
Chapter III

SPECIFIC PURPOSES OF ECONOMIC STOCKPILING

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This chapter is a discussion of the overall operation of an economic stockpile and the rationale used in selecting specific policies and materials for detailed assessment. The following information is presented:

- Conceptual logic of economic stockpiling;
- Development of economic stockpiling policies for initial consideration;
- Interviews with U.S. business, labor, government, and civic action groups;
- Classification of stockpiling policies for detailed analysis; and
- Decision Criteria—a model for developing and implementing economic stockpiling.

A. CONCEPTUAL LOGIC OF ECONOMIC STOCKPILING

From the point of view of economic policy, any materials stockpile involves three basic considerations: first, the possible national purposes which the stockpile might achieve; second, the economic trends and cycles anticipated during the overall stockpiling operation of buying, holding, and selling to achieve the policy objective; and third, the types of benefits and costs which accrue to the country in general as a result of stockpiling.

1. Possible Functions of an Economic Stockpile

A stockpile is an inventory of supplies whether maintained by private individuals and business enterprises or by the Federal Government. Inventories maintained for private purposes are held for convenience, for continuity of supply under a variety of conditions of supply disruptions, for anticipation of price increases, and for several other reasons.

Stockpiles maintained by the Federal Government can also serve a variety of purposes, as the following list indicates:

- Provide source of supply for short-term national shortages,
- Deter monopolistic control of supply,
- Stabilize supply/demand through buffer stock, and
- Provide support to price support programs,

a. Provide Source of Supply for Short-Term National Shortages.—National stockpiles have been established to provide the supply of critical materials for use during wartime and other national emergencies. Stockpiles established under the Strategic Stockpile Act of 1946 still exist, but are limited to use during wartime emergency conditions.

Economic stockpiles can serve similar roles in providing continuity of supply for foreign source materials; for other emergency disruptions of supply such as natural disasters, prolonged labor strikes in the source country, or transportation bottlenecks; and for embargoes as in the recent petroleum restriction by the OPEC countries.

Inventories are customarily maintained by the private sector to provide continuity of supply between orders and are based on cost considerations which could include potential disruptions. However, industrial and commercial users may not individually account for remote possibilities or may not have information to adequately guard against the possibilities. The function of a national economic stockpile would be to serve as insurance against remote, but disastrous occurrences, and the stock would supplement the protection customarily maintained by the private sector.

b. Deter Monopolistic Control of Supply.—Where material producers might form cartels to impose monopolistic pricing and where the United States is a major consumer, the existence of an adequate stockpile could provide the competitive source to restrain monopolistic control. This stockpile would be most effective where the producer countries' economies are highly dependent upon the production of the material, as the economies may not be able to sustain reduced production while attempting to organize and impose monopolistic controls. Many of the source countries in which cartelization is possible are developing countries whose economies are dependent upon their mineral resources. Thus, where cartelization is a significant threat, the formation of a U.S. economic stockpile could serve as an effective counterthreat. The size of the economic stockpile would be an important element in the effectiveness of this stockpile function, as the stockpile must exceed the committed resources of the potential cartel.

c. Stabilize Supply or Demand Through Buffer Stock.—Many raw materials are subject to wide variations in demand which are

nonseasonal, resulting in wide variations in both prices and production of raw material. These variations in production disrupt revenues and employment and can create major social hardships, if not inefficiencies in production, due to idle capacities during low production periods and use of inefficient facilities and equipment during periods of peak production. Wide variations in prices and availabilities of raw materials also create inefficiencies in the consuming industries for similar reasons. A national economic stockpile could serve as a buffer stock to cushion these impacts by absorbing some of the production during periods of low demand and dispensing stocks during times of unusually high demand. Such use of the stockpile could help stabilize production and material availability, and result in more efficient resources utilization for both the producers and the consumers. For internationally traded commodities, a stockpile serving this function in the principal consuming and producing countries could result in a more equitable distribution of stockpile resources and could probably result in more effective moderation of price and production variations.

More specialized versions of this buffer stock function can be served by a stockpile which is designed to accommodate special needs. For example, a "stockpile" for recycled materials generated by municipal waste management programs could provide a constant market so that municipal waste recycling programs would not be subject to widely fluctuating revenues. The purpose of this "stockpile" would not be to influence market prices for scrap material, but rather to stabilize the revenue for public interest ventures,

d. Provide Support to Price Support Programs.—Government price-support programs to encourage marginal and submarginal producers of critical materials can result in stockpiling if the program involves outright purchase by the Government. There are many reasons why the Government might provide support to marginal and submarginal

producers: maintain minimal domestic production, support the development of new technology such as the production of synthetic fuel, achieve welfare purposes such as maintaining employment levels in economically depressed areas. Government purchases leading to a stockpile may have certain advantages over direct production subsidies, depending upon the particular circumstances. A stockpile generated through a price-support program can be used for any of the functions served by a stockpile created from direct market purchases of commodities of equivalent specification,

2. Economic Trends and Cycles of Stockpiling

Any stockpiling operation has three phases: (1) buying, or otherwise acquiring, commodities; (2) holding these commodities; and (3) selling or threatening to sell these commodities to achieve some benefit.¹ Because holding costs may continue throughout all three of these phases in the operation of a stockpile, the decision to continue holding stocks, or to buy or sell, must be periodically reviewed in terms of an assumed future time of operation, and the net benefits (i. e., benefits minus costs, which may be either positive or negative) must be estimated by assuming a particular economic scenario.

Within these operational phases, it is useful to consider stockpiling in terms of the factors of anticipated economic conditions during a cycle of use, and the purpose of stockpiling under these conditions. Over the anticipated lifetime of a stockpile, the policy can be designed in anticipation of (1) fluctuating commodity prices superimposed on a long-time, constant average price; (2) a general trend toward increasing prices; or (3) a general trend toward decreasing prices. For each of these conditions, a stockpile might conceivably be designed either to minimize the deviation from a constant price or accept the

deviations and attempt to use them to benefit some segment of producers or consumers. Five types of economic stockpiles for these conditions are discussed as follows:

a. Stockpile: Type 1.—A stockpile designed to minimize the extent of these fluctuations is the case usually considered in discussions of economic stockpiling. Such fluctuations include the situation in which a cartel is formed to raise the price of a mineral product—not only to the price of potential production from alternate, undeveloped sources, but above this price in the expectation that the high price can be maintained until the alternate sources are brought into production and the latter can then be slightly undercut. A stockpile could provide a deterrent to this action by forcing the cartel to sustain a loss of sales until the stockpile is exhausted. Using a stockpile to deter market fluctuation is the most commonly considered example; however, cartels are not the only cause of relatively sudden changes in commodity prices. Other causes and the resulting stockpile possibilities can be considered as well.

b. Stockpile: Type 2.—In contrast to Type 1, this stockpile could involve accepting the fluctuation price for the general market but providing a stockpile to shelter a particular group of producers or consumers from the full extent of fluctuations. For example, scrap prices may undergo wide variations. A recycling facility for urban waste which depends on the sale of scrap at near-average prices for economic feasibility might be greatly benefited by a stockpile which bought only the recycled output during times of low prices and sold scrap during times of high price. This stockpile would be intended not to reduce price fluctuations, but to minimize adverse loss (or even extract net benefit) for a particular industry in the public interest. Such a stockpile would require much less investment than one which would require a sufficient volume of stocks to affect market prices.

c. Stockpile: Type 3.—A generally rising price might eventually bring presently marginal sources into production. It may

¹See chs. IV and V for a discussion of how the conceptual logic of economic stockpiling provides the framework for the economic impact analysis,

therefore be in the public interest to hasten production from such sources through a third type of stockpile—a publicly supported stockpile which purchases only from such marginal sources. For example, oil prices seem likely to rise as world supplies are slowly exhausted. The desirability of a U.S. oil stockpile to discourage another oil embargo is therefore being implemented. Purchasing oil for this stockpile on the open market may tend to increase the already high prices. If instead, the stockpile were slowly built up by purchasing only U.S. made synthetic oil, double purposes would be served of creating a synthetic fuel and of deterring cartel actions. The alternative of direct subsidy for the synthetic-fuel industry and direct purchase of petroleum for the stockpile may be preferable, but the policy of stockpiling synthetic oil needs to be examined. If carried out successfully, it might actually reduce the rate of price increase through the development of a synthetic-fuel industry,

d. Stockpile: Type 4.—This stockpile offers the potential for making money by holding commodities in anticipation of higher prices. There may be reason to take measures, including stockpiling of selected materials or commodities, for which one may be able to anticipate a future technology and use or demand that may be difficult or inefficient to fulfill in the future in the absence of present preparation. Stockpiling in the present to meet a future use or demand may be compared with saving or, more importantly, if it stimulates technology and the economy, with investment. A federally-supported stockpile for this purpose would be in competition with private speculators and would achieve any profits at the expense of producers and consumers. This type of stockpile does not appear likely to be in the public interest on first examination,

e. Stockpile: Type 5.—A fifth type of stockpile could sustain otherwise declining prices for a while through massive purchases but would eventually suffer heavy losses. Like type 4, this stockpile was not considered further because it does not appear to offer any net benefits.

3. Types of Benefits and Costs Involved in Economic Stockpiling

There are four types of benefits and costs involved in the life-cycle operation of an economic stockpile. These include:

- The direct benefits and costs to materials producers,
- The direct benefits and costs to materials consumers,
- The benefits and costs borne by the stockpile investor, and
- The external benefits and costs to the economy in general.

The first two types of benefits and costs cited above are directly related to the two general interest groups impacted by economic stockpiling: materials producers and materials consumers. To assess the real impact of a public policy on economic stockpiling, one must identify the relative benefits and costs which accrue to each of these interest groups as a result of stockpiling. Other parties which are impacted must also be considered, but an analysis can begin with these two directly impacted groups. In special situations, an economic stockpile might benefit only one party and produce a cost (loss) to the other party. Even so, however, stockpiling might still be considered in the national interest if the benefits are large, or if political considerations override economic costs.

The two parties concerned with stockpiling a particular commodity can be further divided into three categories, depending on whether the impacted party is predominantly domestic, foreign, or mixed to a significant extent. In considering benefits and losses expected to accrue to the United States from a particular stockpiling policy, this distinction is important. Benefits or costs to parties outside the United States may be omitted from an estimate of the benefits to the United States, but should still be considered as an aspect of foreign policy.

In addition to the parties directly impacted, an economic stockpile will also have indirect

economic impacts upon the stockpile investor and create external benefits or costs to the economy in general. The investor might be the Federal Government which would be responsible for allocating the funds required to initiate and operate the stockpile. External costs or benefits would not be to direct consumers of the commodity, but to consumers of products made from the commodity. These indirect impacts on the general economy must be addressed separately from the gains or losses of the principal interest groups so that the relative economic impacts of a materials stockpile can be determined.

4. Rationale for Federal Government Support of Economic Stockpiling

The justification for strategic stockpiles to provide materials critical to national survival during wartime is evident. Under less critical conditions, the question of whether the public interest will be served by an economic stockpile must be carefully assessed. The private-sector producers and consumers maintain their own inventory to serve their particular needs. Since continuity of their own operations is a major motivation for their stockpiling practices, self-interest compels their action to include consideration of the functions which a Government economic stockpile might serve. Clearly, however, the adequacy of the protection provided will depend upon the perceived threats, availability of capital and allocation to competitive uses, and the management attitudes and policies concerning risks.

There are a number of reasons why private inventories will not be adequate. Industrial and commercial inventories are generally based on "normal" uncertainties arising from past experiences, while potential supply disruptions due to politically motivated embargoes, natural disasters, and other reasons for which a national stockpile might be maintained are long-shot risks and are highly erratic occurrences. Even if industrial managers do foresee possible supply disruptions due to

these occurrences, their assessment of the risks may be inaccurate with respect to the timing or the magnitude. Furthermore, and perhaps most important, private investments do not account for the secondary costs or negative externalities arising from a shortage—possible unemployment in both the consuming industry and their customers, as well as the impact of higher prices on the material and its products. A further consideration includes the fact that, even though some private inventories may be adequate to accommodate the disruptions, the smaller firms and the marginal firms may be severely handicapped.

It is unlikely that private inventories, however conscious of potential cartelization of the material supply, will be adequate to deter the formation of cartels and their consequent monopolistic controls for most materials. Private resources and efforts for combating cartelization are unlikely to be successful without the support of the Federal Government. Should the threat of monopolistic control be great enough, there appears to be justification for considering a national economic stockpile as one means of deterring such possibilities. This point of view is supported by the overwhelming approval given to an economic stockpile for insuring materials supply by industry representatives interviewed for this assessment.

The justification of Federal Government maintenance of buffer stocks to stabilize material supply and demand is much more controversial and depends upon the extent and nature of governmental involvement. The case for governmental involvement depends upon whether or not it can be demonstrated that the Government can impartially and equitably moderate market forces without impairing the American market mechanisms and whether the achievable stabilization is worth the costs of the Government enterprise. Buffer stocks maintained in support of international commodity agreements constitute a form of Government involvement which may be beneficial. Also, the justification for a

specialized stockpile—like that, for example, in support of a waste material recycle program where the intent is to assist municipal governments without attempting to influence the general market—is a worthwhile consideration.

The justification for an economic stockpile developed as an integral part of price-support programs will depend upon the feasibility of the price-support program and upon the function to be served by the stockpile.

5. Total **Net Benefits of Economic Stockpiling**

The task of this assessment is to ascertain

whether or not an economic stockpile will yield total net benefits to society. The total net benefits to society of an economic stockpile can be determined as a function of separate economic, political, and social, net benefits. If these separate benefits could be quantified in dollars, the total net benefits to society could then be determined. However, this is not easily accomplished, since only the economic net benefits (in dollars) can be fully determined using quantitative methods, and even these contain qualitative variables. The remaining political and social benefits can only be determined using qualitative methods. For a further analysis of these benefits see chapters IV and V.

B. DEVELOPMENT OF ECONOMIC STOCKPILING POLICIES FOR INITIAL CONSIDERATION

The socio-politico-economic system in which the materials production and distribution activities exist is a complex mechanism which is difficult to understand. Often good solutions to problems turn out to be poor ones in the light of broader overviews, and attempts to institute controls in one sector can produce unwanted impacts in other sectors because of unknown and unanticipated relationships among the system elements. Because critical materials, almost by definition, have many trails into the economic system, investigation of problems for which stockpiling might be a suitable option requires a systematic, problem-oriented analysis. In general, this means embedding the problem within the largest tractable network of influences, constraints, and controls; consideration of all reasonable alternatives; and careful assessment of the impacts of potential actions under clearly defined criteria.

1. National Policy Objectives

It is especially important to select for analysis stockpiling policies which can be related to a set of higher national objectives, such

as those listed below from the National Commission on Materials Policy:

- Provide adequate energy and materials supplies to satisfy not only the basic needs of nutrition, shelter, and health, but a dynamic economy, without indulgence in waste;
- Rely on market forces as a prime determinant of the mix of imports and domestic production in the field of materials but at the same time decrease and prevent wherever necessary a dangerous and costly dependence on imports;
- Accomplish the foregoing objectives while protecting or enhancing the environment in which we live;
- Conserve our natural resources and environment by treating waste materials as resources and returning them either to use or, in a harmless condition, to the eco-system; and
- Institute coordinated resource policy planning which recognizes the inter-

relationships among materials, energy, and the environment. ²

The identification of such national policies, however directly or indirectly stated, should be considered in order to assess, first, whether or not a set of stockpiling policies is sufficiently comprehensive to address today's materials problems, and second, to allow identification of alternatives to stockpiling in relation to a higher level policy objective.

For practical purposes, this assessment considered the multitude of various impacts and issues surrounding each stockpiling policy as separate and independent from the complexities of any other policy. It is possible, however, that several policies could be implemented simultaneously. This suggests that stockpiling policies can be considered in terms of their interrelationships. The simultaneous operation of two or more stockpiling policies would not necessarily add further difficulty, since there may be a great degree of commonality between them. One stockpiling policy may, for example, achieve objectives similar to those of other policies, or two different policies may require the same materials.

2. Eleven Stockpiling Policies (SP) Studied

The various functions which might be served by economic stockpiling can be further specified to achieve particular policy objectives. Eleven such purposes have been identified and are defined below.

a. Discourage or Counteract Cartel or Unilateral Political Actions Affecting Price or Supply.—This stockpiling policy would be directed to a foreign country or combination of countries with the power to affect the price and supply of materials to the United States. The recent multiplying of prices by the oil cartel is an example of the type of situation to which this stockpiling policy could be directed.

Recent actions on bauxite, copper, and iron ore are other examples of such concerns.

b. Cushion the Impact of Nonpolitical Import Disruption.—This stockpiling policy would support the maintenance of operations which depend on foreign source materials. Disruption of imports could result from strikes, shipping problems, disasters, business actions, or any number of nonpolitical events which could not be overcome by the adjustment of prices.

c. Assist in International Materials Market Stabilization.—This stockpiling policy is designed to help stabilize world prices. Since many prices are more volatile abroad than in the United States and have a secondary effect on U.S. prices, it would be advisable to counteract such wide price movements when they first gain impetus. This could include stockpiling in cooperation with other nations or international organizations.

d. Conserve Scarce Domestic Materials.—This stockpiling policy would discourage current consumption of a scarce material by raising the price of the material through stockpile purchases. This policy is worth considering only if a scarce material is thought to have a greater social value in the future.

e. Provide a Market for Temporary Surpluses and Ease Temporary Shortages.—This stockpiling policy would reduce the undesirable economic and societal consequences of temporary surpluses or shortages of selected materials. Dampening wide swings in prices, reducing or eliminating the shortage/surplus caused by unemployment stoppages, and reducing the necessity for increased capital outlays are possible benefits from implementation.

f. Support Domestic Production of Selected Foreign Source Materials.—This stockpiling policy would provide a market to encourage domestic production of materials not competitive with foreign sources regardless of price. It could also be used to decrease and prevent, whenever possible, a dangerous

²NCMP, *Material Needs and the Environment*. The National Commission on Materials Policy, June 1973.

and costly dependence of the United States upon foreign nations for supplies of these materials in times of national emergency. Purchases in the 1950's of chrome, manganese, and tungsten are examples of maintaining or encouraging domestic production of foreign source material.

g. Support Friendly Nations in the Event of Temporary Materials Shortages in Those Countries.—This stockpiling policy would supply friendly nations in the event of materials shortages.

h. Increase and/or Maintain Foreign Country Production of Materials.—This stockpiling policy would maintain the flow of materials from foreign countries, especially during depressed economic times when purchases by U.S. industry might be minimal or even cut off completely,

i. Commodity Trading Between the United States and Foreign Countries.—This stockpiling policy would implement barter arrangements between the United States and foreign countries. Barter arrangements could include the trading of perishable commodities, usually expensive to store, for nonperishable industrial materials. An example of this was

the United States' trading of wheat to India for manganese. An attempt might also be made to obtain a quid pro quo in terms of needed materials for military or economic aid to foreign countries. A possibility might be the exchange of wheat for chromite ore or petroleum from the U.S.S.R.

j. Advance New Technology for Materials Supply.—This stockpiling policy would provide an assured market to stimulate the private development of new technology for materials production which might otherwise lie dormant for lack of urgency or financial support. The purchase of titanium sponge in recent times is a prime example. Purchase contracts utilizing such technologies could provide materials for the stockpile without interfering with industrial demands for raw materials, enhance domestic capacity for continued production, and reduce dependency on foreign sources of supply.

k. Encourage Recycling.—This stockpiling policy would support the domestic recycling of selected materials by providing a temporary market pending the development of a continuous market based on new technology or improved economics.

C. INTERVIEWS WITH U.S. BUSINESS, LABOR, GOVERNMENT, AND CIVIC ACTION GROUPS

Selected interviews were conducted with individuals in American business, labor, government, and civic action agencies. The objectives of the interviews were twofold: (1) to ascertain the views of people with materials expertise regarding the feasibility of the 11 stockpiling policies and the criteria by which one decides what materials should be included in an economic stockpile; and (2) to obtain information relative to the impacts and issues which bear directly upon implementing one or more of the stockpiling policies. The findings of the interviews are grouped below in seven categories.

(1) Use of an economic stockpile by the Government to support prices or ease price pressure is considered risk laden, susceptible to powerful political pressure, and likely to cause substantial disruption in domestic and international markets, s

(2) There is general support among the interviewees of the policies which deal with cartels and nonpolitical import disruptions,

³This includes the political actions affecting price included in the first stockpiling policy to deter or counteract cartels.

although some individuals did express reservations about price elements. There were also reservations with regard to the SP's which directly imply market and price intervention. Where it existed, the intensity of feeling expressed in opposition to other SP's was much less than it was toward price-directed Government actions. As a matter of fact, reservations made to policy objectives other than price manipulation tend to be less philosophic and more pragmatic, with reservations frequently based upon the contention that an economic stockpiling program is not the best method of attaining stated policy objective.

(3) In only three cases out of 18 was the concept of an economic stockpile rejected categorically as unsuitable for any of the 11 policy objectives. In two other cases, acceptance was limited and hedged. In each of the remaining 13 interviews, there was complete acceptance of an economic stockpiling program as a feasible means for achieving one or more of the 11 policy objectives.

(4) Except for those interviewed who expressed a fundamental philosophical objection to economic stockpiling, a stockpile to lessen the impact of a supply interruption (whether politically inspired or not) received wide support. To those who have been heavily involved in stockpiling problems over a period of years, the foregoing conclusions are significant. If the same people had been queried prior to the OPEC oil embargo in the fall of 1973, the maximum number of affirmative responses might not have exceeded two, and might well have been zero instead of 13.

(5) The interviews make it quite clear that over the past 2 years a radical change has occurred in the way informed people think about economic stockpiling. Now only a small number oppose the concept on philosophical grounds. While the use of a stockpiling program to manipulate prices has virtually no support, expressions regarding the remaining policies are mixed. Much of the negative response reflects a belief that some alternative approaches (e.g., Government loans or loan

guarantees, direct subsidies, tax incentives, and the like) represent a more direct and effective way to achieve the objective of the stockpiling policy.

With respect to the feasibility of an economic stockpile, the implication of the interviews is self-evident. The creation of a stockpile to reduce the impact of supply interruption would tend to be well received by virtually all segments of our economic structure and social institutions. This presumes, of course, a high degree of dependence on a material critical to U.S. economic welfare for which a supply interruption, whether for political or nonpolitical reasons, is a significant possibility. Conversely, creation of a stockpile to manage prices is likely to face an opposite reception. For the remaining policies, reception would be mixed, depending in the final analysis upon a comparison with alternative means to achieving the same objective.

(6) A final word with respect to the interviews should be mentioned. Everyone addressing the subject stressed the degree of import dependence as a factor of domestic supply and availability. Consequently, it is clear that the greater the dependence, the greater the impact of a supply interruption and the more serious the economic injury to the Nation.

On the other hand, the actual distribution of a given shortage between the household/commercial sector and the industrial sectors can have a profound effect on the severity of the economic impact of a supply interruption. This raises two questions: (1) Is it possible to effect a degree of redistribution? and (2) Does the Government have the authority and the means to effect the distribution?

Both points were well illustrated in the 1973-74 OPEC oil embargo. It was possible to alter the distribution between the household/commercial sector and the industrial sectors; the Government had the authority to do so and an agency was available to do it. Through the oil allocation program, a disproportionate share of the shortage was distributed among the final consumers. Reduced

gasoline supply resulted in long lines at service stations, some increase in carpooling, some increased use of public transportation, some decrease in pleasure driving, and a substantial rise in public indignation. The economic effects of the OPEC embargo were discernible in reduced sales of large cars, lower demand for motel rooms, curtailed markets for recreational vehicles, and similar economic activities associated with automotive travel. While those effects may not be negligible and were especially severe to the businesses directly involved, they represent but a fraction of the economic injury which could have been anticipated if a greater share of the shortage had to be borne by the petrochemical industry, or any other industry

for which the (energy) input-output ratio is relatively rigid, at least in the short term.

At any rate, it is clear that in some cases the degree-of-dependence rule has to be modified to reflect the responsibility of reducing adverse economic effects by Government allocation actions. This would contemplate a trade-off between reduced unemployment and loss in GNP, on the one hand, and public indignation and/or rationing at the consumer level, on the other,

(7) Great concern was expressed in the interviews about the possible political use of an economic stockpile and the need to insulate the management of an economic stockpile from political pressure.

D. CLASSIFICATION OF STOCKPILING POLICIES FOR DETAILED ANALYSIS

The 11 stockpiling policies developed above were analyzed further to determine which ones should be treated in depth. While some degree of judgment is inherent in such a procedure, the technological and economic information background does exist and permitted a reasoned choice without undertaking a lengthy analysis of alternatives.

1. Problem Origin, Function, and Principal Impact Mode of Eleven Policies

Based upon the problem origin, function, and principal impact mode, the 11 policies defined earlier were organized in five categories. One stockpiling policy judged most important from each of the categories was selected for detailed analysis. Those policies, which are marked with an asterisk, have been numbered SP 1-5 and given an abbreviated title for easy reference,

a. Foreign—Cartel Response

- * SP-1: Discourage or Counteract Cartel or Unilateral Political Actions Affect-

ing Price or Supply (Political Disruptions).

b. Foreign—Nonpolitical Interruption

- * SP-2: Cushion the impact of Nonpolitical Import Disruptions (Nonpolitical Disruptions).

c. Foreign-General

- * SP-3: Assist in International Materials Market Stabilization (International Market),

Support Friendly Nations in the Event of Temporary Materials Shortages in Those Countries.

Increase and/or Maintain Foreign Country Production of Materials,

Commodity Trading Between the United States and Foreign Countries.

d. Domestic—Supply Oriented

- * SP-4: Conserve Scarce Domestic Materials by Reducing Current Consumption (Conservation).

Support Domestic Production of

Selected Foreign Source Materials.

Advance New Technology for Materials Supply.

Encourage Recycling.

e. Domestic-Price Oriented

- * SP-5: Provide a Market for Temporary Surpluses and Ease Temporary Shortages (Domestic Market).

2. Five Stockpiling Policies Selected for Detailed Analysis

The five selected policies can be considered in two main categories: (1) those dealing with problems of foreign origin, and (2) those dealing with domestic situations which might aggravate problems of foreign origin,

a. Category 1.—Stockpiling options in this category have three purposes: (1) discourage or counteract cartels; (2) insure temporary supply to U.S. consumers during nonpolitical, foreign supply interruptions; and (3) assist in international materials market stabilization.

An additional, secondary stockpiling function associated with the third option would be to assist other countries by providing supply during temporary shortages, by maintaining foreign production during temporary surpluses, or by using stocks in commodity trading.

b. Category 2.—Stockpiling options in this category include (1) conserving scarce domestic materials, and (2) reducing domestic price variations through transactions only with domestic producer and producers. Additional functions which could be associated with the first option are stockpiling to support substantially uneconomic domestic sources of imported materials at a minimal level to provide standby capacity, to provide a market for promising new production technologies during early development, and to develop or stabilize the market for production from a recycling center.

Table III-1 is a conceptual display of how the policies in these two categories might be used over the lifetime of an economic stockpile.

Em DECISION CRITERIA—A MODEL FOR DEVELOPING AND IMPLEMENTING ECONOMIC STOCKPILING POLICY

A fundamental proposition of this assessment is that the materials to be stockpiled must be directly related to the problem which the stockpiling policy is designed to alleviate. It is also clear that the materials will vary from one stockpile to another, both in number and in kind. For example, relatively few materials of certain types may be needed for a stockpile designed to overcome cartel actions which are limited in potential scope. On the other hand, a considerably larger number of materials of various kinds may be required for a stockpile aimed at compensating for temporary surpluses and temporary shortages in the economy as a whole.

Since there is no direct U.S. experience with stockpiling to achieve economic goals, there is

a need to consider the entire decision making process related to developing, implementing, and operating an economic stockpile. The decisionmaking model developed in the assessment (hereafter termed "Decision Criteria Model") provides guidelines for determining, first, whether or not to stockpile for economic reasons and, second, how to determine the optimal quantity of materials to acquire and disperse from the stockpile once it is established.

1. Components of the Decision Criteria Model

The Decision Criteria Model is composed of four components: (1) Materials Selection Criteria, (2) Economic Welfare Model, (3) Specification of Functional Nature of

Table 111-1.—Matrix of stockpiling policies and possible operational actions

“Stockpiling Policies	Operational actions		
	Acquisition	Holding	Disposal
SP-1: Discourage or Counteract Cartel or Unilateral Political Actions Affecting Price or Supply.	Buy primarily from foreign sources, preferably in periods of excess supply; or transfer from strategic/critical stockpile if available; or barter for surplus agricultural products.	For purposes of discouraging actions, hold indefinitely.	Sell or threaten to sell when supply restriction or price increase action occurs or appears imminent,
SP-2: Cushion the Impact of Nonpolitical Import Disruptions.	Buy from domestic and foreign sources or transfer from strategic/critical stockpile if available; or barter for surplus agricultural products	Hold until emergency conditions occur.	Sell to overcome temporary shortage conditions, for current use or addition to depleted industry inventory,
SP-3: Assist in International Materials Market Stabilization.	Buy from domestic or foreign producers in periods of low world demand.	Hold during period of normal world demand, until shortages develop.	Sell to domestic or foreign consumers during periods of high world demand.
SP-4: Conserve Scarce Materials by Reducing Current Consumption.	Buy from domestic sources even when no excess supply exists; to raise prices in order to discourage consumption and possibly to encourage domestic output from low-grade resources.	Hold until disposal is appropriate as shown.	Sell when future social value exceeds current value.
SP-5: Provide a Market for Temporary Surpluses and Ease Temporary Shortages,	Buy from domestic producers in periods of low domestic demand.	Hold during period of normal domestic demand, until shortages develop,	Sell to domestic consumers in periods of high domestic demand,

Stockpile, and (4) Operating Cost Model. The Materials Selection Criteria, which are developed and explained in this chapter, are basic considerations or guidelines to use in identifying the materials most directly related to the supply or price problem which the stockpiling policy is designed to alleviate. The Economic Welfare Model is a set of econometric equations which are based on the theory of welfare economics and which can be used to determine the benefits and costs to the United States of implementing an economic stockpile. The Functional Specification is a set of guidelines which can be followed in determining such factors as stockpile location and storage, the form of the materials, and the time

factors implicit in stockpiling decisions. Finally, the Operating Cost Model is a means of quantitatively estimating the direct, out-of-pocket costs to the U.S. Government of operating an economic stockpile. The Materials Selection Criteria are developed and explained immediately below; the Economic Welfare Model, in chapters IV and V; and the Functional Specification and the Operating Cost Model, in chapter VI.

2. Materials Selection Criteria

The selection of materials for each stockpiling policy involves a series of criteria directly related to the particular policy under con-

sideration. Some of these criteria are common to more than one policy. In fact, one criterion may be considered as common to all policies, i.e., the consideration as to whether the material is significant to the U.S. economy as a whole or technologically significant in the manufacture of components important to the U.S. economy. Petroleum and iron ore could qualify for the former, while platinum used in antipollution control devices in automobiles could qualify for the latter. It is apparent that definitions of "significant," "important," and the other terms mentioned will be needed, preferably in quantitative terms to the extent possible. This would be a proper function for the agency involved in stockpiling and would require a considerable amount of statistical computations and measurements. For the present assessment, selections were based on judgmental decisions by a limited group of persons knowledgeable in the materials field. These selections will therefore be illustrative rather than definitive.

Having determined that a material meets the first criterion applicable to each of the policies, one must then consider whether or not it also meets other criteria related to the policy under review. These Materials Selection Criteria are listed below, with brief descriptions of how each one is applicable to the five stockpiling policies considered in detail,

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

(1) Economic or technological significance: Materials of economic significance are those which are basic to manufacturing, construction, and ancillary industries, and without which these industries would be unable to operate. Petroleum and iron ore are examples. Materials of technological significance are those possessing specific inherent qualities or properties (often unique) which are critical to insure the functioning of industrial operations or technological processes. Platinum used in antipollution control devices in automobiles is an example.

(2) High degree of import dependence: This criterion need not refer to total or almost total dependence on imports. For petroleum, for example, the 30- to 40-percent import dependence is high enough to create supply and price concern. On the other hand, setting the degree of dependence too low would tend to blanket in an inordinate number of materials. The potential for substitution should be taken into account in measuring import dependence, but this becomes a difficult problem from at least two standpoints: the extent to which substitute materials can meet the performance standards of the original material, and the new intermaterial supply effects resulting from the substitution.

(3) High potential for political control of supply and price: This is the basic screening criterion for this stockpile. Materials with little or no potential for cartel or unilateral actions could be excluded from consideration at the time the stockpile is established, regardless of the other two elements described above. However, since the creation and effectiveness of cartels are subject to change, a continuing review of developments would be essential.

b. SP-2: Cushion the Impact of Non-political Import Disruptions.

(1) Economic or technological significance: Same as (1) under a, above.

(2) High degree of import dependence: Same as (2) under a, above.

(3) High degree of concentration of supply: This is the basic screening criterion for this stockpile. The total uncertainty of physical disasters, such as earthquakes, fires, explosions, and shipwrecks, could make every material vulnerable to nonpolitical import disruptions. Strikes either at producing installations or on shipping or distribution lines may be partially anticipated and must be monitored continually where periodic labor negotiations are involved, although wildcat strikes are wholly unpredictable. In any event, the seriousness of disruptions would follow from the degree to which supply is concentrated

geographically, through industrial combinations, or because of labor union relationships,

c. SP-3: Assist in International Materials Market Stabilization.

(1) Economic or technological significance: Same as (I) under a, above.

(2) High degree of international trade: International materials market stabilization involves those commodities in which international trade is a significant enough factor to influence stability in foreign markets and therefore in U.S. domestic markets.

(3) Significant volatility of international prices: Significant price volatility of commodities which are traded on an international basis often show wide degrees of fluctuation over short periods of time. As in the case of domestic price volatility, the degree and frequency of fluctuation provide indications of the extent to which stability is needed. These variations can be measured in import and export values or in such markets as the London Metal Exchange, in terms of departures from average price levels in a base period or of spreads between high and low prices over time.

d. SP-4: Conserve Scarce Domestic Materials.

(1) Economic or technological significance: Same as (1) under a, above.

(2) High degree of import dependence: Same as (2) under a, above.

(3) Significant lack of domestic availability: This is the basic screening criterion for this stockpile. The relative unavailability of domestic resources from which production can be pursued without recourse to governmental assistance will determine the extent to which a stockpile is necessary to achieve the policy objective set forth. The elements to be considered include the quality of the resources, present and future, their accessibility, and the potential for technological breakthroughs.

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

(1) Economic or technological significance: Same as (1) under a, above.

(2) Significant volatility of domestic prices: Since domestic price stability is the basic objective of this stockpile, estimates of price volatility as a measure of instability provide indications of the extent to which stability needs to be achieved. Price volatility as a reflection of supply/demand relationships during various phases of the business cycle could be measured, for example, in terms of variations from average price levels or of spreads between high and low prices for each material,

(3) Wide fluctuations in domestic demand/supply: This criterion supplements the price volatility measurements under (2). It could help delineate the extent to which supply surpluses or shortages are responsible for price variations and thus help determine those materials in which governmental intervention in the market place is likely to be most effective.

3. Modified Delphi Technique Used To Identify Problem-Related Materials

For the present assessment, materials have been selected based upon the judgments of a small group of people knowledgeable in the materials field. The primary goal "of these experts was to identify those materials which are directly related to the national problems which the stockpiling policies are designed to alleviate. In this way, a list of Problem-Related Materials was constructed: first, as a means of testing the economic and noneconomic impacts of implementing a stockpile to achieve economic purposes; and second, as illustrations of classes of materials which should be analyzed in more depth by the agency responsible for economic stockpiling. For these reasons, the materials selected in the assessment should be considered illustrative, rather than exhaustive,

The starting point for the materials experts in selecting materials for each of the five stockpiling policies was the list of materials

from Material Needs and the Environment (table 111-2). From this list, which is not intended to be a comprehensive catalog of all materials,

Table III-2.—Classifications of materials

MINERALS		Abrasives and Miscellaneous Minerals	
<i>Iron and Ferroalloy Ores</i>		Fuller's earth	Grinding pebbles and tube-mill liners
Iron	Cobalt	High-grade clay:	
Manganese	Molybdenum	Bantonite	Grindstone, pulpstones, and other special silica stone products
Tungsten	Nickel	Kaolin	
Chromium		Ball clay	Quartz, ground sand, and sandstone for abrasive purposes
<i>Other Metal Ores</i>		Miscellaneous high-grade clay	
Gold	Antimony	Feldspar	Tripoli and rottenstone
Silver	Cadmium	Mica sheet	Peat
Copper	Magnesium	Mica scrap	Diatomite
Lead	Platinum-group metals	Pumice and pumicite	Graphite
Zinc	Selenium	Talc and soapstone	Greensand
Bauxite	Tellurium	Emery and garnet	
Titanium	Tin	Vermiculite	
Uranium-radium-vanadium			
<i>Mineral Fuels</i>		FOREST PRODUCTS	
Anthracite	Natural gas	saw logs	Pulpwood
Bituminous coal and lignite	Natural gasoline	Veneer logs	Miscellaneous products
Crude petroleum	Liquefied petroleum gases	Fuel wood	
<i>Construction Minerals</i>		PAPER MATERIALS	
Dimension stone:	Sand and gravel:	Paper	Paperboard
Limestone	Construction sand		
Granite	Gravel	<i>NONFOOD AGRICULTURAL PRODUCTS</i>	
Slate	Glass sand	Cotton	Oil crops and others
Marble	Other industrial sand except for abrasives	wool	Rubber
Basalt		Fish products	
Sandstone			
Miscellaneous stone	Fire clay	PLASTICS	
Crushed and broken stone:	Magnesite	Polymers	Synthetic fibers
For cement manufacture	Common clay and shale	Elastomers	Other plastic materials
For lime manufacture	Gypsum		
Other limestone	Native asphalt and bitumens	CERAMICS	
Granite	Asbestos	<i>Construction Ceramics</i>	
Slate	Perlite	Glass	Cement
Marble	Shell	Brick	Tile
Basalt		Clay products	Mineral wool
Sandstone			
<i>Chemical and Fertilizer Minerals</i>		<i>Consumer Ceramics</i>	
Barite	Bromine	Glass containers	Pressed glass
Fluorspar	Calcium and calcium-magnesium chloride	China	Earthenware
Potash	Magnesium compounds	Pottery	Porcelain materials
Berates	Sodium carbonate		
Phosphate rock	Sodium sulfate	<i>Industrial Ceramics</i>	
Sodium chloride	Iodine	Pigments	Oxides
Sulfur and pyrites		Refractories	Asbestos products
Arsenious oxide		Abrasive products	
		<i>Electronic Ceramics</i>	
		Transistors	Semiconductors
		Capacitors	Ferrites and magnets

Source: "Material Needs and the Environment Today and Tomorrow," The National Commission on Materials Policy, June 1973.

two other lists were developed: first, a Key Materials List (table III-3) to be used in the computer simulations; and second, (table III-4), a list of identified materials which directly relate to the problems which the stockpiling policies are designed to alleviate.

Having determined that a material meets the first criterion of economic significance, the materials experts then considered whether or not it met the other selection criteria directly related to each of the five stockpiling policies being analyzed. To be included in the set of Problem-Related Materials for a particular policy, a commodity had to meet all of the selection criteria for that policy. Table III-4 displays the Problem-Related Materials for each of the five policies considered in detail.

One material for each of the five policies being studied was then selected from the list of Problem-Related Materials for use in the impacts analysis. These materials are:

- SP-1: Discourage or counteract cartels—petroleum;
- SP-2: Cushion the impact of nonpolitical import disruptions—zinc;
- SP-3: Assist in international materials market stabilization—tin;
- SP-4: Conserve scarce domestic material—tungsten;
- SP-5: Provide a market for temporary surplus and ease temporary shortages--copper.

Table III-3.—Key materials

Energy materials:

Fossil fuels:

- Petroleum
- coal
- Natural gas
- Uranium-thorium

Ferrous metals and minerals:

- Iron ore-steel
- Chromium
- cobalt
- Manganese
- Nickel
- Tungsten

Nonferrous metals and minerals:

- Bauxite-alumina-aluminum
- Copper
- Lead
- Platinum
- Tin
- Zinc**

Nonmetallic *minerals*:

- Asbestos
- Fluorspar
- Helium
- Industrial Diamond
- Potash

F i b e r s :

- cotton
- wool**

Petrochemicals--Plastics

- Forest Products
- Rubber
- Pharmaceuticals

Table III-4.—Problem-related materials for Stockpile Policies 1–5

Material	SP-1	SP-2	SP-3	SP-4	SP-5
Aluminum	***	X	***	....	X
Antimony . . . . .	***	....	...	....	X
Asbestos . . . . .	....	X	....	....	....
Bauxite	X	X	X	....	....
Chromate	X	X	....	....	X
Cobalt	X	..	....	....	***
Columbium . . . . .	....	X	....	....	X
Copper . . . . .	....	....	....	....	X
Fluorspar	X	X	....	X	...
Calcium . . . . .	....	X	....	....	***
Ilmenite . . . . .	....	X	....	....	***
Lead . . . . .	....	***	X	***	X
Manganese . . . . .	....	...	X	....	X
Mercury	X	...	....	....	X
Natural gas . . . . .	***	***	....	X	....
Nickel	***	X	....	X	....
Petroleum	X	***	***	X	....
Platinum group	X	....	....	....	X
Potash	***	X	...	....	....
Pyrite . . . . .	....	X	***	....	***
Selenium . . . . .	....	X	....	***	***
Silver . . . . .	***	..	....	***	X
Sulfur	***	X	***	....	X
Tantalum . . . . .	....	....	....	....	X
Tellurium	***	X	***	....	....
Tin	X	X	k	***	***
Titanium	***	X	....	***	....
Tungsten . . . . .	....	***	X	X	X
Uranium . . . . .	....	X	....	***	***
Vanadium . . . . .	....	***	***	....	X
Zinc	***	X	X	***	....
Zirconium	***	X	....	***	..
Natural rubber	X	X	X	..	X