tons of copper.

(2) Acquisition sources. -copper for this stockpile would be purchased from domestic producers during periods when surpluses develop for which market demand is depressed or otherwise insufficient at market prices,

(3) Form of material.--Copper would be stockpiled in the form of copper ingot or wire bar, forms which provide maximum flexibility in fabrication into mill shapes or for conversion into "specification ingots" in combination with other materials, for use by foundries.

(4) Location.—Because of the short-term acquisition and disposal aspects of this stockpile it would be desirable to locate the copper at locations reasonably accessible to both producers and consumers.

(5) Storage. -Copper would be stored in ingots or wire bars stacked in the open on Government-owned land.

(6) Rotation. -Copper ingots and wire bars stored in the open do not undergo quality deterioration and rotation of this material would not be necessary.

(7) Summary of operating costs.—Taking into account the factors described above, the first year's operating costs for this stockpile are estimated as follows:

	$ million
OC = IC = $C_f + C_i Q$ = $0.5 million + (0) 500,000 tons	= 0.5
+ AC = $C_u Q$ = $1,089 (500,000 tons)	= 544.5
+ HC = $(S + dc_u + ic_u) Q$ = [$0.39 + 0 + 0.08($1,089)] 500,000 tons	= 43.8
+ DC	= 0.0
–CG	= 0.0
	588.3