HI-874/2-RR
MAY 15, 1968

EMERGENCY MOBILIZATION FOR POSTATTACK REORGANIZATION

FINAL REPORT

This report was prepared under Contract No. OCD-PS-65-64, Work Unit 3522A.

HUDSON INSTITUTE CROTON-ON-HUDSON, NEW YORK

66

FINAL REPORT

EMERGENCY MOBILIZATION FOR POSTATTACK REORGANIZATION

By

William M. Brown

with Appendices by:

Raymond D. Gastil
Quentin Ludgin

For

Office of Civil Defense
Office of the Secretary of the Army
Washington, D.C. 20310

HI-874/2-RR May 15, 1968

This report was prepared under Contract No. OCD-PS-65-64, Work Unit 3522A.

HUDSON INSTITUTE, INC.
Quaker Ridge Road
Croton-on-Hudson
New York 10520

TABLE OF CONTENTS

SUMMARY

FINAL REPORT

EMERGENCY MOBILIZATION FOR
POSTATTACK REORGANIZATION

By

William M. Brown

with Appendices by:

Raymond D. Gastil
Quentin Ludgin

For

Office of Civil Defense
Office of the Secretary of the Army
Washington, D.C. 20310

HI-874/2-RR May 15, 1968

This report was prepared under Contract
No. OCD-PS-65-64, Work Unit 3522A.

HUDSON INSTITUTE, INC.
Quaker Ridge Road
Croton-on-Hudson
New York 10520

BLANK PAGE

SUMMARY

This report examines two study areas which may need an increased emphasis in future postattack research. The first of these is the problem of the early postattack reorganization period. This is defined as the interval in which surviving institutions would attempt to begin functioning in the new environment. This could be a critical interval for any institution, one which would precede the postattack recovery period which is concerned with the subsequent viability and growth.

The second focus is upon countermeasures which can be implemented during a time of crisis through mobilizing the population for civil defense action; that is, a concept which would allow--in certain circumstances--the major costs of postattack recovery countermeasures to be deferred to the time of need.

The major finding is that the threat to U.S. society during the reorganization period may be very great. In some scenarios which can be visualized, this threat may be enormous--particularly if some anticipatory preparations are not made. An illustrative brief scenario of this type is presented.

Section I presents a perspective on the postattack research problem which argues that the crisis orientation is the appropriate framework from which to view countermeasures for both long-term recovery and short-term reorganization.

Section II defines and discusses the reorganization period and its potential problems. A number of metaphors are developed to clarify and accentuate the threats to U.S. society and to provide some analogs for thinking about these threats. Thus this section does not assume that the necessary functions of government would be available. Indeed, some of the potentially fragile aspects of postattack government are deliberately emphasized in order to emphasize some of the grimmest possible societal threats.

Section III discusses a number of different aspects of the countermeasures which may be possible during a crisis period and tries to sift out some which would help to mitigate the threats of the reorganization period. In this manner an emergency mobilization for civil defense might instigate actions which would help U.S. society to negotiate the reorganization period successfully. The problems of creating such countermeasures appear to be formidable but possible if: (a) the usable warning provided by the crisis is of sufficient duration (several weeks or more); and (b) the pre-planning for the mobilization action is completed in advance of the need.

Particular attention is given in Section III to the potential for effective countermeasures created by an MTS program (Ref.11). A program which plans to move people to shelter outside the more likely urban targets has some special properties which, during an emergency, might permit better utilization of the national resources to enhance the prospects of a successful solution to both the reorganization and the long-term recovery threats. Once again, preplanning would be needed.

There have, of course, been many studies which related to some of those problems of postattack reorganization. In this report we attempt to develop a "feeling" for the great variety of "intangible" problems and the way they may, through their interaction or interdependence, prevent the national economy from being reconstituted. Thus by creating metaphors and scenarios we attempt to depict this problem, establish its importance, and suggest that countermeasures may be possible. Perhaps the main point at this stage is that it is now especially timely for the problem to be researched with much greater intensity than previously.

I. A PERSPECTIVE FOR POSTATTACK RESEARCH

A. Spasm Wars And Civil Defense

It may be useful to examine some of the conceptual approaches to PA research with the assistance of Figure 1. Part A of this figure shows a time-scale for contemplating CD problems broken into the three intervals: peace, war, and recovery. From 1945 to approximately 1960 most analysis of CD problems was pursued within this framework which, as an end product, always requires a CD program to be almost completely installed during peacetime if it was to be of any use in the event of nuclear war. This conclusion directly follows from assuming a nuclear attack would be a strike out of the blue and would allow only from minutes to possibly several hours for various regions to experience the hazards of the nuclear attack. This concept had similar implications for recovery studies, mainly in establishing a preconception that, for nearly any aspect of recovery, the countermeasures taken essentially had to be completed during times of peace.

This "spasm" view of nuclear war has oriented much thinking in CD research and planning into systems which, to be effective, would require tens of billions of dollars of investments in shelters and stockpiles. Assuming the validity of the orientation of Figure 1-A, this reasonable conclusion unfortunately runs into practical difficulties. Such sums have not been obtainable from Congress (or local governments) and probably will not be unless or until the external situation becomes very threatening. Indeed, during the past twenty years funding for CD programs as well as public interest in CD has generally been very low.

B. Deferred-Cost CD Programs

In retrospect, it seems surprising that the simple conception of Figure 1-A had the profound effect upon the bulk of the thinking, research, and planning that it seems to have had, and may still have in many circles. However, in the late 1950's, about 1957, some military analysts had begun to take seriously cases in which a war was preceded by a period of mounting international tension (Figure 1-B), a crisis period. Serious consideration of this possibility seemed to have certain military consequences that would affect almost every aspect of the defense posture. As more studies began to consider this alternative, the notion became increasingly widespread that the scenario in which nuclear war was preceded by crisis was not only "not unreasonable" but seemed to be much more probable than the "sudden" war (Figure 1-A). It has been argued that if a choice is necessary, Figure 1-B should receive more emphasis than Figure 1-A as the standard basis for defense planning.[1] This perspective has persisted up to the present and has won wide acceptance, although in some studies not much more than lip service seems to be given to the concept while the analysis mainly proceeds on the basis of Figure 1-A. Perhaps some of the reluctance to change to Figure 1-B (besides tradition) arises because the introduction of the extra crisis period greatly

FIG. 1

A. (1945 - 1960)

B. (1957 - PRESENT)

C. (1966 - PRESENT)

D. (1967 - PRESENT)

complicates the analysis and probably also the planning which is suggested by this analysis.

Without going into the military complexities we note that, for CD especially, the acceptance of a crisis period as the most important contingency and therefore as the "design case" for research and planning complicates the picture by introducing many new response options. However, as a positive aspect, it enables CD analysts and planners also to see a potential for designing low-cost systems which may enable nearly all the U.S. population to survive "plausible" nuclear attacks.[2] In particular, survival in the 95-99% range does not seem impossible for attacks in which a few thousand megatons are directed against urban centers. In addition, the visualization of Figure 1-B opens new ways to think about recovery planning--and we will argue here for reorganization planning.

The basic notion is that the systems for survival and recovery need not necessarily be built during peacetime. Figure 1-B implies that plans might be made in peacetime for a general emergency mobilization of the population which, during the crisis interval, could provide the labor and material resources to build rapidly the CD system. Presumably, a reasonable portion of effort during this interval would be allocated to phasing in measures which would improve our ability to recover.[3] This crisis emphasis concept introduces the possibility of deferring to the time of need (when, presumably, funds would be readily available) the major costs of systems which, if built in peacetime, might cost tens of billions of dollars.* The annual federal research and planning budget required in this approach may vary (we would guess) from a few million dollars initially, up to perhaps a few tens of millions in later years. Presumably any large investments in civil defense measures ($ billions) would, <u>if ever needed</u>, be made during a subsequent crisis. In this event the U.S. population would be mobilized in accordance with the perceived need at the time to create the desired survival and recovery systems.

The argument has been generally well received that during a time when nuclear war may be imminent, the competing military demands either would be small or could be compromised, and the availability of funds, public interest, and the motivation for taking protective action should be very high. Thus, Figure 1-B is representative of the current orientation of many analysts who are now doing research in CD. Also we assume that most federal civil defense planners--at least at the working level--use the concept of Figure 1-B. (For planners who are worried about deterrence and who are thus almost <u>required</u> to worry almost as much about the 1-A as the 1-B possibilities the design of the strategic systems needs to have adequate capability in both cases.) But for civilian damage-limiting systems, if they cannot easily and inexpensively be designed to handle both cases, preference should be given to designs based upon Figure 1-B--that is, at present CD seems to have little choice, if it is to obtain a highly effective defense, but to adopt a deferred-cost plan based upon rapid mobilization of the skills and physical resources of the nation

*Of course the costs at the time of need may be greater than those involved in the construction of a peacetime system. Whether the system would be more or less effective than one constructed in peacetime would depend upon the factor of obsolescence and the specific war outbreak scenario under which the system would be "tested."

in a crisis. Civil defense has not been--and is not likely to be--allocated sufficient funds for the development of effective protective systems appropriate to a sudden nuclear attack in which urban centers were struck in the initial phase of the attack.

C. Postattack Reorganization Period

One of the main conceptual points is the introduction of the potential in a preattack crisis period to prepare for the postattack reorganization period, which must be successfully completed before long-term recovery becomes meaningful.

Some previous studies of recovery have concentrated on the reorganization required in a single "institution" (government, petroleum, steel). Generally it has been concluded that none of the problems are insurmountable, and that usually special preparations can be made which would speed up the recovery (see Appendix B). However, as has often been noted in civil defense studies, what may be possible if problems occur singly, may be infeasible if many problems must be solved simultaneously. For example, it is usually assumed in the sections of such studies that treat recuperation that (a) the government is intact, (b) money and inflation problems have been dealt with satisfactorily, (c) credit is available, (d) prices and wages have been settled, etc., etc. Thus the major emphasis has been on repair of the physical damage, not on the socio-economic damage which alone could bring the system to a grinding halt. There have as yet, been almost no studies which seriously attempted to take account of the interacting effects of a, b, c, and d above.

Although going from Figure 1-A to Figure 1-B gave us a framework with a greater potential for solving some survival and recovery problems, the conception of Figure 1-C further complicates the postattack picture by introducing a need to worry about the reorganization phase.* We find it conceptually distinct from the notion of recovery which assumes that the surviving population, distributed among farms, factories, government, retains a capability to function in these occupations without having to solve some basic organizational problems first. Studies based upon that assumption

---

*Winter[4] has conceptually added another interval to PA recovery (see Figure 1-D). He visualizes a survival phase immediately after the attack in which the urgent problems for a few days or weeks (possibly a few months) would be substantially different from the following two intervals (reorganization and long-term recovery). Thus, in the early survival period the main concerns would be in the provisions of welfare items such as food, sanitation, medicine, emergency communications and transportation; the maintenance of law and order; and the remedial relocation of citizens from areas of relatively intense fallout. However, most of these functions have been studied by OCD in research and planning efforts which have been concerned with the period in which people are emerging from shelters. Our analysis will be based on the conception of Figure 1-C without, we hope, losing much validity by avoiding the PA survival questions immediately after emergence from shelters.

focus upon the PA imbalances in a functioning economy rather than the problem of getting the institutions to begin to function; they therefore assume that the primary problems are those which can be solved with the use of tools such as input-output models. It will be argued that reorganization problems precede and may dominate the question of PA economic viability. If this is correct it should follow that the study of these problems deserves high priority in future PA research.

It should be apparent that the effective functioning of long-term recovery plans would first require that the economic reorganization has been effectively accomplished, certainly to the extent that (a) certain elements of the federal government can be assumed to be effective; (b) a functioning money system has been restored; and (c) the manpower can be obtained for the implementation of the emergency government functions. Subsequent discussion will point out that these conditions may be difficult to meet in some environments and that if they are not met, and if the governmental functions which are presumed to be required to complete the reorganization were not available, a major threat to PA economic viability would exist.

BLANK PAGE

II. POSTATTACK SOCIETAL PROBLEMS

We will now attempt to define the postattack reorganization problem better and express our concern with the potential threat to PA society by first presenting a number of allegories or metaphors. Hopefully, this approach will add some clarity, improve our perspective, and thereby help decide not only whether this matter deserves increased emphasis in future research, but indicate some issues that this postattack research should address.

A. Environmental Shock and Personal Identity

The concept of human personality may be defined as much or more by reference to the continual reinforcement of identity through daily experiences, as by physical structure and previous learning. That is, one comes to believe certain people to be friends, acquaintances, or enemies not only because of past interaction (learning) but by current and recent reinforcement of this past; similarly one knows what work he can or does perform by his employment, hobbies, and chores; he knows humor by the events that amuse or entertain him and others. Without conscious thought he "knows" many of his functional roles, such as father, husband, gardener, accountant, commuter, skier, Catholic, Republican, neighbor, driver, voter.... Each of the major roles themselves break down into a set of functions. Thus, it is important to know, without having to think about the matters, how to get breakfast, how to respond to routine questions, how to fill out forms, how to drive an automobile, how to go to work, how to react to a greeting, what a buzz on the intercom means, how to buy supplies for work and home, what to expect in a restaurant, or theater.... One can list thousands of daily functions by which an individual establishes his current identity. These functions must be supplemented by the basic memory necessities, for example the simple recognition through the senses of a house, lawn, mountain, tree, river, road, person, typewriter, violin, fire, perfume, etc.--all of which help remind us of who we are. The point we are trying to illustrate is that, in a major sense, a person's <u>identity</u> is established by a continual and current sensory reinforcement of his past experiences.

Therefore, it is not surprising to find that many, if not most or all, persons who are subject to various degrees of unusual sensory experience (for example, natural disaster, sensory deprivation, drugs) will experience a partial, perhaps in some cases, nearly total, change in personality which we may call <u>loss of identity</u> if it occurs suddenly. This effect in certain clinical or medical experiences is sometimes expressed in other terms such as "depersonalization," psychotic break, hallucinatory experiences, etc. Sensory deprivation experiments have shown that some people are easily susceptible to losing their identity, they "go to pieces" easily in such experiments; others are much more resistant.

This description of possible loss of identity through sensory deprivation, for our purpose, is meant to be allegorical and to express what we fear could be a parallel in postattack recovery. Thus, a sudden and somewhat massive extinction of functional identity may occur among most of the surviving population during or after a large nuclear attack. Individuals and families removed from familiar surroundings, employment and recreation would be deprived of their usual roles. One threat is that such a person may "degenerate" into a kind of listless behavior, for example, of the kind which has often been associated with the occupants of camps for displaced persons (for example, in Germany immediately after World War II, among the Palestinian-Arab refugees, and currently among some relocated South Vietnamese civilians). Another threat is that many individuals may revert to a more primitive, uncooperative, or aggressive behavior leading to riots, gangs, and general lawlessness, possibly leading to a complete breakdown of law enforcement in many areas--if not the whole country.

If the functional shock or deprivation is not too severe or too prolonged, most individuals tend to recuperate rapidly from such experiences, that is, to restore effective, if changed, personalities once any coherent environment is restored.* Thus, after a person emerges somewhat "discombobulated" from a few hours in a sensory deprivation tank, as he recognizes his surroundings, feels his body, and listens to familiar sounds, he tends quickly to return to his "familiar self"--to re-establish his previous identity. However, we might ask what might happen if after such a shock to the "psyche" the person emerged not into a familiar environment, but into a strange land with a murky atmosphere, filled with unfamiliar creatures speaking a foreign language? Could a person learn to adapt himself and function in any reasonable sense of the word in this environment? This question, of course, is not intended to be answered here; it is presented more to suggest the nature of the problem or the threat.

Perhaps another way of posing such a problem would be to think about the shock that an Australian aborigine would experience if he were whisked out of his environment and set down in New York City during a hot summer day, or worse, a cold winter day. In his native environment the aborigine functions satisfactorily by our standard interpretations of that culture. But in New York City? Or to reverse the scene, if we take a New York Madison Avenue advertising man and plunk him in with the aborigines, how would he function?

---

*Of course we do not intend to ignore the possibility that in many experiences suddenly changed environments can be an interesting challenge, an adventure. But this would seem to be quite relevant especially in the early PA period.

B. Institutional Identity

In parallel with individual identity, we can establish the notion of the identity of an institution. Like that of an individual, it is generally slowly changing and thus can usually be easily recognized over short periods of time, months or years. The identity is composed of such things as financial assets and liabilities, employees, buildings and location, products and services, management, internal procedures, and the traditional relationships with other institutions which establish reasonable expectations for credit, sales, services, etc. The expectation that change in any of these important aspects will not take place too suddenly or too massively for a reasonable adjustment to occur is important to the preservation of its identity. Thus, if employment changes very rapidly, shock waves travel through the institution and threaten injury. An institution can be shocked by a sudden change in demand for its output as occurs when war or peace breaks out or an unexpected economic recession develops. If one large firm goes bankrupt, others related to it may fall like dominoes. Certainly, a single massive or sudden change can and often has "killed" an institution. Some are so fragile that they are not even adaptable to the ordinary slow changes of peacetime (in 1965 about 13,000 economic firms were bankrupted in the U.S.*).

We are going to ask what may happen to institutional identity under the impact of a nuclear attack and what the implications are for postattack society. As the reader may suspect under many conditions the "answers" may appear to be very grim. At least in the word picture to be presented the grimness will be deliberately emphasized in order to stimulate reflection on the threat.

The PA institutional identity will be affected by what we may term its tangible and its intangible vulnerabilities. The tangible ones are well known and include (a) physical damage, (b) loss of personnel, (c) loss of demand for its product or services, (d) unbalance in supplies, fuel, or utilities. The intangible problems tend to be socio-economic or politico-economic and affect all institutions, damaged or not, and could have a much greater impact on the ability of the nation to recover. They may be composed of such matters as:

1. Loss of credit or solvency
2. Confusion as to property rights among survivors
3. Legal problems of debts and unfulfilled contracts
4. Meaningless wage contracts or salaries because of extreme inflation

*The Annual Report of the Council of Economic Advisers, 1965 (Government Printing Office, Washington, D.C.).

5. Temporary collapse of government or government authority

6. Temporary suspension of banking

7. Temporary suspension of the judicial systems

8. Wild fluctuation in prices, rents, expectations of future prices

9. Civil disorder arising out of inequitable distribution of surviving supplies and spurious distribution of surviving capital

10. Confusion in communication compounded by wild rumors, perhaps leading to local breakdown in law and order

C. Diseases of the Body

The metaphor of individual or institutional identity may be usefully related to the threat of bodily diseases. For example, when an infection, a burn, or a cut occurs, the body mobilizes its forces and attempts to heal the injury. These disturbances may be analogous to the experience common in natural disasters that injured individuals or institutions are assisted by the external community, the well-known convergence phenomenon. Thus, the uninfected portions of the body contain resources for assisting those parts which are affected, whose identity has temporarily been disturbed or destroyed.

The organism can tolerate certain diseases or injuries and, for practical purposes, recover completely. However, the problem may become rapidly worse with multiple injuries. Thus, if in addition to the Asian flu one simultaneously contracts tuberculosis, cancer, gangrene, a concussion, and a severe heart attack, the chances for recovery are diminished. Thus, the body does not have sufficient resources to handle some multiple disturbances which singly would not be very hazardous.

One analogy with nuclear warfare is that there is some level of destruction beyond which, because of the multiple injuries to society, socio-economic recovery becomes impossible--the economy is "non-viable" to use Winters' term.[4] However, a point which we will try to emphasize is that even if sufficient physical resources for viability survive, because of the reorganizational problems the country might lose its ability to put these resources to effective use; i.e., its economic identity might be changed beyond reasonable or desirable recognition.

In one way the medical analogy may be misleading. The human body, in its pristine organization, might be expected to apportion its resources fairly optimally toward the solution of its problems. Human society, we suspect, is not organized so flexibly and may have sufficient resources but fail to use them well enough to "recover." Or it may recover but not preserve very much of its original identity. Historically societies have

experienced such severe socio-economic blows and were changed in many ways; for example, the great U.S. Depression, the Russian Revolution, and the problems in the early stages of economic recovery of Germany after World War II, just to cite a few. (See Reference 5 for other examples. Also, Appendix A presents an historical example of the long-term prospects of a completely devastated society in Persia, one which was overrun by the Mongols.) While, despite many changes, all of the above societies have many continuities with the past, the changes have been sufficiently large to lead to almost cataclysmic "personality adjustments" and "disorders."

Certain bodily afflictions may be analogous to the potential inability to utilize postattack resources which may be improperly located, that is, inaccessible. For example, a bruise on the shin may create a local infection (which can prove fatal) because that part of the leg may not have enough channels to the available blood supply that are needed to clear up a large bruise before the infection becomes severe. The infection could then spread to the bone and other nearby parts, thereby placing the whole organism in jeopardy. Thus, in this illustration the effective use of available resources is prevented by problems in communication and transportation. Similarly, this is the kind of problem which may be related to a heart attack. If passageways in certain veins or arteries become restricted so that the needed blood flow cannot be achieved, the heart can suffer a substantial injury in its strenuous efforts to overcome this resistance.

Preparations for alleviating some postattack recovery problems may be analogous to the medical solutions for the above situations. That is, postattack preparations can be analogs to the organization of emergency medical supplies and services which make it more likely that the proper resources can be available in time to prevent or reduce the health threats.

In postattack preparations as in medical ones, the amount of resources may be insufficient. Their location, a functioning distribution system, and a reasonable amount of information for their proper application can all be vital.

D. Underdeveloped Countries

To some extent another metaphorical analogy which might help to clarify some of the potential problems of postattack recovery are the growth problems of underdeveloped countries. Thus, a country's needs frequently cannot be expressed by any single requirement such as roads, education, money, shelter, or electric power. It is generally recognized that a multiplicity of interacting problems must be simultaneously and continuously solved. In solving these problems, the society may be said to be experiencing a slowly changing identity. The difficulties experienced in the desired growth process have been profoundly demonstrated in current and recent history. Even without major external shocks snags can develop in which growth does not proceed, and in some cases may even recede (the U.S. Depression, "the great leap forward," Argentina since World War I, etc.).

A society which attempts to move too rapidly in any one direction (e.g., roads, heavy industry, military strength) may be subjected to the penalty of an over-all reduction in the growth rate (or even a negative one) as a consequence of the inefficient utilization of resources.

Applying these as analogs to postattack recovery problems, the U.S. is assumed to be faced with the question of re-establishing a functional identity. This implies that surviving institutions of the postattack society must be reactivated and welded into some kind of reasonably stable relationship, a process which, we will argue, may be extremely difficult after moderate or large urban attacks (500 to 5,000 megatons). Our fear is that the problem of establishing viable postattack relationships among institutions could become rapidly more difficult during the initial few weeks or months. After this much time the institutions may have lost so much of their original identity that they might become passive and rapidly deteriorating, perhaps even plundered (see page 9). Unless the appropriate measures are taken preattack to <u>prevent</u> this loss of institutional identity, the final collapse of the previous national identity could soon follow. This last unpleasant possibility, if not prevented, could take such forms as fragmentation of the country, civil war or wars, or general chaos.

In this view, only secondarily would an economic recovery then depend upon a relatively efficient application of the resources, the common underdeveloped country problem. We would hazard the guess that for the U.S., if we could effectively get through the reorganization phase, the problems of establishing a viable economy would tend to be <u>relatively</u> less threatening but still potentially very great. Problems of reorganization, we fear, might be very much more difficult than many analysts, who have examined postattack problems of a more restricted sort, have assumed or imagined.[4,6,7]

E. <u>Postattack Scenario</u>

This section will offer a single and more specific image of how the reorganization problem could appear by presenting a brief postattack scenario. This scenario assumes that no special countermeasures to prevent this problem were taken before the attack. It deliberately emphasizes many dire developments which cannot logically be excluded in order to attempt to "feel out" a few horrible, but not impossible, postattack outcomes. Assessing them (and others as harsh) is necessarily subjective, but thinking about them may alter subjective judgments. This paper assumes that, as a class, the reorganization problems visualized would be sufficiently probable after an attack to merit considerable attention in current studies.

We will focus upon a small textile mill in Parville, an undamaged Tennessee town: preattack population about 40,000; postattack population about 150,000. The attack against cities is about 2,000 MT. Most city people are assumed to have survived through an emergency evacuation and the use of improvised fallout shelters. Four weeks after the attack (late summer) the following situation prevails:

1. Uncertainty About Present and Future

It is not clear whether the fighting will resume since there has only been a cease fire and communications with the enemy are poor to nonexistent. Indeed it is rumored that the nuclear cease fire has been violated several times, although the authority for this is not clear. The federal government is a shambles with surviving federal employees widely distributed over the countryside. Washington, D.C. is destroyed. Little provision had been made for emergency postattack operations for the federal agencies.

2. Radiation Threat

The fallout threat is under reasonable control. With a few exceptions most people left areas of intense radiation after about a week of shelter and traveled to nearby areas where the fallout was much less severe. Emergency CD and monitoring stations functioned well during the immediate postattack period. There was a lot of confusion and some hysteria about radiation poisoning, but most people have learned to estimate the threat and are not frightened by low levels of radiation.

3. Presidential Rumors

The President (and Cabinet) survived in an emergency shelter but his current location is not known. Various rumors claim he has been killed, murdered, imprisoned, committed, hospitalized, emigrated, etc. Actually, the President has been silent about his whereabouts because he believes there is a possibility that knowledge of his location might bring another Soviet weapon on the U.S., aimed at him, since the S.U. Premier was killed in Moscow.

4. Food

There are severe food shortages in many localities and bartering of labor and supplies for food is becoming widespread. People are generally loath to accept money for goods (especially food) at almost any price. It is widely feared that current money is and will be useless. Food hoarding is widespread. Surviving banks remain closed. People without food are forming into "action groups." In general, foraging for food is a major or dominating activity. Sometimes rumors flood into every community about the location of food stockpiles (some private and some public) resulting in many treks of huge crowds toward these areas.

5. Civil Servants

It is difficult for the surviving remnants of the government agencies to get their personnel back since they have no current means for paying them except by checks--in the old (now nearly worthless) currency. Most of their employees are out looking for food and supplies and would be difficult to find, even if someone tried. No solid information exists about when or whether a functioning federal government can be reconstituted.

6. Early Riots

About 50,000 people arrive at Parville, between September 15 and September 30 looking for non-existing food stockpiles. (Their arrival was mostly based on a false rumor that the "mill" was a vegetable oil producer and had stocks of corn, beans and peanuts.) Friction develops between these people, many of whom believe the residents have already hoarded the stockpiles in secret caches. Riots develop during October 1 and 2, in which a thousand people are injured and three hundred buildings and homes destroyed by fire. The rival groups improvise internal organizations for action and self-protection. Because of time pressure and hostility, effective communications between them is almost impossible. Appeals for State and Federal intervention are unheeded because the remnants of government are already buried under a discouraging avalanche of other urgent tasks. The resolution of the local conflict finally comes through a dispersal of both groups to other areas in search of food.

7. Managerial Problems

The owner of the mill contemplates his problems in trying to restart production. He finds:

a. many of his former employees cannot be located;

b. there is much labor available but no one will work for money (a gallon of gasoline trades for about $50 and a can of corn for $70);

c. the banks are closed and no one knows when or if they will open or even what the banks' business will be if they do open;

d. he has no useful idea of what factory supplies can be obtained, or when, or how much they may cost, or even what "cost" means;

e. he has no sales for his merchandise nor any reasonable way of getting any soon, at least that he is aware of. Besides he would not know what to charge for any of the mill's products if he were asked;

f. he does not know whether he will be solvent or bankrupt when a new balance sheet can be calculated, if it ever can be. Thus, he reasons, any firm that might attempt to deal with him may be similarly unreliable. Certainly credit cannot be extended--nor could he expect to get any--even if stable prices developed for which he sees little hope.

To help resolve his dilemma, he looks to the local Chamber of Commerce, which in turn looks to the town government, which looks to the county, which looks to the state, which looks to the federal, which is not functioning effectively and some fear is threatened with imminent collapse. Each of these government institutions has only a small fraction of its normal personnel and is trying to find useful guidelines to fulfill some of the

important needs in the new situation. Because of the job frustration, massive confusion, lack of adequate payment, and because of the prevailing food, transportation, and housing shortages, most government personnel are either transient or voluntary.

8. Food Distribution

Although there is no over-all food shortage in the country, the extreme problems in distribution, aggravated by a nearly universal tendency to hoard, have caused food stocks to disappear from usual wholesale and retail distributors. People flock to the farming districts to obtain whatever food they can, which is then either hoarded or bartered. Market places for the exchanges of food and other goods through barter are springing up in certain streets within most inhabited areas. Steers and pigs are traded and often butchered in the street under improvised arrangements.

Because of a shortage of gasoline, there is a huge demand for bicycles, wagons, carts, and beasts of burden for which animal feed is locally available. The farmers are complaining that shortages of gasoline are threatening their capability to harvest, plant, and fertilize mechanically. Some are predicting that the next year's crop may be a disaster because of this threat and some shortages of pesticides and fertilizers. Also about half the crop land is considered too radioactive to farm for the next several months.

Some farmers will only trade food for fuel and fertilizer. Others, whose crops are more perishable, trade for anything of postattack value. In some areas farmers and the local townspeople have armed themselves for fear of armed invaders in search of food.

9. Some Federal Problems

Economists agree, generally, that the main problem is to re-establish confidence in federal money--that is, to create an expectation of stable and reasonable prices for goods. But there is little agreement on what can be done to bring such a situation about before it may be too late. The federal government can barely be said to be functioning usefully at this time and is losing its remaining authority rapidly. Rumors without substance abound about currency reform, banks, damage compensation, welfare, starvation, renewed enemy attacks, epidemics, and bacteriological warfare. The government is blamed for the lack of preattack preparations, for getting into a nuclear war, for their current incapacitation, and for hoarding food. (Actually, the federal government doesn't know how to manage the effective distribution of its food stockpiles without losing most of the food to "hoarders." Indeed, it is widely known that many people with caches of food sufficient for 6-12 months are still begging and gathering what they can, perhaps in fear of future starvation.)

10. Military Dilemmas

The armed services are threatened with disintegration since their normal channels for supplies have been disrupted and it is not clear how these can be reconstituted. Factories producing munitions are closed, food suppliers are not operating, and teamsters will not work for their preattack contractual wage, if there were goods to transport. (Besides, there have been widespread rumors about extensive hijacking.)

In addition, most servicemen are worried about their families and are requesting leave (even though transportation is uncertain). They are also grumbling because their pay has become meaningless. The armed services are afraid that if the men do leave, they won't get them back and if they don't leave that they won't be able to feed them.

11. Changing Values

Law enforcement, preattack style, has become meaningless in most areas. Local police in food-rich communities help defend the status quo against outside "mobs" which in turn may have police assistance from evacuated or food-poor communities. Primary loyalties are to the local group and its leaders who are focusing first on the group's short-range needs. Violence is common when these groups meet. Pitched battles have occurred accentuating the nuclear disaster and inducing survivors to devote a substantial portion of their effort to the problems of local security.

Fear and rumors increase the instability of the accident-prone situations and frequently lead to unfortunate clashes triggered by misconstrued information. Suspicion of outsiders grows to include all of the non-local government efforts--especially those efforts which attempt to requisition supplies from the relatively undamaged regions without offering solid or acceptable compensation.

12. Prognosis

The country is believed to be on the verge of a second major disaster--a collapse of all but local community authority with little prospect of an early re-establishment of the preattack constitutional structure. The prevailing expectation among the pessimists is a total shattering of the country into numerous independent groups which over years--perhaps decades--would have to evolve a new federation into the "second U.S.A."

The optimists, of course, believe that these pessimists are very likely to be wrong. As indicated in Appendix A, there may be an almost overwhelming pressure to restore more or less the same pattern that was destroyed. This is more likely to be true for the United States than for most countries because since the Civil War the U.S. has not experienced a serious movement to replace the current system. The optimists assume that when "legitimate" authorities can assert their preattack traditional rights

it would be almost impossible for improvised local authority to oppose them on the principle of sovereignty, except to disagree very sharply on practical details. In the limit, of course, if the national government were reformed, the federal authorities could try to impose martial law. This would arouse a number of difficulties. First of all, there is the intrinsic magnitude of the problem, the relative inexperience of the U.S. Army, the weakness of federal authority, the numerous widespread factions and even possible factionalism within the military forces themselves. In addition, there is some tradition in the U.S. that by and large the federal government negotiates with the local authorities rather than orders them around (e.g., the decentralization decision of the Supreme Court in 1954 is still not fully implemented). What could happen in a few weeks or months is therefore quite difficult to foresee. In a matter of a year or two the optimists feel confident in the reassertion of the sovereignty of the central authorities. About the only anticipated exception to this would be if there were a serious dispute as to who the legitimate authorities were. And even then they imagine that this conflict would soon be resolved, by violence if negotiation or public pressures failed. The pessimists believe this kind of resolution may require a decade or two, would involve a great deal of violence and may greatly alter American values and traditions.

BLANK PAGE

III. EMERGENCY ACTIONS FOR POSTATTACK REORGANIZATION

In Section I on Perspectives, the two prominent points were: (1) that institutional reorganization after a sizable nuclear war could be very difficult; and (2) that with small budgets for peacetime planning during a crisis much might be done to enhance PA recovery prospects. The first point was illustrated in the previous section through several metaphors and then by a stark PA scenario. The second point originates from a previous paper[3] and will be elaborated on in this section to suggest not only some important actions that can be taken in a crisis for long-term recovery (stockpiles, training, policies), but that there may be a considerable potential to obtain simultaneously some countermeasures against the threats of the PA reorganization period.

A. Stockpiling During Crises

As discussed in the Perspective section, if one holds a conception (consciously or unconsciously) that excludes a crisis period between peace and nuclear attack, then any desired stockpiling for recovery obviously must be accomplished during times of peace, times when the incentive for strategic stockpiling is relatively low, especially as stockpile requirements can easily cost tens of billions of dollars. Indeed, stockpiles requiring hundreds of billions of dollars have been mentioned as requirements for recovery from large nuclear attacks.[8] On the other hand, if one visualizes a severe nuclear threat of weeks or months in duration, it becomes apparent that during this critical period stockpiling could become a necessity, that is, a natural consequence of traditional prudential thinking. One need not be an alarmist or very perceptive analyst to understand the utility of hedging against an imminent threat. Thus it should follow that if plans did not exist which would facilitate stockpiling for survival and recovery, that at least rudimentary efforts are likely to be improvised in accordance with the perceived needs at the time. However, if at a time when action to create stockpiles for PA recovery are desired and little knowledge of the appropriate ways and means is available (because the research and planning have not been done), the actions taken are likely to be misguided and the impact on the recovery potential of the country could prove to be very unfortunate.

We argue that during a crisis there would be constantly changing values which increasingly would lean toward acceptance of emergency survival and recovery measures as the intensity of the crisis deepens. At such a time citizens, institutions, and government would become greatly concerned with these problems, perhaps dominated by them. We would like to discuss the impact of such interest on different approaches to creating large stockpiles which would have postattack utility.

There come to mind three major ways in which such stockpiling could be emphasized during a crisis period. These will be illustrated in the

discussion to follow of specific commercial operations, but should be of general applicability. They are:

1. increasing production

2. reducing consumption

3. increasing imports (and reducing exports)

Thus, production can be increased by a more intensive use of labor in those segments of the economy which are producing goods and services for the military mobilization and for survival and recovery.* A substantial increase in this production may be possible by increasing (a) hours of work per shift, (b) number of shifts per day, and (c) days of work per week. This development might require a substantial shift in labor to the more critical industries and an increase in the total labor force.

A profitable area for research and planning by the OCD would appear to be that of obtaining a capability in the U.S. to shift manufacturing capacity rapidly during times of international tension in order to create survival and recovery stockpiles. Research in this area might first try to determine how the demand and supply of goods and services would shift during a developing crisis in accordance with a hypothetical stockpiling program in order to assess the varying production requirements over time.

If manufacturing transitions are to be made relatively smoothly and effectively, it might be necessary first to do the studies which would suggest the needed PA supplies and some ways to induce a rapid shift into the emergency production of these items. Thus, at some time early in a crisis one can imagine that manufacturers, considering the possibility of changing production, would want to know what changes in demand are likely to occur and, more particularly, what stockpiling purchase orders the government intends to give out. While it does not seem feasible now to create

---

*Of course during a crisis, there may develop some competition between military and civil defense requirements. Traditionally, in the U.S. the military needs for conventional war have had the highest priority. Whether this would be true in the future would depend upon the details of the crisis. For example, if a large conventional war in Europe involved the U.S. in an industrial mobilization for months or years, it might be difficult to switch a large fraction of our industries from armaments production to CD needs. (Although in a long war of this type if, because of the increased likelihood of nuclear escalation, a small fraction of the industrial establishment were allocated to civil defense it should be able to produce tens of billions of dollars of survival and recovery supplies without a major impact on the military effort.) Other possible threats may be more basically nuclear, for example through local battlefield use of tactical nuclear weapons and/or in strategic threats or ultimatums or overt demonstrations of nuclear intent. During such crises it seems quite reasonable to suppose that the production of some military hardware might have lower priority than a number of survival and recovery options.

a full list of emergency needs with priorities and requirements, it may be wise at least to attempt to put together a preliminary list with estimated ranges of expected demand related to the kinds of crises that may occur. As a basis for planning, a detailed list of this kind, with regular updating, could become an important beginning to a solution of the problem.

The second major way by which we may gain resources for emergency stockpiling is through reducing purchases of consumer goods and of producers' durables. In part, some "natural" reduction should occur with the shift of manufacturing into new products. For example, we would expect that for most heavy industries, which produce machinery and equipment whose value must be amortized over many years, demand would be diminished as the crisis became more severe. This could imply reduced production of standard producers' durables such as automobiles, trucks, railcars, ships, buildings, turbines, or office equipment. In some cases the federal government may wish to aid the conversion and stockpiling program either through direct purchase for its own stockpile or by encouraging voluntary "hoarding." In this latter case some supplies would become widely distributed among private civilian stockpiles. For individuals these could include food, medicines, working clothes, tools, batteries, gasoline; commercial establishments could stockpile raw materials, tools, machines, plans, etc. Presumably, most of these private stockpiles would be protected against many kinds of nuclear attack by suitable location or shelter.

In some emergencies rationing may be advisable in order to obtain stockpiles rapidly and still maintain an equitable distribution. For example, if it were possible to store large quantities of petroleum products (e.g., by returning gasoline to formation through selected abandoned wells) then the government might wish to reduce consumption to, say, half-normal during the extreme portions of the crisis. In this event, it probably would seem reasonable to ration gasoline and heating fuels. Of course, rationing might also apply to the control of food products if the government policy wished to discourage the development of individual hoards of food. Such a policy might be in accord with one which planned for a temporary postattack control of food by the federal government (see discussion, page 22). The decision between these alternatives would need to be made relatively early in a crisis. It would be affected by prior studies, existing preparations, and the details of the crisis.

The third area in which stockpiling can be effective is that of imports and exports. Clearly, the desirable goal would be to increase imports of survival and recovery items and reduce or eliminate their export. Items which come immediately to mind are food, petroleum, and nonferrous metals; a review of current export-import products would quickly suggest many others. Indeed, in view of both the threatened vulnerability of stockpiles within the U.S., and transport limitations, it might be advisable to place orders with foreign countries for goods to be delivered to storage depots within those countries themselves. This could assist the rapid build-up of stockpiles of important materials which later could be

shipped and distributed as transportation became available. Thus, the U.S. might be able to place orders for 10 or 20 billion dollars worth of supplies over and above that which could be delivered during the crisis period. Of course, we do not argue that this could come about easily, since we should also expect a tendency for other countries to hoard goods. Nevertheless, if the U.S. could act rapidly and pay promptly, it might be able to make some extremely significant purchases. Certainly this would not seem to be an option to be ignored (see discussion of foreign assistance to the U.S.).[9]

Although crisis stockpiling seems to be a useful concept, one which would appear even more important during a nuclear threat, the actual stockpiles for recovery may be relatively less important than the creation of an organization which can effectively manage the stockpiling needs during and after the crisis period.* This, we believe, is an important point. If accepted it should stimulate more detailed study of the emergency mobilization of the U.S. economy in order to understand its potential to create rapidly a great organization which: (1) would develop as required by the needs of the mobilization; (2) would be competent to carry out the measures needed to enhance survival reorganization and recovery prospects; and (3) would attain the potential to become an effective new entity which, if needed, could take over the major management functions of the postattack reorganization period.

B. Emergency Supports for PA Currency

This section suggests that the feasibility of economic recovery may depend upon the existence of a new support for postattack currency, that is, a more stable support for the dollar than now exists. We argue that the major emergency support or replacement of the dollar could occur through a nationalization of the food industry and its control during the reorganization by the surviving elements of the government.

The previous discussion has led us to worry about the danger of not being able to emerge "intact" from the reorganization phase. As we see it the existence of an effective federal government simultaneously implies a functioning civil service which in turn implies a reasonable short-range confidence in the value of a federal currency acceptable to the public. Thus, we argue, the federal government needs personnel, personnel require usable money, usable money demands that we have (or are confident we soon will have) an effective federal government. The argument thus seems to have circular dependence, a loop which, once broken, may not lend itself readily to reconstruction. It is somewhat analogous

*This problem is discussed from another point of view in Section D, page 30.

to the simpler chicken and egg story; to get one we need the other. If its personnel disappeared, the government and the money system would also vanish. If the government lost its authority, its personnel would leave and the dollar would collapse. If the dollar collapsed, the personnel could not be paid and would have to leave and the government would then disappear or lose its authority.*

If this argument has merit, it is not at all clear that once collapsed the federal organization could be reconstructed in anything like months (or even years). A federal system might then have to be reborn and redefined from the surviving fragments of the country--a process which could take years if not decades and by almost any definition would constitute a major tragedy. A new postattack environment of this kind would probably witness independent, competing, and perhaps feuding regions. Outbreaks of civil wars could be one form of potential additional disasters which could then follow--civil war which could be either intra- or inter-regional. The problems of visualizing a "functioning society" developing out of this environment are so complex and at the moment seem to be so unrewarding that we turn instead to our explicit purpose of examining the preparations needed to prevent the occurrence of such unpleasant possibilities.

It seems that we would need to take appropriate actions to assure the simultaneous continuing viability of the three factors in the government-personnel-money loop. Certainly formal government authority can, in principle, be maintained by simple procedures such as "continuity-of-government" legislation. Second, the desired personnel could probably be maintained or obtained if they are given both preattack and postattack assurances that their services are or will be needed and if they believe that their remuneration will be either in good dollars or their equivalent. Thus there need be nothing magic about the present greenback dollar. Any slip of paper or other medium which can be traded for goods and services might be made to do. (See reference 9 for a discussion of PA monetary problems.)

Third, in attempting to either bolster confidence in the postattack dollar or supplant it (temporarily?) with an equivalent exchange medium we will offer the suggestion that the federal government may wish to create (probably during the preattack crisis) a separate authority which would be prepared, if necessary, to take over, import, produce, and distribute all items of food. This may amount to creating a capability for

---

*This argument is based on a simplified model of interdependence and examines a pure case in order to make the stark point about the loop of interdependence. While any reality situation would be probably very much more complex involving partial losses of personnel, or severe inflations rather than total collapse, nevertheless, our deliberate purpose here for an initial orientation is to consider very extreme cases which may be nearly the same as the pure one. It is clear that in many historical cases, monetary systems have collapsed without the above consequences. However none of them have the massiveness and the suddenness of a large nuclear attack.

the emergency nationalization and operation of the entire food industry. Of course it may not be necessary to implement a full nationalization. Partial measures may be deemed sufficient if plans for them exist. The choice can be made at the time by the government decision-makers in light of their problems. The larger the government stockpiles of useful PA supplies the less the controls that might be needed over the food industry.

It would not be correct to suppose that this function would properly reside in the Department of Agriculture or the Department of Commerce since, we would argue, most of the required management functions are not within their existing experience. More effective, we believe, would be an emergency management group put together from the current organizations which make up the food industry. This would include assistance from the Departments of Agriculture and Commerce but mostly would be composed of farmers, food processors, wholesalers, retailers, railroads, teamsters, and others. As a matter of fact, we are arguing that the emergency measures which might be taken during a crisis of several weeks or more in duration would facilitate the growth and emergence of the needed organization (see page 29).

If, in fact, the government also succeeded in creating large stockpiles of recovery supplies during the preattack crisis period, it would have real reserves which can be used to back up any new monetary policies which are required to enable the reorganization to occur and the recovery to proceed. Thus, with huge stockpiles of food, petroleum products, metals, lumber, paper, medicines, and chemicals, the government has a much better basis for supporting the dollar or any other currency or guarantee that it may wish to utilize. It is certainly not difficult to believe that fifty billion dollars in distributed stockpiles of such items would be a far superior underpinning for postattack money than a continuation of present monetary policy.

Finally (to throw in a random thought that needs much more study), the federal government normally has many other assets which might be useful in supporting the postattack dollar although their use would probably be more complex. For example, some of the federal lands, perhaps worth tens of billions of dollars, might in part be used to peg the postattack value of the dollar by the announcement of offers to sell parcels to the highest bidder or even at certain <u>fixed</u> prices. Similarly, some surviving federal buildings might be sold for dollars or a sale announced for some near future date.

One problem with the sale of real estate is that it may be somewhat difficult to arrange quickly enough with the federal government in a somewhat chaotic condition and with the dollar (we assume) threatening to collapse in the postattack confusion. Thus, it might be a suitable stabilization technique to be applied later during the long-term recovery period in order to reduce violent price fluctuations. However, if this use of federal real estate had been previously announced as an important federal option to be used as needed in conjunction with the other measures (food control and stockpiles of recovery supplies) it could help assure dollar stability.

C. Local Industrial Studies

Eventually, in order to understand the potential of crisis recovery measures, it will be necessary to study various industries separately in order to determine the potential of individual plants for emergency actions. These local studies would take into account such factors as:

a. vulnerability to nuclear effects;

b. preattack and postattack utility of the physical assets and production capacity;

c. problems of emergency shutdown;

d. the expected usable warning times associated with a spectrum of nuclear attack scenarios.

A consideration of these factors in the planning for a number of industrial or commercial establishments would undoubtedly lead to a variety of emergency responses which we will try to illustrate through some hypothetical examples.

1. Chemical Manufacturing

Consider an insecticide manufacturing plant in a rural location. It would have a relative invulnerability to blast because of its distance from any likely targets. Because of the anticipated postattack shortage of pesticides, we will suppose that federal preparations have been made that would give the plant the needed incentives to start on the following options early in any crisis:

a. increase its orders for raw materials which may be hard to obtain postattack (or even later in the crisis);

b. increase its current output by use of additional labor, overtime, and double or triple shifts;

c. provide for early postattack resumption of operations by making plans as needed for: safeguarding inventories and equipment, fallout protection, decontamination, emergency power, increased fuel stockpiles.

The above preparations would be made for two purposes: first, to increase the preattack stockpile of pesticides in order to hedge against the threat that after a sizable attack the plant may be inoperative for months or even years, perhaps mainly for economic reasons not related to its physical destruction (e.g., due to the inflation, the unavailability of raw materials, or the collapse of government). Secondly, some of these measures could help achieve a steady production relatively early in the postattack period.

Clearly, many of the actions which could increase preattack inventories and production levels would be more feasible and useful in the more protracted crises, those lasting from several weeks to several months. However, emergency measures to create protection against fallout and to prepare for postattack decontamination might be accomplished within a few days. (For example, this might be feasible in constructing and equipping suitable shelters and in training a cadre in decontamination techniques.)

Thus, the non-urban industry capable of producing important postattack supplies has some special potential. Because of its relative invulnerability it can be expanded during the preattack crisis to the limit of its output, it can stockpile nearby (both raw materials and finished products), and it can provide a physical base for early postattack resumption of essential production. Its operational plans would be relatively independent of the strategic warning provided by various scenarios and, except for plants with very complicated shutdown procedures, it might be expected to remain in operation up to the time that tactical warning is received--if we can assume that fallout protection has been made available nearby.

2. Railroad Transportation

As a second example, we consider some of the crisis operations of railroads, in particular a railroad yard in a metropolitan area. In addition to the expectation that freight cars would be in great demand during a crisis, the railroad system can anticipate three functions for which advance planning may be very helpful. These are:

a. their role in an emergency program which plans to relocate a substantial part of the vulnerable urban assets within a few days or weeks;

b. the transition to a new set of demands on the railroad distribution system during a protracted crisis in which much of the urban population has moved out from the cities, either as part of an emergency program or a planned MTS-type program (see page 30);

c. the reduction of their own vulnerability to nuclear effects.

Thus, there could easily arise a very abnormal requirement for rail service, with changing demands both during and after a phased relocation of population and some recovery assets. The substantial shift in railroad operations would imply large volumes of freight entering many areas which normally handle small volumes--and vice versa. Presumably as the transportation system can better anticipate the future demand it would make better preparations to facilitate the flow of traffic.

At any rail yard the traffic would be affected by the shifting demand for services as the crisis went through its various phases. These phases might include:

a. the military demands of a conventional war;

b. the relocation of major urban food stockpiles;

c. removal of some high priority or excess commercial inventories;*

d. the more general relocation of personal property and small business assets which would accompany an urban evacuation;

e. the maintenance of a flow of goods to and from the redistributed population for the duration of the crisis; and

f. the restoration to more normal traffic patterns in event the crisis ends without a nuclear exchange.

What measures should be taken at what time needs to be determined by more detailed studies, which presumably would lead to an estimate of the utility of advance planning at various rail centers. Such studies would involve important vulnerability considerations. For example, measures which would reduce the chance of freight trains being in the more probable target areas (such as urban rail centers) would protect: (a) the unloaded freight; (b) the freight cars and locomotives; and (c) the track and other yard equipment (which are much less subject to blast damage when the yard is empty of cars). For these reasons the more intense the crisis the more important it would be to keep the urban yards empty or nearly so.

There may be other important aspects to reducing the vulnerability of rail centers during an emergency period--emergency measures to reduce the vulnerability to electronic control equipment may be found (although such studies have not yet been done). Certainly fallout protection in some key control areas may be created during a crisis to enable a part of the personnel to remain at their assignments longer during the emergency and to return earlier in the postattack period. And, of course, there may be important documents which can be preserved through relocation or shelter.

---

*E.g., if consumer demand for standard household furnishings became very low these could be taken out of urban inventories and placed into protected storage. Also, the felt need to protect selected items such as engineering drawings, corporate records, electronic computers, and works of art would probably be very high.

3. Petroleum

As a third illustration, let us consider some petroleum industry problems and focus on a petroleum refinery at the outskirts of a large city. We first assume that estimates of a number of hypothetical city attacks suggest that the particular refinery could be subjected to blast effects from 1 to 10 psi depending upon various targeting and yield considerations. If some reduction of the national refinery capacity late in a crisis (to reduce vulnerability) were deemed a prudent hedge, then refineries in areas where the blast threat is marginal (1-10 psi) perhaps should be the first to be closed.* Shutting down such a refinery would improve its survivability against fire and the smaller blast threats--the more so, if some special steps were taken to reduce vulnerability (such as filling the pipes and stacks with water and bracing the more vulnerable stacks). Indeed, if a study of possible countermeasures were undertaken, other emergency actions would undoubtedly become apparent which could improve the survivability. For example, providing protection to control instrumentation by baffles, or even by temporary dismantling, might not be unreasonable at some stage (see Appendix B).

Prior to the stage of an emergency that would instigate a general shutdown each refinery may be able to contribute to a plan designed to improve postattack petroleum prospects. For example, any reasonable increase in protected storage capacity (including use of abandoned wells to reach below-ground reservoirs) could be used to increase the postattack stockpile. During a protracted crisis of a few weeks or months the threat of a subsequent petroleum shortage could lead to a build-up of the national stockpile, including the use of procedures which though uneconomic in peacetime, would then appear to be prudent. The stockpiling measures could be combined with restriction on consumption and increased production and imports. If protected stockpiling achieved during the emergency could equal 10% of the normal annual requirements it could have a tremendous utility during the first postattack year--not only as a productive resource but also as an aid to PA federal stability.

The local refinery may wish to obtain some emergency fallout protection during the crisis. Improvising shelter for key personnel should generally not be difficult or costly if the plans for this option have already been drawn. Indeed, studies have shown that expedient single-purpose fallout shelters can often be constructed in 24 hours or less.**

---

*Where the blast threat is low (less than 1 psi) the refinery would still need rapid, but less urgent, shutdown procedures because of the fallout threat. Where the blast potential is high (greater than 10 psi) little can be salvaged after an attack (short of preattack dismantling). Thus, in either of these two cases since there would be less of a need to shut down early in the crisis period or to take measures to reduce the vulnerability of the plant, production might continue up to tactical warning. (See Appendix B for further discussion.)

**Wood and earth construction using local lumber and hardware supplies.[10]

Such facilities on or near the refinery grounds should help keep the critical personnel on the job during the last hours or days required for shutdown. However, to obtain an early postattack operating capability it would be advisable also to make preparations for decontamination in and around the refinery--in the event that no more than light blast damage occurs. Decontamination plans of this type may require the education of maintenance men in decontamination techniques, a liaison with city departments (or private contractors) who might be able to provide some men or equipment, and the spelling out of various decontamination procedures depending upon the level of blast damage, if any. There is reason to believe that motivated companies working with local government officials during a low-level crisis would be able to develop such plans within a few weeks if the technical information were made available. Perhaps no more technical guidance would be absolutely necessary than that which could be furnished by a few previous studies on fallout and decontamination--these could be selected in peacetime (by the OCD) and distributed early in a crisis when the perceived need is high.

4. Growth of CD Mobilization Teams

The above examples suggest that a plausible outcome of the emergency do-it-yourself approach would be the early formation of civil defense teams in commercial and industrial establishments; teams which, with federal guidance and local encouragement, could develop plans for the specific survival and recovery options deemed best for their establishments. These plans could then be implemented in accordance with international developments and national policy.

As a crisis developed, the growth of these teams and coordination with others, including government groups having area and state responsibilities, suggest a potential of millions of "trained" people nation-wide, perhaps more than ten million, with special training and education in survival and recovery tasks. Of course, a rapid development of this type would severely test our ability for emergency organization and coordination and in this manner suggests an important area for future studies. This kind of research, if undertaken, could have two major purposes: (1) the development of plans for assisting the emergency CD effort at various levels (from technical inputs for specific industries to interstate or even international coordination); and (2) the creation of an integrated corps of millions (tens of millions) of people with some training in recovery measures who could be welded into a temporary "paramilitary" organization to help the government fulfill its major responsibilities to the country during the potentially chaotic and perhaps very critical postattack reorganization period.

Thus, we have visualized the growth during a nuclear emergency of a loose national organization of trained citizens of millions with previous talents in technology, management, maintenance, repair, production, distribution, and government, and with which the probability of an effective social and economic reorganization after an urban attack could be greatly

enhanced. Also, remarkably enough, it seems not unreasonable to hazard the guess that to develop the research and planning which would facilitate this development would involve only a modest peacetime cost; for example one which would probably be quite small compared to the R&D costs of most strategic weapons systems (usually about $1 billion). Even in its later stages the planning costs may not substantially exceed that of the current civil defense budget (about $.1 billion). Certainly such guesses about costs are very uncertain and at this time are not meant to be defended. However, a pursuit of this problem would probably include the formulation of better cost estimates as one of its early objectives.

D. Food Distribution Problems in an MTS Program

As an application of the concept of emergency measures for postattack recovery we would like to suppose that there exists an MTS shelter program, one in which shelters either already exist in rings around, but outside of, the major urban areas or, it is assumed, can be built rapidly during the early stages of a crisis.* In this program, the shelters would be designed to provide very good protection for the occupants against any attack not deliberately aimed at the relocated people (and relatively good protection compared to the current CD program against population attacks).** We will discuss some problems of the preattack and postattack food supply for this program under the assumption that through appropriate but inexpensive preplanning attempts have been made to anticipate and solve such problems (using as major resources only those that could reasonably be mobilized during the crisis).

One important advantage of the assumed MTS program for postattack planning is that it should provide a better estimate of the postattack population distribution than fallout shelter programs which do not move the urban population and therefore a better planning basis for the emergency requirements of the early postwar period. Thus, for estimating requirements, if we can reasonably assume that there is no deliberate targeting of the relocated population we would infer nearly 100% survival in the MTS areas.*** Thus, the major change in population would depend upon the numbers of people in the cities during the attack and the targeting details.

---

*For a detailed discussion of an early concept of an MTS (Movement to Shelter) program, see reference 11.

**Relatively good protection means that in moderate (or small) attacks against the shelter areas it would require several times the number of weapons to cause the same number of fatalities.

***For some arguments supporting this assumption see reference 11. Of course even if the MTS areas are struck the estimated fatalities are generally much less than that for urban attacks of the same magnitude against the non-dispersed population.

The food distribution problems for the MTS areas should be considerably alleviated if there were time to phase-in the preparations gradually. Of course in this respect the war outbreak scenario can be crucial. With a surprise attack out of the blue little can be accomplished; civilians would be lucky to reach shelter in time. However, for scenarios which provide some strategic warning, the possibilities are very different. Even a scenario which gives as little as a few days of usable warning (which is relatively unlikely in our judgment) would permit a movement to (existing) shelters to be accompanied by the transport of a substantial amount of food from homes. Families moving by auto could without great difficulty take up to about 500 pounds of valuable supplies with them and much more if there was time to recycle. Perhaps even more important would be the movement of food and other supplies by trucks and trains. The capacity of existing vehicles in the U.S. now permits the movement of over 100 million tons to dispersed locations if we assume only a single loading of each vehicle--this comes to about 2,000 pounds for each urban citizen.[3]

However, for this last kind of operation to be effective, it would need to be well organized and there is considerable doubt that the needed coordination could be effectively accomplished within a few days. In this connection it becomes important to emphasize the scenarios (perhaps the least unlikely ones) in which the available warning would be measured in weeks or months. Effective warning, in the civil defense context, means the time in which emergency CD options can be exercised that allows a phased mobilization of the population to take planned protective actions. In these scenarios, it should be possible within such a mobilization not only to create protected stockpiles of important supplies, but equally, if not more important, to adopt the policies and promote the development of the organizations which would be urgently needed during the postattack economic reorganization period.

A relocation of a large fraction of urban citizens to the outlying shelter rings would require a massive change in the food distribution system including new routes for transportation and new outlets for distribution. The longer the crisis persists, obviously the greater the interval during which the economic adjustments can be made. However, we observe that those adjustments required for maintaining the population during a lengthy crisis should also have substantial utility for solving some of the postattack food problems. First, they could facilitate the establishment of large food stockpiles in or near the relatively safe MTS shelter rings, stockpiles that might be distributed roughly in accordance with immediate postattack needs. Secondly, some of the important aspects of a postattack food distribution system would already have been learned and created preattack, thus eliminating much of the confusion which otherwise would be expected to occur at a much more inopportune time. Third, the lessons learned in developing the food distribution system should have important carry-over into systems to produce and distribute other important consumer supplies. In this manner it is possible for a handle to be gained on many other important aspects of postattack requirements (housing, banking, communications, transportation, etc.).

In this last respect, a crisis-oriented MTS program, one which was designed to build the required shelters early during a nuclear crisis, rather than simply to move people to existing shelters late in a crisis, would have two additional utilities. The first is that the large rapid shelter construction program would require a CD mobilization that would develop both an experienced management for the organization of the construction effort, and a number of active auxiliary groups, in almost every locality, involved with the other CD problems such as radiation, communication, transportation, stockpiling, health, decontamination, postattack remedial movement, and postattack economic reorganization and recovery. The groups formed initially to aid the shelter program should provide an excellent basis from which to expand the mobilization into a more extensive national effort with principal emphasis on postattack recovery measures if the international tension became sufficiently severe. Perhaps most important, they might provide the personnel and useful experience for managing the economic and social reorganization required for postattack recovery.

A second advantage of the mobilization for shelter construction within an MTS program is that it can be expected to develop relatively early a major interest in survival and recovery problems among local and state governments--as well as among agencies of the federal government. This interest should help to adapt the government organizations to the new functions which would be required of them during the mobilization and to develop contingent preparations for postattack recovery. These preparations might emphasize economic reorganization and recovery problems of inflation, banking, employment, credit, war-damage compensation, prices, wages, and rationing, as well as such physical problems as stockpiles, decontamination, and repair.

For the federal government to be able to give reasonable guidance to local recovery preparations during a CD mobilization would require an extensive program based on prior research. Some of the extremely formidable problems to be solved in such a program have been pointed out by some investigators who have projected their imagination into the potentially wild confusion (if not incomprehensible chaos) that could follow a widespread nuclear attack.[4,6,7,12] Nevertheless, if the research is reasonably funded, the formulation of the problem and perhaps the understanding of feasible countermeasures promises to take recognizable shape out of the murk and gloom which presently hovers about these problem areas. The initial research effort should soon be able to suggest the potential of further study; the payoff could be immense, it could be the nation.

IV. CONCLUSIONS

1. After a nuclear attack, before national recovery can begin, the country may need to emerge satisfactorily from a reorganization phase during which any surviving institution might have to establish a new "identity." This means that institutions must find ways to determine their postattack functions, that is, to hire employees, obtain supplies, and find outlets for their production--all within a new and possibly wildly changing system of prices, wages, rents, taxes, and government influence. Indeed, each government (Federal, State, local) would have the problem of establishing its own "identity," that is, make the necessary adjustments or radical changes for performing the required postattack functions. Even a superficial examination of the extremely interrelated and complex nature of this problem suggests that situations could occur in which the PA recovery effort in the nation might not be able to begin in any reasonable or desirable sense unless there had been a prior major effort in research and planning for the needs of the economic reorganization phase. Thus, even though a major fraction of the physical resources survives a nuclear attack, a rapid enough recovery to preserve or restore the economic viability of the country is not assured. For want of an effective understanding of the needs of the PA reorganization period, the country could experience an economic "starvation in the midst of a potential plenty."

2. During an international nuclear crisis, some mobilization would probably occur in the U.S. in order to respond to the military threat, the population threat, and even to PA recovery needs as they are perceived at the time. The purpose of preplanning for a CD mobilization is to enable it to proceed rapidly and effectively at the time it is needed. Thus, if the preparations are satisfactory, we believe much time could be saved and, among the thousands of activities that would occur as a result of the mobilization, the efforts which would promote the subsequent PA recovery could reasonably be balanced with survival activities. Unbalanced protective activity, even though extensive, may leave great gaps which could prove disastrous during the trans- or postattack periods.

3. The appropriate balancing of crisis activities includes the option to create a large emergency organization which could be indispensable if we wish to assure early effective PA economic reorganization. It is argued that if a CD mobilization is programmed, it should include preparations to produce just such an organization. That is, during the mobilization special groups would be organized for performing functions such as protecting the population, speeding up production of vital materials, converting industries to manufacture survival and recovery supplies, developing procedures to handle postattack problems of decontamination, law and order, postattack remedial movement, preattack and postattack transportation, emergency communications, and taking action to protect food, utilities, and petroleum products. These groups would have a potential to be coalesced into a "paragovernmental" agency of several millions of people who are already partially trained through their preattack emergency functions in the skills needed for managing postattack reorganization problems.

4. Another great threat to an effective reorganization following a nuclear attack is the collapse of federal currency--that is, a nearly complete loss of confidence in the dollar. If this occurred, it could readily be followed by a collapse of the federal civil service and federal authority. It is suggested that preventive actions could include the option to develop during the preattack crisis a capability to seize a portion of or even the entire food industry (nationalize it) and, if needed, to operate it during the reorganization period as a temporary federal institution. Some ability to manage this new institution effectively might be provided by the paragovernmental organization mentioned in the preceding paragraph. The major purpose of seizing the food industry would be to give the government commodity reserves with which to effectively bolster the dollar or any other postattack money the government may wish to issue. Thus, if the federal government can back its currency by the entire stockpile of food, there is likely to be a very great respect for it.

5. In addition to seizing the food industry, it is argued that during a crisis period the federal government could begin rapidly building up stockpiles of survival supplies other than food, e.g., petroleum, metals, chemicals, medical supplies. While these goods would undoubtedly have great postattack value, a major impact for the reorganization period would be to provide the federal government with additional "currency" to help assure that the government would survive and function in a way that would meet its major PA responsibilities.

6. In order to provide a solid basis for an industrial role in a mobilization for postattack recovery, local studies are needed in selected industries to uncover their potential for emergency responses within days, weeks, or months. These studies are needed to understand (a) the utility of protective measures to reduce vulnerability, (b) the utility of preattack emergency stockpiling of raw materials and finished products, and (c) the potential of developing talented groups which, through the performance of these emergency functions during a crisis, would provide the large number of experienced personnel needed for a "paragovernmental" organization which would manage the PA reorganization.

7. The MTS program options as now conceived[11] have some special advantages for PA recovery. They (a) provide a better estimate of PA population distribution; (b) encourage the creation of emergency protected stockpiles of food and recovery supplies; (c) provide, in crises of longer duration, an opportunity to solve many distribution problems which would crop up postattack; and (d) provide an unusual opportunity, especially if the shelters are constructed early in a crisis, for deeply involving local, state, and federal government agencies in preparations for reorganization and recovery.

8. The complex problems involved in researching and analyzing the requirements for planning a mobilization effort that would greatly enhance the viability of the U.S. economy by rapidly effecting a reasonable PA reorganization may require substantial funding ($ millions, annually) for a decade. It is recommended that this aspect of postattack research should be strongly emphasized in forthcoming years.

REFERENCES

1. William M. Brown, et al, Changing Prospects, Missions, and Roles for Civil Defense: 1965-1975, HI-447-RR (Croton-on-Hudson, N.Y.: Hudson Institute, February 22, 1965).

2. William M. Brown, A New Look at the Design of Low-Budget Civil Defense Systems, HI-478-RR (Croton-on-Hudson, N.Y.: Hudson Institute, August 2, 1965).

3. F. Rockett and W.M. Brown, Crisis Preparations for Postattack Economic Recovery, HI-661-RR (Croton-on-Hudson, N.Y.: Hudson Institute, July 15, 1966).

4. Sidney G. Winter, Jr., "Societal Recovery After Nuclear War: The Economic Dimensions," Chapter IV of Vulnerabilities of Social Structure: Studies of the Social Dimensions of Nuclear Attack (McLean, Va.: Human Sciences Research, Inc., December, 1966).

5. Jack Hirshleifer, Disaster and Recovery: A Historical Survey, RM-3079-PR (Santa Monica, Cal.: The RAND Corporation, April, 1963).

6. David F. Cavers, "Legal Planning Against the Risk of Atomic War," Columbia Law Review, Vol. 55, No. 2 (February, 1955), pp. 127-157.

7. William M. Brown and Herman Kahn, Nonmilitary Defense Policies: A Context, Reappraisal, and Commentary, HI-359-RR (Croton-on-Hudson, N.Y.: Hudson Institute, May 5, 1964).

8. Sidney G. Winter, Jr., Economic Viability After Thermonuclear War: The Limits of Feasible Production, RM-3436-PR (Santa Monica, Cal.: The RAND Corporation, September, 1963).

9. John Karlik, Aspects of Postattack Economic Recovery, HI-872-RR (Draft) (Croton-on-Hudson, N.Y.: Hudson Institute, December 15, 1967).

10. E.C. Harvey, Comparison of the Five Field Studies Relating to Provision of Expedient Shelter Conducted by the Corps of Engineers, Preliminary Report (Menlo Park, Cal.: Stanford Research Institute, December, 1964).

11. "Analysis of Movement to Shelter Systems," Civil Defense Study-1966. Report to the Secretary of Defense. (Department of the Army, Office of Civil Defense, September 1, 1966) CONFIDENTIAL

12. F.W. Dresch and H. Ellis, Methodology for Assessing Total Vulnerability (Menlo Park, Cal.: Stanford Research Institute, August, 1966).

BLANK PAGE

APPENDIX A

THE MONGOL INVASION OF KHORASAN

(An Historical Disaster Experience: With Primary Emphasis on Sociocultural Continuity or Discontinuity)

Thermonuclear war would likely be seen as a disaster in the light of history, yet as it is a disaster which may occur, and as societies often recover from disasters, it is incumbent upon those presently alive to try to understand in advance some of the ramifications of large-scale disaster in a society. Some useful analogies to some aspects of a thermonuclear disaster are given by at least three types of historical examples: (1) the careful study of circumscribed recent disasters by the methods of the behavioral sciences, (2) the study of recent military disasters, such as the destruction inflicted on certain societies in World War II, and (3) the consideration of great historical disasters such as the great plagues or the depredations of Jenghiz Khan and Tamerlane. These three types of examples are correctly placed in descending order as to ease of study and ascending order as to similarity to the scale of destruction which thermonuclear war may entail.

This paper presents an ancient historical example in the third class. The data here is crude and vague, and the framework is that of civilization. The concentration is on, and should be on, longer-term effects of overwhelming disaster on society and culture (or specifically not "society" at all but on what the last generation of anthropologists understood as "culture" in its broadest sense).

There have been, of course, historical disasters from which there was no return. Small primitive peoples and their cultures have been starved out, eliminated by disease or by the attacks of enemies. On a more complex level perhaps this was the fate of the Mayan civilization or the Roman, certainly of Aztec and Incan. But in most of these cases the suspicion remains that the disaster broke down the previous sociocultural system because of prolonged periods of imposition from the outside (or inside) of new systems. This imposition is not entirely separable from the disaster experience, and yet neither are the new systems simple products. The destruction of Carthage offers an example of two processes of dissolution. First, it was a disaster so meticulously imposed that there never was another Carthage (later Roman colonies give only a spatial continuity). Secondly, with the head cut off, the Punic culture of North Africa gradually disappeared under the imposition of foreign rule.*

---

*B.H. Warmington. Carthage (especially pp. 196-213). New York: F.A. Praeger, 1960.

It is true, then, that for a mixture of reasons some great historical disasters have either initially or finally extinguished cultures or civilizations, though parts of the old usually fused into newer systems. To relate many of these cases to nuclear aftermaths would mean assuming 100% biological destruction or removal and/or enemy occupation. However, it is probably true that one or a series of blows can cause a cultural group to stagnate or decline without other apparent reason.

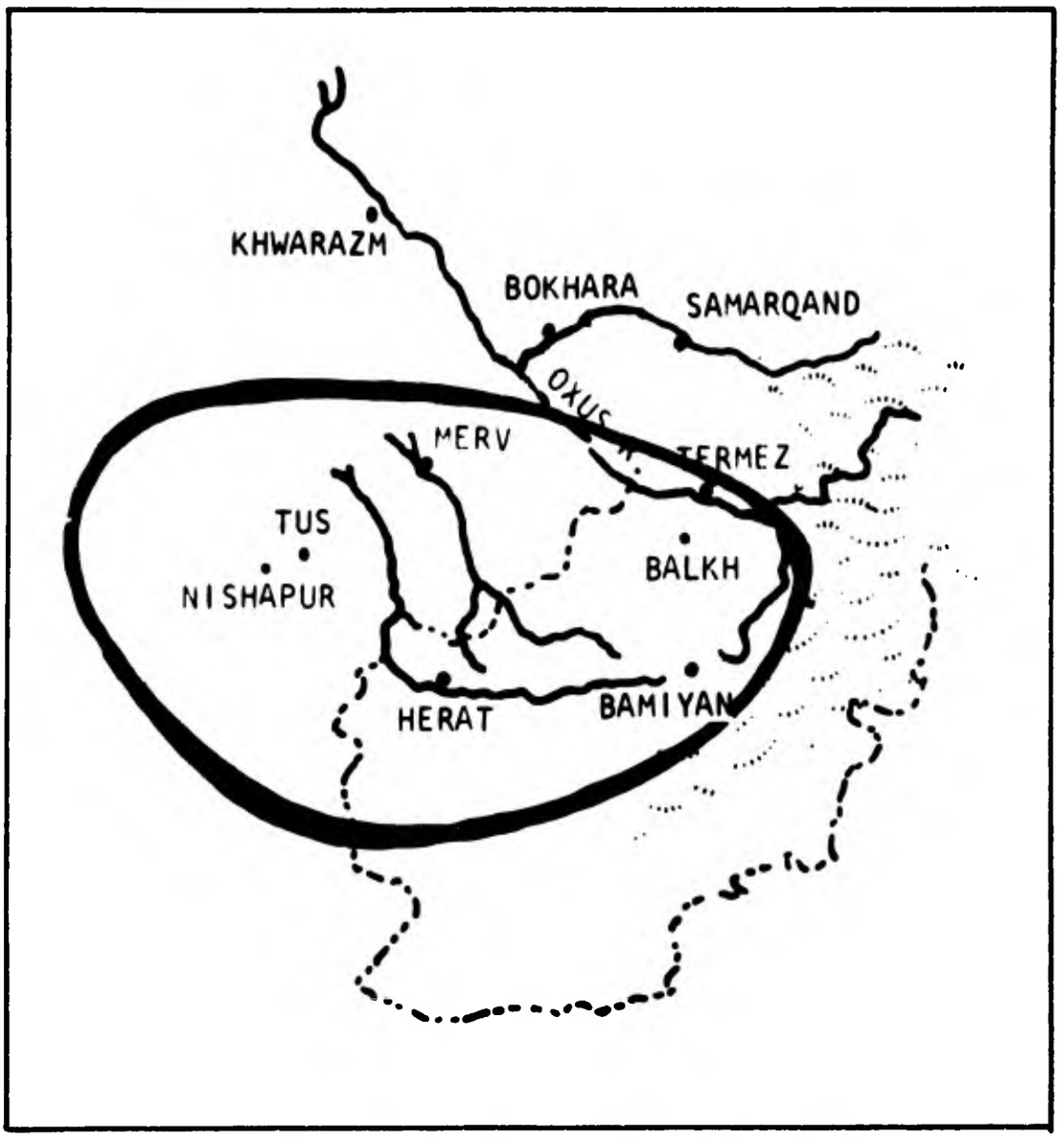
In our consideration of this ancient disaster the effort is made to establish: (1) the actual scale of destruction; (2) the immediate reactions of the populace and their leaders to this destruction; (3) the short-term reaction to the disaster; and (4) the long-term cultural and societal effects of the disasters. An attempt is made to point out the ways in which the disaster is particularly similar to or different from certain predicted types of thermonuclear holocausts. If the following account seems thin and incomplete, this is related to the paucity of available sources and the irrelevance of most of what history offers to our particular problem.

The Mongol Destruction of the Eastern Iranian World

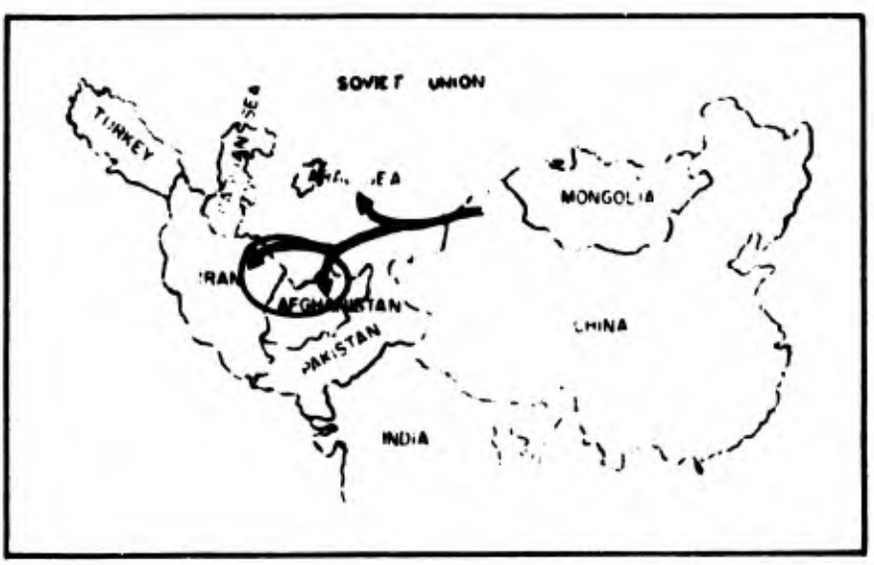
Although there were many Mongol campaigns which eventually reached to the borders of Egypt, and covered more than half a century, the most devastating attacks were those lasting less than two years from late 1219 A.D. to early 1221 A.D. And, although there was great destruction in Central Asia, the particular area of our concern shall be that classically called Khorasan, lying south and west of the Oxus. It is significant, however, that Mongol destruction in all four directions from Khorasan was sufficiently severe that there could be no initial convergence phenomena, although provinces further away could accept refugees.

Eastern Iran was at the beginning of these attacks a populous, relatively urbanized area. Although in population percentages the vast mass of people had to remain peasants on the land in order to support the cities, Islamic civilization, and no where more than here, was an urban civilization whose core was a highly religious, artisan-merchant-priest class ruled over by erratic princes, plundering chieftains, and their entourages of scholar-bureaucrats. The great cities of Nishapur, Herat, Balkh, Merv (and Samarqand and Bokhara further east) were outstanding centers of both Arabic and Persian learning in spite of the Turkish intrusions which had periodically devastated the country for two centuries and placed the rule of Iran almost universally in Turkish hands.

The Mongol invasions of 1219-1221 were particularly destructive, for the invaders desired only martial glory, the exercise of brutal might, and pasturage for their horses. People and productivity were useful to them only in the following ways: (1) to carry tales of slaughter to others; (2) to be used as cannon fodder or in other minor military ways; (3)to provide women for distribution as booty; or (4) to provide artisans of superior ability to be transported to Mongol centers further in the interior.



EASTERN IRAN OR "KHORASAN"
APPROXIMATE BOUNDARIES INDICATED



The Extent of the Destruction

The Mongol armies engaged in Khorasan during these years were primarily flying columns, and the resistance they encountered was relatively slight outside of engagements before walled cities. Thus, while we hear of the general destruction of villages, it is probable that the destruction of the peasant base, the "B country" of strategic discussion, was, at least compared to the "A country," moderate. That is, even if crops and grain storages were destroyed for one or two years, many peasants lived on. The exception to this was often in the environs of besieged cities where canals were destroyed and agriculture systematically disrupted (e.g., Juvaini, p. 176 passim). Unfortunately, some of the most productive areas of Iranian agriculture were in the environs of the larger cities.

The Mongol treatment of captured cities can be divided into three types: (1) the city was systematically looted, perhaps a few citizens were executed and some artisans transported; (2) destruction through siege, bitter fighting, and larger-scale executions and impositions; and (3) methodical execution of all inhabitants, with the exception of the transportation of certain artisans, maidens and an occasional prince, with the further precaution of sending back a column to search out the ruins for any who had hidden away or been temporarily absent. The buildings, walls, and works of such cities were often destroyed through fire, siege weapons, by hand or by neglect (which works very fast on Iranian cities). All of the large cities in our area of particular concern suffered the third treatment whether or not they resisted.

Let us turn to some examples. The city of Merv was estimated variously to have 700,000 or 1,300,000 persons,* which in spite of possible exaggeration indicates a large city. On surrender, its population was destroyed by distribution for execution among the victorious soldiers. Only 400 artisans were taken away. Several succeeding columns then proceeded to destroy survivors, including the peasants and tribesmen of surrounding areas who moved in to live off the riches of the destroyed city. The buildings of the town were systematically destroyed.** Finally,

> ...in the towns and the villages there remained not a hundred souls alive and not enough food even for these enfeebled few. Some few...wretches escaped and were scattered throughout the country; and except for ten or a dozen Indians there was no one left in the town.***

Nishapur was leveled and the population extinguished. Balkh suffered the same fate and was systematically destroyed twice. In terms of figures we are lost, but it is safe to say that most of the A country was

---

*Browne. p. 439.

**Juvaini. pp. 153-168.

***Ibid. p. 168.

completely destroyed, the inhabitants dispersed either locally or widely (90% or more of the people removed). Fifteen years later towns such as Tus and Herat remained completely or almost completely uninhabited. Merv, Balkh and Bamiyan remained uninhabited or nearly uninhabited until much later.*

The Immediate Response

In the face of attack the Khwarazmshahs who had ruled Eastern Islam, largely abandoned the area and each city stood alone. Many stood bravely. Several revolted even after crushing defeats. These revolts led to their ultimate extinction. But once defeated, the people submitted meekly before their execution in a manner reminiscent of the Nazi executions. Political order in the surviving towns was often in the hands of a Mongol official, or even a local lord. But since the occupation was not complete, some towns might have inflicted on them the rule of several competing Turkish, Mongol, and Iranian lords. However, although the societal order collapsed at the top, and along with that trade was interrupted and famine spread, this did not necessarily mean the breakdown of local order which was administered by the small landlord-merchant-artisan-ulema (religiously learned) combination. Robber bands became more powerful and exacting, but in doing so they filled a power-vacuum. They were probably both a product and a survival of the onslaught.**

Short-Term Response and Recovery

Although a semblance of order soon developed, even in "completely destroyed" towns, attempts to rebuild the urban centers were not seriously undertaken for ten to twenty years. By 1260 the Middle Eastern bureaucratic apparatus of government was again in full swing, and governorships under Mongol sway were allotted. Yet Khorasan showed few signs of regaining its former prosperity. The land lay largely in ruins while beyond the Oxus recovery had largely been accomplished.***

In the 1230's the Mongol governors of Khorasan, perhaps under the influence of their Persian ministers, began to become interested in the province's revenues and thus its prosperity. They resisted efforts from the central government to exterminate all Khorasani because of the latter's

---

*Ibid., p. 501, passim; Ibn Battuta, p. 175; Marco Polo, p. 26; Browne, p. 439.

**Juvaini, p. 168, passim.

***Ibid., pp. 96-7.

continued rebelliousness* and began to establish their residences in cities which they then started to rebuild.**

Herat provides a good example of resurrection of a large city. Herat had fallen after two long and bloody sieges, and its population had been systematically exterminated. The buildings were knocked down and the moats filled and the walls destroyed. Again a column was sent back to destroy the survivors. And several thousand girls and artisans had been taken to the Great Khan. Only a small group of 16 citizens who had hidden in a nearby mountain returned to bury their dead and mourn. After twenty days they established their camp in the outskirts. When forty survivors were assembled they moved camp to the central (Friday) mosque of Herat. According to tradition, after two and a half more months they counseled. One group suggested that since the area was now empty and neither meat nor grain nor clothes were to be had, and there was danger of another Mongol visitation, they should leave their beloved homeland. But the other group suggested that since Khorasan was almost uniformly in a state of ruin, they would have to go too far for a new life. It would therefore be better to stay and trust to God and their leader's abilities (Sharaf-ud-Din, presumably a preacher). The latter argument was accepted and all gave an oath of fealty. It was then agreed that before provisions ran out, small groups should be sent in all directions for food, while others stayed home and sifted chaff. Yet despite all efforts, supplies went down and the survivors began to subsist on religiously unclean meat and even human flesh. This condition was general throughout Khorasan due to burning of the grain stores.*** The people of Herat were able to capture horses and other stock from peasants and merchants. In the third year, they captured a large caravan at a distance of hundreds of miles. By the fourth year they had become a rich robber band, trading captured goods with the area of Merv for grain. However, their stores were plundered in a battle of passing armies in which they could take no part. And by this time the remaining buildings of Herat had collapsed due to the weather. For the next decade this transient robber band was supposedly the only occupant of Herat.

However, when the Mongol government came into the hands of Ogetei, son of Jenghiz, an attempt was made to restore certain parts of Khorasan, in spite of well-grounded fears among the general staff that such help would lead eventually to rebellion. The weavers guild of Herat which had been settled under their original leader closer to the Mongol court was now asked to return to the city. The old guild leader then led the first group of 100 families back. He was to repair the city and welcome new inhabitants from elsewhere in Khorasan. The returning weavers were welcomed by the citizens who had been forced to banditry. Consulting together on the rebuilding of the city, the leaders of the two groups now

---

*Ibid., pp. 485-7.

**Ibid., p. 501, passim.

***al-Harawi, p. 87.

instructed every man to plant a certain amount of grain. And since the ditches were closed, water had to be drawn from wells, and since there were no animals, men both high and low were put in place of the oxen. The people of Herat were also able to grow some cotton which was traded with southeastern Afghanistan for sheep and supplies. They then turned to opening an irrigation ditch. However, attempts to enlist the support of formerly dependent and now thriving villages in the rebuilding of Herat proved more difficult.

More of the weavers were then requested to return, and more Mongol officials were sent. However, the latter continued to live in camp outside the city, and difficulties with Mongol officials almost led to another rebellion and flight. But the old priest-leader of the remnants managed to control the situation, while preserving local control in the hands of the Iranians. Taxes were regularized to one-sixth. Two hundred more families arrived by order of the Khans. The ditches were finally cleared by an ordered administration.

Now, however, the combination of artisans, priests, and minor Mongol officials was no longer allowed to rule. A young descendant of a powerful aristocratic family of the period of the Khwarazmshahs was placed with his entourage of bureaucrat-scholars over the growing town as its feudatory. He carried on the reconstruction, and he raised an army. The census showed only 6,900 persons, but twenty years after the destruction of Herat, life was fast rebuilding.*

This may seem a long and anecdotal digression, yet it is interesting to note that the adaptive power of the survivors was considerable. The effete characteristics of Muslim city life were transcended--first to live off the land by force and secondly to turn to agriculture even without tools and experience. The successive forms of governance were also innovative reactions to the needs of the moment which tended to temporarily suppress personal ambitions. But the object was clearly: (1) to survive; and (2) to restore the old way of life when the opportunity came. And, except for certain aspects of Mongol culture, especially in the political and military areas, this is what the people of Herat accomplished.

The periods of disaster and recovery might be summarized as:

1. previous society and culture
2. resistance and disaster
3. postattack disorganization (3 weeks)
4. organized but nonproductive subsistence system under Sharaf-ud-Din (15 years)
5. reconstruction under Sharaf-ud-Din and guild (6 years)
6. feudal control and most of old sociocultural system reestablished.

---

*Ibid., pp. 66-127.

Long-Term Cultural and Societal Effects in Eastern Iran

Although one must proceed with great caution, a general study of Iranian history suggests that the following effects were involved:

1. Arabic ceased to be the language of learning in Khorasan, being replaced by Persian. This was an acceleration effect on an already existing trend, and was related to a general breakup of the Islamic world. Often, however, the literary result was a strange mixture of the two languages.

2. The focus of Persian scholarship and literary effort never returned again to Khorasan, shifting dramatically to India, western and southwestern Iran, Asia Minor, and even central Asia. Refugees often sparked such developments.

3. The development of Persian miniatures was one of the results of several transfusions of Chinese culture through Mongol conquest.

4. The urban culture of Khorasan probably never fully recovered, at least until the twentieth century. Urban culture, however, recovered in western Iran and central Asia.

5. Certain standards of political barbarity were introduced which perhaps made easier the later destructions of Tamerlane and others down to the twentieth century. The systematic destruction and transportation of populations was not a characteristic of earlier Islam. Yet this change is probably more attributable to cultural transfusion than to the disaster itself.

Yet, with all this the society and culture was rebuilt on essentially the same formulations as before. The Mongol attack was primarily a sharp interjection in a long-term process of change which included depopulation, stagnation, and brutalization among its fruits.

Thermonuclear War and the Mongol Destruction

The scale of the initial destruction was similar to that of a moderately large countervalue attack. The result of the attack was directly or indirectly the destruction of property as well as people--in this way differing considerably from plague effects. The longer-term effects of nuclear radiation were of course not present, though the continued destructiveness of Mongol raiders over the next few years bears some analogy. Basic ecological effects are not present, although some agricultural land reverted to pasture and desert. Specialization by trade was far advanced and dependency on commerce considerable, yet there were recuperative advantages to the relative simplicity of economic techniques which could be learned without a long period of basic education. This fact may have made decentralization recovery easier than in the twentieth century, although Herman Kahn has suggested the greater adaptability of modern technology to new materials as a counterproposition. It would seem that

the urban Khorasani had to begin again from nothing, yet he had his culture and a personally understood physical environment to build upon. In this respect our post-nuclear descendants may not have nearly as supportive an environment to build upon.

The account stands on its own as an enriching experience for the understanding of the meaning of future thermonuclear disaster. No one can claim that the material is directly applicable, but it may offer a better hope for understanding the longer-term meaning of a nuclear blow than do the more heavily documented, but relatively insignificant (with the exception of the Jewish extermination) disasters of recent years. It is the best possibility for handling problems of scale which appear otherwise overwhelming and incalculable in the social, cultural, and psychological spheres.

In the cultural area it does seem possible to draw at least one generalizable conclusion. Peoples rebuild their lives with the mental tools they have in being before the disaster. The disaster may change the balance of sociocultural forces, will almost certainly accelerate some current trends and changes, but it is unlikely to create many really new forces and systems. No matter where or how overwhelmed, the survivors in our story tried to re-establish their old system of life and generally succeeded. One may hypothesize, then, that where there are several lively sociocultural systems in conflict (as in Italy or Spain) before a thermonuclear disaster, the surviving population may form a different majority after the attack (if they are free to choose). But survivors are unlikely to create radically new systems as a result of the disaster. Where, on the other hand, there is only one lively sociocultural choice before the attack, as perhaps in the U.S., then the re-establishment of the generally accepted preattack way of life will be one of the primary concerns of the survivors. In America, whether one year or several decades of tragedy follow the disaster, one would imagine Robert's Rules of Order to be rescued from the rubble for the first council of the new world. Fascism, militarism, communism, totalitarianism--these are unlikely choices for the parochial American survivor.

BIBLIOGRAPHY

Bahar, M., ed. Tarikh-e-Seistan. Khavar, Tehran, 1935 (written 440-725 A.H.).

Barthold, W. Turkestan Down to the Mongol Invasion. 2nd Ed. London: Oxford University Press, 1928.

Browne, Edward G. A Literary History of Persia. Vol. II. Cambridge, England, 1906.

al-Harawi, Ya'qub. Ta'rikhname-e-Herat (A History of Herat). Calcutta, India, 1944. (Original early 14th Century).

Howorth, Henry. History of the Mongols. Part III, "The Mongols of Persia." London, 1888.

Ibn Battuta, Abu abd Allah, Mohammad. Travels in Asia and Africa, 1325-1354 (trans. H.A.R. Gibb). London, 1929.

Juvaini, 'Ala-ud-Din 'ata-Malik. The History of the World Conqueror (trans. J.A. Boyle). England: Manchester University Press, 1958.

Polo, Marco. The Adventures of Marco Polo (ed. Richard J. Walsh). New York: John Day, 1948.

Minhaj-ud-Din. Tabakat-i-Nasiri (trans. Major H.G. Raverty). Vol. II. London, 1881 (written about 1260).

Rashid-ud-din, Fazlullah. Jami'ut-Tawarikh (ed. E. Blochet). London: Brill, 1911.

Sykes, Sir Percy. A History of Persia. Vol. II. London: Macmillan & Co., 1390.

APPENDIX B

CRISIS MEASURES FOR POSTATTACK INDUSTRIAL RECOVERY

I. INTRODUCTION

This paper is based on concepts developed in previous Hudson Institute reports.* The central concept is that a nuclear attack will be preceded by a period of mounting tension. During this crisis period it might be possible to allocate men, money, and materials to crash measures to increase protection. At a relatively low cost, advance planning would help to assure that during the crisis, when resources are likely to be available, that they would be used to best advantage.

This report which is mostly based on previous OCD studies attempts to outline some possible measures which might be undertaken during the nuclear emergency to reduce the vulnerability of equipment and stockpiles in several critical industries. Because of the uncertainty of the length of a crisis, those measures which might be effected in a matter of hours or within a few days are stressed but some potentially useful measures which could take a longer time to achieve are also mentioned.

Most of the suggestions must be tentative since they are mostly based on existing literature rather than field research. Further detailed study will be needed if this approach is to bear promise.

II. PETROLEUM

A. Protecting Petroleum Refineries

Recent studies have shown that oil refineries are highly vulnerable to nuclear attacks. A 1-MT airburst can create blast pressures severe enough to damage refineries anywhere within a radius of about ten miles. Calculations showed that 163 1-MT weapons were required to hit all of 288 operating refineries, but only 13 could destroy 61% of the oil refining capacity of the nation. The thirteen points are within major metropolitan areas which could be targeted anyway in a nuclear attack.**

---

*Frederick C. Rockett, Management Requirements for Crisis Civil Defense Programs, HI-612-RR (Croton-on-Hudson, N.Y.: Hudson Institute, November 5, 1965); William M. Brown, CD Options for Emergency Response to Nuclear Crisis, HI-614-RR (Croton-on-Hudson, N.Y.: Hudson Institute, September 26, 1966); Frederick C. Rockett and William M. Brown, Crisis Preparations for Postattack Economic Recovery, HI-661-RR (Croton-on-Hudson, N.Y.: Hudson Institute, July 15, 1966).

**Olaf H. Fernald and Robert C. Entwisle, Critical Industry Repair Analysis: Petroleum Industry (Wellesley Hills, Mass.: Advance Research, Inc., October 1965).

To protect refineries from large blast threats they would need to be dismantled and shipped out. But many refineries are located in areas sufficiently distant from targets that they might experience only relatively low blast effects, up to perhaps a few psi. We are mostly concerned with the reduction of vulnerability of these "marginal" cases. Despite their vulnerability to low blast pressures, precautions can be taken in the crisis period which might considerably lessen these vulnerabilities. The options outlined are only partially inter-related and, if found feasible, may be instituted singly or in combination.

1. Controlled Shutdown

Although it may seem advisable to keep some refineries open during a severe crisis, most probably would be shut down as a major attack seemed sufficiently imminent. A refinery is far more vulnerable to blast and fire damage if it is operating, for the escaping gases can produce severe secondary explosions. If the plant experienced only minor damage, it would be very unlikely to be operable in a highly radioactive environment. Unlike some industries, a refinery cannot be run from an underground control room. Although many refineries are semi-automated, the control processes require constant visual observation. This matter is discussed at length in a study by the Stanford Research Institute* which concludes:

...it is not feasible to continue operation of a refinery in critical fallout without exposing personnel to excessive radiological doses. There are other reasons that support shutting down refineries as follows:

1. A refinery which has been shut down will be far less vulnerable to blast effects, or to sudden utility failures that might result from the attack. Such effects are of special concern to plants located near potential target areas.

2. The most critical resources in the industry are the skilled and experienced personnel. Thus the first concern is for their protection, which will be best served by safely shutting the units down and moving personnel to shelters.

3. Continued production during the critical fallout period is far less important than subsequent restoral of capacity.

4. Most terminal operations at a refinery involve considerable manual labor and attention. Therefore, even if the process units could be operated in fallout, in most instances there would be little opportunity to dispose of finished products.

*Fred R. McFadden and Charles D. Bigelow, Development of Rapid Shutdown Techniques for Critical Industries (Menlo Park, California: Stanford Research Institute, January 1966), pp. 29-30.

Shutting down a refinery not only loses production but the processes of shutting down and starting up have special costs attached. Thus, it might often be advisable to wait until the later stages of a crisis before initiating a shutdown. However, it is also very costly to try to shut down a refinery too rapidly. A skilled crew could terminate all operation in 20-30 minutes, but to restart after such a hasty abandonment would require extensive cleaning of vessels, replacement of parts, and repair of equipment. A careful shutdown which would cause few special difficulties in restarting could be accomplished in 18-24 hours.

To avoid irreparable damage the shutdown must be conducted slowly and carefully. Many of the refining processes operate at high temperatures and at great pressures. These temperatures must be lowered slowly to avoid the solidification of some of the products (many of which are solids at ambient temperatures). Some catalytic agents would also solidify if not carefully removed and stored for future use. Rapid solidification of either catalysts or intermediate products could foul valves and might require a subsequent cleanout and repair of the whole vessel. In extreme cases, the vessel would be worthless if sufficiently caked. Slow cooling is also needed to avoid thermal damage to equipment. Kilns, furnaces and boilers used in the various steps could be cracked or warped by too rapid changes in temperature.

A properly conducted shutdown also involves the cleansing of equipment after the contents of a vessel have been removed. This will avoid the corrosion caused by the residues of acids, caustics, and other chemically active substances left on the walls of vessels and equipment. It also includes a thorough checking to make sure all primary and auxiliary equipment is turned off. Otherwise, for example, a generator might be left running without sufficient lubricant.

However, the most important reason for slow careful shutdown is to reduce the danger of fire and explosion. It is estimated that most major fires occur during startup or shutdown. Both processes involve special procedures that create a far greater chance of catastrophe. Often, high volatile gases must be released and "flared." Even small mistakes can allow explosive mixtures to accumulate.

Thus, a carefully planned and executed shutdown during a crisis would be very important. A last minute effort, with a short-handed and anxious crew is an invitation to disaster. Only in an unforeseen emergency (such as a power failure) should a refinery be shut down in less than six hours. In planning for actions in a crisis preceding a possible nuclear attack, it would be desirable for the full 18-24 hour routine to be followed but other shorter options should also be available.

2. Storage and Removal of Products

If it becomes prudent to shut down a particular refinery during a crisis a time-phased program might also be considered initiating various

efforts to decrease the vulnerability of the facility either before and/or after it is shut down. For example:

a. At an early stage the plan might be to terminate or curtail the inflow of crude oil to a particular refinery in order to reduce the amount of crude in storage. If a decision is later made to shut down the refinery within a few days, the crude oil on hand might be processed through before the cessation of operations.

b. As time permits, the end products should be shipped out to relatively safe storage points where they would be useful postattack. If there is insufficient time to ship out all the flammable end products, the local storage should be as far from the refinery as possible, to reduce the threat of damage from spreading fires.

If the input and output of the plant are both removed, the shut-down refinery is less vulnerable to fire hazards. An attack might still cause moderate or severe damage but this would be more easily reparable if no fires occur. For example, although large reactor towers have been dropped while being hoisted into place it has been possible to straighten them out and put them into service. However, a fire near the base of one of these towers probably would so damage the vessel as to make it unusable.*

c. It may be feasible to reduce the vulnerability of the storage facilities to blast damage. Empty cylindrical storage tanks are relatively vulnerable to blast effects. The critical failure mode is the uplift of the base of the shell, causing rupture and loss of contents. This occurs from 1.0 to 1.5 psi, well below the level where the shell wall will bend or buckle. However, a filled or partially filled tank may not fail at overpressures of about 6 psi, depending on the height-to-diameter ratio.** If the storage tanks have previously been emptied or partially emptied, filling the tanks with water would increase their blast resistance. Full tanks would be more likely to withstand the blast.

d. Another measure that might be feasible in an emergency would be to mound-up earth to increase the diking around each tank "farm." At present, the dikes are built high enough to contain the contents of the largest single tank in the "farm." However, increased diking might serve to contain the contents of several tanks which might develop leaks.

3. Partial Dismantling During Crises

a. Protecting Tools and Instruments. Many of the gauges used in monitoring the various refining processes are quite delicate. They could be easily damaged by flying debris or by the blast. One of the most

---

*Fernald and Entwisle, op. cit., p. 3-58.

**Effects of Nuclear Weapons (1964 edition), p. 170.

vulnerable parts of a refinery is the control house. It is estimated that the roof can stand no more than 1.0-1.5 psi overpressure before buckling, and perhaps smashing some of the equipment beneath. Even if the building housing them is left standing, some gauges may be irreparably damaged. Some of these instruments are permanently mounted or otherwise difficult to remove. However, it might be neither time-consuming nor expensive to remove and protect many of these gauges, recorders, and other instruments, perhaps by sealing them in plastic watertight pouches which could then be buried for protection and retrieved postattack. Since this approach may not be feasible, other methods of decreasing vulnerability might be determined by a local investigation.

b. Protecting Machinery. Some of the machinery used cannot readily be disassembled, but perhaps could be protected in place. Sandbags or earthmounds could be placed around and atop certain critical pieces of machinery such as the furnace for the pipe still. This would help protect both from blast and from flying debris.

c. Guy Wires. For equipment which is too tall to be protected with sandbags or earthmounds guy wires might provide enough additional blast resistance to be a useful option in some instances. For example, "tower-supported flare stacks are more vulnerable to blast than guyed flare stacks..."* Thus, it is possible that the emergency installation of additional guy wires might afford sufficient further support for structures like pipe stills and flare stacks to be deemed worthwhile.

d. Fractionating Columns. After the shutdown of a refinery, some of the equipment such as fractionating columns and pipe stills could be filled with water. This precaution is sometimes used when battening down in preparation for a hurricane. The water increases the resistance of the structure to the drag effects of the blast wave.

B. Protecting Tetraethyl Lead Plants

Tetraethyl lead (TEL) has been the most important single gasoline additive. Currently, both regular and premium gasoline grades are produced by a combination of refining techniques and the addition of small quantities of TEL. In 1959, the regular grade gasoline contained an average of 1.7 cubic centimeters per gallon of TEL while the premium grades averaged 2.5 cc/gal. The effects of the addition of TEL is shown in the following table:

---

*Fernald and Entwisle, op. cit., page 3-81.

Table I

LEAD SUSCEPTIBILITIES OF VARIOUS TYPES OF GASOLINE

	Research Octane Number	
Type of Gasoline	Unleaded	3 cc TEL per Gallon
Straight Run	58.0	77.1
Thermal Cracked	70.4	82.0
Catalytic Cracked	92.6	97.8
Polymer	96.8	101.1
Reformate	97.8	102.5

Source: W.C. Healy, C.W. Maasen, and R.T. Peterson, A New Approach to Blending Octanes. (Detroit: Ethyl Corporation, May, 1959.) Table C-1, Page 15.

Because of the importance of TEL, it might be advisable to undertake preattack crisis measures designed to assure supplies of tetraethyl lead postattack. Some possible approaches are outlined below to suggest that further research in this area appears to be valuable.

1. Stockpiling

By transferring existing supplies of tetraethyl lead and tetramethyl lead to protected locations, the stockpile of antiknock compounds for postattack production could be augmented quickly. However, current production is at 85% of capacity with all on-line units operating 24 hours a day. It would take 45-60 days to increase the current 1½ months' inventory to a two months' supply. Thus, although the inventory can be protected quickly, without reduction in consumption it would only be in long crises that it could be substantially increased. However reduced consumption, preattack, may be a very desirable option.

No data has been obtained on the lead times required to increase production of the critical inputs to the manufacture of TEL-sodium, ethylene, ethyl chloride, ethylene dichloride, and lead--but it might be advisable to study the feasibility of protecting existing inventories during a crisis. Some of the smaller TEL plants are outside potential target zones and might remain in production or resume production soon after the attack. Thus, if storage space is available near these plants it might be well to concentrate any increased inventories of raw materials to these locations.

2. Protecting the Plant

A typical batch process TEL plant is in a five-story steel-framed building with reinforced concrete floors and brick walls. Critical elements

are the autoclaves, where the main process occurs under heat and pressure, and the still where the TEL "oil" is stripped by steam distillation. As with a refinery, the stills could be guyed and filled with water. Both the stills and the autoclaves could be protected by sandbags. This would be more effective if the likely direction of blast could be predicted.

C. Protecting Pipelines

Most pipelines are difficult to damage for they are buried deep enough that a nuclear weapon would have to detonate quite close to damage them.* Even river crossings are generally on the river bottom and are therefore not very vulnerable. Of 742 crude-oil pipeline river crossings, only 70 were overhead; and of 813 product pipeline river crossings, only 54 were overhead.

However, other parts of the pipelines system are vulnerable, and pre-attack protective measures which can be taken during an emergency might be advisable. As part of a larger study of the vulnerability of the petroleum industry, a Stanford Research Institute study examines the vulnerability of elements of the pipeline system.** It concluded that pumping stations, which are generally located on the edge of communities or in more remote areas, are vulnerable in about the 3-5 psi range.*** The less vulnerable electric-powered centrifugal pumps and the diesel engines inside the pumping station would be severely damaged between 10 and 20 psi.**** The controls, recorders, gauges and communication equipment would probably be damaged beyond repair if the pumping station was severely damaged. For those pumping stations which are within a 10-mile radius of any potential target it might be useful to determine if it would be feasible to dismantle and then bury delicate instruments in waterproof pouches, or to sandbag or earthmound the buildings to add protection. Further study could determine the magnitude of the vulnerability problem--the number of pumping stations within ten miles of potential targets, the average time it would take to repair damage, and the amount of protection that could be obtained in a few days or weeks during a crisis.

D. Protecting Oil Fields

In case of a threatened atomic attack, the safest place to store crude oil probably is deep underground. Even in existing oil fields blast and thermal effects could cause blowouts and/or fires, doing extensive but localized damage. Radiation levels might also reach levels temporarily

---

*0.5 miles for a 4-MT weapon, 0.8 miles for a 10-MT weapon groundburst.

**Sanford B. Thayer and Willis W. Shaner, The Effects of Nuclear Attacks on the Petroleum Industry (Menlo Park, California: Stanford Research Institute, July 1960).

***Six miles for a 4-MT weapon; 8 miles for a 10-MT weapon.

****About three miles for a 4-MT; 4 miles for a 10-MT.

hazardous to employees. Therefore, at some point in a crisis it might be advisable to shut down pumping operations in those oil fields which are either important enough to be separately targeted or are vulnerable through proximity to other potential targets.

Shutdown could be quickly accomplished by turning off the pump and closing all valves. Both the pump and the "Christmas Tree" of outlet valves rising out of the well could be easily protected by covering with a tarpaulin and, if deemed desirable, by mounding earth or sand around the whole wellhead.

If feasible, urban tank farms and other vulnerable bulk storage tanks would be emptied of oil and filled with water, the petroleum to be transferred to other storage facilities using tankers, tank-trucks, pipelines and railroad tankcars. If insufficient storage is available, it is possible that the carrier vehicle might serve as a temporary storage container. Thus, for example, railroad tankcars filled with oil or gasoline might be stored on rural siding until the course of the crisis is determined.

III. TRANSPORTATION

A. Railroads

1. Relocation and Storage

Railroads can obviously play an important part in any mass evacuation. However, their role in the emergency relocation of supplies vital to post-attack recovery has only recently been stressed. The Hudson study* finds that the 1,540,000 freight cars, if used only once, could carry 86 million tons of food, goods, and raw materials out of target areas. However, with the possible shortage of storage facilities certain classes of freightcar may be used as temporary storage. Because of the large quantities of fuel which will have to be stored, some tankcars might be used in this manner, but other specialized cars--refrigerator cars, closed gondola and hopper cars, special purpose boxcars, etc.--may also be used temporarily to good advantage if better storage space is not available.

2. Protection of Equipment

An emergency program may not only allow the transfer of valuable cargoes but can also preserve the transport vehicles for later use. If railcars were in yards near targets, they would be subject to blast damage. Also, the yards are safer if empty. A rail presents a low blast silhouette and is thus unlikely to be affected except at high overpressures. If the track is loaded, the impact from the car as it overturns, the debris scattered by ruptured cars, and the blast effect transmitted through the flanges are all likely to damage the track.

---

*Crisis Preparations...., op. cit.

The protection of signals and communications equipment used by railroads has not been studied in any detail. However, some of the measures suggested for protecting refinery equipment--sandbags, guying, burying delicate gauges, etc.--might have some applicability. Special studies are needed to determine the feasibility of various crisis measures to protect the rail transport system.

B. Motor Vehicles and Roads

In addition to the 40 million urban automobiles which might be used in a large scale evacuation, in 1963 there were 12.7 million trucks of various sorts in America.* Of these 8.9 million are small pickup and panel trucks whose loaded weight is under five tons. 1.1 million are medium trucks which weigh up to ten tons when loaded, while 2.7 million are heavy trucks and semi-trailers which can carry up to a 20 ton load. Thus it can be seen that trucks can carry about 50 million tons in preattack crisis measures involving the relocation of emergency supplies.

A postattack advantage of motor transportation is its flexibility. If one route is blocked, a truck can detour by way of other highways or secondary roads. Except for a few bottlenecks, it is unlikely that the road network between cities will be severely curtailed. There are roughly 3.4 million miles of roads in America, but 2,725,000 miles are local rural roads which will be of small value to intra- and inter-state shipment of goods. 346,000 miles of highways and 405,000 miles of urban streets comprise the major road network.

A study by the Stanford Research Institute on truck transportation concludes that the damage to the national interstate and Defense highway system would be extensive, because it connects many cities likely to be targeted.** However, an examination of road maps of many of these cities shows that the circumferential roads and bypasses that skirt these cities and the web of secondary roads that surround them would in most cases allow traffic to avoid bombed-out cities. More detailed analysis in this area would probably prove fruitful.

In a few cases, a river or other body of water is crossed at only a few points, all of which are vulnerable. An extreme example is at Mobile, Alabama. If the bridge and tunnel are destroyed, a detour of over 50 miles would be needed to cross Mobile Bay. Similar problems exist at El Paso, New Orleans, and Portland, Oregon. Local planning to meet this threat would be advisable. Perhaps during a crisis pontoons and other components might be stored for building a temporary bridge postattack.

---

*Bureau of the Census, Statistical Abstract of the United States, 1966. (Washington: Government Printing Office, 1966), p. 575.

**Charles D. Bigelow and Harvey L. Dixon, The Effects of Nuclear Attack on Motor Transportation in the Continental United States. (Menlo Park, California: Stanford Research Institute, January, 1963), p. 45-49.

From a quick examination of road maps only two major breaks in the road network could occur which would not be detoured around. These are the bridges from New York City to Long Island and the crossing of Chesapeake Bay from Norfolk to Cape Charles on the Delmarva Peninsula. Emergency measures could undoubtedly improve the postattack transportation prospects for these two areas. For example, the regular ferries that ply between Long Island and Connecticut might be augmented by some of the New York railroad barges. These potential ferries should be moored away from New York harbor. Thus it might be worth investigating the feasibility of improvising a local ferry service until more permanent arrangements could be made. In addition, it might be useful to consider (1) the role of airplanes and small boats for emergency needs postattack; (2) planning to evacuate some of the population of these two areas in the preattack crisis; and (3) creating emergency stockpiles which would reduce the need for early commuting.

Except for the bridges and roads in central core of cities, damage to roadways is likely to be slight. Damage to short-span bridges would depend on their orientation to the blast but roughly correspond to reinforced concrete buildings. Both are still much "harder" than the trees, poles, brick buildings, and other objects that are likely to be strewn on the roads. Thus, clearing rubble will be an earlier task postattack than repair or reconstruction. Therefore, as part of a program for crisis CD measures in a city, it should be useful to plan to move motorized equipment such as bulldozers, snowplows, and streetsweepers to protected locations from which they would be available for postattack cleanup. In general, all motorized vehicles (and attachments for them) that can be driven out of the cities should be considered for this type of protection.

C. Airplanes and Airfields

The non air-carrier aircraft fleet consists of about 75,000 planes, of which 9,000 are multi-engined and over 40,000 will carry four or more persons.* Current planning includes the use of some of these planes for civil defense support.

Although some jetports are out of the probable damage range because of the distance from the cities they serve, most major airports are vulnerable. However, it may be feasible to move most of the non air-carrier fleet to some of the 4,300 smaller airports around the country. Present FAA instructions seem remarkably thorough on proper step-by-step procedure for performing such a "fan out" maneuver.**

It is difficult to protect most airport buildings because of the vulnerability inherent in their structure. Hangars would probably be damaged

---

*Federal Aviation Advisory Circular, State and Regional Defense Airlift Planning, AC NO: 00-7, January 5, 1965.

**Ibid.

at 1.5 psi or less. Control towers might also suffer some damage in the 1.0-1.5 psi range. It is not clear without specific study whether emergency protective measures of consequence would be feasible for the control tower or its equipment.

It might be useful, however, to transfer fuel stores elsewhere or seal off all fuel storage points. Although aviation gas is used less often now, the jet fuel is highly flammable. Therefore, if an airport is to be "buttoned up," this fire hazard should be minimized through emergency action.

IV. ELECTRIC POWER

Recent studies have concluded that even a major nuclear attack on the United States would probably leave intact a large portion of the electric generating capacity and its transmission system. However, certain crisis measures might be taken to protect the more vulnerable equipment.

A. Generation Plants

Generally we would expect that hydro-electric generating plants would be less likely than steam plants to be close to potential targets and that they are also less vulnerable to weapons effects. Dams are generally difficult to damage severely and the generation equipment often would receive some blast shielding from the dam or the terrain.

Hydro-electric plants can more easily be run from fallout-protected shelters than can steam plants. Thus, even if a steam plant is not in a likely target zone, it might be advisable to consider shutting it down before the arrival of fallout since in the late crisis and trans-attack periods load demand is likely to be or can be made to be well below normal. Because of the fallout threat, currently the TVA plans to shut down all of its steam plants and leave the hydro-electric plants running. As with a refinery, a properly conducted shutdown allows time for critical components, such as the turbine shafts, to cool gradually. It may require up to 40 minutes, before the load can be reduced to a point where the turning gear can be operated from auxiliary power.*

For both steam and hydro-electric plants it should be possible to add some blast protection by using sandbags and earthmounds as baffles to diffuse the blast waves. However, estimates of the increased protection are not now available.

Thus although it seems that some crisis actions may be taken relatively quickly in a generating station they need to be carefully prepared for in advance as part of a contingency plan for emergency operations.

---

*Randle H. Powley (ed.), Critical Industry Repair Analysis: Electric Power. (Cleveland, Ohio: Advance Research, Inc., n.d.)

B. Transmission Network

Power transmission lines form a grid so complex and with so may interconnections that it is highly unlkely that service would be knocked out except in local areas. Even if major high voltage transmission lines are knocked down, alternative routings are possible. In a report by the Research Triangle Institute,* the vulnerability of the transmission grid now through 1980 is examined. The report concluded that at no time would it be likely that damage to the power grid would exceed comparable damage to the industries which are the major customers. Thus, the surviving electric power grid should be capable of handling the load demand of the damaged economy.

Transmission poles and towers are relatively vulnerable to blast but reparable at almost any level of damage. Stockpiles of repair equipment and parts are maintained in small depots across the country. This industry is perhaps one of the best equipped to deal with a nuclear emergency since a major fraction of all repairs are done under emergency conditions.

Further research might shed additional light on the need for stockpiles of special parts and tools. Since it would probably be relatively easy to obtain these parts pre-attack, it might be valuable to augment existing stockpiles during a crisis and relocate the more vulnerable ones even at some additional cost.

As another precaution the company could either assign the locations for linemen to evacuate to, or at least to keep records of their location. Also, the crew chiefs might take with them loaded equipment trucks which would otherwise be vulnerable.

*F.J. Lewis & K.E. Willis, Defense Implications of the National Power Surveys. (Durham: Research Triangle Institute, September 17, 1963).

UNCLASSIFIED

Security Classification

DOCUMENT CONTROL DATA - R&D

(Security classification of title, body of abstract and indexing annotation must be entered when the overall report is classified)

1. ORIGINATING ACTIVITY (Corporate author)

HUDSON INSTITUTE, INC.
CROTON-ON-HUDSON, NEW YORK 10520

2a. REPORT SECURITY CLASSIFICATION
UNCLASSIFIED

2b GROUP

3. REPORT TITLE

EMERGENCY MOBILIZATION FOR POSTATTACK REORGANIZATION

4. DESCRIPTIVE NOTES (Type of report and inclusive dates)
FINAL REPORT

5. AUTHOR(S) (Last name, first name, initial)
Brown, William M.

6. REPORT DATE	7a. TOTAL NO. OF PAGES	7b. NO. OF REFS
15 May 68	58	20

8a. CONTRACT OR GRANT NO.	9a. ORIGINATOR'S REPORT NUMBER(S)
OCD-PS-65-64	HI-874/2-RR
b. PROJECT NO. Work Unit 3522A	
c.	9b. OTHER REPORT NO(S) (Any other numbers that may be assigned this report)
d.	

10. AVAILABILITY/LIMITATION NOTICES

This document has been approved for public release and sale; its distribution is unlimited.

11. SUPPLEMENTARY NOTES	12. SPONSORING MILITARY ACTIVITY
	Office of Civil Defense, Office of the Secretary of the Army

13. ABSTRACT

This report emphasizes the dangers to eventual reconstruction that are posed by the disorganization inevitably following a nuclear war. What can go wrong in this reorganization period is examined by the use of scenarios and analogy. It is then suggested that during the crisis period preceding a nuclear war a number of useful actions enhancing the chance of postattack recovery should be undertaken as part of an emergency mobilization for civil defense. This mobilization might instigate actions which would help U.S. society to negotiate the reorganization period successfully. The problems of creating such countermeasures appear to be formidable but possible if: (a) the usable warning provided by the crisis is of sufficient duration (several weeks or more); and (b) the pre-planning for the mobilization action is completed in advance of the need.

DD FORM 1 JAN 64 1473

UNCLASSIFIED

Security Classification

Security Classification

14. KEY WORDS	LINK A		LINK B		LINK C	
	ROLE	WT	ROLE	WT	ROLE	WT

INSTRUCTIONS

1. **ORIGINATING ACTIVITY:** Enter the name and address of the contractor, subcontractor, grantee, Department of Defense activity or other organization *(corporate author)* issuing the report.

2a. **REPORT SECURITY CLASSIFICATION:** Enter the overall security classification of the report. Indicate whether "Restricted Data" is included. Marking is to be in accordance with appropriate security regulations.

2b. **GROUP:** Automatic downgrading is specified in DoD Directive 5200.10 and Armed Forces Industrial Manual. Enter the group number. Also, when applicable, show that optional markings have been used for Group 3 and Group 4 as authorized.

3. **REPORT TITLE:** Enter the complete report title in all capital letters. Titles in all cases should be unclassified. If a meaningful title cannot be selected without classification, show title classification in all capitals in parenthesis immediately following the title.

4. **DESCRIPTIVE NOTES:** If appropriate, enter the type of report, e.g., interim, progress, summary, annual, or final. Give the inclusive dates when a specific reporting period is covered.

5. **AUTHOR(S):** Enter the name(s) of author(s) as shown on or in the report. Enter last name, first name, middle initial. If military, show rank and branch of service. The name of the principal author is an absolute minimum requirement.

6. **REPORT DATE:** Enter the date of the report as day, month, year; or month, year. If more than one date appears on the report, use date of publication.

7a. **TOTAL NUMBER OF PAGES:** The total page count should follow normal pagination procedures, i.e., enter the number of pages containing information.

7b. **NUMBER OF REFERENCES:** Enter the total number of references cited in the report.

8a. **CONTRACT OR GRANT NUMBER:** If appropriate, enter the applicable number of the contract or grant under which the report was written.

8b, 8c, & 8d. **PROJECT NUMBER:** Enter the appropriate military department identification, such as project number, subproject number, system numbers, task number, etc.

9a. **ORIGINATOR'S REPORT NUMBER(S):** Enter the official report number by which the document will be identified and controlled by the originating activity. This number must be unique to this report.

9b. **OTHER REPORT NUMBER(S):** If the report has been assigned any other report numbers *(either by the originator or by the sponsor)*, also enter this number(s).

10. **AVAILABILITY/LIMITATION NOTICES:** Enter any limitations on further dissemination of the report, other than those imposed by security classification, using standard statements such as:

(1) "Qualified requesters may obtain copies of this report from DDC."

(2) "Foreign announcement and dissemination of this report by DDC is not authorized."

(3) "U. S. Government agencies may obtain copies of this report directly from DDC. Other qualified DDC users shall request through _____."

(4) "U. S. military agencies may obtain copies of this report directly from DDC. Other qualified users shall request through _____."

(5) "All distribution of this report is controlled. Qualified DDC users shall request through _____."

If the report has been furnished to the Office of Technical Services, Department of Commerce, for sale to the public, indicate this fact and enter the price, if known.

11. **SUPPLEMENTARY NOTES:** Use for additional explanatory notes.

12. **SPONSORING MILITARY ACTIVITY:** Enter the name of the departmental project office or laboratory sponsoring *(paying for)* the research and development. Include address.

13. **ABSTRACT:** Enter an abstract giving a brief and factual summary of the document indicative of the report, even though it may also appear elsewhere in the body of the technical report. If additional space is required, a continuation sheet shall be attached.

It is highly desirable that the abstract of classified reports be unclassified. Each paragraph of the abstract shall end with an indication of the military security classification of the information in the paragraph, represented as *(TS), (S), (C), or (U)*.

There is no limitation on the length of the abstract. However, the suggested length is from 150 to 225 words.

14. **KEY WORDS:** Key words are technically meaningful terms or short phrases that characterize a report and may be used as index entries for cataloging the report. Key words must be selected so that no security classification is required. Identifiers, such as equipment model designation, trade name, military project code name, geographic location, may be used as key words but will be followed by an indication of technical context. The assignment of links, rules, and weights is optional.

GPO 886-551