# Disaster Planning

## FOR THE

## OIL AND GAS INDUSTRIES

NATIONAL PETROLEUM COUNCIL

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This Manual Helpful in Their Disaster Planning Programs

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Additional copies may be obtained
from Council headquarters

# FOREWORD

Most organizations in the Oil and Gas Industries are prepared to effectively cope with emergencies such as personal injury, crash shutdowns caused by equipment failure, and fire from whatever cause. Such incidents can usually be handled by the regular staff of workers on hand during normal operations because such incidents are ordinarily small, or local, or of such a nature that they do not cause serious distortions in the over-all plant equipment or working force. An enemy attack, however, is likely to result in damage that is both more intensive and extensive, and to introduce the additional hazard of radioactivity. Such an occurrence will require greater defense in depth and new protective measures.

This guide for the Oil and Gas Industries begins where the normal peacetime protective measures leave off. The descriptive material is therefore devoted primarily to the abnormal conditions which might arise in the Petroleum and Natural Gas Industries, and to the variety of extra measures necessary to handle them. Rather than repeat (or reproduce sketchily) information which is already published or which refers to ordinary emergencies and incidents, many references are made throughout this text. Those interested in further elaboration on a specific subject can obtain information in detail by referring to these sources. Furthermore, detailed check lists are provided in the Appendix for certain main topics. These check lists encompass both small incidents and major disasters so that a comprehensive review is available for all levels.

This manual is intended to provide a comprehensive review of the many problems to be considered in disaster planning and includes possible solutions to many of these problems. In many cases the approaches mentioned are those actually in effect in some plants. It is hoped the manual will be a useful guide to individual companies in formulating their own disaster planning programs.

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# INTRODUCTION

## A PROBLEM FOR TOP MANAGEMENT

Every executive in the oil and natural gas industries realizes that his company is subject to peacetime disasters; such as, fires, floods, earthquakes, vehicle wrecks, hurricanes and explosions. Each must now recognize the existence of a new and greater threat . . . enemy attack with present-day weapons. Nation-wide destruction of our industrial facilities is entirely possible. Moreover, it is militarily desirable from an enemy standpoint, for within our generation the corporate production line has emerged as the most vital battlefront of modern warfare.

In World Wars I and II, the continental United States was virtually free from attack and had a time interval in which to train and produce for battles fought overseas. In the event of another war, there may be no time to prepare, so preparedness must precede the conflict.

In a future war, our enemy will undoubtedly put forth tremendous efforts to swiftly destroy our vital installations. It is probable that the initial onslaught will once again be delivered without warning, but this time with an intensity and scope designed to prevent effective recovery from the first blow. The most devastating weapons known would presumably be used to accomplish this purpose. We must therefore anticipate that attack may involve not only atomic war with its blast, heat and radiological effects, but also biological and/or chemical warfare.

The potential enormity of the consequences imposes on industrial management an urgent responsibility to minimize them. The Oil and Gas Committee for Emergency Defense Organization has studied the magnitude and multiplicity of problems involved in reducing the effects of enemy attack on our facilities and of speeding the resumption of production. It is convinced that the best answer to the problems lies in thorough pre-attack planning by the oil and gas industries themselves.

The Committee therefore recommends that each company act promptly to (1) insure the continuity of its management, and (2) provide measures for rehabilitation as are reasonable under the prevailing circumstances. Many of the problems involved are considered in this manual. Individual companies may either apply the solutions suggested or develop solutions most appropriate to their particular situations.

Management's most important step is to promptly delegate responsibility for this project to men who have the necessary imagination, ability and authority to initiate and vigorously carry out a disaster control program for the Company.

# BACKGROUND INFORMATION

1. This manual is intended to cover both the Petroleum and the Natural Gas Industries. In most instances the principles set forth can be applied beneficially to both. Where exceptions to this assumption apply, the type of organization concerned is specifically mentioned.
2. The scope of this manual is primarily "intra-company," and does not consider inter-company relationships in the petroleum industry in great detail. The National Petroleum Council has before it for consideration the problem of inter-company relationships in the event of a major conflict.
3. All chapters contain an intermingling of company level and plant level information because the basic principles apply at both levels, and duplication is undesirable. The reader can very easily avoid topics unrelated to his field of interest by use of the detailed Table of Contents; also, he can skip each unrelated topic in the text without delay because he is forewarned by the frequent paragraph titling.
4. Industry is generally subject to natural and man-caused disasters, such as floods, fires, explosions, hurricanes, earthquakes and vehicle wrecks. Preparations made for coping with the effects of enemy attack will improve a company's ability to reduce the damage and injury caused by such peacetime catastrophes.
5. Even in an atomic attack, there will be large fringe areas in which damage and injury will be much like that suffered by European industry due to conventional bombing in World War II. Not all company facilities will be destroyed nor all employees killed.[1] The larger the bomb, the larger the fringe areas as well as the area of complete destruction.
6. An inexpensive and reasonably effective corporate defense and disaster control plan can often be created simply by the maximum utilization of company organizations and equipment already in existence.
7. "Plant" is used herein very broadly to include production facilities, refineries, gasoline extraction plants, gas compressor stations, marine and pipe line terminals, bulk plants, administrative offices and any other company facilities where the subject matter is applicable.
8. At plant level, a good plant protection program can serve as the inexpensive nucleus around which a pre-planned defense organization can be quickly expanded.
9. Some persons may be interested in additional details concerning plant-level disaster control organization and functions for process operations. They are referred to the manual "Emergency and Disaster Planning for Chemical and Allied Industries." Some material from this manual is contained in Appendix "R", and other pertinent information is in the chapter on Training.
10. A step-wise plan with reasonable achievement dates is the most practical approach for developing a company defense program. Progress can be hastened if the seriousness of the enemy threat increases.

(1) *Appendix "A,"* Bomb Blast Tables and Charts.

# Chapter I

# ADMINISTRATION

## THE OVERALL PLANNING PROCEDURE

All industry can't go underground for protection; the cost would be prohibitive. Similarly, when considering the type and degree of protection it requires, each oil company must balance expense against reasonable calculated risk. Fortunately, reasonable protection at minimum cost can be provided quickly by use of a step-wise or "phased" program. (See Appendix "B".)

Phase number one involves the maximum use of existing company personnel and equipment through planning, organizing and training. Phase number two involves: (a) planning for additional material and equipment, and for minor construction; (b) progressive accomplishment of these plans in a pre-attack period. Phase number three concerns procedures to be put into effect in the event of war, and must be thoroughly developed in advance.

Subjects which should be of interest to top management in its disaster control planning are considered below.

## CONTINUITY OF MANAGEMENT

Natural or man-caused major emergencies have often left industrial equipment without major damage, while at the same time inflicting heavy casualties on company personnel. American industry now faces the real possibility that entire cities, housing most of its key personnel, might be wiped out without warning. Leadership needed for reconstruction of the organization could become virtually non-existent. Therefore, plans for helping to insure continuity of management are vital to the industrial corporation.

### EXECUTIVE SUCCESSION

Corporate management can plan to avoid chaotic conditions during a critical period by developing an emergency "executive succession list." (See Appendix "C".) It would set forth the emergency functions of surviving successors and would list the personnel in sequence. Thus, the available surviving person highest on the list would assume temporary direction of the organization. Each line of succession should include at least one person from an entirely different area.

This plan could be developed for executives within each autonomous unit of the typical decentralized petroleum corporation. The separate lists might then be integrated, as appropriate, with a Corporate Headquarters list, for it is apparent that the management of a parent company may have to be replaced by various surviving top executives of dispersed affiliate or subsidiary companies. Parent company Boards should make provision for conduct of business with a minimum number of members constituting a quorum– (they in turn could augment their membership).

These general procedures would be applicable also to the various organizational units within each affiliate or subsidiary company.

#### *Executive Vulnerability*

As a first step in planning succession, the planners should appraise the vulnerability of their key personnel. Consideration must be given to the geographic and volume concentration of the corporate executives. A high percentage may be in one general area, but that may not be a critical target area. Conversely, the executive forces may be widely dispersed, but with many or all of their individual locations in critical target areas.

#### *Qualified Replacement*

The depth of organization is also important. In some firms qualified replacement personnel stand three or four deep for each key position, as a result of executive development programs and confidential emergency manning tables. In addition, personnel may be available from similar organization structures at scattered locations.

### EMERGENCY MANAGEMENT FUNCTIONS

One corporation has planned for the creation of teams of supervisory employees chosen from a variety of distant plants to report immediately to a pre-designated plant in the event of a major disaster at that plant. There is also a team of executives at the Executive Headquarters of the company, assigned to handle rehabilitation operations at damaged plants. See Appendix "D" for a statement of assigned duties. The oil and gas industries are especially fortunate in this respect due to having multi-plant corporations with practices of decentralization of authority, and rotation of key personnel among the dispersed locations.

### CORPORATE SECURITY COMMITTEE

A good industrial defense plan requires that a Corporate Security Committee be organized as one of the first steps. Top management committees of this type would be expected to function mainly in a planning and advisory manner. The committee should be responsible for determining the sequence of action necessary to develop the Corporate Disaster Plan. It should have authority to refer tasks to the company organizations concerned. The committee members should represent the varied corporate departments; e.g., the production, manufacturing, medical, personnel, financial, marketing and legal functions. The frequency of meetings is best determined by the committee. Such committees can determine their goals and appraise their progress by means of a check list such as that in Appendix "E".

### CORPORATE SECURITY OFFICER

Management should designate one person to coordinate the development, maintenance and execution of the corporate disaster plan. He might conveniently be made chairman of the Corporate Security Committee, but should at least be a member of this committee. In either case, he should be selected from upper management levels and be given the authority and the time to perform his functions. These functions may be presumed to include:

1. Work with the Corporate Security Committee in developing the disaster plan.

2. Encourage and help coordinate similar disaster planning by committees set up in the various companies or plants of the corporation.

3. Advise the various company units on the organization of their defense training programs.

4. Periodically appraise the overall company progress toward a state of readiness.

5. Encourage the formation of Mutual Aid organizations among industries and communities where company facilities are located.

6. Act as liaison officer between the corporation and Civil Defense authorities.

## CONTINUITY OF OPERATIONS

Certain basic preparations must be made if there is to be an effective continuance of the corporation's operations after attack. They are discussed below:

### ALTERNATE CORPORATE HEADQUARTERS

If the continuity of management is to be effective, it would be advisable to designate a specific location as emergency or alternate company headquarters. It should be furnished with the minimum equipment and facilities needed to allow effective operation of the reconstructed executive team.

One typical firm believes that the criteria for site selection of this headquarters should include these considerations:

1. It must not be in a critical target area.

2. The neighboring community must be large enough to provide facilities for adequate transportation, communication and housing for employees.

3. It is desirable that it be at a point where the Company already has an installation.

Construction, rental, or purchase of facilities may be involved. The requirements to consider before selection of a location are: security, accessibility, communications, and accommodations.

Several companies have purchased and equipped emergency headquarters remotely located from their home offices in critical target areas. Senior management personnel have been assigned to carry on or reconstitute the business from these locations. In some instances practice drills have been conducted for principals and their alternates. In one case the facility has sleeping accommodations; in others, arrangements have been made with nearby hotels. Space and facilities for working and feeding are normally provided. Communications media are varied, with emphasis on emergency telephone facilities.

The procedures to be followed at the alternate headquarters will vary from one company to another. One company's procedure is described in Appendix "F".

### REMOTE REPORTING CENTERS

Additional emergency reporting points will provide rendezvous locations for other levels of designated key personnel.

One company has almost a score of reporting centers set up at the homes of designated executive personnel at company and plant levels. Various records are kept at these locations. The home phones are expected to be on a preference list, arranged with the telephone company, for continued service in an emergency.

The use of radio communications facilities on the petroleum industry frequencies should be considered for such centers. Locations should be chosen with the foreknowledge that traffic movement may be regulated during and after attack, and personnel may have to walk to the locations. The cost involved is insignificant when compared with the advantages of recovery-planning which can be conducted at these locations during or after the emergency.

## PROTECTION OF RECORDS

There are certain records in every company that should be safeguarded due to their vital nature and irreplaceability. The effects of their destruction could include:

1. A slowing or stoppage of production.
2. Impedance of financial and physical rehabilitation.
3. Complication of dealings with suppliers and customers.
4. Harm to employee and stockholders' interests.

One firm has described the disabling results of a loss of vital records as "corporate amnesia." Records protection is the easiest concrete precaution a company can take, and might well be its first step in disaster planning.

### *What Records to Protect*

Each company must make its own determination on this question. However, the list should obviously include stock records and those of accounting, contracts, patents, insurance, operations, research, statistics, engineering drawings and supplies specifications. In short, anything vital to continuance of operations. The classification of records for disaster storage purposes is generally made into these four categories:

1. Vital
2. Important
3. Useful
4. Unnecessary

### *How to Protect Records*

Detailed methods of protecting records in wartime are described in a National Industrial Conference Board Study (No. 51). The process is essentially this: Make up a records inventory, decide upon which records are needed, grade them as to relative importance, prepare desired duplicates, and then send either the duplicates or the originals to storage, preferably underground, in non-critical target areas.

Some firms have utilized bank vaults, abandoned mines, caves and quarries at safe distances. Also, companies have sprung up which specialize in such storage for the business world. Micro-filming saves storage space, but requires equipment for viewing purposes. It may be wise to duplicate in a more readily usable form those records potentially important for emergency operating purposes.

In the oil and gas industries there is at least one firm which makes extra copies of important business transactions each day for delivery at the close of business to short-term storage at its Emergency Corporate Headquarters. Here a small maintenance staff files the material.

The total expense will be cheap insurance against partial or complete paralysis of the corporation. A procedure should be set up in each company to insure continuous follow-up of records protection with regard to scope, selectivity and currency. (See Appendix "G", Records Protection.)

## PROTECTION OF CURRENT ASSETS [1]

Normal banking and other financial services will probably be disrupted by enemy attack, and the resulting shortages could create serious problems. Among the factors to consider are:

1. Cash; appraise:

Geographic concentration of bank accounts.

Advantages of maintaining bank accounts of an unrestricted nature at scattered locations.

Advantages of establishing lines of credit at scattered locations.

2. U. S. Government and marketable securities; appraise adequacy of custodian's procedures, records and storage place.

3. Inventories; appraise:

Size and character.

Practicability of dispersion or subdivision of inventories.

Adequacy of storage facilities in relation to inherent potential hazards.

4. Accounts receivable (should be covered under the program relating to safeguarding accounting records).

## EMERGENCY BUSINESS OPERATIONS

This subject deals with pre-planning concerning payrolls, purchasing, payments, credits and collections, order writing, invoicing, accounts receivable, communications, etc. The planning here should include:[2]

1. Appraisal of the ability to continue any or all plant operations in the event of loss of office personnel and equipment.
2. Consideration of the risks created by geographic concentration of any of the above functions.
3. Evaluation of the practicability of correcting any hazardous situations.

All accounting records should be reviewed as part of a general records protection program. Loss of current accounts receivable records could be disastrous, particularly if the debtors should also lose their records of accounts payable. The same is true of inventory records, especially when materials, supplies, products and replacement parts

(1) *Emergency and Disaster Planning for Chemical and Allied Industries,* November 1953, U. S. Department of Commerce.

(2) *Industrial Defense Planning Manual,* October 1954, Iron and Steel Institute, 350 Fifth Ave., N. Y. 1, N. Y.

are stored at many places in the plant or on the premises of other business concerns.

A simplified emergency accounting and auditing system should be developed to take care of at least the elementary requirements in the immediate post-attack period. Copies of this emergency accounting procedure should be filed at alternate company headquarters.

Management and the purchasing department should identify their most critical supply requirements and review the sources of those supplies. If such sources are vulnerable, critical items should be sought in less vulnerable locations. If the supply item is of a complicated character, experimental orders could be placed.

## EMERGENCY FINANCIAL PROCEDURES

Post-disaster conditions may be such that normal company accounting procedures are badly disrupted. However, money may be needed promptly for wage payment, cash advances to employees, payment of bills, and for other important reasons such as cash purchases of needed medicines, food or equipment. It is therefore advisable to pre-plan a procedure for drawing company funds.

### *One Company's Approach*

The emergency financial procedures of one large corporation are quoted below for illustrative purposes:

The normal banking arrangements of the Company are considered adequate for any emergency. The Bylaws have ample provisions for withdrawal of funds. The Treasurer and the President, or in their absence or disability, Assistant Treasurers and Assistant Secretaries and Vice Presidents, may authorize the withdrawal of funds. A list of depositories in which the Company keeps its funds is on file and kept current each month at one of the Company Security Storage Vaults. At each of the Security Storage Vaults there is also a list of approximately 100 persons who have authority to sign and/or countersign checks. This list is kept current each month. Signatures of these individuals have been furnished the various depositories.

There are numerous banks in various cities in the United States in which the Company maintains accounts for the convenience of its local operations. A current list of all banks is transmitted each month to the Company Security Storage Vaults.

For emergency purposes it may be desirable, depending on the international situation, to deposit a small amount of cash in one of the Security Storage Vaults. If and when such action is taken, that information will be included in the Confidential copies of the corporate disaster Plan stored in the Security Storage Vaults.

## DISPERSION CONSIDERATIONS

Geographic dispersal of industrial facilities forces an enemy to seek out many targets instead of one, increasing his problems and decreasing potential attack damage. However, process industries are difficult to break up and decentralize—witness German World War II trouble with the synthetic oil industry.[1] Process operations involve such huge expenditures for capital equipment that they are not readily dispersable from either a time or a cost standpoint.

### *New Installations*

However, in planning for new installations, managements should consider the advantages of dispersion. With respect to future plants, the disaster considerations should be weighed in relation to other factors, as follows:[2]

1. Consider Government's view as to priority rating of product, but recognize that such ratings may change radically over the years.

2. Selection of plant site; consider:
Dispersion vs. concentration.
Vulnerability rating.
Natural hazards.
Location of primary and alternate raw materials.
Primary and alternate sources of power, water and transportation.

3. Selection of source materials; consider:
Possibilities of substitution.
Probable priority rating of materials in relation to rating of finished product.

4. Engineering
Safety aspects in relation to all types of hazards.
Standardization, for maximum ease and speed in replacement of parts, motors, etc.

A company can develop a "progressive dispersal program," built around normal expansion and obsolescence factors.

### *Modified Dispersal Activities*

Patent rights may restrict the number of producers of strategic items such as lube additives. Companies could profitably consider dispersion of such essential operations when they are conducted in or near target areas. Numerous petro-chemical processes in refineries are in this category. In many cases they are run on a relatively small-scale and their relocation may be practicable. All else being equal, management should consider remote sites for such processes; frequently they are self-contained operations which do not require physical interconnection with the refinery.

(1) *See Appendix "H," "German Oil Industry Countermeasures to Allied Bombings."*

(2) *Emergency and Disaster Planning for Chemical and Allied Industries,* p. 25, November 1953, U. S. Department of Commerce.

Modified dispersal activities may be feasible and helpful when:

1. Relocation is practicable for key departments in a single critical facility located in a vulnerable area. This includes executive and management offices.

2. Individual facilities can be rearranged or modified to increase the independence of particular operations.

3. Pre-attack planning can be made for post-attack relocation in the event of extensive damage to a major facility in a vulnerable area. In World War II the German government ordered that if a plant were 75% destroyed it was not to be repaired, but rebuilt elsewhere in the dispersal program.[1]

4. War damage to property provides an unexpected opportunity to effect long deferred improvements in plant layout, process design, etc. However, governmental war damage insurance procedures may limit protection to replacement only, and approval for changes will have to be obtained.

### CORPORATE DISASTER CONTROL PLAN

The work of the Corporate Security Committee will produce various defense policies, procedures, organizations and recommendations. In toto, these will represent the company's plans to meet disaster. All such information should be assembled and consolidated into a type of publication known generally as a "corporate disaster control plan" and kept up to date. It should contain detailed information on each of the subjects important to the continuance of the business. Pertinent subjects would include: Executive succession lists, reorganization charts, records protection information, emergency financial procedures, emergency headquarters procedures, reporting center locations, communication information, appropriate government agency contacts, critical material inventories, and supply sources. Sufficient copies should be maintained in Security Storage and at the emergency corporate headquarters.

Top management practice-drills in applying the corporate disaster plan are vital. Such drills should be held at the emergency headquarters, with directors periodically spending a day or two conducting their regular business from the emergency headquarters, working singly or in small teams.

#### *Organization and Training Manual*

The general organization and training functions required by the corporate disaster control plan should be detailed in a separate master manual on a company-wide basis. Of course, it should not include details of the subject matter of all training programs, but should contain provisions to insure that all disaster organizations are created, trained and retrained, and that progress is reported regularly. Basic subjects, such as organization, defense planning, police protection, first aid, rescue work and fire fighting should be included.

Individual company locations should be made responsible for developing and conducting within their own organizations the training necessary to meet certain standards of defense security. Each plant should, of course, have its own organization and training manual.

### INDUSTRIAL MOBILIZATION PLAN

Converting from production of peacetime products to military items is a difficult job for many industries. A good company mobilization plan will obviously help immeasurably in meeting a sudden shift, say, from producing automobiles to producing airplanes. The oil and gas industries are fortunate in that they need make relatively few radical change-overs in product to meet military demand. Rather, they mainly shift emphasis on which types of production are to be maximized.

However, there may well be benefits from company defense planning which considers the possible product modifications the military may suddenly require. The urgent World War II projects for aviation gasoline and butyl rubber are cases in point. Interested companies might obtain a copy of "Defense Mobilization—What Management is Doing."[2] It is in the field of petro-chemicals that such effort might be best applied.[3]

## CONTINUITY OF PRODUCT AVAILABILITY

A post-attack shortage of oil or gas products would reduce our military offensive strength, paralyze transportation, decrease the nation's productive capacity and prevent heating of homes. A full scale oil and gas drought could actually render us defenseless against attack repetition and invasion.

### STORAGE

Immediate post-attack petroleum needs will be met by drawing upon stored stocks. Several steps can be taken to safeguard these materials.

#### *Protection of Facilities*

In World War II, the technique of fragmentation bombing followed by incendiary bombing

(1) *Damage Control in Wartime,* Studies in Business Policy No. 53, National Industrial Conference Board, Inc., N. Y. C., N. Y.

(2) *Defense Mobilization—What Management is Doing,* March 1951, Controllership Foundation, Inc., Research Arm of Controllers Inst., 1 E. 42nd St., N. Y. C., N. Y.

(3) *Industrial Mobilization Plan,* 1954, Koppers Company, Inc., Pittsburgh 19, Pa.

was very effective against oil and gas facilities. Yet European experience proved tankage protection too costly, except for key structures which were sometimes provided with surrounding brick walls to good effect. Greatest danger to oil tankage and gas holders in the perimeter of an atomic bomb blast is from fire. Sufficient tank spacing, plus properly sized and well maintained fire banks, will help prevent fire spread.

Government tests show that even at rather close range there is little appreciable danger of direct atomic radiation ignition of oil and gas products. However, the high heat input will accelerate vaporization. Secondary fires of paper, rubbish and vegetation could ignite the resulting vapors, or the liquid leaking from openings torn in containers by fragments or blast. Thus, housekeeping becomes especially important for fire prevention in storage facilities. Also, light color paints are helpful in reducing secondary fires.

Finally, tests show that the oil products surviving the blast will be usable. Even the solid radioactive materials of a bomb "fall-out" will settle to tank bottoms after a reasonable period and permit product use without hazard.

### *Alternate Storage Methods*

Storing products at points distant from target areas is desirable. For economic reasons, tankage existing at water and pipeline terminals and other remote locations is sometimes not utilized. Where joint operations have been abandoned, or for other reasons field tankage is not in current use, steps may be taken to return such tanks to useful service. Wherever the practice exists of maintaining minimum inventories of products, it could be changed to the more practical defense approach of full tankage in remote areas.

Underground storage deserves consideration. Tankage in the ground is costly and hard to inspect, but disadvantages may be offset by concrete construction. Storage is also possible in remotely located quarries; this method is economically competitive.[1]

Techniques of the natural gas industry paved the way for the relatively new development of underground storage of liquefied petroleum gases, an inexpensive method safer than surface storage.

Seasonal storage or stock piling of certain petroleum products in government mothballed tanker fleets might prove financially advantageous to some firms upon arrangement with the government.

## SOURCES OF SUPPLY

Transfer of equipment or petroleum stocks between undamaged areas and attacked areas may be practicable. In this regard, a critical review should be made of the possible benefits to be derived from additional interconnections between pipelines. Governmental control will apply under post-attack circumstances, regulating priorities and allocations. Foreign nations expected to be neutral may be sources of supply.

## REHABILITATION

Reconstruction of all facilities is not necessary in order for some production to be resumed. The extent of damage incurred will vary at different points within any plant which escapes complete destruction. Resumption of production, then, is a matter of operating whatever is available until permanent repairs can be made. Rapid repair requires planning, organizing, and properly equipped teams of repair personnel. Planning should insure that the especially critical repair materials are ready and waiting. Further information on rehabilitation measures is given later.

# GENERAL ADVANCE PLANNING

Disaster control planning encompasses a variety of additional subjects. Some are treated below.

## BUDGET PROVISIONS

A continuing corporate defense program will obviously require a provision for funds in the annual budget. The amount allocated can be minimized by a realistic appraisal of vulnerability and good organization of existing personnel and equipment. The existing facilities of many plants can be utilized per se, or with minor modifications. A good disaster plan designed to meet the hazards of normal operation can be rapidly expanded to meet problems of enemy attack. Funds allocated should be determined on much the same basis as money provided for insurance against peacetime threats to the business.

## INCENTIVES AND ASSISTANCE

A variety of incentives for disaster planning exist. A number of them are set forth in an Office of Defense Mobilization Report.[2]

### *Rehabilitation Time*

Peacetime disasters frequently cripple production for long periods. Defense planning will facilitate speedier recovery from non-war damage.

### *Federal Fund Matching*

The Contributions Program of the Federal Civil Defense Administration provides Federal funds to

(1) *Petroleum Processing,* Page 1583, No. 10, Volume 9, October 1954, McGraw-Hill Publishing Co., 330 W. 42nd St., New York 36, N. Y.

(2) *The Job Ahead for Defense Mobilization,* Jan. 1, 1953, 8th Quarterly Report to the President, Office of Defense Mobilization, Washington, D. C.

be equally matched by the States for selected types of civil defense organization equipment and supplies. Federal contributions are made for attack warning, communications, public safety services, medical supplies and equipment, educational services, mass care equipment and engineering supplies and equipment. No Federal funds are presently available for contributions toward the purchase of fire equipment. Industrial firms integrated with their local Civil Defense organization in disaster control plans may desire to investigate. For details of the Contributions Program see the Federal Contributions Manual (M25-1) published by the Federal Civil Defense Administration.[1]

*Loans to Industry*

When customary private financing is unavailable for an expansion project because of the business risk involved, loans for investment in facilities or working capital may be made directly by the Government or guaranteed through banking channels.

*Tax Amortization*

See Appendix "I" for information relative to the Government's accelerated tax amortization program on certain facilities which meet the standard of protective construction as related to industrial defense.

As provided under Section 168 of the Internal Revenue Code the taxpayer is permitted to amortize a portion of the cost of a facility attributable to protective construction, for tax purposes, over 5 years instead of the normal depreciation period.

*Insurance for Industrial Disaster Personnel*

A program exists in some states which provides free accident insurance coverage for death or hospitalization for Civil Defense Workers. This coverage may include Industrial Disaster or Rescue Units under certain conditions. See Chapter 12 of the New Jersey Public Laws of 1952.

*Records Protection*

Ordinary hazards such as fire threaten records at all times. Attack-anticipated protection measures have peacetime values.

*Guaranteed Markets at Guaranteed Prices*

When a project involves an abnormal risk or when an assured market is required to induce either investment or production, commitments may be made for Government purchase of the output. In some cases, these consist of contracts to buy the output of a particular project, if not otherwise sold, at a negotiated price. In other cases, the Government has merely announced a general floor price guarantee for materials produced which cannot be sold on the commercial market at or above the floor price.

## CIVIL DEFENSE FACTORS

Relatively few persons know how broad and far reaching are the emergency powers of the Federal Civil Defense Administration that were granted by the Federal Civil Defense Act of 1950, as amended (Public Law 920, 81st Congress). Title III of the Act, for instance, becomes "effective upon declaration of an emergency" by Congress or the President. It states that the F.C.D. Administrator then may:

1. "Exercise the authority contained in Title II, Section 201 (h) without regard to the limitation of any existing law" . . . to "Procure by condemnation or otherwise, construct, lease, transport, store, maintain, renovate or distribute materials and facilities for civil defense with the right to take immediate possession thereof . . . Provided . . . , that the Administrator is authorized to lease real property required for the purpose of carrying out the provisions of this subsection, but shall not acquire fee title to property unless specifically authorized by Act of Congress."

2. "Sell, lease, lend, transfer or deliver materials or perform services for civil defense purposes on such items and conditions as the Administrator shall prescribe and without regard to the limitations of existing law."

There is similar, but more restrictive, authority in the "non-emergency" portion of the Federal Civil Defense Act of 1950 , as amended.

In some states, disaster control coordinators (state, county and local levels) have similar authority in non-war emergencies, such as aircraft or train wrecks, explosions, storms, fires, floods and earthquakes.

Some executives are concerned because positions of authority in Civil Defense and civil disaster control organizations are held in the main by persons with no industrial background. In an emergency situation, they reason, industry might not be adequately provided for. It is conceivable that in the immediate post-attack period, the municipal fire equipment might be assigned to fight fires in dwellings or stores while an essential oil or gas facility was being destroyed by fire. It is recommended that top management give encouragement to appropriate supervisory personnel to take an active part in such organizations at the state and local levels.

It is obvious that the Corporate Security Officer should become familiar with the full authority and activity range of the Civil Defense Organization people and maintain a close liaison with them.

(1) *Federal Contributions Manual, M25-1 Revised,* October 1954, $1.35, U. S. Government Printing Office, Washington 25, D. C.

*Typical Matters to Consider*

—For key company personnel, arrangements should be made with Civil Defense officials for maximum allowable freedom of movement to and from company property during emergencies.

—Provision for maximum advance warning of enemy attack should be arranged for top management.

—Coordination of company's disaster plans with the community disaster plans of Civil Defense agencies will eliminate confusion and duplication of effort.

—Priorities for fire fighting assistance might be arranged with the local officials in advance of enemy attack to minimize damage to facilities producing strategic materials for the military.

—Advance arrangements with local police will help in controlling crowds or traffic on company property, or on contiguous roads which become clogged, during various types of emergencies.

—Sources of information should be established for obtaining current information concerning new developments in protective measures, communications, defense legislation, etc.

*Areas of Cooperation*

The following Civil Defense measures are either in effect or are expected to be required with increased danger of enemy attack:

1. Industry to install on its properties adequate warning signal systems, coordinated with the systems of the surrounding area.

2. Shelters or protection to be provided against radiation, blast, missiles and debris in accordance with design standards of Civil Defense.

3. Drills for evacuation of employees to be developed and conducted.

4. Industry to install shielding or structural protection of special equipment in defense plants.

5. Larger companies to organize, train and equip industrial rescue teams, fire fighting crews, air raid wardens and auxiliary plant guard forces.

6. Industrial medical facilities for treating injured personnel to be coordinated with the community's facilities. Company emergency first aid facilities to be expanded, especially those that would handle stretcher cases.

7. An intensification of fire inspection schedules and enforcement of fire prevention standards.

In summary, there will be increasing emphasis on: (1) Protection efforts; (2) rehabilitation plans. These will apply to personnel and equipment, and in many instances will be compulsory.

## INDUSTRIAL MUTUAL AID

Prohibitive costs prevent any one company from regularly maintaining enough emergency equipment to fully cope with disasters producing large-scale injuries and damage on its property. Even if so maintained, the disaster could possibly destroy a sizable proportion of the equipment on hand. Thus, in a widespread and serious industrial emergency, the equipment needed will probably not be available unless companies in a given area participate actively in a pooling arrangement for mutual emergency assistance. By pooling, considerable equipment is made available to participating members. This eliminates the need for large individual purchases or inventories. Such plans are in current use by industrial plants in a number of locations, including Texas City, Texas,[1] Linden, N. J.; the Kanawha Valley, W. Va.; Hudson County, N. J.; and Baton Rough, La.

Trained personnel from the individual plants normally accompany their equipment dispatched to the disaster scene. During restoration, damaged firms may need (1) heavy mobile equipment to clear rubble and debris, (2) mobile machine tool units to quickly repair production equipment, and (3) stop-gap materials and equipment for temporary replacement of damaged facilities holding up resumption of production. In some locations, the Mutual Aid Councils are closely coordinated with the local Civil Defense Organization. Mutual aid arrangements in Germany and Great Britain in World War II proved highly successful.

Planning with other companies and municipal authorities for mutual disaster aid should include the establishment of organizational structure, standardizing of procedures, formulation of lists of equipment available, stockpiling of medical supplies, sharing of facilities in emergency, combined test exercises and cooperative training.

## LEGAL CONSIDERATIONS

The legal problems which may arise in future wars appear so complex and so unusual that the Harvard Law School has made them the subject of a current special study. Corporate law departments should obtain pertinent information on the results of this study.

Even those industrial firms which are not physically damaged by enemy action may be economically injured by factors such as destruction of customers' or suppliers' facilities, with resulting inability to carry out contractual obligations. It is expected that some retroactive Government legislative relief would be provided in the event of a surprise enemy attack. Some of the legal factors are considered in Appendix "J", as it is believed they may be handled.

(1) *Organizing for Disaster Control,* by W. H. Shearon, Chemical and Engineering News, September 10, 1951.

*Contract Provisions*

Companies should review their contract forms to protect themselves against loss in the event of inability to perform due to enemy action.

*Internal Legality*

The legal authority for emergency executive succession in a disaser makes it advisable to review and perhaps revise the corporate by-laws and charter.

## MARKETING AND DISTRIBUTION

Almost all petroleum products are of importance in a war effort. However, those product lines which might be dropped should be determined in advance. Sellers' markets will create surplus sales personnel; plans should be readied to utilize them in other capacities. Distant sales territories might have to be abandoned due to limited production and/or transportation difficulties.

Pre-knowledge of the government's intentions concerning post-attack transportation can be used to determine alternate distribution methods for serving customers. At the local level it will pay even to map the routes intended exclusively for military and Civil Defense vehicles, and to determine if clearance procedures or alternate routes exist for getting vehicles through.

# Chapter II

# PERSONNEL

## THE PROBLEM

Modern superordnance weapons provide the chilling fact that hundreds of thousands of people can be killed, maimed, or lingeringly sickened in one enemy attack. In addition, the "fall-out" of radioactive dust could prove sufficient to create panic and widespread blind flight.

Manpower was the most critical U. S. shortage in World War II, and it probably would be again in another war. Thus, the continued existence of our country will obviously be dependent upon its loyal and patriotic industrial workers. It is a responsibility of management to seek every possible means for safeguarding the lives and health of employees.

## PROTECTION

The hard learned advice of bombed European industrialists is appropriately significant: "Above all, protect your people." If its work force survives, a business can be effectively reconstructed despite severe damage to its physical facilities; but not vice versa. Many people believe that protection of personnel against atomic explosion is an impossible or at least impracticable task. This is not true. At Nagasaki, Japan, people 300 feet from ground zero survived in tunnel shelters in a hillside. In the areas surrounding any size blast, some zones will exist where shelters can provide similar protection.

### A SHELTER PROGRAM

Top management at all locations in the oil and gas industries should survey the possibilities of establishing a personnel shelter program. The cost of providing adequate shelters for all personnel may seem too great to undertake. However, there are many existing buildings which could be utilized with little or no additional construction. These should be marked with appropriate signs after an engineering analysis of all company structures is made. The latest available government information on protective construction should be used as a guide.

European industrial shelter programs included elaborate "keyman" shelters right at the equipment site for employees who volunteered to run boilers, turbines and critical process equipment during raids.

A company having no shelter protection upon the outbreak of a war may find that a considerable number of its employees have become absentees or quit, rather than risk injury from enemy action.

The executive who becomes coordinator of the shelter program should study publications such as "Protecting Personnel in Wartime," Studies in Business Policy, No. 55, National Industrial Conference Board.

### DISPERSION

Long range personnel dispersion is worth considering. Persons not directly connected with production could be transferred well in advance of attack to locations distant from the company's operating facilities and be set up there to perform their regular duties. Unfortunately the oil and gas industries are not accommodated by these measures except where office concentrations may be divorced from plant areas.

Short range dispersions would involve cessation or curtailment of production, while all or most of the work force was allowed to evacuate company property on the theory that distance and scattered distribution are the best insurance of survival. Of course, the Civil Defense regulations on travel during impending attack may prevent such dispersal. Local management must know the current Civil Defense regulations on such matters as they pertain to each respective facility.

Fortunately, many operating phases of the oil and gas industries work shift hours so that more than two thirds of the operating personnel are away from the facility and dispersed most of each day.

Dispersion is also important in assignments of employees to shelters. For example, if all the engineering staff were assigned to one shelter which was later destroyed, the loss would be greater than if the occupants had been a cross section of the work force.

### RADIOLOGICAL PROTECTION

All employees should be informed about preparations for this very important function as covered under the chapter on Plant Damage Control. Squads of competent, well equipped technicians will be needed, and their services should be quickly available around the clock.

## JOB COVERAGE

Company operations can be effectively sustained only so long as competent personnel are available

to operate the equipment. Following attack, it is likely there will be manpower gaps caused by casualties, disrupted transportation facilities, damage to employees' homes, etc. Only advance personnel planning can provide the manpower flexibility to insure maintenance of production. A number of factors which enter into such manpower planning are considered below.

### INVENTORY OF JOBS

All current functions of the company should be analyzed from the standpoint of their value during wartime conditions. Some jobs could be eliminated, if necessary. Many jobs, although important, could be postponed for the duration. In others, the work could be doubled up.

A study should be made throughout the company to distinguish the vital functions from the non-vital. It should be initiated and coordinated by the Corporate Security Committee, with the work done by the individual company units.

### INVENTORY OF SKILLS

A similarly-coordinated project to inventory all personnel skills is advisable. Emergency personnel qualification records should be assembled at all levels by all company units and kept current. Such records should carry the name, address and telephone number of the individual and his emergency alternate, if designated. Also of value would be:

(a) job title
(b) time in job
(c) time in same type work with other companies
(d) experience in other jobs, within company
(e) other jobs with other companies
(f) hobby skills (e.g. amateur radio operator) of use in wartime
(g) military background
(h) educational background, including engineering training, apprenticeships, or any other formal job training ever obtained
(i) leadership potential
(j) physical qualification.

Such information can be obtained from the personnel records, personal employee questionnaires and by interviews with subordinates.

Keeping the information current is a simpler matter. A duplicate of this information, down to a selected personnel level, should be retained in the Alternate Corporate Headquarters or in the Security Storage Vaults, with the appropriate inventory of jobs, to aid in emergency mobilizing of employee resources.

### ROTATION OF PERSONNEL

The Europeans set up company labor control centers to which employees reported after attack. Here were located the personnel records showing the sub-skills which employees could put to use during rehabilitation. Following rehabilitation, key vacancies were filled by qualified people (determined from the skills inventory) who were taken from work of lesser importance (determined from the job inventory). Duplicates of these inventories could be kept also at the Remote Reporting Centers described earlier.

### RECALL OF PERSONNEL

Another source of emergency manpower lies in those former employees who for one reason or another have left the company. Records of these people could provide sufficient information to enable them to be contacted and offered re-employment. Some will be undesirables, and might better be left uncontacted. Others will be especially valuable; for instance, retired supervisors.

### TRANSPORTATION

Disrupted transportation facilities or restrictive traffic regulations will make it impossible for many employees to get to work. It may be necessary for the company to follow the World War II European practice of sending out official trucks or other vehicles to transport employees. This procedure would be facilitated by advance plans for transporting, advance permission to travel under the governing regulations, and current lists of employees' home addresses and phone numbers.

### CONTRACTS AND OUTSIDE ASSISTANCE

Company personnel provide the most reliable source of manpower for continuity of operations. The regular employees know the plant procedures, they know the physical facilities and, equally important, they know one another. But certain company contractual obligations with the employees may prove obstacles to the efficient organization and use of manpower during rehabilitation. In a disaster, however, loyalty and patriotic spirit should prevail over reluctance to generally perform work normally assigned to a specific craft.

Many employees could be made available for work on vital jobs if their own jobs could be farmed out. The use of contract personnel to carry on certain types of work should be investigated during the above mentioned compilation of an Inventory of Jobs.

## POST-ATTACK WELFARE

A wide variety of activities will be necessary in order to properly provide for the welfare of employees following attack. Most important of these are: (1) rescue of persons trapped or buried by debris, and (2) the providing of medical aid. These subjects are treated in a following chapter on Medical Aid. Nervous anxiety and similar distractions may be minimized by furnishing spe-

cial welfare services to the working forces. Examples of such services are considered below.

## INFORMATION SERVICES

In enemy attack, employees will want to know what has become of their families. Past experience dictates that every effort should be made to provide employees with up-to-the-minute reports on the areas attacked. Workers from those areas might be allowed to go home and, if necessary, transportation could be provided. However, temporarily-imposed traffic restrictions may pose very serious problems in this respect.

All available means of communication likewise may be interrupted or overloaded so that local managements will be confronted with difficulty in obtaining information on the areas attacked. This may also preclude employee knowledge of family welfare. However, internal company communications systems which survive should be used to transmit any moderating information which will help prevent panic.

The Europeans advise creation of a special staff to handle only personnel-disaster problems. Refineries especially should set up these information teams, preferably manned by their experienced employee relations people. These teams could obtain valuable training and perform currently needed services by functioning during fires and other peacetime emergencies.

Employees will want information on matters such as: Care of orphans; emergency food; temporary accommodations; housing; injury allowances; medical services for casualties; problems attending deaths; home repairs; furniture salvage; lost identity cards; relief for loss of money, clothing, or household effects; employment loss due to damage of their work area.

## FINANCIAL AID

If disaster renders the regular payroll machinery inoperative, some alternate means will have to be arranged to provide surviving employees with an income. To meet this contingency, special payroll checks should be on file or stored in various locations. Such checks can be identified in various ways, including significant color paper, and they may be prepared in fixed amounts. A list of signatures of pre-designated officials authorized to sign these checks in a disaster should be placed on file with the respective banks. Normally, files of these checks are retained under lock and key at Reporting Centers and Emergency Operating Headquarters.[1]

## EMERGENCY FEEDING

Among the reasons for emergency feeding arrangements by the Company are: (1) possible long confinement of employees to shelters, (2) longer work periods, (3) restriction of travel during raids. Problems of alternate power for cooking, and alternate sources of water will arise. The company must see to it that its various units organize food preparation teams, store food for the emergency, and keep on hand the equipment needed to prepare meals. These steps are a "must" in every plant disaster program. Emergency feeding teams should be alerted to function during fires and other peacetime emergencies; the training obtained will be beneficial.

## EMPLOYEE HOME DAMAGE

The earliest possible resumption of duties by employees will be vital, but the worker whose home is open to the elements is more likely to repair his home than report for work. During rehabilitation periods, therefore, such time off will have to be allowed. Management may be able to reduce and standardize home repair activities in some measure by the setting up of mobile company crews for emergency home repairs, and by the storing of building materials. The Inventory of Skills technique mentioned earlier can be used to find and assign persons to these crews.

## EMERGENCY BILLETING

Another program to consider is one in which temporary quarters for bombed-out employees are provided in the plants, or the company helps find such quarters in the vicinity. A list of local buildings for out-of-plant billeting could be compiled. First preference should be given to those with sanitary and cooking facilities, such as lodge halls, American Legion homes, schools, churches, unoccupied industrial plants, etc. Facilities need be only of a rudimentary sort. Some firms have questioned suppliers concerning the emergency availability of cots, blankets, sleeping bags and mattresses. Plant buildings, such as cafeterias and storehouses which are not damaged dangerously, could hold many people. Finally, bedding large groups outdoors in warm weather may be practicable.

## MORALE

Wars are won when the will to survive and sacrifice are maintained. High morale helps maintain that will and certain activities help maintain morale. The company can do the most important thing possible for morale if it acts *to keep the people busy*. Idleness will increase anxiety and threaten panic. Thus, information, welfare, and activity evolve as the three areas of greatest company assistance. Advance plans to actually put people at work as soon as possible in cleaning up the rubble and restoring operations are most important.

(1) *Industrial Defense Planning Manual,* Iron and Steel Institute, 350 Fifth Avenue, New York City, N. Y.

# Chapter III

# SECURITY

## SCOPE

A vast amount of detail is associated with the twin problems of industrial espionage and sabotage (See Appendix "K"). Therefore, only certain highlights are covered here for top management consideration. Detailed information on security matters is presented in "Security Principles for the Petroleum and Gas Industries," a manual prepared by a task force of the Petroleum Administration for Defense, and published by the National Petroleum Council.

### ESPIONAGE

Accurate military and industrial information vastly increases an enemy's chances for success in war. Prevention of espionage is therefore an important defensive measure. The responsibility for espionage security of classified matter is vested in government agencies and the armed forces; actual apprehension of espionage agents is the direct responsibility of the FBI. Industry, however, has these responsibilities: (1) Follow the Department of Defense directions for protecting classified matter; (2) cooperate fully with the FBI in apprehending suspects. Regulations for handling classified matter are always made part of classified military contracts. They are set forth in the "Industrial Security Manual for Safeguarding Classified Matter," U. S. Government Printing Office.

### SABOTAGE

While the prime responsibility for preventing espionage lies with the government, for sabotage it lies with industrial management. Fortunately, most anti-sabotage procedures have an anti-espionage effect, providing double benefit from security measures adopted. Sabotage will be considered as all those subversive measures which could be employed to deny our country the use of certain industrial facilities. In this category could fall: Fires, power failures, strikes, slowdowns, equipment damage, record thefts, injury of personnel, etc.

## THE SITUATION

In a conclave (supposedly of loyal members only) at the 15th national convention of the Communist Party in the United States, it was announced that the number of dues-paying members employed in basic American industries was 22,000. Of these, 1,700 were in the petroleum, chemical and rubber industries.

### THE MISSION

From the former top American Communist, Louis Budenz, we learned that industrial potential is so important in Communist thinking that it is marked for first action; that their sabotage plans exist in a ready status; and that their plans will preferably go into action before the severance of diplomatic relations. Their plans call for action in three main areas: (1) Labor disturbances; (2) paralysis of transportation; (3) destruction of critical industries.

### SUBVERSIVE CAPABILITIES

Communist surveys of strategic American industries have been made periodically since 1946. Their ability to steal secrets from the Atomic Energy Commission, Bureau of Ordnance, Naval Intelligence, etc., makes the success of their industrial espionage ventures seem certain. In addition, their sabotage training is thorough; many have practical experience from the Spanish Civil War, and instructions are sent to the United States from abroad (the FBI once intercepted detailed sabotage instruction manuals in cans of "imported sardines" at a Philadelphia dock).

Every plant manager knows the simple steps that he could take, as just one person, to destroy bottleneck manufacturing equipment and make his entire plant inoperable. The subversives also have this knowledge. They are wise enough to apply it first against those surprisingly few petroleum facilities which, for example, they know account for 80% of our aviation gasoline. They undoubtedly know where and how to cause the oil and gas industries grievous damage when the time comes. Action must be taken to deprive them of all opportunities for doing so.

## THE SECURITY PROGRAM

Industrial security is management's responsibility; government agencies merely provide advice. However, if a company is working under classified contracts there will be direct aid. Since the basic problems of security are (1) protection of property, and (2) control of persons, most firms do not create new organization units for handling security operations. In the main, they assign the necessary functions as additional duties of existing police,

fire and/or accident prevention units at the various levels. Provisions are generally made for continuous planning and overall coordination of Company security efforts; the instruments of this continuity are sometimes known as the Corporate Security Committee and the Corporate Security Officer, both mentioned earlier.

### CORPORATE SECURITY COMMITTEE

In addition to the duties described earlier, the Corporate Security Committee should decide upon the measures to be taken by the company to prevent espionage and sabotage. Their security planning might well consist of individually devising practical methods for damaging the company, and then jointly determining defensive measures to each threat. One large company divided its "sabotage committee" into two groups; one group plans aggressive sabotage tactics for the other group to protect against.[1] This sabotage technique is simple, but effective . . . especially at plant level. When applied to espionage, it involves the question, "What Company information would interest a subversive agent?" The answers indicate which records need protection.

### CORPORATE SECURITY OFFICER

This company level individual (see page 3) should have authority to expedite widespread adoption of anti-espionage and anti-sabotage measures decided upon by the Corporate Security Committee, especially those that do not materially affect cost. He should be a man with liberal security experience. His advisory and informative assistance to the Committee should encompass: Proposals of Policy, classification of information, physical protection procedures, identification systems, security investigations, employee security procedures, visitor control methods, and compliance with the law and government security requirements. He should arrange periodic meetings of the Chairmen of security committees in individual plants or associated company units, and he should visit the various corporate facilities to disseminate information and observe progress.

### LEGAL CONSIDERATIONS

It is of interest to note that some states have laws on the subject of security; they are effective upon proclamation of the Governor. One state law requires that an employee " . . . shall be appointed by the plant manager . . . (to serve) . . . as plant security coordinator . . . ." This person is charged with effectuating Civil Defense rules and regulations for plant protection. The law advises, "For larger plants, the plant security coordinator should be the chairman of a plant security coordinating committee which should include the Production Manager, Plant Engineer, Personnel Director, Safety Director, Plant Physician, Fire Marshal, a representative of the collective bargaining unit or units, if any, a representative of the Accounting Department and such other personnel as the plant manager may deem necessary." This particular law further states, "The plant security coordinator shall conduct his duties from a suitably protected security control center." State security inspectors are empowered to conduct investigations into compliance with the organization, personnel and equipment requirements of the state law.

Federal laws on the subject are described in the Department of Defense "Industrial Security Manual for Safeguarding Classified Information." See also "Questions and Answers on Safeguarding Classified Information," same source.

## EMPLOYEE SECURITY MEASURES

In its publication "Industrial Security," the National Industrial Conference Board says, " . . . even if you don't have a trained saboteur in hire, industrial security can pay off in peacetime. It can help you rid your plants of agitators who create labor unrest, who promote excessive grievances, slowdowns and strikes, and encourage worker antipathy toward management. These actions cost your company money. It can help you rid your plant of arsonists and criminals. It can help you eliminate from your payrolls unstable employees—drunkards, homosexuals, and just plain fools like the one who repeatedly set fire to his plant so that he could get home early and see his new bride. It can help improve your normal plant protection activities—protection against accidents, fires and theft."

### PERSONNEL INVESTIGATIONS

The people who routinely enter upon company property have the greatest potential for effective sabotage action. In most instances this means employees. Keeping security risks from becoming employees is one of the most effective personnel security measures which can be taken. However, it is difficult to identify a "security risk," whether he is an applicant or already an employee; for some criteria see Appendix "L".

#### *Applicants*

Many companies consider loyalty investigations of applicants as indispensable. The degree of investigation usually varies with the security level into which the applicant may be hired. A number of firms require a statement of non-subversive connections by the applicant. This provides a means for dismissal of any who are later proven subversives on the grounds that they falsified their employment application. Anti-discrimination laws of some states prevent company inquiry into racial background, birthplace, military service, whether

(1) *How to Protect Your Plant,* Factory Management and Maintenance, July 1951, McGraw-Hill Publishing Co., Inc., 330 West 42nd St., New York 18, N. Y.

native born or a naturalized citizen, etc., and may thereby hinder pre-employment determination of security risks. Some companies use the services of organizations which conduct employment investigations for a fee. The fee varies with the extent and type of information desired, but is generally claimed to produce measurable savings even in non-security type investigations of potential employees. It is the Corporate Security Committee's function to determine the measures its company should use to keep subversives off the payroll, and to recommend their adoption. For information concerning the security control of aliens, see Appendix "M".

### HANDLING EMPLOYEE SUBVERSIVES

Getting rid of subversives already on the payroll is not always easy. Rarely are they dismissed specifically for their Communist affiliations. The legal proof needed takes time and money to obtain, and may not stand up in a libel suit. Dismissal upon violation of a company rule is more effective. While employed, the known subversive should be assigned to work where he can do the least harm, with his movements restricted, and under some observation for he may have decoy value, disclosing unsuspected associates.

#### *Union Cooperation*

Numerous union officials have publicly stated their desire to cooperate with management on the matter of subversives. A non-Communist dominated union will probably even aid in matters concerning proven security risks. Their cooperation is important in such instances as dismissal for infraction of company rules. In a number of cases, revision of the labor contract has been made to provide an extended probationary period in which new hires can be dismissed without cause. This procedure provides time for a thorough security investigation of new employees.

### SECURITY WATCHES

At least one oil company has instituted in some of its refineries an organization of several hundred "security watchers" from process employees who, in the conduct of their normal duties, provide service around the clock. A short training program is given, explaining the nature of subversive actions and what to look for in detecting subversives. A number of trespassers have been apprehended as a result of reports from these employees.

### REWARD PLAN

The effectiveness of a "security watcher" program, and of personnel security generally, might be improved by a reward plan like that of the Socony Mobil Oil Co. and its subsidiaries, the Magnolia Petroleum Co. and the General Petroleum Co. The offer of rewards of these companies totals $300,000 for evidence leading to the conviction of saboteurs of company property. The highest individual reward is $25,000. No rewards were paid throughout World War II or the Korean conflict. However, today's dangers appear greater because of the thousands of intelligent, aggressively organized United States citizens who owe primary loyalty to the international Communist movement.

## PERSONNEL CONTROL MEASURES

Effective security control of employees, and of non-employees who enter upon company property, can be achieved in a variety of ways.

### PREVENTION OF UNAUTHORIZED ENTRY

A saboteur may, of course, remain at a distance and yet cause damage through chemical means (arson, explosives) by shipping, throwing or shooting destructive materials into company property. It is more likely, however, that he will strive to enter upon the property to do his work as effectively as possible.

The saboteur may come by stealth. The Corporate Security Officer should insure that the various company facilities have knowledge of the value of: Perimeter fencing; electronic devices for detecting intruders; screening or barring of windows, ventilators, skylights, sewers, adjacent roofs, etc.; perimeter lighting; and varied-schedule guard patrols. Details on such matters are contained in government publications on plant protection standards. See the Bibliography for references.

The saboteur may also come openly, under the guise of an employee, visitor, salesman, contractor, service representative, truckdriver, etc. A careful check should be made of the credentials of all persons authorized to enter company property. This can be done most effectively by guards and receptionists. Tightening of security regulations may require actual inspection of trucks, railroad cars, large packages, automobiles, etc., upon entry. In some industrial facilities, a security clearance is required of vendors and other service personnel, with the investigation being the responsibility of the visitor's company. Frequently, only one entrance and exit point is authorized for such visitors.

### CONTROL OF AUTHORIZED ENTRY

Certainly some subversives will get through, authorized either as employees or as visitors of some type. Controlling the movement of persons on the company property then becomes important because it may restrict further progress toward the target.

#### *Identification Systems*

A badge system provides the most practical means for continuous identification and control of

personnel during their time on company property. Visitors should have distinctive identification, preferably by means of badges that are unlike employees' badges. One petroleum company uses a visitor's badge which is wedge shaped and carries a large letter "V". All badges should be tamper proof. Employee badges should carry descriptive personal information and a photograph, and be under strict controls to minimize loss, theft or duplication. It is most important that badges be worn always in full view in a designated place on clothing. Variations in design of badges within a company can help prevent use of one plant's badge to gain entrance elsewhere. Enforcement is the essential features, regardless of the system adopted.

### *Restricted Areas*

Vital company facilities are often restricted against unnecessary traffic for security reasons. The restricting may be accomplished by fencing, locked doors, etc. Government regulations for safeguarding classified material frequently make such restrictions necessary. Alternate Corporate Headquarters, power plants, cooling water, pumping stations, research laboratories, and telephone switchboard rooms are typical of areas which should be restricted. Coast Guard requirements on waterfront security often make barge and tanker dock areas restricted, with perimeter fencing and special passes used to prevent unauthorized entry.

Special written permission should be required for a person to enter a restricted area where he does not normally work. Badges of distinctive coloring or shape are generally used to identify persons who regularly work in restricted areas. An especially careful security investigation should be made of persons who have access to restricted areas. Guard patrols in such areas should be frequent and thorough. All instances of persons wandering into restricted areas should be thoroughly investigated. The Corporate Security Officer should insure that the individual plants have acted to identify and protect such areas.

## PHYSICAL PROTECTION MEASURES

Most peacetime plant protection measures also serve as effective anti-sabotage measures. Fences, gates, guard forces, receptionists, escorts, alarms, floodlights and accident investigations all help in one way or another.

### PROTECTION OF SENSITIVE POINTS

Each company facility contains points which are exceptionally vulnerable to sabotage. Some were mentioned earlier in the consideration of "Restricted Areas." Many, however, are not such areas (in which numerous people may work) but are facilities at isolated locations, with few or no personnel. Examples are electrical sub-stations, pumping stations, switchboards, transformers, important pipe lines, and other special machines or equipment whether in use or in storage. It is advisable for management to determine if the various plants have identified, and provide suitable protection for, such locations. Barriers of some sort are a minimum precaution. The American Petroleum Institute's "Guide to Protection of Petroleum Facilities" gives detailed information on this and many other facets of plant protection.

### FIRE PROTECTION

Subsequent fires in oil and gas facilities may do far more damage than that caused by the original sabotage act. Security planners should therefore give much thought to means for preventing the spread of fire and for effecting rapid extinguishment by day or night. Some companies have set up and trained shift fire brigades in their plants, thus providing a ready and reliable source of manpower around the clock. In like manner, advance arrangements can be made with municipal authorities for obtaining fireboats during waterfront fires. Another example is that pre-arranging with railroad companies for the removal of tank cars during fires at loading racks. These are only a few of the measures which the Corporate Security Officer can urge upon those company facilities where they do not exist.

# Chapter IV

# COMMUNICATIONS

## CONTINUITY OF INFORMATION

All accomplishments of an organization are based on the transmission of information. Thus, a breakdown of communications causes a breakdown in the organization's power to get things done. The most urgent needs for getting things done exist during periods of emergency. In many emergencies the damage to communications facilities is severe. It is essential therefore that each oil and gas facility make advance preparations to assure some minimum flow of communications at all levels in any disaster which may occur.

Contact with remote field producing operations, pipe line systems and other transportation facilities (particularly marine), may prove very difficult under disaster conditions. An authoritative engineering survey by communications experts is recommended to determine the most practical emergency uses of or substitutes for existing systems. Jointly owned facilities where the most modern communication methods are employed should be included in this study with the hope that such equipment might be partially diverted to more general usage in an emergency.

### THE PARTICIPANTS

Disasters may be natural or man made, and may occur in peace or war. The type and extent of the disaster will determine the participants in emergency communication. The overall scope of management's emergency communications includes the individual plants, employees and their families, Alternate Corporate Headquarters, Civil Defense officials, executive reporting points, Mutual Aid member firms, police forces, fire departments, hospitals, suppliers, customers and stockholders, to name a few. Procedures for dealing with all who may be concerned should be readied at the various levels.

## PRE-DISASTER ACTIVITIES

Pre-disaster communications to employees may utilize bulletin boards, house organs, official company correspondence, reading rack service and the like. Information conveyed should include alarm signals, air raid procedures, rescue and medical facilities, and fire fighting procedures. Although training is a form of communications, it is considered in a separate chapter later on. Manuals should be prepared at each facility to describe the organization and procedures of groups assigned to first aid, rescue, policing, fire fighting, etc. In some companies, persons who are assigned to such groups carry personal wallet size instruction cards bearing their specific emergency instructions.

One promising innovation is the use of instruction plaques mounted on vehicle dashboards. Some mobile equipment will be assigned to demolition work, others to radio communication posts, others to transport of fire fighting personnel, etc. Plastic dashboard tabs can carry the vehicle's emergency duty assignment and its activating alarm.

A further insurance of effective coordination is the procedure of reviewing disaster plans with state and local police, Civil Defense officials, fire departments and others who may lend assistance during trouble. Conducting "dry runs" of emergency situations with these groups is a training technique considered extremely worthwhile.

For operating emergencies, some oil firms have specialized preparedness programs requiring periodic drills on emergency handling of process operating equipment in simulated test cases.

All these measures afford means for communicating in advance of trouble; there is little value in turning pages in emergency manuals once an emergency has started.

## ALERTING TO EMERGENCIES

"The basis of all air protection measures is timely information of the approach of enemy aircraft."[1] Early notification is essential to effective control of every emergency, whether it be air raid, fire, flood, or other catastrophe.

### CODED SIRENS

Industrial firms use either sirens or plant whistles to warn of impending air raids. At some locations use is made of a coded siren system. Several megaphone sirens pointed radially outward from a common point are sounded simultaneously from a remote location by electric control. A coding device controls the frequency and duration of the

(1) *Air Raid Protection in Industry,* A Forum, National Industrial Conference Board, New York 17, N. Y.

air flow through the sirens and allows distinct blasts of sound. Thus the same installation can be used for plant fire alarms, work signals, noon whistle, air raid alert and all-clear. Locating the control button in a restricted area like guard headquarters or a telephone switchboard room helps insure its use by authorized persons only.

### BELL AND LIGHT SYSTEM

In most parts of the country there is available from the telephone company (at a nominal rental charge to industry) an air raid alerting installation known as the Bell and Light System. The Air Defense Headquarters for a given area originates the alerting signal. Operators at military control points in the area then switch a control dial to a color which represents a specified signal. All subscribers to the telephone company service will at once receive this signal on a special telephone. At this writing, Yellow means a confidential alert notification; Red means imminent danger; the All-Clear signal is White. This system affords industry in general its earliest and most reliable means of notification of impending attack.

## PROCEDURES AND EQUIPMENT

Improved measures for emergency communication are continually being developed. In some instances techniques are so new as to be unique with one company or even one plant in a company. In the chapter on Personnel, the topic of "Information Services" for employees was considered and will not be dealt with here. Other communications topics are described below.

### DOCUMENTING

Some oil and gas firms have made provision for certain emergencies to be recorded. The duty of documenting the progress of fire fighting, for instance, is specifically assigned to competent persons. They note the time of arrival of equipment, spread of fire, injury to personnel, and other information useful later on in reconstructing the event, analyzing its cause, and improving fire fighting techniques. Similarly, standing orders often exist for movies and photographs to be made of such emergencies. The application of similar procedures for selected type emergencies might be considered by those firms not now active in this area.

### TELEPHONE COMMUNICATIONS

The Bell and Light System described earlier is only one of numerous telephone communications measures useful in emergencies.

#### *Telephone Failures*

Peacetime breakdowns of telephone communications due to rupture of underground cables results occasionally from the continual repair and construction digging so common on oil and gas properties. Regardless of cause, such phone failures are handled in some plants by dispersing radio equipped vehicles to posts at important process units for use by the operators as a temporary communications network. Posts are often designated on the dashboard instruction tabs mentioned previously, and the radio dispatcher gives the alarm.

#### *Field Telephones*

Telephone service at the scene of an emergency is advantageous. Some oil facilities have equipment for running long lines from the nearest telephone connection to the field control post of the emergency coordinator at the emergency scene. The dial phone so connected provides service identical to that of any company extension phone, allowing direct conversation with higher management or with sources of needed manpower, materials and equipment. This system is especially useful during fires in tank fields.

#### *Sound-Powered Phones*

Power failures do not affect sound-powered phones. The human voice is their source of energy. Naval vessels, therefore, utilize such systems extensively. Key industrial positions such as medical aid centers and disaster control headquarters would find them of advantage.

#### *Emergency Call Lists*

Some concerns make up lists of persons to be called in designated emergencies. The names are often published in bracketed groups so that the first person called in a group is responsible for phoning two others in the group, and so on. One refinery made up a wallet-size card entitled "Emergency Telephone List." Each person concerned uses this neat form to record emergency numbers important to him.

#### *Answering Services*

In after-hours or weekend emergencies such as fires or explosions, the few company telephone operators on duty are usually overloaded with calls. Delays in phoning appropriate key emergency personnel can be costly. Some oil firms use the services of local telephone-answering companies for rapidly notifying large numbers of persons at their homes that they are needed. The oil firm operator merely designates to the service company which emergency list in their possession they should immediately call. A nominal monthly charge is made for this service.

#### *Incoming Management Calls*

In emergencies, top management personnel may phone the company facilities from outside to be

apprised of the situation. Their calls are usually indistinguishable from any others in the overload with which operators must cope during emergencies. A special unlisted phone installed in the telephone room can obviate this delay so that top management people do not have to "wait in line" for emergency information.

*Alternate Internal Systems*

For emergencies such as a failure of the regular internal dial phone system, some concerns rely upon permanently installed "private line" systems which connect related key operations. Magneto powered hand ringing is employed.

Field telephones can also be quickly set up to provide complete, independent communications networks . . . as done in army field maneuvers. In refineries, field phones can earn their way by being used on units undergoing turnaround.

*Radio-Telephone Equipment*

Some companies have certain vehicles such as visiting nurses' cars equipped with telephone company rental equipment which allows phone calls to be made to or from the vehicle and any point in the country. These units could be useful in certain types of telephone emergencies.

*Alternate Corporate Headquarters*

Obviously this location must be provided with access to all company communications systems. In some areas it may be possible to reroute company telephone trunk lines through the alternate location. Switchboard connections could then be made with the most important lines and rendezvous points. Elsewhere it may prove advisable to plan rerouting of trunk lines through non-target areas. These problems may be solved with the assistance of the respective telephone companies.

## TELETYPE OR TELEGRAPH

In most areas these facilities are operated in conjunction with telephone lines and therefore are susceptible to similar damage. Therefore, they cannot be fully relied upon for service in a disaster, and suitable substitutes should be developed.

## RADIO COMMUNICATIONS

The independent power sources of mobile radio systems makes them extremely reliable for continuity of communications during emergency or disaster situations. It should not be overlooked that a mobile fleet of small trucks properly equipped could provide a connecting link between an alternate control center and some distant undisturbed city where conventional telephone connections might have been re-established. In some areas a hook-up of this kind could be provided for tie-ins with existing private or company-owned communication systems (as on pipelines) that might provide very important services.

*Internal Radio Networks*

Many oil and gas companies have recognized the value of equipping control centers, remote reporting points, Alternate Corporate Headquarters, and various vehicles with radios. Frequencies are assigned by the Federal Communications Commission to specific refineries, bulk plants, etc., from the band reserved for the petroleum industry. Key vehicles, such as Night Superintendents' cars, often have "selective call" equipment which allows remote control blowing of the vehicle's horn to get the driver's attention when he has left the vehicle.

When one refinery aided in rescuing victims of a serious passenger train wreck, the vehicle radios were used to coordinate efforts and to obtain additional personnel and welder-burner equipment from the plant. Some petroleum facilities use two frequencies—one for mechanical forces and the other for process and emergency functions. A separate frequency for the guard force exists in some locations, thereby increasing the security of plant protection information.

A number of oil and gas firms have installed company-frequency radios in the personal autos of selected management personnel to allow emergency contact during hours out of the plant. For the same reason, some firms provide radio equipped company cars to certain supervisors overnight and on weekends.

Ways to use the radio facilities of company tug boats and tankers during emergencies depend upon flexible imagination. During oil dock fires, for instance, conversation between the disaster control coordinator and company tugs working off shore could be arranged from a land telephone by asking the "Marine Operator" for connection with the tug desired.

The use of walkie-talkie radio communications is of importance. On a separate frequency from the mobile units, these short-range sets are useful at emergency scenes for rescue personnel, fire fighting coordinators, and guard forces controlling traffic in the area.

*Conelrad*

To prevent enemy bombers from using television or radio beams as navigational aids, the government will regulate broadcasting during impending attack. A system for the "CONtrol of ELectromagnetic RADiation" (Conelrad, for short) has been set up to provide disaster information to the public. A standard AM radio set will be able to receive these messages on 640 or 1240 KC. In all cases, portable battery radios will provide the surest means of continuity of reception due to built-in power source.

*Out-of-Plant Networks*

Disaster damage to the regular communications facilities may seriously interfere with a company's disaster control efforts. For this reason and for peacetime disaster advantages, a scheme known as RACES (Radio Amateur Civilian Emergency Service) is worth investigating. Oil and gas companies should work through state and local Civil Defense officials to arrange this communications system. If approved, it would provide for radio contact from within company property to locations outside. For example, the system would allow the various companies in a Mutual Aid Disaster organization to communicate with one another from each company-property command post, even though their separate internal radio networks would remain on their individual frequencies. Communication would also be possible with the local and state Civil Defense organizations. Understandably, there are regulations preventing use of the facilities under certain circumstances as mentioned under "Conelrad," above.

In the RACES system, employees who hold amateur radio operators' licenses would be solicited by the company in an effort to enlist volunteers for operating transmitter-receiver equipment located in the plant. A certain percentage of the employees authorized to operate the radios could be "non-Hams," qualified by possession of a lesser radio license.

Another radio organization, known as MARS (Military Affiliate Radio System) can be set up in cooperation with army headquarters in any given area of the country. The military will aid industry in the formulation of radio clubs in its plants and will provide instruction and radio equipment without charge.

## MISCELLANEOUS

The variety of communications methods necessarily includes messengers, who should be selected for their physical fitness and knowledge of the company facilities. They could use bicycles or motor scooters to perform their duties.

Another communications media lies in the constructive use of color. Personnel are given colored safety hats which indicate their team or the emergency function they are assigned to perform. Some assistance to the maintenance of order is thereby made. The same could apply to the use of color in identifying certain emergency vehicles.

# Chapter V

# MEDICAL

## PLANNING

Company medical planning should be based on the probability that for the first 24 hours after enemy assault, a stricken plant will be almost completely on its own. It will very likely take that long for trained and equipped medical personnel to be organized and transported under adverse conditions from distant areas. In the meantime, medical treatment at the scene will have to be limited mainly to the relief of pain and to the fundamental life and limb saving procedures.

Management should recognize that the preparations made to care for the casualties of enemy attack may pay unforeseen dividends during company or community peacetime disasters, and thus are of double benefit.

### ALTERNATE CORPORATE HEADQUARTERS

Injured persons will likely be among the key personnel who make their way to the Alternate Corporate Headquarters. Minimum medical facilities should be provided at this point, and arrangements made with nearby hospitals for necessary treatment.

### COMMUNITY CONSIDERATIONS

It should be determined whether the states in which a company operates have existing or standby catastrophe laws which could influence emergency medical planning. Some laws allow the municipal disaster control directors to commandeer any services and property necessary to protect the health and safety of the residents. Company medical facilities in such cases are in reality a part of the community emergency medical service and should be designed for the giving and/or receiving of medical aid.

#### *Medical Liaison*

Only a community-wide scheme can solve the problems of medical defense. No one company could take care of the employee casualties an atomic attack could produce. Company and plant defense officials should therefore plan and have frequent communications with state and local defense authorities and with other companies.

#### *Mutual Aid*

Advance planning with other companies concerning the potential dangers to outsiders rendering medical aid on their property is of importance. Harm could come to would-be rescuers by means of explosions, electric shock, chemicals, etc. Maps, charts of processes and safety briefings in advance would help.

#### *Location*

Company facilities in critical target areas may need more medical assistance than those outside such areas. Medical planning should be based on an estimate of the percentage of employee casualties anticipated and the expected nature of the injuries. It is anticipated that the distribution of injuries among the wounded would be:

| | |
|---|---|
| Traumatic | 40% |
| Burns | 40% |
| Radiation | 20% |

Casualties should be checked for radioactive matter at the casualty stations and be decontaminated if necessary. It is of interest that treatment for radiation exposure is not given for a full day or more and thus need not be considered in plant level planning. Furthermore, the human body does not become radioactive and may be safely handled although previously exposed to radiation.

## ORGANIZATION

The planning described above should be done by a group specifically organized for the purpose. This group and other segments of the medical organization are considered below.

### MEDICAL PLANNING COMMITTEE

The Corporate Security Committee should have reporting to it a Medical Planning Committee headed up by the company's medical director, or other designated person. The medical directors of the various plants should make up this committee.

### MEDICAL PERSONNEL

The bulk of medical emergency personnel function at plant level. Their functions are described below:

#### *Plant Medical Director*

A medical director should be appointed in plants which do not have such a position. Smaller installations may wish to make a part time contract

arrangement with a local physician who would take part in the necessary advance planning and organizing and take charge of the plant medical service in disasters.

*Doctors*

Many firms in the oil and gas industries have a staff of industrial physicians in permanent employ. These will, of course, be assigned emergency duties. Smaller concerns may seek the services of local civilian doctors on a consultant and/or stand-by basis. They could aid in the planning and training activities of the company's medical service, and work with it during emergencies. Notifications of commitments of this sort should be made to the local Civil Defense medical officials, "as the doctors may be considered more valuable in other locations and assigned accordingly in emergencies by the Civil Defense officials."

*Nurses*

Plants without the services of company nurses may wish to arrange for such services with trained nurses in the community who are on private duty and/or those who are inactive due to marriage, etc. Their part-time employment and assignment to assistance during emergencies should be considered.

## OTHER PERSONNEL

Care should be used in selecting the following non-medical personnel so that emergency shutdown operations will not be affected.

*Rescue Teams*

Improper handling of injured persons often causes more harm than the original injury. Therefore, the finding and extricating of trapped persons is basically a medical function and the rescue teams should be part of the medical organization. Thus, it is not a contradiction that the teams' personnel should include carpenters, welders, riggers, electricians and others with a knowledge of building construction. Eight persons per team is desirable, and one team per 1000 employees is a reasonable goal.

*First Aiders*

Casualties of enemy attack will need on-the-spot treatment, followed by evacuation of the more serious cases to casualty stations and to surviving or improvised hospitals. Since those who might administer early medical treatment may themselves be casualties, it is important that widespread first aid instruction be given to the work force. Some authorities advocate that one employee in ten receive thorough first aid training; others advise one in five. This is especially important in oil and gas installations where the facilities and employees are generally scattered over large areas, and self-help may be the only immediate help. Many lives can be saved by simple first aid measures, such as artificial respiration, stoppage of bleeding and treatment of shock.

From those who are given first aid training a number of Roving First Aid teams may be made up.

*Stretcher Bearers*

A team of stretcher bearers comprises four persons who should be trained in rudimentary first aid, and in the delicate work of moving injured persons on stretchers. Some sources advise one representative team per 100 employees, initially.

*Casualty Station Personnel*

The number of persons assigned to operate an industrial casualty station will vary with the size of the work force. Medical planners in the oil and gas industries may wish to use the community standards in Civil Defense manuals as a guide. The suggested personnel for a Civil Defense community casualty station per 10,000 population is shown in Appendix "N."

# FACILITIES AND PROCEDURES

Functions of the emergency medical service and some of the equipment utilized are mentioned below:

## SUPPLIES AND EQUIPMENT

It is impossible for a firm to stock for a disaster all the medical materials it might need, but it should stock some. Civil Defense officials advise industry to stock items from the standard lists, and in a quantity that would be a significant addition to the local community supply. Where a company medical installation exists, a supply equal to the routine consumption of a 6-month period should be procured and maintained.

For a list of supplies for Roving First Aid Teams see Appendix "O."

Equipment and supplies for a 500 casualty load for a community casualty station is shown in Appendix "P." First aid supplies for 100 or for 500 casualties are available for purchase in sterile, standardized, packaged units. The "Dural" type and others are marketed by major medical supply companies.

*Storage*

Deteriorative supplies should be rotated, and special control exercised over pain-relieving narcotics.

Dispersion of supplies about the property will help insure their survival. Dispersed storage in locked, palletized, metal containers will provide protection and a mobility through the use of lift trucks. The portable metal storage boxes known

as Dempster-Dumpsters are also of value. Such storage units should be marked with a large red cross on all sides.

*Outside Supplies*

Supplies which survive will last only a short while. Liaison with the local Civil Defense authorities will then prove important in obtaining outside help. Procedures should be established for procuring medical supplies from the Emergency Medical Supply Depots which have been designated by the state and local defense agencies.

## THE PROBLEM OF CASUALTIES

All plans for handling casualties should be developed with the thought in mind that plant dispensaries may be destroyed or overburdened. With this in mind a program for immunization against Tetanus with Tetanus Toxoid should be considered along with other routine company immunization procedures.

A select number of non-medical personnel may be instructed in the injection of morphine and the giving of intravenous fluids.

*Identification of Injured*

Early knowledge of the identity of the injured is important to the medical personnel and to families. Adequate quantities of identification tags should be maintained in readiness. The government has provided standard medical tags to state Civil Defense officials, and companies should determine how to obtain a supply.

*Duties of Roving First Aid Teams*

1. First Aid for hemorrhage and shock.
2. Emergency splinting of fractures. Improvising of splints from debris.
3. Treatment of burns. (Especially developed occlusion tie-on dressings come in 3 sizes and fit arms, legs and trunks—gauze cellucotton plastic coated on outside—sterile and sealed in Vinyl plastic bags.)
4. First aid treatment of wounds.
5. Identification tags for casualties, indicating initial treatment given.
6. Advice and direction to the minor wounded, the hysterical and the panic stricken.
7. Cooperation with rescue teams.

*Casualty Stations*

Numerous casualty treatment stations should be pre-designated in representative areas of the plant, with appropriate alternate locations. Cafeterias, locker rooms, storehouses, and other buildings with open interiors might be used if there is no danger of collapse from damage. Plans for the operation of outdoor casualty stations should be made; portable medical supply storage facilities will help. Large identification markers should be installed at the selected storage sites to promote employee knowledge of their location. The philosophy will be to "treat all on the spot, send the bad cases to casualty stations, and send the worst out of the plant."

*Duties of Casualty Stations*

1. Receiving casualties.
2. Sorting and classifying casualties according to the nature and severity of the wounded, into: (a) Hopelessly injured, (b) Severely injured, (c) Injured.
3. Monitoring clothing for radiation and decontamination (remove clothing and shower with water).
4. Administering first aid and giving initial professional care. (a) Arrest of hemorrhage. (b) Giving plasma, serum albumen, plasma expanders. (No whole blood would be available in less than 24 hours. 6% Dextron with disposable intravenous sets is the cheapest; most available, stores best, and is recommended for immediate use.) (c) Relief of pain. (d) Minor repair of lacerations. (e) Dressing of wounds. (f) Immobilization of fractures, (g) Giving tetanus toxoid or T.A.T. (h) Giving antibiotics.
5. Preparing proper records and reports and affixing identity tags when not previously done.
6. Providing supplies to all Roving First Aid Groups.
7. Coordinating with Civil Defense Authorities.

*Transportation of Casualties*

Except for the Stretcher Teams, the actual transportation of casualties need not be the responsibility of the medical service. Rather, transportation in general should be centrally controlled, but with highest priority given to movement of the wounded. A medical transportation coordinator should be designated to work with the transportation unit and he should have control of those vehicles which are pre-assigned to medical service.

Trucks convertible to ambulance service should also be pre-designated. Some plants have contracted for ambulance service, but this is unreliable if the community is affected. Firms contemplating the purchase of ambulances should consider the multiple-casualty type. Prior arrangements should be made with the guard force to insure the rapid passage of ambulances to disaster scenes.

*The Deceased*

Peacetime disasters which produce numerous deaths require special handling. Reception facilities will be needed for inquiring families. A receiving room for the inspection and tagging of bodies is advisable, and (separate from this) there

may be need for a viewing area for the dead not yet identified. There is a basic need for separate facilities for the handling of unrecognizable bodies . . . a sort of medical examiner's room.

Atomic attack may produce huge numbers of dead. Identification should be made wherever possible, and a record kept. Literally human debris may be all that remains and it may be advisable (perhaps even required) to carry out mass cremation or common-grave mass burial promptly in the interests of health and morale.

The reader is referred to "Organization and Operation of Civil Defense Casualty Services"—Part III—Medical Records for Casualties—TM-11-3, Federal Civil Defense Administration.

## COMMUNICATIONS

An ability to communicate quickly from one casualty station to another is essential, whether by radio, field phones, or other means. The vehicle assigned to medical service should be radio-equipped. Medical communications procedures with local Civil Defense authorities should be pre-arranged so that these officials can be informed if people are still alive, and the type of help that is either needed or can be given by the plant.

## HEALTH AND SANITATION

It is anticipated that the U. S. Public Health Service, working through the state and local health agencies, will regulate and set standards for emergency sanitation procedures following atomic attack. Matters to consider include mass burials for the prevention of pestilence, sources of drinking water, improvised waste disposal facilities, exposure to radioactive materials, and decontamination procedures. Medical liaison with local health agencies is again emphasized.

# Chapter VI

# TRAINING

## THE DISASTER CONTROL TRAINING PROGRAM

Unless someone has specific responsibility for developing and coordinating the disaster control training, there won't be a worthwhile program. This principle applies to every level at which training is to be conducted.

### DEVELOPMENT

In a company with no full-time training director, the Corporate Security Officer may have to develop the program himself, or he may have the responsibility delegated to someone qualified to function part-time as the Disaster Training Director. The same choices exist for each Plant Disaster Control Coordinator when there is no training organization at plant level.

The Organization and Training Manuals for company and plant levels, mentioned on page 5, should, upon completion, contain appropriate information concerning: Type, purpose and scope of each course; facilities required; lengths of courses; size of classes; types and frequency of test exercises; frequency of refresher training; anticipated training schedules; and samples of forms for recording and reporting to appropriate authority concerning training conducted.

#### *What Training?*

Determination of what to teach may be developed logically by:

1. Listing the functions to be performed, such as fire fighting, demolition and repair, rescue and first aid, Alternate Corporate Headquarters procedures, communications, etc.

2. Breaking down each function into the jobs required for its performance.

3. Compiling a list of the skills and knowledge a person would need to perform each job.

All training should be planned toward achievement of the four main purposes of disaster control efforts: (1) Prevention of sabotage and espionage, (2) Survival of people and facilities, (3) Reconstruction of equipment and the organization, and (4) Resumption of operations. Any contemplated disaster training which would not serve one of these goals is probably an unnecessary expense. In at least one respect, every employee is involved in the program, since every one must perform a self-preservation function and should be trained for it.

#### *Training Methods*

The training method will vary with the subject, facilities available, time provided, etc., but should comply with these general rules for this type of program:

1. Keep the sessions short; schedule them frequently.

2. Maximize the use of demonstrations and group participations, and minimize lectures. In topics such as rescue team training, there is no substitute for "doing."

3. Conduct a variety of unannounced test drills periodically.

Suitable publicity in house organs and/or local newspapers should be given each course or test exercise. Training aids such as posters, films, pamphlets, and instruction manuals are helpful. Personal pocket cards which carry statements of emergency duties, location of shelters, instructions for self-protection, etc., are ready-reference training aids when alarms sound. Simulated disasters provide by far the best training; the more realistic the better.

### TRAINING STAGES

First of all, certain organizations must be created to conduct and/or receive training. At plant level, the advised steps are: (1) Set up a skeleton organization of carefully selected persons to head the various functions; (2) prepare them thoroughly to serve as instructors; (3) appoint the full organization which they in turn will train.

#### *Instructor Training*

Aid is available from many sources to prepare leaders to become instructors. Courses are conducted by many local Civil Defense organizations. The Red Cross trains persons to be first aid instructors in a thirty-hour program. The Federal Civil Defense Administration operates instructor training schools and encourages industrial management to send trainees. Information may be had from the FCDA Staff College, Olney, Maryland. In addition, there are FCDA training manuals available on the

individual subjects of fire fighting, police activities, and rescue procedures.

Civil Defense courses are conducted by some colleges, particularly in technical specialties, such as radiological defense. Oklahoma A & M conducts fire training courses for industrial fire chiefs. Some fire equipment manufacturers offer free training to customers' trainees. Some professional societies conduct specialized courses. Industrial consultants can often provide defense training programs, especially at administrative and staff levels. Other companies with existing disaster programs may help a company which plans to set one up, particularly if the latecomer intends to be a member of an existing Mutual Aid organization.

### *Team Training*

The instructor-leaders of the various functions should work with the Disaster Training Director in creating the course material and schedules for their teams. Following team training in the basics of their specialties, practice drills should be held to determine individual proficiency and cooperation within the team.

### *Functional Unit Training*

All the teams that make up a functional unit (such as "Maintenance and Demolition") should simultaneously engage in a broader type of test drill to develop measures for working together in large scale plant emergencies.

### *Collective Training*

Simulated, catastrophe-scale plant emergencies should be conducted as practice exercises for the full plant disaster control organization. Preplanned and pre-announced at first, they should become surprise drills when the organization appears ready.

### *Combined Operations*

Mutual Aid members should occasionally conduct general disaster exercises to improve the effectiveness of their combined operations. In addition, the local Civil Defense officials may occasionally request company participation in area-wide tests of effectiveness of Civil Defense measures. Collective Training and Combined Operations should be minimized because they are costly due to numerous employees being off the job. In all practice exercises, designated observers are important for taking notes of events. Critiques promptly following each drill will help improve performance.

### *The Real Thing*

Plant disaster organizations are not created exclusively for enemy attack. Standing-duty assignments should exist to help in coping with peacetime emergencies and in training. When the plant fire alarm sounds, for instance, a gas detection team, a rescue team and a first aid team might automatically respond with the fire fighters. Their presence would be advantageous because the fire area would temporarily be the most potentially hazardous location in the plant. Other applications of this training method are easily developed. Rotation of such team assignments would help distribute experience.

### *Individual Training*

Every employee needs some sort of training. Pamphlets, safety talks, movies, and lectures are appropriate in transmitting to employees the basic information needed concerning panic control, evacuation procedures, and self-protection. Dangers to personnel can be reduced sharply by (1) preassignment to every employee of some function to perform upon threat of enemy action, (2) practice in going to shelters, and (3) becoming accustomed to actually being in shelters.

### *Panic Control Training*

Guard force training in the handling of crowds is essential to the prevention of panic. Practice in orderly evacuation will help develop panic-preventing discipline.

The alternative to such training is chaos. One authority states, "The Japanese estimate that some 20,000 people died in Hiroshima from the effects of panic alone. The people, unprepared either physically or mentally in civil defense matters, ran from the city wildly, and many were trampled, or rushed into fires, or were pushed off bridges into lakes and rivers to drown. Many fled into the hills suffering from radiation illness, removing themselves beyond the reach of medical aid.

"Following the atomic bombings, the appearance of a single plane over a Japanese city caused a wave of terror in the populace, total stoppage of production, and more widespread damage than hundreds of planes had done previously." [1]

## TRAINING OF OPERATING PERSONNEL

Operating personnel will be represented in very few of the disaster control training activities mentioned earlier, because they usually may not leave their operating units. Training activities which do concern them are mentioned below.

### *Shift Fire Brigades*

Round-the-clock operation requires round-the-clock fire protection. For this reason, many petroleum installations have trained all their shift personnel in fire fighting. (See page 28.)

(1) *Business Survival in the Face of Atomic Attack,* by Mervyn Molloy, Systems and Procedures Association of America, P.O. Box 96, Madison Square Station, New York City, N. Y.

*Unit Shutdowns*

In impending air raids, most processes will probably be shut down hurriedly. Training for emergency shutdowns will help in such instances, and in non-war situations also. Modern units are shut down so infrequently that every opportunity to gain experience in this area should be utilized. Anticipated turnaround shutdowns can be turned into training sessions by scheduling appropriate operating personnel to be present in addition to the crew on duty. Also, emergency shutdown procedures should be written out and made available in control houses.

*Practice Emergencies*

Some plants conduct a planned program providing practice in handling of process emergencies. A representative observation team selects a certain unit for the weekly test, goes there, and announces to the operating crew that some vital piece of equipment has just failed. The crew is observed and rated as it goes through the motions of appropriate remedial action. Normally, notice of the type of emergency and the unit selected are preannounced for the advantages of employee discussion and self-education.

*Emergency Replacement of Casualties*

The flexible work force is a basic factor in all plans for resumption of operations after a disaster. Explosions or other disasters might occur which could be serious enough to incapacitate an entire unit shift crew. Immediate control or shutdown of the unit is needed promptly to prevent further harm or damage. Shift foremen may form a replacement crew from unaffected units. In one oil firm, they determine who is qualified for emergency replacement assignments by means of "experience charts." These show graphically the operating positions each employee is capable of filling. The chart records are kept current on each process employee as he moves through the different positions at his job level on the various units.

The charts are used also as guides for making regular work assignments, since they clearly identify the qualifications of each man. In addition, training efforts are directed toward the positions that have the minimum number of replacements available. The Process Superintendent periodically provides the Plant Security Committee with a tabulation showing the percentage of process employees capable of filling the critical operating positions at each level. (See Appendix "Q.") The goal is 100% flexibility, i.e., each employee trained to perform satisfactorily in all equivalent jobs on all units in his area.

# Chapter VII

# PLANT DAMAGE CONTROL

## SCOPE

All efforts to limit the extent of injury to personnel and damage to equipment are considered within the scope of "damage control." This chapter will be primarily concerned with such efforts at plant level, with particular emphasis on the more populated and concentrated facilities such as refineries.

## ORGANIZATION

The disaster plan should be so formulated that there is a clear allocation and designation of responsibility to each of the necessary participating units. Personnel should be adequate in number and trained in their functions. All units should immediately and automatically begin to function the instant the alarm is given, without waiting for orders or instructions.

### THE DISASTER CONTROL COORDINATOR

The first step is to designate one person, the Disaster Control Coordinator, to be in full charge of all emergency protective activities. He should be of such executive rank that his decisions will have the force of unquestioned authority. One or more deputy coordinators must be appointed with the power to take command in the event of the Coordinator's absence or injury. The shift superintendents appear to be a logical choice as deputies.

A prime duty of the Coordinator is to establish liaison with the local Civil Defense officials, and to arrange some sort of integration of the plant protection plans with those of the municipality. "Even if a particular area is not attacked, there still remains the problem of evacuation from damaged areas, and plants may be required to furnish transportation, to house refugees . . . and possibly to feed them. . . ." [1]

### FUNCTIONAL UNITS

Directly responsible to the Coordinator will be the chiefs of the following functions: fire department, guards, medical, wardens, transportation, cleanup and repair, welfare, and communications. Each chief will be responsible for selecting his group's personnel, for coordinating their training, and for providing their equipment. Each chief should have a carefully selected deputy. Appendix "R" shows one form the organization may take.

### DISASTER CONTROL CENTER

Coordination of the Disaster Control Organization should come from a well equipped and well protected control room. If damaged, control could pass to less elaborate sub-headquarters (guard headquarters, telephone switchboard room, etc.) designated in advance. Equipment should include emergency power and light facilities, large scale maps, telephone lists, assignment-plotting boards, alarm signal controls, radio for newscasts, prints of utilities systems, etc. Alternate means for communicating within and without the plant are of utmost importance. Personnel will of course have preassigned duties and be trained in their performance. In this connection, the value of standard operating procedures cannot be overemphasized.

## FIRE FIGHTING

Fire will be the immediate major threat to survivors of an atomic explosion. Information concerning the fire fighting function is given below.

### THE FIRE CHIEF

Where no full-time plant Fire Department exists, the Disaster Control Coordinator should make a careful choice of a qualified person to fill the post of Fire Chief. Long-service process supervisors frequently have the fire fighting knowledge and experience needed for the job. Another source lies in employees who are members of community fire departments.

### SHIFT FIRE BRIGADE

In some plants, specified lower echelon process jobs have fire fighting functions assigned as part of the duties of the job. The job incumbents on every shift respond to the fire alarm and perform predesignated fire fighting duties. Each job is designated on the basis that (1) it is manned 168 hours every week, thus guaranteeing manpower, (2) absence of the employee for short periods should cause no complications on his unit, and

(1) *Disaster Control,* Reprinted from American Machinist, November 13, 1950, McGraw-Hill, 330 West 42nd St., New York 18, N. Y.

(3) the employee is to receive permission from the head unit operator on every fire occasion before leaving the unit. At the fire scene, the employees are formed into fire squads as they arrive and a squad leader is designated at that time.

## OTHER FIRE SQUADS

In a number of plants groups of firemen are organized from the non-shift personnel. These employees are assigned to squads of from seven to ten members, and a permanent squad leader is designated. Effort is made to select squad members from employees who live nearby so that they are quickly available when the alarm sounds after hours. At such times they are normally under orders to assemble at manpower control points in the plant (usually at the fire headquarters), where they stand by as a manpower reserve while the shift fire brigade fights the fire. This relieves the fire area of overpopulation and confusion. The non-shift squads are trained as units under the direction of their pre-assigned squad leaders.

## OUTSIDE ASSISTANCE

Calling the municipal fire departments for help sometimes creates considerable confusion unless planning has been done in advance on the procedures for cooperating during fire fighting. Unindoctrinated municipal firemen may not know how to fight certain types of oil and gas fires. There may also be difficulty due to non-familiarity with plant layout, buildings, processes, and fire lines. Accordingly, some plants conduct periodic instruction for municipal firemen on these matters. The outside firemen are at the disposal of the plant fire chief during a fire, and are subject to his strategy and his orders. A similar situation exists with the mutual aid organizations of neighboring industries.

Plant management should plan its fire organization on the assumption that no outside help will be available; outsiders may be busy fighting their own fires.

## EMPLOYEE FIRE FIGHTING

Since thermal radiation will cause many exposed inflammable materials to burst into flame, there will be a multitude of isolated small fires at scattered points. Any one of these might grow to serious proportions in oil and gas facilities. They can be extinguished while small only if the employees generally are trained for fire fighting with portable extinguishers and if these extinguishers are available all over the plant. This means that the entire work force, or at least a representative cross section, should receive realistic fire fighting training on a recurring basis. Fire training is meaningless unless each trainee personally extinguishes actual fires.

## FIRE MANUAL

Fire fighting information should be available in printed form to every supervisor and to every employee who has been assigned a fire duty. Generally, the manual should contain information concerning the structure of the organization, fire communications methods, fire fighting procedures, and descriptions of specifically assigned functions to be performed by personnel in designated jobs.

## FIRE EQUIPMENT

A variety of matters must be considered in plans concerning fire fighting equipment. Some are indicated below.

### *Protection*

To be of any use, the equipment must survive the blast and be accessible. For defense planning purposes, the ideal location for the equipment is along the perimeter of the plant and of the manufacturing areas. Dispersion makes it less vulnerable, and the distribution provides better fire protection coverage. Fire engines should be provided with protective individual garaging. For wheeled extinguishers and portable pumps, concrete shelters should be considered. Stationary pumps on the fire line need protective construction to assure their undamaged survival.

As the air war progressed, the Germans lost so much fire fighting equipment that they adopted the practice of physically removing their heavy fire equipment to points miles from the refineries upon the first warning alarm. After the raid, the equipment was rushed back to the plant.

### *Standardization*

Municipal fire departments and the other plants in mutual aid organizations may have fire fighting equipment which could not be used in conjunction with company fire equipment. Apparatus does not have to be identical, but should be interchangeable. Thread differences on hose and hydrant couplings are the main problems. Sufficient quantities of thread adapters should be obtained. As a further precaution, different companies might agree to adopt the same method of foam extinguishment and thereby increase the foam supplies usable by each.

### *Portability*

Heavy apparatus will be difficult to get through the debris and rubble after the attack, and may therefore be temporarily useless where needed most. Small trailer pumps and other portable equipment will be of value. Of interest is the newly developed gas turbine fire pump. It can be carried easily by two men, is hand cranked for starting, and is rated at 500 g.p.m. at 100 psi pumping from draft.

*Operation*

Responsibility for the operation of fire line pumps should be definitely assigned. Some pumps on the fire line should have gas engine drives to offset the failure of steam or electricity.

Portable equipment may have to run for hours at a time . . . and will need fuel to do so. The fuel should be provided in advance, be separately located, and be stored in portable containers because vehicle movement may be blocked by debris.

*Fire Water*

If pumps on the fire line are all inoperable, nearby pools or creeks can be utilized to some extent by pumping from draft with portable gas-driven pumps. Sections of the fire line might be pressurized by fireboats or company tugs and tankers pumping into dock hydrants; if thread differences exist, adapters should be made up.

## GAS FIRES

Descriptions of the ingenious techniques of German and English gas companies for preventing explosions and controlling gas fires are contained in "Damage Control in Wartime" [1] and in "Experience of the Gas Industry in London." [2] Excerpts from the former are given below. One basic precaution in all gas fires is to let the gas burn until the fuel source can be shut off; otherwise the gas will disperse and perhaps be ignited, causing an explosion more serious than the original fire. An exception to this rule applies only when extinguishment of the fire will allow quick access to a control valve for shutting off the gas.

"Among the most treacherous fires that were dealt with in the last war were those caused by gas escaping from broken mains. While in most instances these fires were handled directly by the utilities, many European factories also organized special crews to deal with gas flames. The simplest method of control is to stop the flow of the gas by closing valves on either side of the break. However, gas mains in some European cities and factories are not valved as completely as they are in the United States, and closing a valve to stop the flow through a break in a main might have disrupted service in a large portion of the city or plant. Therefore other measures were developed to deal with gas fires resulting from cracked or broken mains.

"If it was not possible to shut off the valve, the lines were plugged in many cases. Metal or wooden disks were shoved into the line to cut off the flow of gas. The disks were sealed into the main with clay or mud or some other substance which would harden and prevent the flow of gas.

"In other instances, the flow of gas was not shut off completely, but was diverted into a twelve- or fifteen-foot funnel-shaped pipe. The large end of the funnel was placed around the leaking main and the small end of the funnel was left exposed to the air where the gas was then burned. By this means the flow of gas could be controlled.

"Another method was devised to deal with gas which had escaped from a cracked or broken buried main and which had seeped through to the ground surface and had started to burn at that point. An extinguishing box, made of sheet metal, was placed over the flames and smothering agents were led into the box by means of pipes. When using this method it is important that the box lie flat on the ground as no air must be allowed to enter.

"Still another device developed by the Germans for extinguishing gas fires involved placing a deflated asbestos bag into the broken main. The bag was then inflated, which stopped the flow of the gas, and the flames were extinguished by chemicals which were fed into the line through a small tube which passed through the asbestos bag.

"A utility in England also developed a method of control that was based upon the use of an inflatable bag. This company tapped into its mains with standpipes. Rubber bags were installed in the standpipes and, whenever it was necessary to repair the mains the bags were inflated until they cut off the flow of gas."

# RADIOLOGICAL PROTECTION AND DEFENSE

One of the chief hazards of radioactivity is that it can be detected only by instruments. It cannot be seen, smelled, heard, felt or tasted. The greatest danger lies in the swallowing of long-lived radioactive materials which can do damage for a long period inside the body. Dust which settles on equipment, buildings, or grounds may be stirred up and get into the body by breathing, swallowing or through open sores and wounds. During emergencies and rescue work, the allowable radiation rates and doses will likely have to be higher than those permitted by the normal peacetime standards. It would be well to decide in advance the permissible doses. See Appendix "S" for a check list on radiological protection matters.

Buildings should be sealed as rapidly as possible to prevent the entry of radioactive dust. Intact doors and windows should be shut, broken windows boarded over, and ventilating systems shut off.

Decontamination poses two major complications: (a) it does not neutralize the radioactivity, but

(1) *Damage Control in Wartime,* Studies in Business Policy, No. 53, Sept. 1951, National Industrial Conference Board, 247 Park Ave., New York 17, N. Y.

(2) *Air Raid Protection in Industry*—A Forum, National Industrial Conference Board, 247 Park Ave., New York 17, N. Y.

only transfers into another place; (b) the contaminant may be an unknown, and spelling out in advance the details of procedure for handling it is highly speculative. For these reasons, it is desirable to have a nuclear specialist available for advising the treatment to be used for each locality, unit, and type of contaminant.

Whenever radioactive contamination is found, decontamination-team technical men will be needed to measure rates of decay, the shrinkage of the boundary of the contaminated areas and the decrease of radioactivity with distance from the source; to collect samples; and to otherwise help the nuclear specialist diagnose and evaluate the kind and degree of radioactivity present. Survey monitors should be available for all operating shifts, with enough spares to function effectively in case an attack puts a number of them out of action. First aid and decontamination centers need to be designated and staffed with a monitor for measuring personnel contamination.

Low-sensitivity, high-range rate meters are useful for initial surveying, for marking the boundary of the contaminated areas, and indicating the degree of hazard within them. High-sensitivity low-range instruments are useful for personnel and equipment contamination, and for locating isolated pieces of highly radioactive debris. They should have aural as well as visual indicators for use at night. It would be well to obtain monitoring instruments in advance because demand after an attack is likely to limit supplies. Dispersed storage and spares are desirable to insure that they will all not be destroyed by a burst.[1] Monitors should operate in pairs for protection.[2]

Radioactivity decreases with time. If the rate of decay is sufficiently fast, the best decontamination procedure may be to allow the unit to stand until the radioactivity has decreased to a safe level. Contamination will be largely a surface problem, and may be removed by vacuum sweeping, brushing, water, steam, detergents, chemicals, or abrasives (sandblasting). Painting prevents dispersion of dust; time must then be allowed for decay of radiation to safe levels. The concentrated radioactive materials accumulated from decontamination should be buried according to set standards.[3]

Decontamination workers need to be accompanied by monitors with radiation-measuring instruments. Decontamination workers will need protective clothing. For isolating the contaminated areas they will need equipment such as signs, ropes and stakes. It is desirable that such items be of a distinctive color and be visible at night.

## IMPENDING ATTACK MEASURES

Upon sounding of the raid alarm, the primary concern is evacuation of employees to their designated shelters. Releasing them to disperse to their homes may be forbidden, to prevent panic-producing congestion on roads and highways. Furthermore, there is no guarantee concerning the period of warning, and persons caught in the open would have no protection.

### WARDEN SERVICE

Supervisory employees should normally be assigned as wardens, for they are familiar symbols of order and authority. Employee monitors may be assigned to assist. Wardens are responsible for the unconfused movement to the shelters of all employees under their jurisdiction. Wardens should be able to administer any needed first aid. They are to maintain order and alleviate fear among employees in the shelter.

### GUARD FUNCTIONS

If disorders break out after the alarm, guards are to aid wardens and monitors in the control of crowds, close gates, etc. They are to stop vehicles not authorized to move, and insure that vehicles are not abandoned where they act as roadblocks. When evacuation to shelters has proceeded satisfactorily, guards should take shelter at assigned posts.

### GENERAL ROUTINE

Most employees will have some functions to perform rapidly before heading for the shelter. Process operations will be shut down with all furnaces and fires extinguished; utilities will be shut down selectively because of their need during emergency conditions . . . with gas, water, electricity, etc., turned off at specific points; hoist operators will lower loads . . . with train cranes centered in their bays to brace the rails and building; shop personnel will cover machinery with tarpaulins (especially electric motors); and papers will be cleared from desks. Operators of bulldozers, cranes and similar heavy machinery should be under orders to take their machines to positions in the nearest open area where they will be clear of collapsing structures, before going to personnel shelters. Turning off of electric power at designated points is doubly important because of the frequent post-disaster electrocution of rescue and debris-clearance workers. It is of utmost importance to get the majority of employees to shelter areas immediately. Those without assigned emergency duties are to stay there until the "All Clear."

(1) *Radiological Monitoring Methods and Instruments* (1952), Handbook No. 51, National Bureau of Standards.

(2) *Fundamentals of Radiological Defense,* Navpers 10870, Bureau of Naval Personnel, U. S. Government Printing Office, Washington, D. C.

(3) *Radiological Decontamination in Civil Defense,* TM-11-C, Federal Civil Defense Administration (1952).

### CONTROL CENTER FUNCTIONS

Upon alarm, designated personnel will promptly man the Control Center. The Coordinator's objective at this stage is to assure that the plant is in a state of readiness by the time the attack is delivered. He will determine that the following measures have been carried out: process units and the power house will shut down or reduce operations as previously instructed; the plant radio frequency will be placed on emergency status; phone calls to the outside will be regulated; employees generally will go to the nearest shelters; fire fighters, medical personnel, decontamination teams, etc., will proceed to shelter at their assembly points; and chiefs of disaster control teams will phone the Control Center from shelter for information and instructions.

## POST-ATTACK MEASURES

After attack, management should be continuously represented in the plant. Senior executives may organize shift teams to provide such coverage.

Most post-attack activity falls into the category of Rehabilitation and is covered in the following chapter. However, there are some immediate measures which should be mentioned here.

### LIMITING INJURY AND DAMAGE

The Disaster Control Coordinator will direct all immediate "containment" efforts to save lives and prevent additional damage. Calls for help will pour into the Control Center, requiring priority decisions on the dispatching of equipment and personnel.

The Coordinator will decide when to permit the disaster teams to leave shelter to perform their duties. Assuming only one bomb run, it is safe (except for fall-out) to leave shelter about one minute after an atomic blast.

### TERMINATION OF AUTHORITY

At some point in the recovery procedure, the Disaster Control Coordinator's work will end and the plant will be returned to normal management lines. This may be done upon extinguishment of the last fire, or it may be continued indefinitely to expedite reconstruction. Decisions will be made at the time.

# Chapter VIII

# REHABILITATION

## BASIS OF PLANNING

The effects of atomic attack are so widespread that neighboring plants and communities are likely to be equally damaged. Consequently, under the worst conditions they will either no longer have their facilities or be unable to spare them for mutual aid. Rehabilitation planning should therefore recognize that a stricken plant may have to rely primarily on its own resources until distant aid can be brought in; this is likely to be quite some time after the attack.

Fringe damage, or lesser damage from peacetime disasters may also occur. Preparations for handling the worst attack conditions will prove valuable in the handling of these comparatively less serious peacetime events.

## ENGINEERING PLANNING

To facilitate reconstruction, the important engineering blueprints, specifications, etc., should be safeguarded in the records protection program described earlier. New facilities should have protective features designed into them from the standpoints of personnel shelter, equipment dispersal and shielding, and/or remote location of the facility itself.

### PROTECTIVE CONSTRUCTION

Plans for new shelters or for shelters in existing buildings should be prepared according to FCDA standards and kept ready for immediate use in case their construction is suddenly authorized. Similarly, protection for important equipment such as pumps, turbines or compressors should be planned; some might actually be prepared, such as the preformed, portable concrete barriers found so effective against blast.[1]

### IDENTIFYING MOST-CRITICAL EQUIPMENT

The key functional operations of each company facility should be determined locally, and the types of essential equipment in each operation listed separately. ("Essential" here means that their destruction would shut the operation down for some period of time.) In each list of equipment (pumps, for instance), one item will normally be found to be more critical than the others, due to longer procurement time, bottleneck flow location, etc. If no spare is available, this item may be designated the most critical of its type in that operation. The same procedure will identify the most critical item in the other equipment lists. Planning should then be undertaken to reduce their controlling influence. A form has been developed to aid in the identifying procedure (Appendix "T"). The functional operations which warrant primary planning attention may be determined by (1) ranking the operations in relative importance to overall production, and (2) estimating the relative susceptibility of equipment to damage.

### REPLACEMENT DESIGNS

In preparing emergency replacement orders for critical equipment, engineers should substitute standard equipment for items of long lead time, and simplify designs as suggested by operating experience and/or research developments.

### DETERMINING PROCESS FLEXIBILITY

It is difficult to predict which operating equipment will best survive an enemy attack. Fortunately, almost any refinery unit which is made operable can manufacture a variety of products. For this reason, and because of the unpredictability of crudes and other feed stocks which will be available in the post-attack period, it is considered unnecessary and impracticable to plan in advance for post-attack process operations.

### PIPELINES

European experience indicates that little can be done to protect pipelines.[1] However, important control valves, regulators, manifolds, and pumphouses are worth shielding. Spare piping parts were stored in Europe, and flexible hose was used to some extent in bridging damaged sections. "Hot tap" machines should be utilized to permit making line connections without interrupting vital production. Stocks of special alloy valves and pipe could be accumulated for processes where other materials would affect the process.

Natural gas pipeline companies should plan advance procedures for by-passing bombed out areas

(1) *Damage Control in Wartime,* Business Policy Study No. 53, National Industrial Conference Board, Inc., 247 Park Ave., New York 17, N. Y.

so as not to disrupt service elsewhere. Worth considering is the installation of automatic valves where they do not now exist. Their value would lie in (1) avoiding the drainage which would result if sectionalizing valves had to be visited and operated manually, (2) facilitating the by-passing of damaged compressor stations, and (3) preventing the flow of gas into damaged stations.

## PROCUREMENT FOR RECONSTRUCTION

After the disaster, efforts will be made to get equipment replacements from every conceivable source. Advance preparations to facilitate these efforts are worthwhile.

### EMERGENCY REPLACEMENT ORDERS

"Ghost" orders for critical equipment might be placed in advance with dispersed contractors on a "when, as, and if" basis. Thus, the prints, specifications, and other information essential for replacement are completed, remotely located, and ready for use when time will mean everything.

### NEW SOURCES

Alternate sources of supply of the same equipment should be explored. Educational orders may have to be placed. Construction projects and equipment purchases might be divided between service organizations widely separated.

### IN USE ELSEWHERE

Multi-plant companies often build identical installations at different plants, and needed equipment may exist as a spare in the storehouse of one of these plants. In emergency, it might be cannibalized right off the distant plant installation . . . assuming other damage there is preventing its use. Further, items of equipment of identical or similar size and capacity may exist on several different units in the same plant. Lastly, similar or identical operating units in the plants of competitors might provide an emergency replacement source. All such information is essential and should be prepared.

### STOCK PILING

The oil industry's basic stock pile of raw materials is crude in the ground, and it takes only from two to four weeks, including transportation, to change it into finished products. Thus, extensive stock piling of hydrocarbons does not appear necessary or practical. However, plans concerning protective measures or devices for some essential finished products are worthwhile . . . such as the alternate storage methods on page 6. Also, the merit of stockpiling of vital catalyst materials should be evaluated.

### STORED REPLACEMENTS

Scarcity of equipment, not process materials, is the potential bottleneck in oil and gas industry recovery. Where practical, considerations should be given to storing replacements at a safe distance, preferably out of plants which may suffer damage.

Multi-plant companies might well consider geographically centered storehouses, designed to serve a number of plants. The efficiency of "wholesaling" from these locations, instead of "retailing" from plant storehouses offers economy incentives as well as improved security. Rental of distant warehouses may be preferable to storehouse construction. Cooperative "Security storage" ventures with competitors is an expense-reducing possibility.

### INVENTORY RECORDS

A knowledge of supplies on hand is essential following disasters, but keeping remotely located duplicate records current with normal consumption seems impractical and unnecessary. The existing inventory records should be particularly well protected from blast and fire, and the dispersed duplicate records need show only the max-min quotas established for each item. However, where critical spare parts are specially obtained for disaster purposes, duplicate records should be current and complete.

## UTILITIES PREPARATION MEASURES

Consideration should be given to designing and keeping ready protective construction or shields to safeguard boilers, turbines, generators, transformers, air compressors, fire pumps and the like. Some protection might be obtained by in-plant dispersion. For disaster control, the following measures are important.

### LIGHT AND POWER

Continuity of light and power are essential if normal sources fail. On a plant-wide basis, they may be provided by tie-ins with neighboring plants or communities, by stand-by units, or by having more than one generating plant.

First aid, rescue, and Control Center operations may go on for several nights at a stretch. Emergency lighting will be essential for them, and helpful for around-the-clock damage determination and debris clearance. Battle lanterns and wheeled generator units are typical substitute equipment. A knowledge of where to borrow or buy lighting equipment in a hurry may prove of value in any emergency. In reconstruction, pipes can be filled with sodium for use as temporary buss bars.

### WATER

A secondary supply of water is essential. It may be provided by such alternate sources as rivers, lakes, wells, reservoirs, multiple storage tanks, or possible tie-ins with neighboring plants and communities. Separate fire, process, and drinking water systems are desirable, together with spare water-chlorinators or purification equipment.[1]

Because of potential radiological hazards, it may be desirable to store a supply of canned drinking water. Another solution is to set up procedures for routine filling of drums, tanks, kettles, etc., to be started immediately upon sounding of an attack alarm. Enough drinking water to last the work force at least two days should be provided. Refineries could pre-plan to improvise evaporators for producing drinking water; mere boiling of radioactive water is ineffective.

## CLEARANCE AND REPAIR

Debris clearance will be the first major job in physical rehabilitation. With the rubble removed and unsafe structures demolished, engineering teams can make realistic damage assessments. Salvage areas can be set up on lawns, parking lots, etc., for reclamation of equipment. Clearance and repair procedure plans should be developed in advance.

### SUBCONTRACTING

One non-petroleum firm has subcontracted the handling of any disasters on its property. Bulldozers, cranes, snowplows, graders, shovel loaders and other heavy earth-moving equipment is thus made available nearby, in large numbers, with skilled labor, but without the expenses of ownership. This arrangement helps insure that the equipment will not be destroyed "in the same emergency for which it should be used."[2] The service is utilized even for clearing heavy snowfalls which shut down neighboring plants.

*Note:* A check list of Rehabilitation topics is provided in Appendix "U."

(1) *Water Supplies for Wartime Fire Fighting*—FCDA Technical Manual, July 1951, Supt. of Documents, U. S. Government Printing Office, Washington 25, D. C.

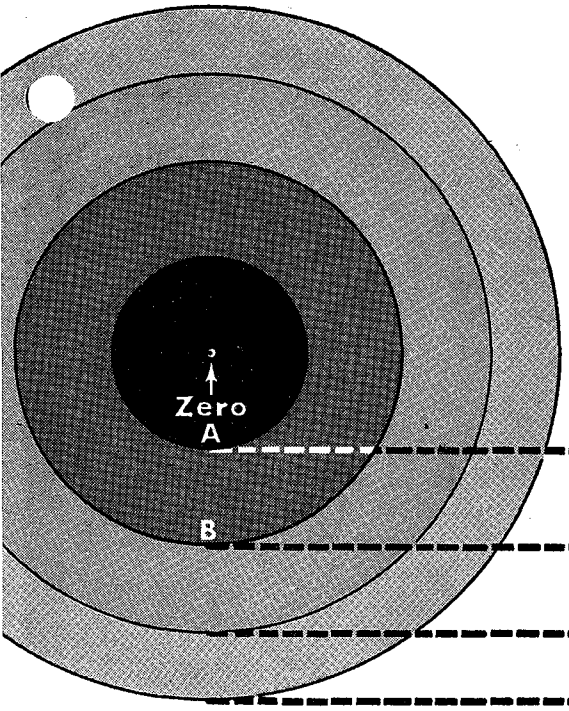
(2) *How to Protect Your Plant,* Factory Management and Maintenance, July 1951, McGraw-Hill Publishing Co., Inc., 330 W. 42nd St., New York City, N. Y.

# APPENDICES

| *Designation* | *Title* |
|---|---|
| A | Bomb Blast Tables and Charts |
| B | Typical Defense Planning Program |
| C | Emergency Succession Table |
| D | Illustrative Functions of Management Disaster Teams |
| E | Industrial Defense Planning Status Check List |
| F | Example of Procedures at Corporate Reorganization Point |
| G | Records Protection |
| H | German Oil Industry Countermeasures to Allied Bombings |
| I | Tax Amortization Incentive for Protective Construction |
| J | Legal Considerations for Administrative Planning |
| K | Security Survey Form |
| L | Criteria for Determining Security Risks |
| M | Industry Security Control of Aliens |
| N | Personnel Assigned to a Casualty Station |
| O | Minimal Supplies for Roving First Aid Teams |
| P | Equipment and Supplies for a 500 Casualty Load |
| Q | Operations Personnel Experience Report |
| R | The Disaster Control Organization at Plant Level |
| S | Check List—Radiological Protection |
| T | Emergency Replacement Table of Basic Refinery Equipment Components |
| U | Check List—Rehabilitation |

APPENDIX "A"

(From Page ii)




| | Relative radii and areas | | | Estimate of destruction | | | |
|---|---|---|---|---|---|---|---|
| Degree of damage | Radius | Circle area | Ring area | Value units in ring | Percent destroyed | Value units destroyed | |
| Complete destruction | 1 | 1 | 1 | 100 | 100 | 100 | |
| Severe | 2 | 4 | 3 | 300 | 50 | 150 | 360 units |
| Moderate | 3.2 | 10 | 6 | 600 | 25 | 150 | |
| Partial | 4 | 16 | 6 | 600 | 10 | 60 | |
| | | | | | | total 460 | |

## Outer areas are more important

While popular imagination centers on the inner zones where bomb has maximum effects, the fact remains that the far larger outer areas of less severe damage are much more important from the angle of total casualties and total property damage.

For any bomb, take the radius (from ground zero) of complete destruction as unity, *1, above.* Then the radius of severe damage (by shock wave) will be *2,* radius of moderate damage *3.2* and of partial damage *4,* corresponding to the four circles *A, B, C* and *D* in the diagram above. *These ratios hold for all sizes of bombs from the smallest A bomb to the largest H bomb.*

Remembering that area increases as the square of the radius, and that any ring is the difference between two concentric circles, we see that the relative areas of rings *A, B, C* and *D* are 1, 3, 6, 6.

If we assume a uniform distribution of population and property over the bomb pattern, and the indicated percentages of destruction in each ring, we see that nearly 80% of all lives lost, and of all property destruction, is outside the central zone of complete destruction.

After making all allowances for the actual, very irregular, patterns of population and property, it is clear that shelters of moderate strength and cost, plus other common-sense protective measures, will probably save more lives in the outer areas than the total lost in the central inferno. This conclusion holds true for the largest H bomb and shows the irrationality of the popular fatalistic attitude.

# Bomb-Blast Table and Charts

By PHILIP W. SWAIN

*Editor of Power*

Recent popular discussions of H bombs of unprecedented power have loosed a confusing torrent of "bomb rhetoric." Colorful journalistic adjectives have created excitement and apprehension without conveying the cool understanding that is so urgently needed in matters of this sort.

It would seem that engineers, along with scientists and military experts, are about the only Americans who habitually view physical phenomena in quantitative terms. It is important that they, in particular, understand the destructive effects of nuclear bombs in terms of distance and area, as related to the energy of the bomb.

For that reason I have computed table and charts primarily as a guide to my fellow engineers, for

| Bomb Energy (TNT-equivalent) | | Radius of damage, miles | | | | Area of damage, square miles | | | |
|---|---|---|---|---|---|---|---|---|---|
| Kilotons | Megatons | Complete | Severe | Moderate | Partial | Complete | Severe | Moderate | Partial |
| 20 | | .5 | 1.0 | 1.6 | 2.0 | .8 | 3.2 | 8.0 | 12.6 |
| 40 | | .6 | 1.2 | 2.0 | 2.5 | 1.1 | 4.5 | 12.6 | 19.6 |
| 60 | | .7 | 1.4 | 2.3 | 2.9 | 1.5 | 6.2 | 16.6 | 26.4 |
| 80 | | .8 | 1.6 | 2.5 | 3.2 | 2.0 | 8.0 | 19.6 | 32.2 |
| 100 | | .9 | 1.7 | 2.7 | 3.4 | 2.5 | 9.1 | 22.9 | 36.3 |
| 200 | | 1.1 | 2.2 | 3.4 | 4.3 | 3.8 | 15.2 | 36.3 | 58 |
| 300 | | 1.2 | 2.5 | 3.9 | 4.9 | 4.5 | 19.6 | 47.8 | 75 |
| 400 | | 1.3 | 2.7 | 4.3 | 5.3 | 5.3 | 22.9 | 58 | 88 |
| 500 | | 1.4 | 2.9 | 4.7 | 5.8 | 6.2 | 26.4 | 69 | 106 |
| 600 | | 1.5 | 3.1 | 4.9 | 6.1 | 7.1 | 30.2 | 75 | 117 |
| 700 | | 1.6 | 3.3 | 5.2 | 6.5 | 8.0 | 34.2 | 85 | 132 |
| 800 | | 1.7 | 3.4 | 5.5 | 6.8 | 9.1 | 36.3 | 95 | 145 |
| 900 | | 1.8 | 3.6 | 5.7 | 7.1 | 10.2 | 40.7 | 102 | 158 |
| 1000 | 1 | 1.9 | 3.7 | 5.9 | 7.4 | 11.3 | 43.0 | 109 | 172 |
| | 2 | 2.3 | 4.6 | 7.4 | 9.3 | 16.6 | 66 | 172 | 271 |
| | 3 | 2.7 | 5.3 | 8.5 | 10.6 | 22.9 | 88 | 227 | 353 |
| | 4 | 2.9 | 5.8 | 9.3 | 11.7 | 26.4 | 106 | 272 | 430 |
| | 5 | 3.1 | 6.3 | 10.1 | 12.6 | 30.2 | 125 | 320 | 499 |
| | 6 | 3.3 | 6.7 | 10.7 | 13.4 | 34.2 | 141 | 360 | 564 |
| | 7 | 3.5 | 7.1 | 11.3 | 14.1 | 38.5 | 158 | 401 | 625 |
| | 8 | 3.7 | 7.4 | 11.8 | 14.7 | 43.0 | 172 | 437 | 679 |
| | 9 | 3.8 | 7.7 | 12.3 | 15.3 | 45.4 | 186 | 475 | 735 |
| | 10 | 4.0 | 7.9 | 12.7 | 15.9 | 50 | 196 | 507 | 794 |
| | 11 | 4.1 | 8.2 | 13.1 | 16.4 | 53 | 211 | 539 | 845 |
| | 12 | 4.2 | 8.4 | 13.5 | 16.9 | 55 | 222 | 573 | 897 |
| | 13 | 4.3 | 8.7 | 13.9 | 17.3 | 58 | 238 | 607 | 940 |
| | 14 | 4.4 | 8.9 | 14.2 | 17.8 | 61 | 249 | 633 | 995 |
| | 15 | 4.5 | 9.1 | 14.5 | 18.2 | 64 | 260 | 661 | 1040 |
| | 16 | 4.6 | 9.3 | 14.8 | 18.6 | 65 | 272 | 688 | 1087 |
| | 17 | 4.7 | 9.5 | 15.1 | 18.9 | 69 | 284 | 716 | 1122 |
| | 18 | 4.8 | 9.7 | 15.4 | 19.3 | 72 | 296 | 745 | 1170 |
| | 19 | 4.9 | 9.8 | 15.7 | 19.7 | 75 | 302 | 774 | 1219 |
| | 20 | 5.0 | 10.0 | 16.0 | 20.0 | 79 | 314 | 804 | 1257 |
| | 25 | 5.4 | 10.8 | 17.2 | 21.6 | 92 | 366 | 929 | 1459 |
| | 30 | 5.7 | 11.4 | 18.3 | 22.9 | 102 | 405 | 1052 | 1647 |
| | 35 | 6.0 | 12.1 | 19.3 | 24.1 | 113 | 460 | 1170 | 1825 |
| | 40 | 6.3 | 12.6 | 20.2 | 25.2 | 125 | 499 | 1282 | 1995 |
| | 45 | 6.6 | 13.1 | 21.0 | 26.2 | 137 | 539 | 1385 | 2157 |
| | 50 | 6.8 | 13.6 | 21.7 | 27.1 | 145 | 581 | 1479 | 2307 |

**RADIUS** and area of various degrees of damage from high air burst of A bombs or H bombs. Radius is measured from ground zero (1 kiloton is 1000 tons; 1 megaton is a million tons)

**People everywhere are badly confused about A bombs and H bombs. Dispelling this confusion is a public duty for every engineer. Here are some unvarnished facts.**

they will have many opportunities to point out that the H bomb, great as it is, is not infinite. However big the bomb, its destructive effects can always be stated in everyday terms.

Table above gives the radius and area of destruction for various degrees of blast damage from the shock wave of an A bomb or H bomb set off high in the air (presumably several thousand feet for the larger bombs). Distances are measured from "ground zero," the point on the ground directly underneath the bomb.

This table covers the extreme range from the original 20,000-ton (TNT equivalent) A bomb to H bombs larger than any yet tested. In the column headings, bomb energies are abbreviated by the use of "kiloton" to mean 1000-ton TNT equivalent, and "megaton" to mean 1,000,000-ton TNT equivalent.

I have computed these tables from data and blast scaling law given in the official book, *The Effect of Atomic Weapons,* prepared for the U. S. Department of Defense and the Atomic Energy Commission. This was published in 1950 by the McGraw-Hill Publishing Company.

Page 55 of this book states that the radius of a given degree of blast destruction varies as the cube root of the energy of the bomb.

Pages 134 and 136 give the following radii for the original (Bikini) 20-kiloton bomb.

Virtually full destruction, 0.5 mile
Severe damage, 1 mile
Moderate damage, 1⅝ mile (we call it 1.6)
Partial damage, 2 miles

Because assessment of damage in these terms is somewhat vague, I have avoided unwarranted refinement in the computation. Radii are tabulated to the nearest tenth of a mile. From these radii, in turn, areas are computed to the nearest tenth of a square mile up to 50 square miles—beyond that to the nearest square mile.

As stated above, the radius of a given degree of damage from the shock wave varies as the cube root of the bomb's energy. Multiplying the bomb's energy by 8 merely doubles the damage radius. Multiplying energy by 27 triples the damage radius. Multiplying energy (say, by jumping from a 20-kiloton A bomb to a 20-megaton H bomb) by 1000 multiplies the damage radius by 10.

It follows that *area* of destruction increases much more slowly than the bomb's energy, since area varies as the square of the radius, or as the square of the cube root of the energy.

What happens when a bomb is made 8 times as powerful? We take the cube root of 8 to get 2 and square this to get 4. So a bomb 8 times as powerful will destroy only 4 times as much area. And a bomb 27 times as powerful will destroy only nine times as much area.

*It follows that the efficiency of an H bomb, expressed as area destroyed per unit of energy, varies inversely as the cube root of the energy. The bigger the bomb, the less the efficiency.* Multiplying the power of a bomb by 1000 divides its efficiency by ten. *Per unit of energy,* a 20-kiloton bomb destroys ten times as much *area* as a 20-megaton bomb.

Note, also, that the larger bomb has a lower "target efficiency," meaning the degree to which the outer circles of destruction are solidly full of worthwhile objectives.

It is perhaps fortunate that the destructiveness of an H bomb is not proportionate to its energy. Consider an H bomb of 8 megatons (8,000,000 tons TNT), a size supposedly surpassed in the Pacific tests. This is equivalent to 100 lb of TNT for every one of the 160,000,000 men, women and children who inhabit the United States. Now it needs no arithmetic to show that 160,000,000 TNT charges of 100 lb each, properly distributed, would do vastly more damage than a single 8-megaton H bomb, or, in fact, than a single hill of 16 *billion* pounds of TNT.

To measure the relative effectiveness we take the cube root of 160,000,000. This is 540, so the energy of the small charges would be used 540 times as effectively in terms of area destroyed.

Note that *the table is for shock-wave blast damage only.* The other important effects are radiant heat and gamma radiation. For the original 20-kiloton atomic bombs, radiant heat ignites exposed combustibles at a distance of more than a mile.

For the same bomb the "median lethal" range of the gamma radiation (range at which exposed people have a 50-50 chance of survival) is about 3500 ft from ground zero.

Radiant heat and gamma rays do not follow the cube-root scaling law. The book, *Effects of Atomic Weapons,* gives information regarding their range in relation to the energy of the bomb.

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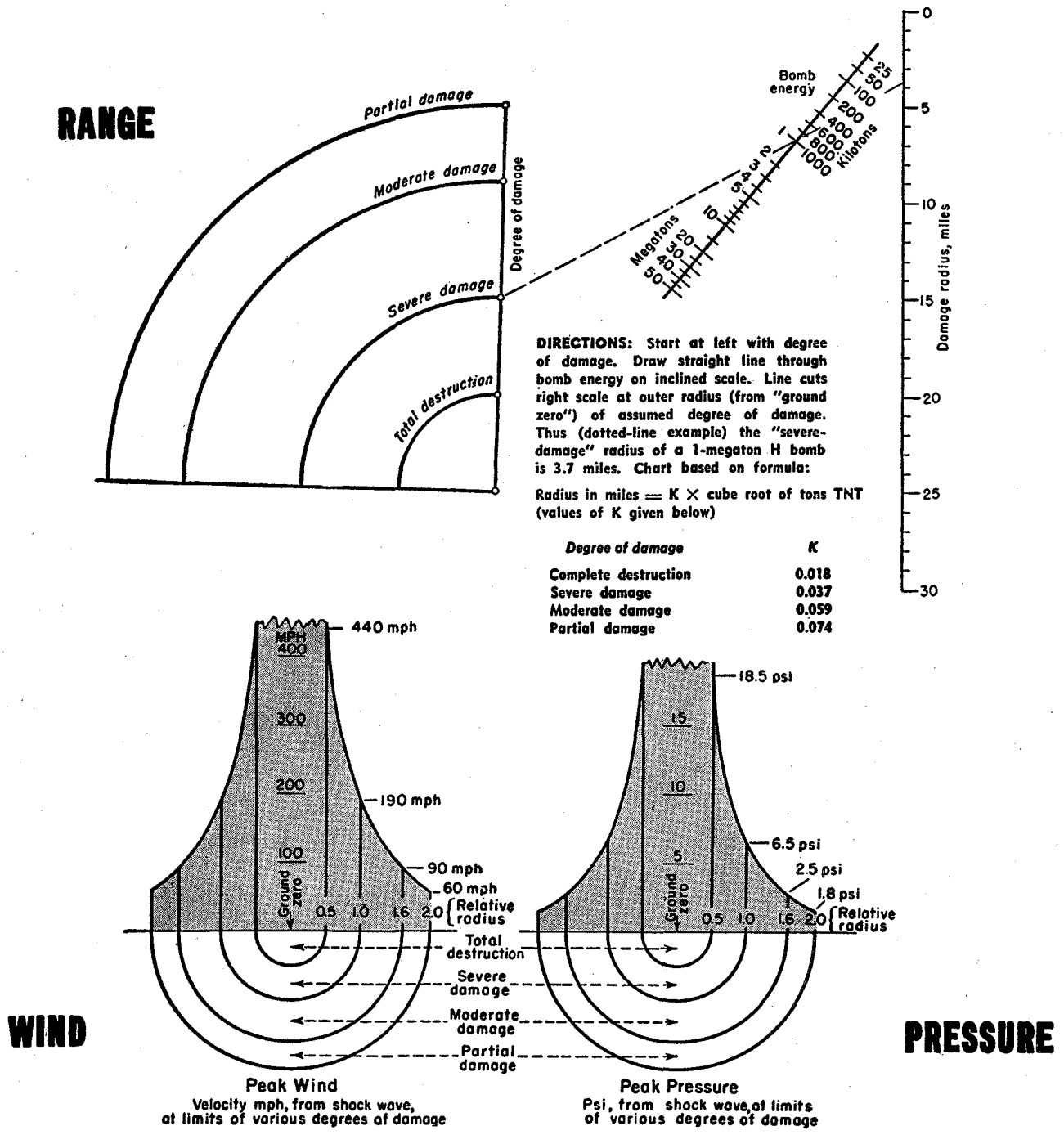
The above article is a reprint from the August 1954, issue of POWER Magazine, McGraw-Hill, 330 West 42nd St., New York 18, N. Y.




# Universal bomb charts for structural engineers

I have plotted these three charts from officially published data for the original 20,000-ton (TNT equivalent) A bomb and from the scaling law that the radius of any given intensity of shockwave effect increases as the cube root of the energy of the bomb.

The charts hold true for a bomb of any size from the original A bomb to the largest H bomb. No matter how powerful the bomb, the radii from ground zero to the limits of total destruction, severe damage, moderate damage and partial damage, respectively, will be in proportion to the numbers 1, 2, 3.2 and 4.

Top chart gives the actual radius in miles of any degree of damage from a bomb of any power. Having determined this radius, the puff-wind velocity and pressure (above atmosphere) of the shock-wave front reaching that radius will be as plotted in the two lower charts.

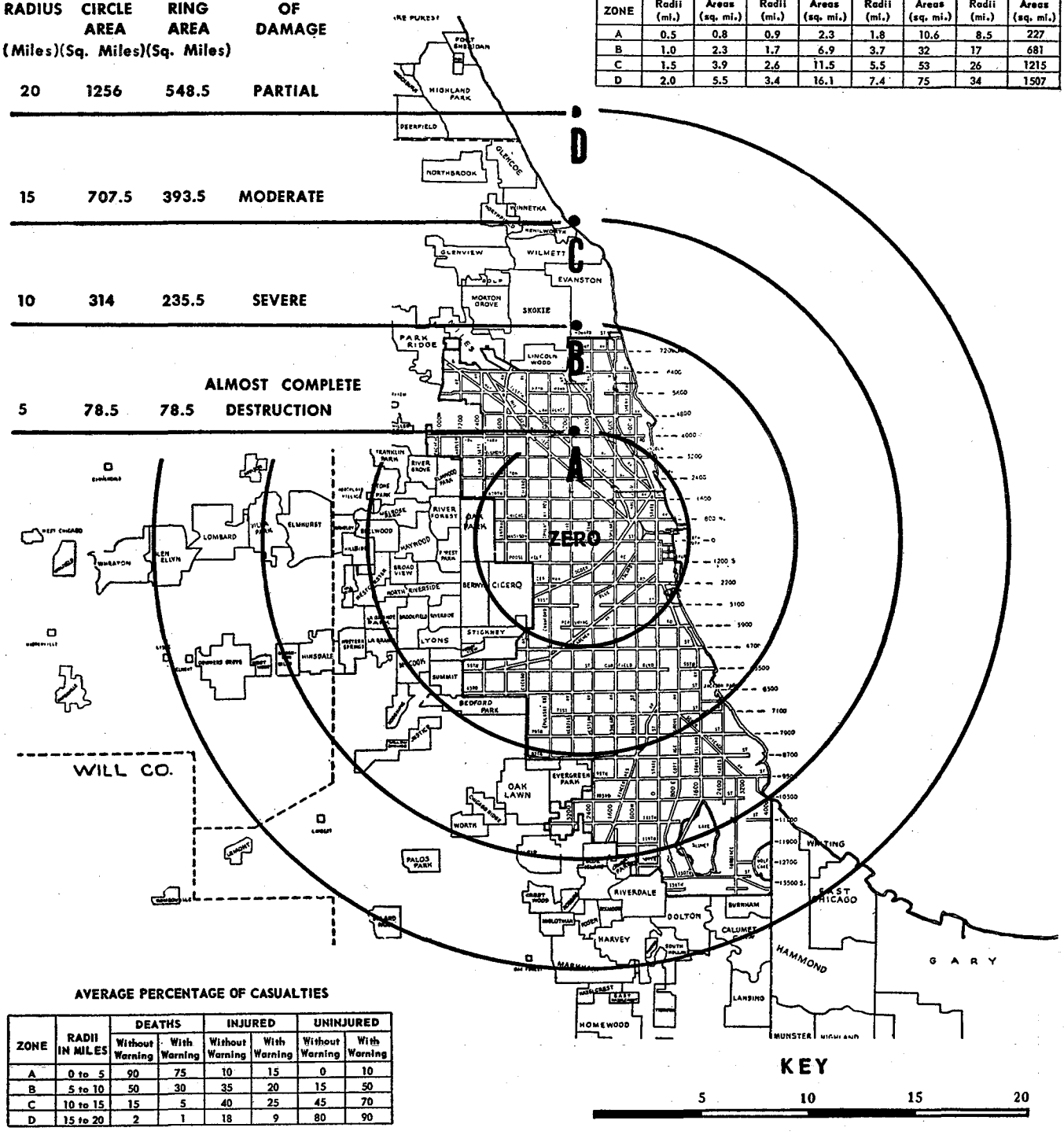
These three charts give structural engineers the data they need to design structures (shelters, etc.) to stand up at a specified distance from a bomb of specified strength. Pressure lasts long enough to be figured (roughly) as a static pressure. Safety factors will naturally be more skimpy than in commercial work.

# CHICAGO
# AREA OF H BOMB DAMAGE
## FOR 20 MEGATON BOMB
## ( TNT EQUIVALENT = 20,000,000 Tons)
## HEIGHT OF DETONATION=20,000 FEET

**RADII & AREAS OF CONCENTRIC ZONES OF A, B, C, & D DAMAGE FOR BOMBS OF VARIOUS SIZES**

| ZONE | Hiroshima Bomb (20,000 tons) | | 5 Hiroshimas (100,000 tons) | | 1 Megaton (1,000,000 tons) | | 100 Megaton (100,000,000 tons) | |
|---|---|---|---|---|---|---|---|---|
| | Radii (mi.) | Areas (sq. mi.) | Radii (mi.) | Areas (sq. mi.) | Radii (mi.) | Areas (sq. mi.) | Radii (mi.) | Areas (sq. mi.) |
| A | 0.5 | 0.8 | 0.9 | 2.3 | 1.8 | 10.6 | 8.5 | 227 |
| B | 1.0 | 2.3 | 1.7 | 6.9 | 3.7 | 32 | 17 | 681 |
| C | 1.5 | 3.9 | 2.6 | 11.5 | 5.5 | 53 | 26 | 1215 |
| D | 2.0 | 5.5 | 3.4 | 16.1 | 7.4 | 75 | 34 | 1507 |

| RADII & AREAS RADIUS (Miles) | CIRCLE AREA (Sq. Miles) | RING AREA (Sq. Miles) | DEGREE OF DAMAGE |
|---|---|---|---|
| 20 | 1256 | 548.5 | PARTIAL |
| 15 | 707.5 | 393.5 | MODERATE |
| 10 | 314 | 235.5 | SEVERE |
| 5 | 78.5 | 78.5 | ALMOST COMPLETE DESTRUCTION |




**AVERAGE PERCENTAGE OF CASUALTIES**

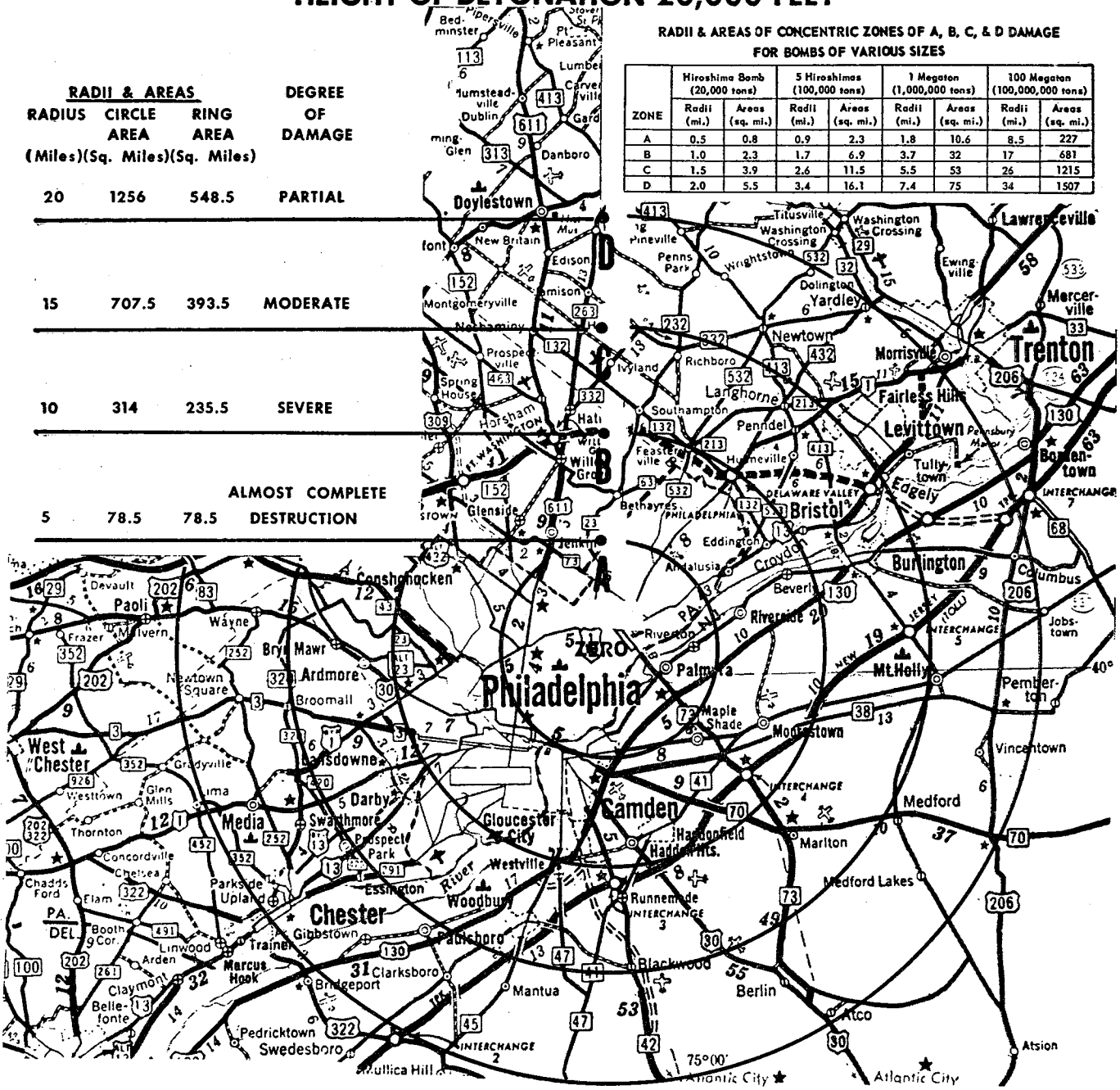
| ZONE | RADII IN MILES | DEATHS | | INJURED | | UNINJURED | |
|---|---|---|---|---|---|---|---|
| | | Without Warning | With Warning | Without Warning | With Warning | Without Warning | With Warning |
| A | 0 to 5 | 90 | 75 | 10 | 15 | 0 | 10 |
| B | 5 to 10 | 50 | 30 | 35 | 20 | 15 | 50 |
| C | 10 to 15 | 15 | 5 | 40 | 25 | 45 | 70 |
| D | 15 to 20 | 2 | 1 | 18 | 9 | 80 | 90 |

# PHILADELPHIA
# AREA OF H BOMB DAMAGE
## FOR 20 MEGATON BOMB
## ( TNT EQUIVALENT = 20,000,000 Tons)
## HEIGHT OF DETONATION=20,000 FEET

| RADII & AREAS RADIUS (Miles) | CIRCLE AREA (Sq. Miles) | RING AREA (Sq. Miles) | DEGREE OF DAMAGE |
|---|---|---|---|
| 20 | 1256 | 548.5 | PARTIAL |
| 15 | 707.5 | 393.5 | MODERATE |
| 10 | 314 | 235.5 | SEVERE |
| 5 | 78.5 | 78.5 | ALMOST COMPLETE DESTRUCTION |

RADII & AREAS OF CONCENTRIC ZONES OF A, B, C, & D DAMAGE FOR BOMBS OF VARIOUS SIZES

| ZONE | Hiroshima Bomb (20,000 tons) | | 5 Hiroshimas (100,000 tons) | | 1 Megaton (1,000,000 tons) | | 100 Megaton (100,000,000 tons) | |
|---|---|---|---|---|---|---|---|---|
| | Radii (mi.) | Areas (sq. mi.) | Radii (mi.) | Areas (sq. mi.) | Radii (mi.) | Areas (sq. mi.) | Radii (mi.) | Areas (sq. mi.) |
| A | 0.5 | 0.8 | 0.9 | 2.3 | 1.8 | 10.6 | 8.5 | 227 |
| B | 1.0 | 2.3 | 1.7 | 6.9 | 3.7 | 32 | 17 | 681 |
| C | 1.5 | 3.9 | 2.6 | 11.5 | 5.5 | 53 | 26 | 1215 |
| D | 2.0 | 5.5 | 3.4 | 16.1 | 7.4 | 75 | 34 | 1507 |




AVERAGE PERCENTAGE OF CASUALTIES

| ZONE | RADII IN MILES | DEATHS | | INJURED | | UNINJURED | |
|---|---|---|---|---|---|---|---|
| | | Without Warning | With Warning | Without Warning | With Warning | Without Warning | With Warning |
| A | 0 to 5 | 90 | 75 | 10 | 15 | 0 | 10 |
| B | 5 to 10 | 50 | 30 | 35 | 20 | 15 | 50 |
| C | 10 to 15 | 15 | 5 | 40 | 25 | 45 | 70 |
| D | 15 to 20 | 2 | 1 | 18 | 9 | 80 | 90 |

KEY

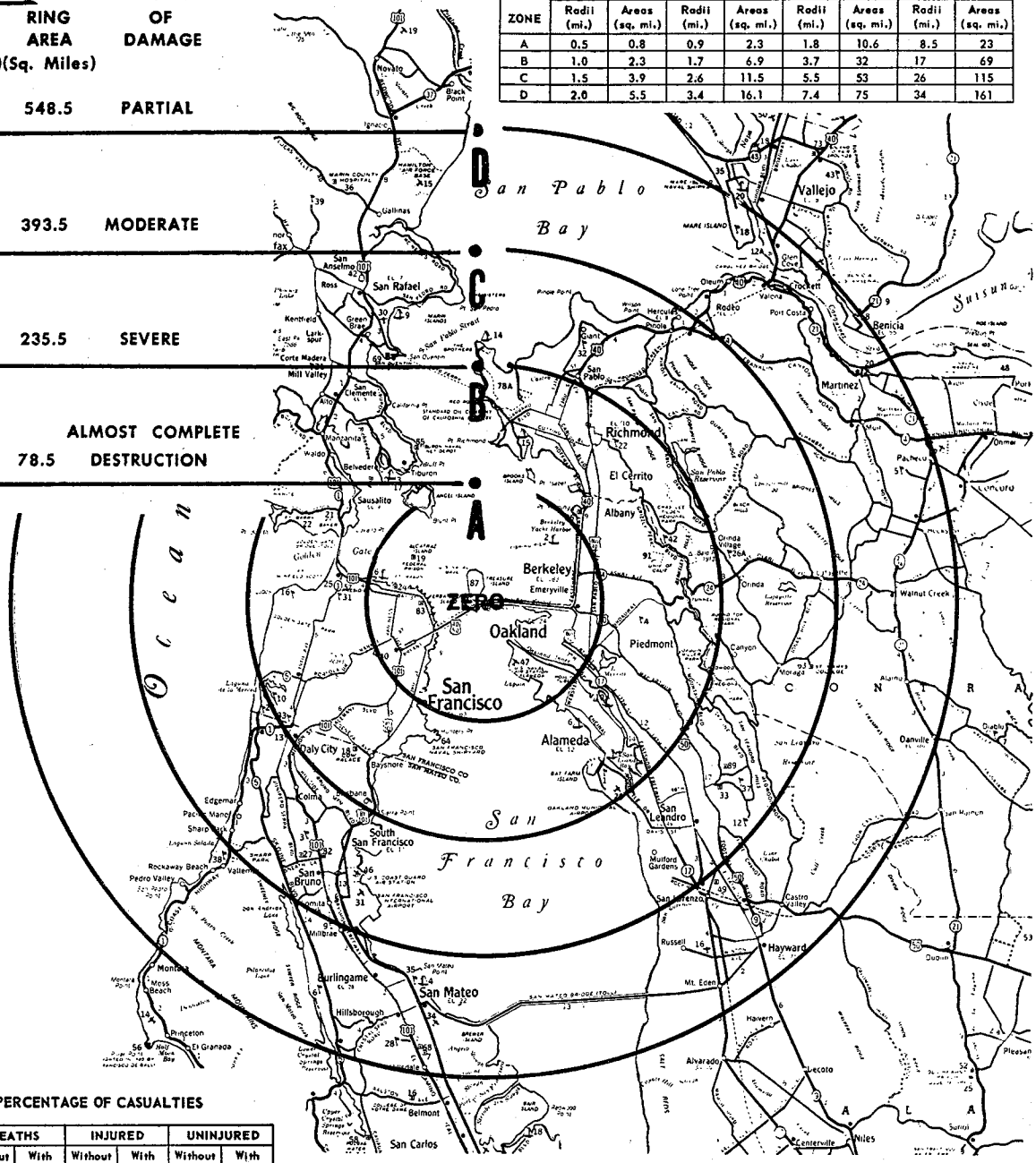
5 10 15 20

# SAN FRANCISCO
# AREA OF H BOMB DAMAGE
## FOR 20 MEGATON BOMB
## ( TNT EQUIVALENT = 20,000,000 Tons)
## HEIGHT OF DETONATION=20,000 FEET

**RADII & AREAS OF CONCENTRIC ZONES OF A, B, C, & D DAMAGE FOR BOMBS OF VARIOUS SIZES**

| ZONE | Hiroshima Bomb (20,000 tons) | | 5 Hiroshimas (100,000 tons) | | 1 Megaton (1,000,000 tons) | | 100 Megaton (100,000,000 tons) | |
|---|---|---|---|---|---|---|---|---|
| | Radii (mi.) | Areas (sq. mi.) | Radii (mi.) | Areas (sq. mi.) | Radii (mi.) | Areas (sq. mi.) | Radii (mi.) | Areas (sq. mi.) |
| A | 0.5 | 0.8 | 0.9 | 2.3 | 1.8 | 10.6 | 8.5 | 23 |
| B | 1.0 | 2.3 | 1.7 | 6.9 | 3.7 | 32 | 17 | 69 |
| C | 1.5 | 3.9 | 2.6 | 11.5 | 5.5 | 53 | 26 | 115 |
| D | 2.0 | 5.5 | 3.4 | 16.1 | 7.4 | 75 | 34 | 161 |

| RADIUS (Miles) | CIRCLE AREA (Sq. Miles) | RING AREA (Sq. Miles) | DEGREE OF DAMAGE |
|---|---|---|---|
| 20 | 1256 | 548.5 | PARTIAL |
| 15 | 707.5 | 393.5 | MODERATE |
| 10 | 314 | 235.5 | SEVERE |
| 5 | 78.5 | 78.5 | ALMOST COMPLETE DESTRUCTION |




**AVERAGE PERCENTAGE OF CASUALTIES**

| ZONE | RADII IN MILES | DEATHS | | INJURED | | UNINJURED | |
|---|---|---|---|---|---|---|---|
| | | Without Warning | With Warning | Without Warning | With Warning | Without Warning | With Warning |
| A | 0 to 5 | 90 | 75 | 10 | 15 | 0 | 10 |
| B | 5 to 10 | 50 | 30 | 35 | 20 | 15 | 50 |
| C | 10 to 15 | 15 | 5 | 40 | 25 | 45 | 70 |
| D | 15 to 20 | 2 | 1 | 18 | 9 | 80 | 90 |

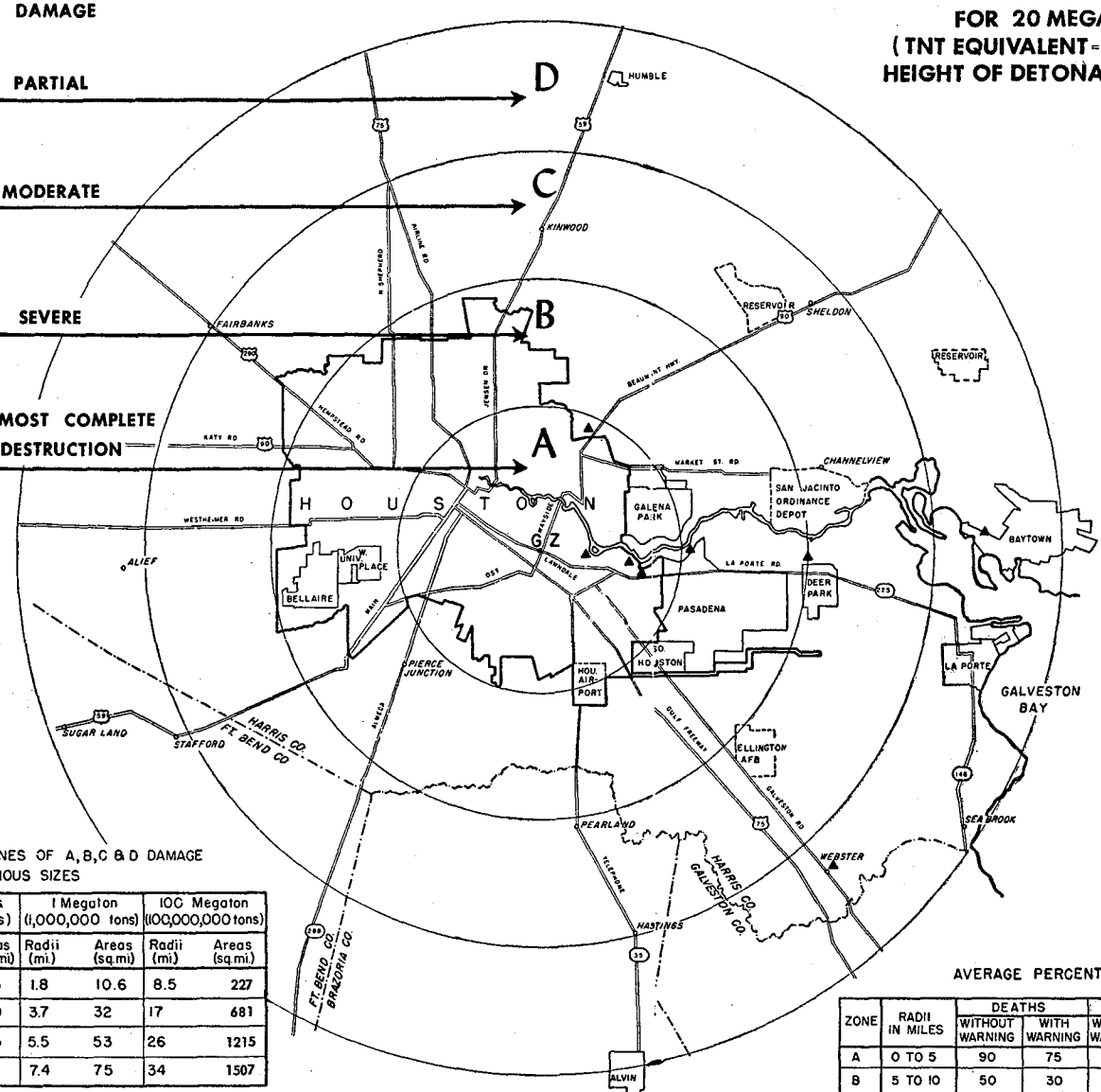
**KEY**

5 10 15 20

# HOUSTON
# AREA OF H BOMB DAMAGE
## FOR 20 MEGATON BOMB
## ( TNT EQUIVALENT = 20,000,000 Tons)
## HEIGHT OF DETONATION = 2,000 FEET **

** ALL HOUSTON AREA PLANS BASED ON A 2000' BURST (GROUND TYPE).

| RADII & AREAS RADIUS (Miles) | CIRCLE AREA (Sq. Miles) | RING AREA (Sq. Miles) | DEGREE OF DAMAGE |
|---|---|---|---|
| 20 | 1256 | 548.5 | PARTIAL |
| 15 | 707.5 | 393.5 | MODERATE |
| 10 | 314 | 235.5 | SEVERE |
| 5* | 78.5 | 78.5 | ALMOST COMPLETE DESTRUCTION |




KEY
- HOUSTON CITY LIMITS
- OTHER TOWN LIMITS
- COMMUNITIES
- REFINERIES & TANK FARMS

RADII & AREAS OF CONCENTRIC ZONES OF A, B, C & D DAMAGE FOR BOMBS OF VARIOUS SIZES

| ZONE | Hiroshima Bomb (20,000 tons) Radii (mi.) | Hiroshima Bomb (20,000 tons) Areas (sq.mi.) | 5 Hiroshimas (100,000 tons) Radii (mi.) | 5 Hiroshimas (100,000 tons) Areas (sq.mi.) | 1 Megaton (1,000,000 tons) Radii (mi.) | 1 Megaton (1,000,000 tons) Areas (sq.mi.) | 100 Megaton (100,000,000 tons) Radii (mi.) | 100 Megaton (100,000,000 tons) Areas (sq.mi.) |
|---|---|---|---|---|---|---|---|---|
| A | 0.5 | 0.8 | 0.9 | 2.3 | 1.8 | 10.6 | 8.5 | 227 |
| B | 1.0 | 2.3 | 1.7 | 6.9 | 3.7 | 32 | 17 | 681 |
| C | 1.5 | 3.9 | 2.6 | 11.5 | 5.5 | 53 | 26 | 1215 |
| D | 2.0 | 5.5 | 3.4 | 16.1 | 7.4 | 75 | 34 | 1507 |

*Radius of "A" ring is actually 5-2/3 miles. This allows for 3500' radius "Bombadier Inaccuracy Zone".*

AVERAGE PERCENTAGE OF CASUALTIES

| ZONE | RADII IN MILES | DEATHS WITHOUT WARNING | DEATHS WITH WARNING | INJURED WITHOUT WARNING | INJURED WITH WARNING | UNINJURED WITHOUT WARNING | UNINJURED WITH WARNING |
|---|---|---|---|---|---|---|---|
| A | 0 TO 5 | 90 | 75 | 10 | 15 | 0 | 10 |
| B | 5 TO 10 | 50 | 30 | 35 | 20 | 15 | 50 |
| C | 10 TO 15 | 15 | 5 | 40 | 25 | 45 | 70 |
| D | 15 TO 20 | 2 | 1 | 18 | 9 | 80 | 90 |

HOUSTON - HARRIS CO. CIVIL DEFENSE CORPS. - TEXAS

**APPENDIX "B"**

**(From Page 1)**

# TYPICAL DEFENSE PLANNING PROGRAM

**PHASE I**—Procedures utilizing existing equipment and personnel. To be started immediately and carried to completion as soon as possible.

1. All applicants for employment and any doubtful employees designated by the plant management will receive a security check.

2. Augmenting the normal security organization with auxiliary personnel. Such organizations will be strengthened as necessary for each local situation.

3. Training of auxiliary plant personnel will be initiated and carried out in accordance with a training directive.

4. Psychological training of all employees in connection with panic prevention during enemy attack will be carried out in accordance with a training directive.

5. "Sabotage Prevention" training for supervisors and other key personnel.

6. Emergency shutdown and restoration procedures will be established for all principal processes.

7. Establishment of close liaison with local Civil Defense authorities. Preparation of procedures for reception of air raid warning signals and the necessary plant warning signals. Periodic drills to test the communications of warnings should be held together with evacuation drills.

8. A shelter program utilizing existing shelter in the plant should be initiated. Instructions concerning evacuation to shelters should be contained in the above-mentioned psychological training program.

9. Safeguarding the corporate interests of the Company in event of a major disaster. This includes a microfilming point for use as an emergency company headquarters; emergency reorganization and operating procedures; and a management succession plan.

**PHASE II**—Procedures requiring minor construction and procurement. To be started concurrently if possible or immediately after completion of Phase I.

1. A survey should be conducted of the plant to determine adequacy of existing personnel identification systems.

2. A survey should be conducted of the plant to determine vital plant equipment and utilities requiring additional protection than that furnished by the normal security plan. Information with respect to electrical detection equipment is available.

3. A plan for the construction and equipping of perimeter fire protection houses should be initiated.

4. Recommendations should be submitted to Company Headquarters for the procurement of additional fire fighting equipment when considered necessary.

5. A plan looking toward the providing of auxiliary fire water should be prepared and submitted to Company Headquarters. Information is available concerning World War II experience.

6. A plan for protection of Company equipment and tanks should be prepared and submitted to Company Headquarters.

7. Normal communications will undoubtedly fail under attack. Telephone lines will be broken and all power may be off. Accordingly, an alternate communication system should be planned. This should include some form of radio transmission, and also should include ample messenger service from disaster control rooms to vital points in the plants.

8. A plan for stockpiling of replacements and materials should be developed. The items should be studied with respect to vulnerability and importance with reference to plant operation. Particular attention should be given to stockpiling vulnerable hard-to-get items in overhead pipe lines.

9. The question of floodlighting for critical parts of the plant should be examined and recommendations submitted in event such security is considered necessary.

10. Other arrangements for process and utilities peculiar to the plant should be studied and appropriate recommendations submitted.

**PHASE III**—Procedures in event of declaration of war or enemy attack.

1. Accelerate Phases I and II.

2. Prepare to construct auxiliary fire water systems.

3. Prepare to construct protection for equipment and tanks.

4. Prepare to construct small area employee shelters.

CONFIDENTIAL

# OIL AND GAS INDUSTRY
## EMERGENCY SUCCESSION TABLE
### FOR KEY MANAGEMENT POSITIONS

CONFIDENTIAL

| | JOB NUMBERS & TITLES | | | | |
|---|---|---|---|---|---|
| | NO. 1 | NO. 2 | NO. 3 | NO. 4 | NO. 5 |
| | | | | | |
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |
| | NO. 6 | NO. 7 | NO. 8 | NO. 9 | NO. 10 |
| | | | | | |
| 1 | | | | | |
| 2 | | | | | |
| 3 | | | | | |
| 4 | | | | | |
| 5 | | | | | |
| 6 | | | | | |
| 7 | | | | | |
| 8 | | | | | |
| 9 | | | | | |
| 10 | | | | | |

NOTES *1. THIS FORM IS FOR USE AT ALL LEVELS OF MANAGEMENT PERSONNEL PLANNING.*

*2. NAMES FOR EACH JOB SHOULD BE LISTED IN THE SEQUENCE OF DESIRED EMERGENCY REPLACEMENT.*

*3. EACH NAME MAY OF COURSE APPEAR IN A NUMBER OF COLUMNS, AND WITH VARIED PRIORITY OF SUCCESSION.*

J-1644

**APPENDIX "D"**

**(From Page 1)**

# ILLUSTRATIVE FUNCTIONS OF MANAGEMENT DISASTER TEAMS[1]

The duties assigned include the following:

—General administration and coordination of activities, including security at the disaster site, issuance of passes, control of records and re-establishment of communications.

—Labor, including assigning duties to workers, recruiting labor or disposing of unallocated labor and staff.

—Food, shelter and welfare, including provision for the employees and their families after an attack and during rehabilitation.

—Machine tools; including examination, appraisal of damage, protection, removal, salvage, repair or replacement. Plant managers prepare lists of the most vital spare parts that would probably be needed in rehabilitation of damaged machine tools and other equipment at their respective plants. On the outbreak of war, some of these could be procured and stored at remote locations.

—Utilities, including restoration of gas, water, electricity and sewerage systems and provisions for temporary arrangements.

—Construction, including recommendations for and the supervision of repair, reconstruction, demolition, salvage and procurement of materials.

—Transport, including movement of men and materials.

—The members of these teams should begin as soon as feasible to familiarize themselves with present conditions in their respective fields at the plants for which their respective teams are designated and should conduct drills of their rehabilitation measures.

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(1) *Industrial Mobilization Plan,* Part I, Page 27, American Machine and Foundry Company, 261 Madison Avenue, New York 16, N. Y. The above is a paraphrased version.

APPENDIX "E"

(From Page 2)

# INDUSTRIAL DEFENSE PLANNING

## STATUS CHECK LIST

| ITEM | COMPANY "A" | COMPANY "B" | YOUR COMPANY |
|---|---|---|---|
| **A. ADMINISTRATION** | | | |
| 1. Continuity of Management | Principals and Alternates Selected | Qualified Replacements Designated | |
| 2. Corporate Security Committee | War Emergency Advisory Committee Exists | Corporate Emergency Advisory Group Appointed | |
| 3. Corporate Security Officer | Appointed | Designated | |
| 4. Plans for Business Operations in Emergency | Prepared | Under Study | |
| 5. Alternate Corporate Headquarters | Selected and Equipped | Planning Stage | |
| 6. Remote Reporting Centers | Designated, and Personnel Assigned | Locations Selected | |
| 7. Protection of Current Assets | Plans Being Formulated | Under Study | |
| 8. Protection of Records and Blueprints | Microfilms Records to Underground Storage | Duplicating Essential Records; Storage at Remote Locations | |
| 9. Emergency Financial Procedures | Banking Arrangements Made | Plans Under Development; Necessary Checks Ready | |
| 10. Corporate Plan for Disaster Control | Formulated; Includes Organization and Training Manual | Currently Under Revision | |
| 11. Industrial Mobilization Plan | Exists for Chemical Products Operations | Being Considered | |
| 12. Budget Provisions | Allocations Reviewed Yearly | No Comment | |
| 13. Liaison With Civil Defense Authorities | Maintained Through Security Officer | Maintained Through Security Officer | |
| 14. Industrial Mutual Aid Organizations | Company Units Participate Where Existing Locally | No Participation; Planning Stage | |
| **B. PERSONNEL** | | | |
| 15. Shelter Program | Designated in Existing Locations; No New Construction Authorized | Under Study | |
| 16. Emergency Personnel Qualifications Records | Prepared; Duplicates at Alternate Corporate Headquarters | Being Developed | |
| 17. Feeding and Housing Disaster Victims | Under Study; Cafeteria Facilities Available | Under Study in Individual Company Units | |
| 18. Financial Aid | Being Studied at Company Units | See Item 9 Above | |
| **C. SECURITY** | | | |
| 19. Security Coordinators | Corporate and Plant Level Appointed | Designated | |
| 20. Personnel Security Investigations | Independent Agency; on All Applicants | Being Considered for New Hires | |
| 21. Security Control of Personnel | Fingerprinting; Badges; Restricted Areas; Guards | Fingerprinting; Badges | |
| 22. Security Watchers from Shift Personnel | Exist in Some Plants | Planned | |
| 23. Protection of Sensitive Points | Fences; Guards; Alarms | No Unusual Precautions | |
| **D. COMMUNICATIONS** | | | |
| 24. Emergency Communications Equipment | RACES System; Vehicle Radios; Field Phones | Vehicle Radios; Walkie-Talkies; Magneto Phones | |
| 25. Emergency Alerting | Bell and Light; Sirens | Whistle Systems | |
| 26. Communications to Employees | Daily Plant News Bulletins; House Organ | Employee Paper; Reading Racks; Bulletin Boards | |

## APPENDIX "E" (cont'd)

| ITEM | COMPANY "A" | COMPANY "B" | YOUR COMPANY |
|---|---|---|---|
| **E. MEDICAL** | | | |
| 27. Medical Planning Committee | Functioning | Recently Appointed | |
| 28. Liaison with Municipal Organizations | Handled Locally | Individual Plant Arranges | |
| 29. Plant Medical Directors | All Plants; Full Time MD | Some Plants, Company MD; Others Part-Time Contract MD | |
| 30. Emergency Medical Supplies | Certain Plants; 1½ Normal Needs | Local Plant Decision | |
| 31. Emergency Casualty Stations | Selected | Designated and So Marked | |
| 32. Rescue and First Aid Teams | Appointed and Trained | Under Formation | |
| 33. Identification and Disposal of Casualties | Under Study | Plan Developed | |
| **F. TRAINING** | | | |
| 34. Disaster Training Manual | Plants Developing Locally; Corporate Exists | Under Development | |
| 35. Rescue and First Aid Training | Completed; New Refresher | Instructor Group Completed | |
| 36. Guard Force Training | Refresher Program in Progress; All Plants | Being Developed; All Plants | |
| 37. Fire Training Program | All Employees—1 Hour; Fire Groups Continuing | Shift Workers Only; 2 Hours | |
| 38. Wardens and Monitors | Surprise Drills; Lectures | Occasional Drills; Meetings; Movies | |
| 39. Emergency Shutdown Procedures | Program Being Developed | Practice Emergency Method Used on a Scheduled Basis as a Regular Training Procedure | |
| 40. Panic Control Training | Guard Force Training; Reading Racks; Surprise Drills; House Organ | Occasional Air Raid and Fire Drills | |
| **G. PLANT DAMAGE CONTROL** | | | |
| 41. Disaster Control Center | Recommended for All Company Plants | Exist in Some Plants | |
| 42. Shift Fire Brigade | Functioning | Recently Trained | |
| 43. Non-Shift Fire Squads | Some Plants Have | Under Study | |
| 44. Fire Manual | Some Plants Have | Recently Requested; All Plants | |
| 45. Radiological Protection | Groups Organizing | Being Considered | |
| **H. REHABILITATION** | | | |
| 46. Protective Construction | Not Currently Active | Under Consideration | |
| 47. Identifying Most Critical Equipment | Plant Operating Supervisors to Identify for Management | Plan to Request Information from Plants | |
| 48. Engineering Planning of Replacement Designs | Project in Abeyance | Being Considered | |
| 49. Alternate Sources of Supply | Educational Orders Placed on Some Items | Exploring Possibilities | |
| 50. Storage of Critical Equipment Replacements | Plan Off-Site Storage for Certain Plants | Centralized Company Storage Facility Exists | |
| 51. Inventory of Vital Equipment | Company-Wide Location Study Planned | Normal Inventory Records Duplicated at Remote Location | |
| 52. Demolition Organization and Equipment | From Regular Usage | Normally Available | |
| 53. Emergency Water, Light and Power | Provided for | Wells at Some Sites; Portable Generators | |
| 54. Dispersion of Company Facilities | New Construction, Consider Non-Target Areas Seriously | Plan Company Hdqtrs. Office Movement to More Remote Area | |

**APPENDIX "F"**

**(From Page 2)**

# EXAMPLE OF PROCEDURES AT CORPORATE REORGANIZATION-POINT

The general procedures to follow in utilizing an alternate corporate headquarters during disaster conditions will vary from firm to firm. The procedure of one typical corporation is generally as follows:

Upon learning that the Headquarters Building has been disabled to a point of not being able to carry on the affairs of the Company, the specified executives will proceed by the fastest available transportation to the Corporate Reorganization Point. The President, or in his absence the available senior officer acting as President, will be responsible for setting up the Reorganization Point and picking up and carrying on the business and affairs of the Company.

The first duties of the President or the Acting President will be to take the necessary steps to reconstitute and reorganize the Company. The following procedures are furnished as a guide. Other action may be necessary depending on the existing circumstances.

a. Surviving Board Members may fill Director Vacancies, even though a quorum of Board Members is not present, according to the revised By Laws. (Copy of By Laws included in Plans in Security Storage Vaults.)

b. Reorganize the Company in the event of non-availability of any General Managers and Managers of Operating Divisions and Staff Departments. Authority to appoint officials of the Company by the Board Members is contained in By Laws. Also see Reorganization Chart.

c. Complete the reorganization of the other personnel required in the temporary headquarters.

d. Make the necessary local arrangements for office space and equipment.

e. Obtain any required information of the Company's business from the duplicate records at the two Security Storage Vaults.

f. Contact all Company facilities advising of any temporary changes in Company problems. (Booklets of addresses and telephones are in the Security Storage Vaults.)

APPENDIX "G"

(From Page 3)

# RECORDS PROTECTION

In the process of records protection, various considerations arise. Some are described below:[1]

## RECORDS INVENTORY

An inventory of all records should be made to determine irrelevant or obsolete material which can be discarded immediately. The residue then presents a smaller problem. The inventory may uncover duplication of files and will aid in determining record retention and disposal schedules. The inventory form will be most useful if it shows:

1. Title of record.
2. Specific description to avoid confusion with other records.
3. Quantity on hand (by number of file drawers, or otherwise).
4. Why the record exists and for whose use.
5. How the records are filed (carbon copy, microfilm, etc.)
6. Where filed.

The inventory should be made by designated and experienced personnel and not by means of an inventory questionnaire circulated through the organization. These have sometimes been found over 50% inaccurate.

## RECORDS CLASSIFICATION

The classification of records must be in the order of their importance in accomplishing one major goal: rehabilitation of the business. The records needed to accomplish this in Company "A" will differ from those of Company "B". No firm should use another's records evaluation except as a general guide.

A top executive should coordinate the classification activity. He must have final authority to determine the true relative importance to the overall company operation of all records. Some will initially be classified too highly by lower echelon personnel who are close to the records and attach undue significance to them.

The categories for classification may be:

1. **Vital**—Indispensable to the operation of the business. May be irreplaceable material.

2. **Important**—Reproducable, but only after considerable time and expense.

3. **Useful**—Fairly easily replaced. Destruction would be inconvenient, but not hindering in starting operations again quickly.

4. **Unnecessary**—The National Records Management Council estimates that as high as 35% of the records in the average office are retained because there is no program of disposal.

Fully labelled file containers and a current records index are necessities if rapid rehabilitation is to be achieved.

## A CONTINUING PROGRAM

The protection program will operate best if made part of an over-all records control program at a high management level. The records control program may save enough money through housecleaning and efficiency to pay a goodly portion of the protection program costs.

## TYPES OF PROTECTION

Vaults will generally give good protection against blast or fire, even above ground. Underground vaults are better, but are more subject to flooding from water used fighting fires.

Special fire-resistant safes or file cabinets are available and provide good protection. Paper in such storage is less susceptible to damage than non-burning microfilm in ordinary storage. This is because moisture in the microfilm emulsion vaporizes at a temperature (212° F.) lower than that at which paper chars (350° F.).

## LOCATION

Records surviving blast and fire may be buried under rubble and be inaccessible. Subsequent salvage efforts have been known to damage records more than the effects of the emergency. For these and other reasons, many companies store their records at remote locations. Various methods and various costs are involved.

1. **Business Storage Firms**—There are companies specializing in business records storage. Their services include receipt of mailed records, periodic messenger pickup of records, unpacking, indexing, filing, and eventual disposal. Banks and warehouses at distant locations rent storage facilities reasonably, often at a set price per cubic foot.

(1) This information was condensed and paraphrased primarily from:

(A) *Your Business and the A-Bomb,* Research Institute of America, December 1950, 589 Fifth Avenue, New York 17, New York.

(B) *Protecting Records in Wartime,* Studies in Business Policy No. 51, 1951, National Industrial Conference Board, 27 Park Avenue, New York 17, New York.

2. **Alternate Corporate Headquarters** — Some firms store records at their alternate corporate headquarters, or near it, in commercial storage facilities.

3. **Company Storage Centers**—Purchase of a records storage facility is one practicable solution. A pool of companies could share the costs in a common depository.

Also, conversion of a company's branch office facilities for storage purposes may prove cheap and perhaps feasible despite their locations in target areas, especially if the simultaneous destruction of both sets of records in both target areas appears unlikely.

A novel World War II British technique proved effective: small firms stored important records in the garages of management personnel with country homes.

If distance is sufficient and storage facilities good, cost can be cut by using fibreboard or pasteboard boxes instead of metal filing cabinets.

## CHOICE OF LOCATION

In choosing a storage center, certain factors are important:

1. **Access**—Limited distance is desirable (300 miles or less). Transportation should be adequate (good roads or a railroad).

2. **Protection**—A fire-resistant building is the minimum requirement. Insects and mildew are hazards.

3. **Expansion Area**—Storage may be a long term proposition and room is needed for volume increase in records.

4. **Facilities for Use**—Space to work and equipment for viewing (if microfilm) are basic.

APPENDIX "H"

(From Page 4)

# GERMAN OIL INDUSTRY COUNTERMEASURES TO ALLIED BOMBINGS[1]

In May 1944, oil became a priority air target, and heavy sustained bombing of the industry began. Total production and imports dropped by two-thirds between the first and last quarters of the year. Synthetic production dropped by more than three-quarters, and bore the brunt of the attack.

Strenuous repair efforts were immediately undertaken, and machinery, materials, and labor were expended almost without regard to consequences. High pressure tanks were taken from the chemical plants, causing a drop in the output of nitrogen. Bombed oil plants were cannibalized. Some new construction was also begun.

Although repeatedly attacked, refineries and synthetic plants were back in production on the average in about six weeks, much faster than Allied expectations. A large-scale dispersal program began in 1944, but was handicapped by the disruption of rail transport, the diversion of repair efforts to recently bombed plants, and the shortage of certain machinery components, mainly compressors. Relatively little had been accomplished in dispersal by the end of the war.

Shortage of electrical machinery prevented installation of stand-by power units in dispersed plants.

Damage to water lines, gas mains, sewers, and electric cables kept some oil-chemical plants shut down.

Oil production was stopped mainly by primary damage. Secondary effects of bombing—absenteeism, lack of raw materials, transport difficulties, and destruction of personnel—did not contribute heavily. The oil industry could not obtain enough construction workers to put in the steel actually delivered. By far the greatest proportional reduction in supply of refined oil products occurred in aviation gasoline.

## ORGANIZATION

Alarm systems, particularly important in high-pressure operations (hydrogenation plants), allowed preparatory shutdown of certain plant operations.

Leuna had a typical air-raid organization with 60% of employees in Air-Raid Protection groups for alarm receiving and sending, contact, recording (all air raids were recorded), watching, emergency repair, first aid, gas detection and decontamination, and fire fighting (coordinated with local fire forces).

## PLANT DISPERSALS

The entire dispersal program called for 140 plants ranging in size from small distillation units to large complicated hydrogenation plants. Extreme cost and the scarcity of labor and materials acted as deterrents to the program. Progress was also handicapped by disruption of rail transport and emphasis put on repair work. Frantic efforts at dispersal resulted in additional strain on the economy.

There was opposition to putting hydrogenation plants underground because of their size and complexity. A dispersal program on such a large scale was impractical. Even though plants were protected, their transport system was still vulnerable. Plants that had been knocked out completely were brought back to some production in a few weeks.

The great weakness of the dispersion program was its reliance on railroad transportation. Lack of storage space and reliance on outside power were further defects.

All underground plants were built in solid rock, so concrete linings were unnecessary and no air-raid shelters or extra buildings were needed. Underground plants were more dangerous with respect to leakage or fire, but safer from continual bombing. The whole dispersal program of the oil industry was weak. Sources of electric power, fuel, and feed stock for carbonization and coal hydrogenation plants were still vulnerable to bombing. Earlier planning of the dispersal and underground program, with a system of pipelines to replace railroad transportation and with protection of power and feed-stock plants, would have made a successful system.

## PROTECTIVE CONSTRUCTION

Vital processes were protected by blast walls and reinforced concrete "dog houses."

Equipment (turbo-generators, compressors, etc.) was protected by splinter walls (wood or concrete sections filled with gravel, paper sacks filled with lean concrete mixture and allowed to harden after in place, brick walls, or precast concrete sections). Tall equipment (distillation towers, etc.) was some-

(1) *Industry Guide to Planning for Restoration of Production,* September 15, 1954, for U. S. Department of Defense by the U. S. Air Force, Sup't of Documents, U. S. Government Printing Office, Washington 25, D. C.

times protected with brick firewalls (built-in panels—supported on steel columns and beams). Mats of metal turnings packed between screens and suspended from angle iron frames were used for splinter protection.

Oil tanks were protected by 20-inch-thick brick walls built directly against or some distance from the tanks. Sometimes removable concrete slabs were held in place against tanks with steel cables or rods.

More progress was made on underground lubricating oil plants than on other parts of the underground program. The end of the war found only a few small refineries finished.

Some plants found it cheaper to employ a large staff of repair construction workers than to wait for repair squads from outside. Bombed plants recovered rapidly at first, but more slowly with repeated attacks.

In January 1945, there were 350,000 employed in rebuilding the oil industry.

Strenuous repair efforts were made in synthetic plants. New plants under construction were butchered to speed repairs on damaged plants. On the average, plants were back in production in about 6 weeks and in some cases in a matter of days. By quick repairs, the Germans were able to get at least partial production out of bombed plants. Repeated air attacks caused almost complete breakdown of oil production.

Fuel tanks at hydrogenation plants burned during early attacks, so fuel had to be transported immediately from process. This was later impossible with transportation difficulties. German policy was to keep stocks of final products at refineries and synthetic plants low, production being shipped daily. This kept loss of stocks from raids on oil plants small.

Modern fire-fighting equipment was available at refineries. Stationary systems, easily damaged by bombs, were soon discarded for portable fire equipment.

**APPENDIX "I"**

**(From Page 7)**

# TAX AMORTIZATION INCENTIVE FOR INDUSTRIAL PROTECTIVE CONSTRUCTION[1]

Office of Defense Mobilization Order VI-4 extends to defense-supporting plants in the 193 target areas (designated by the Federal Civil Defense Administration) the offer of 100% accelerated tax amortization on funds spent for protective construction.

It also eliminates the requirement that at least $25,000 be spent on protective construction before a plant becomes eligible for rapid amortization.

*Dispersion*

The O.D.M. Director stresses that the government urgently encourages the location of new defense plants away from critical target areas in accordance with the National Industrial Dispersion Policy.

*Protective Construction*

However, he also points out that protective construction, while not considered a substitute for dispersion, is urged for vital existing facilities presently located in target areas and for contemplated facilities for which exceptions from the dispersion criteria may be granted for impelling reasons.

Protective construction is described in Order VI-4 as "that extraordinary construction, above and below ground, designed to resist weapons effects, including structural strengthening of buildings, installation of damage-resistant materials, compartmentation, special shelters for personnel and equipment, and protection for plant services and utility system."

To assure that the protective construction undertaken meets the technical standards published by the F.C.D.A., applicants for the fast tax write-off must file supporting declarations from the design architect or engineer and the local Civil Defense director.

*Eligibility*

To be eligible for the 100% fast tax write-off, a facility must conform to these criteria: (a) it must produce the material or service for which ODM has established an expansion goal, whether or not the goal has been filled; (b) it must be located inside the "target area"; (c) it must conform to technical standards prescribed by the Federal and local Civil Defense Administration; (d) the costs applied for must be attributable solely to protective construction.

These criteria alone do not permit the allowance of rapid tax write-off for facilities such as installations for protection of records.

Although this program is primarily designed for facilities located in the "target areas," consideration will be given to facilities located outside these areas which may in themselves constitute "special targets."

*Information Sources*

Information on specific expansion goals is available at the Departments of Commerce, Interior and Agriculture and the Defense Transport Administration. In general, the Department of Commerce has information on all manufacturing expansion goals; Interior on petroleum, gas and electric power; Agriculture on farm equipment and the Defense Transport Administration on transportation and storage facilities expansion goals.

Application forms are available at the Field Offices of the U. S. Department of Commerce and the Small Business Administration.

(1) *Industrial Defense Planning Manual,* p. 31, October 1954, American Iron and Steel Institute, 350 Fifth Avenue, New York 1, New York.

APPENDIX "J"

(From Page 8)

# LEGAL CONSIDERATIONS FOR ADMINISTRATIVE PLANNING

The Government will undoubtedly provide some sort of emergency legislation to aid the victims of enemy industrial attack. Even those companies which are not physically damaged may be economically injured by factors such as damage to customers' or suppliers' facilities. Such damage may result in relief from certain contractual obligations. It is expected that Government legislative relief would apply retroactively in the event of surprise enemy attack. A few of the legal factors are considered below, as it is anticipated they will be handled.[1]

*Debtor Relief*

The validity of mortgages, contracts, leases, options, etc., would probably not be questioned but any enforcement of their terms would probably be suspended where the debtor can show war-caused hardship which developed after the legal obligation was made. Great Britain had such debtor relief in its successful Emergency Powers Act.

*Government-Ordered Evacuation*

Protective Government legislation will undoubtedly be available for companies which incur legal obligations due to inability to fulfill contract commitments because of Government orders to evacuate given locations.

It is probable that during evacuation a state of suspension would apply to such things as rental payments, charges for utilities services and various contractual obligations.

*Reimbursement for War Damage*

Government legislation on insurance coverage for damage which is war-caused may be patterned after the satisfactory World War II British War Damage Act.

*Reconstruction Materials Priorities*

European governments in World War II used "emergency repair licenses" to control allocation of critical repair materials, such as lumber, structural steel, glass, etc. Companies that prepare pre-attack inventories of essential rehabilitation items would have the advantage if a similar program were set up in this country.

*Personnel Protection*

A war that may cause staggering civilian casualties puts practically everyone in the Armed Services. Governmental assistance to the wounded may well include medical care and disability allowances.

*Anti-Trust Laws*

It is possible that certain limited exemptions from the anti-trust laws (similar to those in the Defense Production Act of 1950 . . . terminated June 30, 1955) might be granted by Congress in the event of attack or an increase in international tensions.

(1) *Your Business and the A-Bomb,* Research Institute of America, December 1950, 589 Fifth Avenue, New York 17, N. Y.

APPENDIX "K"

(From Page 13)

# SECURITY SURVEY FORM

The form below is an adaptation of a plant protection survey form.[1] Company headquarters offices might use this form or variations of it for checking on the status of security measures in the various company facilities.

## COMPANY PLANT SECURITY SURVEY

PLANT.....DATE.....

LOCATION.....SURVEY COORDINATOR.....

### A. PHYSICAL CONTROL OF PLANT PROPERTY

1. What percentage of plant perimeter is fenced?.....
   Type fencing.....Condition of fence.....
   Height.....Unfenced area.....
2. Is plant area floodlighted?.....Adequate lighting.....
   Perimeter fence line floodlighted.....
3. What is total number of entrances and exits?.....
   Number vehicular.....Locked or guarded.....
   Number pedestrian.....Locked or guarded.....Turnstiles.....
   Number railroad.....Locked or guarded.....
   Railroad crew have key.....
   Wharves.....Others.....
   Windows, fire escapes, drains and other similar openings which might be used for unauthorized entry adequately protected.....
   Exceptions.....
   Shipping platforms guarded.....By whom.....
   Burglar alarm system.....Tested.....
   Number of employees who have gate keys.....
   Keys collected by guards.....When.....
4. Are parking lots located outside plant area?.....
   Inside plant area.....Separately fenced.....
   Control measures.....
5. List critical areas within plant (indicate protective measures for each).....
   .....
6. List critical areas off the plant (indicate protective measures for each).....
   .....
7. Remarks.....
   .....
   .....

(1) *Industrial Security*, Studies in Business Policy No. 60, Part I, Nov. 1952, National Industrial Conference Board, 247 Park Avenue, New York 17, New York.

## APPENDIX "K" (cont'd)

### B. GUARD FORCE

1. What is the total number of guards?.....Number of shifts.....
   Number of guards on each shift.....Guards on duty Sundays,
   holidays and nonworking hours.....

2. Are guards thoroughly investigated for reliability?.....
   Police records checked.....
   Loyalty to country established.....
   Physical examinations.....Frequency.....
   Average age of guards.....Average length of service.....
   Women guards or matrons.....Number.....

3. Are guards specially trained in their duties and responsibilities?.....
   Furnished printed rules and regulations.....(Attach copy if possible)
   Taught defensive tactics.....
   Methods of espionage and sabotage studied.....
   Location and use of fire equipment.....
   Conditions which may cause fires.....
   Duties in event of fire.....
   First aid methods.....
   Investigation of unusual incidents.....
   Written reports of unusual incidents.....
   Bomb disposal.....
   Action to be taken in other emergencies.....

4. Are guards deputized as law enforcement officers?.....
   Wear uniforms.....Special badges.....
   Carry firearms.....Authorized.....
   Practice shooting.....Riot sticks available.....
   List other special equipment.....

5. Are regular guard patrols made?.....Frequency of rounds.....
   By foot or car.....All important plant areas patrolled.....
   Fence gate locks checked.....Patrols punch clocks.....
   Order in which key stations are punched changed periodically.....
   Are clock dials inspected and explanations required of deviations.....
   Guard assignments changed periodically.....
   Guards know assignments in advance.....Submit written reports.....

6. Do guards check passes of all persons entering and leaving plant?.....
   Packages, briefcases, lunch boxes, etc., inspected on entering plant.....
   Packages, briefcases, lunch boxes, etc., inspected or pass required on leaving plant.....
   Trucks and autos inspected on entering and leaving plant.....
   Noncompany trucks escorted while in plant.....
   Railroad cars inspected on entering and leaving plant.....

7. Remarks.....
   .....
   .....

## C. PERSONNEL INVESTIGATION

1. Are all employees investigated for honesty and loyalty to country?.....
.....(Attach "Application for Employment" form used)

Does personnel reference investigation include:

Query to former employers.....(Attach copy of letter)
Check with police departments.....(Attach copy of letter)
Query to schools.....(Attach copy of letter)
Query to personal references.....(Attach copy of letter)
Other sources (retail credit, etc.).....(Attach copy of letter)
Is field investigation made by company investigator.....
Number of years investigation covers.....
Investigation completed before applicant accepted for employment.....
All employees hired since 1945 similarly investigated.....
Exceptions.....
Describe investigative procedures for outside contractors, truck drivers, etc.....
.....
Number of aliens in plant.....
Date of last determination.....

2. Remarks.....

## D. IDENTIFICATION

1. Are all employees issued passes?.....(Attach samples)
Passes made at plant.....(If not, explain under "Remarks")
Passes numbered.....Exceptions.....
Passes include photograph.....Size.....
Pass tamper-resistant.....Describe.....
Passes area or shift coded.....Separate passes for restricted areas.....
Passes or badges worn on outer clothing by all employees.....
Describe "lost pass" procedures and precautions against unauthorized use.....
.....
When employment terminated, are badges, passes, etc., recovered.....
Exceptions.....

2. What identification system used for outside contractors or other noncompany employees? (Attach sample passes, if possible).....
.....

3. Are all employees fingerprinted.....Exceptions.....
Use Form LG-4915.....No. of copies.....Disposition of forms.....

4. Are public tours or other visitations permitted?.....
Are permitted tours or visitations adequately supervised.....
List types.....
Visitor register maintained.....How are visitors identified.....
Special passes issued to visitors.....Worn on outer clothing.....
Collected at end of visit.....Visitors escorted.....
Exceptions.....
Taking of pictures or photographs permitted.....

5. Remarks.....

## E. OFFICE BUSINESS PROTECTION

1. Is mail room restricted?.....
   Employees handling mail thoroughly investigated for loyalty.....

2. Are important documents stored in fireproof vaults?.....
   Charged out to employees by name and date.....
   Vaults locked when unattended.....
   Combinations of safes limited to a few trustworthy employees.....
   Combinations of safes changed at periodic intervals.....
   Valuable records microfilmed.....
   Films stored off plant at safe location.....

3. How is waste paper disposed?.....
   Special procedures for "classified" papers.....
   Any waste paper sold to outside companies.....
   Shredded before sale.....
   Disposition of stenographers' notebooks.....
   Operations or research notes.....
   Janitors and charwomen supervised.....Activities spot-checked.....

4. Remarks.....

## F. MISCELLANEOUS

1. To what branch of Department of Defense has plant been assigned?.....
   Date facility security survey was made of plant.....
   Identity and headquarters of inspectors.....
   .....

2. What is address of nearest FBI office?.....
   Has liaison been established.....
   Plant employees encouraged to report to FBI.....

3. What is number of employees on day shift.....2nd shift.....3rd shift.....

APPENDIX "L"

(From Page 14)

# CRITERIA FOR DETERMINING SECURITY RISKS[1]

The Industrial Employment Review Board uses the following criteria in reviewing appeals from decisions rendered by any of the personnel security boards of the military services which deny access to classified information.

## INDIVIDUALS

Access to classified military information shall (except as provided in paragraph 6 below) be refused to an individual if, on all the evidence and information available to the Board, reasonable grounds exist for belief that the individual:

1. Has committed acts of treason or sedition, or has engaged in acts of espionage or sabotage; has actively advocated or aided the commission of such acts by others; or has knowingly associated with persons committing such acts.

2. Is employed by, or subject to the influence of, a foreign government under circumstances which may jeopardize the security interests of the United States.

3. Has actively advocated or supported the overthrow of the government of the United States by the use of force or violence.

4. Has intentionally disclosed military information classified confidential or higher without authority and with reasonable knowledge or belief that it may be transmitted to a foreign government, or has intentionally disclosed such information to persons not authorized to receive it.

5. Is mentally or emotionally unstable, is an habitual offender of the law, or does not possess the integrity, discretion, and responsibility essential to the security of classified military information.

6. Is or recently has been a member of, or affiliated or sympathetically associated with, any foreign or domestic organization, association, movement, group, or combination of persons: (a) which is, or which has been designated by the Attorney General as being, totalitarian, fascist, communist or subversive; (b) which has adopted, or which has been designated by the Attorney General as having adopted, a policy of advocating or approving the commission of acts of force or violence to deny other persons their rights under the Constitution of the United States; or (c) which seeks, or which has been designated by the Attorney General as seeking, to alter the form of the government of the United States by unconstitutional means, provided that access may be granted, notwithstanding such membership, affiliation or association, if it is demonstrated, by more than a mere denial, that the security interests of the United States will not thereby be jeopardized.

## ALIENS

Access to information or material subject to Section 10 (j) of the Act of 2 July 1926 (10 USC 310 (j)) whether or not classified, shall be refused to an alien if, on all the evidence and information available to the Board, reasonable grounds exist for belief that the alien is ineligible for access under the criteria specified in (a) above.

## CONTRACTORS

Access to military information necessary for the negotiation, award or performance of a contract shall be refused to a contractor or prospective contractor if, on all the evidence available to the Board, reasonable grounds exist for belief that:

1. Any of the personnel of the contractor or prospective contractor who will have access to such information or material is ineligible under the criteria specified in the previous two sections.

2. The contractor or prospective contractor is owned by or is under the control or influence of foreign interests under circumstances which may jeopardize the security interests of the United States.

(1) *Studies in Business Policy*, No. 60, Part I, Nov. 1952, National Industrial Conference Board, 247 Park Avenue, New York 17, N. Y.

APPENDIX "M"

(From Page 15)

# INDUSTRY SECURITY CONTROL OF ALIENS[1]

The Division of Industrial Security of the Office of the Secretary of Defense published a statement in April 1954 concerning policies pertaining to the employment of aliens in defense plants.

## ALIENS

"Department of Defense policies do not prohibit the employment of aliens in any industrial facility engaged in defense production."

## GOVERNMENT HIRING INFLUENCES

"The Department of Defense does not advise management who should or should not be employed within their plant. Neither does the Department participate in any personnel actions within industry, except where access to classified information . . . is involved."

## EXPOSURE TO CLASSIFIED INFORMATION

"A security clearance is required before any individual is permitted access to classified information. Therefore, if an alien's work in an industrial plant requires him to have access to classified information, his employer must first obtain a security clearance for him through the Military Department concerned. Normally, security clearance action is initiated by plant management through the security office of the Military Department which has been assigned security cognizance of the facility."

## FOREIGN NATIONALS

"Immigrant aliens are considered by the Department of Defense to be those individuals legally admitted into the United States for permanent residence under an immigration visa. All other non-citizens, such as students, tourists, etc., are classified by the Department of Defense as foreign nationals. These individuals are not employable within industry without special work authorizations granted by the Immigration and Naturalization Service."

(1) *Industrial Security,* Studies in Business Policy No. 60, Part I, Nov. 1952, National Industrial Conference Board, 247 Park Ave., New York 17, N. Y.

APPENDIX "N"

(From Page 22)

# PERSONNEL ASSIGNED TO A CASUALTY STATION [1]

(Civil Defense Community Standards)

## FIRST AID STATION GROUP

| | |
|---|---|
| Physicians | 3 |
| Dentists or Veterinarians | 2 |
| Nurses | 3 |
| Nurses Aides | 8 |
| Administrative Asst. (Pharmacist) | 1 |
| First Aid Technicians | 20 |
| Orderlies | 14 |
| Chaplain | 1 |
| Clerks | 3 |
| Decontamination Technicians | 2 |
| Messengers | 2 |
| | 59 Persons |

## FIELD FIRST AID GROUP

| | |
|---|---|
| First Aid Technicians | 27 |
| Messengers | 1 |
| | 28 Persons |

## LITTER BEARER GROUP

| | |
|---|---|
| Litter Bearers | 105 |
| Messengers | 2 |
| | 107 Persons |

## AMBULANCE GROUP

| | |
|---|---|
| Orderlies | 19 |
| Ambulance Drivers | 16 |
| Medical Regulator | 1 |
| Messengers | 2 |
| | 38 Persons |

**TOTAL PERSONNEL FOR A FIRST AID STATION** ..... 232 Persons per 10,000 population

(1) *Organization and Operation of Civil Defense Casualty Service,* Part I—The First Aid System—Federal Civil Defense Administration, TM 11-1, Sup't of Documents, U. S. Government Printing Office, Washington 25, D. C.

APPENDIX "O"

(From Page 22)

# MINIMAL SUPPLIES FOR ROVING FIRST AID TEAMS[1]

| | Number | Unit |
|---|---|---|
| Acetylsalicylic Acid, 0.3 gm 100's | 1 | each |
| Ammonia Inhalant, aromatic, 1/3 cc amp. 10's | 3 | pkg. |
| Bandage, gauze, roller, 3" x 10 yds. | 12 | each |
| Bandage, muslin, triangular, compressed 37" x 37" x 52" | 8 | each |
| Boric Acid Ophthalmic Ointment 5%, 1/8 oz. in tube, 12's | 1/12 | pkg. |
| Dressing, first aid, large (pad 11" sq.) | 3 | each |
| Dressing, first aid, medium (pad 7-1/2" x 8") | 6 | each |
| Dressing, first aid, small (pad 4" x 7") | 8 | each |
| Dextron I.V. Sets | 3 | each |
| Identification Cards | | |
| Pencil, lead, medium, with eraser | 3 | each |
| Pins, safety, large, 12's | 3 | cards |
| Plaster, adhesive, surgical, 3" x 5 yds. | 3 | spools |
| Pouch, canvas, with carrying strap or suitcase type of container | 1 for each first aider | |
| Soap (hand) | 6 | bars |
| Scissors, bandage, Lister | 3 | each |
| Splints, basswood, size 2 (3/16" x 4" x 18") | 6 | each |
| Tourniquet, web | 3 | each |

*Note:* The above list is current as of the date of publication of this manual. Industrial medical planners should keep in touch with their local Civil Defense medical officials for changes which may develop.

(1) *Organization and Operation of Civil Defense Casualty Service,* Part I—The First Aid System—Federal Civil Defense Administration, TM 11-1, Sup't of Documents, U. S. Government Printing Office, Washington 25, D. C.

APPENDIX "P"

(From Page 22)

# EQUIPMENT AND SUPPLIES FOR A 500 CASUALTY LOAD FOR THE FIRST 8 HOURS FIRST AID CASUALTY STATION[1]

| | Number | Unit |
|---|---|---|
| Alcohol, Ethyl, denatured, 23 H 1 qt | 2 | Bottles |
| Ammonia Inhalant, aromatic, 1/3 cc. amp. 10's | 64 | pkgs. |
| Antiseptic, skin organic mercurial compound, or Benzalkonium compound USP 1 pint | 4 | Bottles |
| Applicators, wood, cotton-tipped 6", 100's | 1 | Box |
| **Arm Band and Identification Card | 1 per person | |
| *Atropine Sulfate, 2 mg (1/32 gr. (1 cc.)) | 400 | each |
| Achromycin, Hydrochloride, capsules, 0.25 gm (4 gr.) 100's and/or other broad spectrum antibiotics | 3 | Bottles |
| Bandage, gauze, 2" x 6 yds., 12's | 12 | pkgs. |
| Bandage, triangular, muslin, 52" x 37" x 37" | 50 | each |
| Basin, wash, enamelware | 4 | each |
| Blanket, paper | 188 | each |
| Boric Acid Ointment, ophthalmic, 5%, 1/8 oz. in tube, 12's | 3 | pkgs. |
| Brush, hand | 6 | each |
| Bucket, enamelware, 12 qts. with lid | 4 | each |
| **Can, corrugated with cover, 10 gal. | 4 | each |
| Catheter, urethral, rubber Robinson, 18 Fr. double eye, hollow tip | 2 | each |
| Catheter, urethral, rubber Robinson, 12 Fr. double eye, hollow tip | 2 | each |
| Compress and bandage, gauze, field, 22" x 18", first aid treatment of burns | 100 | each |
| Compress and bandage, gauze, field, 22" x 36", first aid treatment of burns | 50 | each |
| Cotton, absorbent, 1 lb. | 4 | rolls |
| Cups, paper—50's | 100 | pkgs. |
| Depressor, tongue, wood, 100's | 1 | box |
| Dressing, first aid, large military type, 11-3/4" sq. | 100 | each |
| **First aid station marker | 1 | each |
| Flashlight (chest light) 2-cell without battery | 24 | each |
| **Gasoline containers, 5 gal. | 1 | each |
| Gauze, plain, 36" x 100 yds. | 1 | bolt |
| Gloves, surgeons, rubber No. 8 | 8 | pair |
| Instrument Set (one set for each of 6 surgical tables) each containing: | 6 | set |
| 1 Forceps, dressing, 5-1/2" straight | | |
| 2 Forceps, hemostatic, 5-1/2" curved | | |
| 1 Forceps, tissue, spring, 5-1/2", 1 x 2 teeth | | |
| 1 Forceps, tongue holding, 7" | | |
| 1 Handle, operating knife, No. 3 | | |
| 1 Needle Holder, Hager-Mago 7" | | |
| 2 packages of blades, operating knife, No. 10, 6 per package | | |
| 2 Retractors, general operating, nested | | |
| 1 Scissors, surgical, Mayo 5-1/2" straight | | |
| 1 Scissors, surgical, Mayo 5-1/2" curved | | |
| 1 Tube, Breathing, Airway, adult | | |
| 1 Tube, Breathing, Airway, child | | |
| **Kitchen Equipment (small oil burner or gasoline stove, and supplies for hot drinks, etc.) | 1 | each |
| Lantern (Coleman type) | 3 | each |
| Litter or Stretcher | 100 | each |
| Matches, safety, 10's | 6 | pkgs. |
| **Morphine Tartrate Syrette, 0.016 gm., 1.5 cc (1/4 gr.), (collapsible tube, with needle) | 500 | each |
| Needle, hypodermic, 25 gage, 1-1/2", 12's | 1 | box |
| Needle, hypodermic, 20 gage, 1-1/2", 12's | 1 | box |
| Needles, suture, 3/8 circle, skin 6's | 2 | pkgs. |
| Needles, suture, size No. 1, 3/8 circle, trocar point, 6's | 2 | pkgs. |
| Pad, heat, chemical | 24 | each |
| Pan, bed, enamelware | 3 | each |
| Paper, toilet | 12 | rolls |
| Pencil, skin | 6 | each |
| Pencil, indelible, 12's | 3 | pkgs. |
| Pentobarbital tablets, 1-1/2 gr., 500's USP | 1 | bottle |
| Pins, safety, large, 12's | 100 | pkgs. |
| **Petrolatum, USP, 1 lb. | 4 | jars |
| Plaster, adhesive, 3" x 5 yds. | 24 | spools |

(1) *Organization and Operation of Civil Defense Casualty Service,* Part I—The First Aid System—Federal Civil Defense Administration, TM 11-1, Sup't of Documents, U. S. Government Printing Office, Washington 25, D. C.

## APPENDIX "P" (cont'd)

| | *Number* | *Unit* |
|---|---|---|
| Procaine, hydrochloride and epinephrin tablets, 1/3 gr. procaine, 1/1200 gr. epinephrin, 100's | 2 | bottles |
| Or Procaine Penicillin and Penicillin powder dry for water suspension | | |
| *Procaine Penicillin G, 300,000 units per mil., fortified with crystalline; Penicillin G, 100,000 units per mil., in oil, single dose, disposable unit | 500 | each |
| Scissors, bandage, Lister, 7-1/4" | 6 | each |
| Silk, dermal, medium, 40" strand | 24 | each |
| Soap, Hand | 12 | cakes |
| **Splint, arm, Universal | 6 | each |
| Splint, basswood, size 3, 3/16" x 4" x 18", 12's | 4 | pkgs. |
| **Splint, leg, 1/2 ring Thomas | 6 | each |
| Sponge, surgical, 4" x 4", 200's | 3 | pkgs. |
| **Sterilizer, instrument boiler, gasoline-heated | 2 | each |
| **Stove, gasoline (2 burner) | 2 | each |
| Suture, silk braided, single, armed, size 0, 12's 1/2" circle cutting edge, size 16 eyed needle, affixed, black, non-capillary, in sealed glass tube | 2 | pkgs. |
| Sutures, surgical, gut, nonboilable, sterible tube, plain No. 1, 12's | 2 | pkgs. |
| Syringe, hypodermic, Luer, 10 cc | 6 | each |
| Tags, medical, emergency, book of 20 | 6 | books |
| Towel, hand, paper | 6 | pkgs. |
| **Towel, hand | 25 | each |
| Tourniquet, web, with buckle, 3/4" to 1" wide x 32" long | 25 | each |
| Tray, sterilizer, 2" x 8-1/2" x 10" | 4 | each |
| Urinal, male, enamelware | 3 | each |
| **Water, 5-gal. carboy (for medical purpose) | 10 | each |
| **Water Containers, 5-gal. or equivalent (steel drums) for personnel | 5 | each |
| Water for injection, 50 cc ampule, 12's USP | 1 | pkg. |
| Water for injection, 10 cc ampule, 12's USP | 1 | pkg. |

*Items should not be stored with the First Aid Station supplies; these should be acquired, stored and used in conformity with Federal Regulations for Narcotics and Other Drugs.

**Items are not offered in the Federal Contributions Program, however, they should be included in First Aid Station supplies.

*Note:* The above list is current as of the date of publication of this manual. Industrial medical planners should keep in touch with their local Civil Defense medical officials for changes which may develop.

**APPENDIX "Q"**

**(From Page 27)**

# OPERATIONS PERSONNEL EXPERIENCE REPORT

## CATALYTIC AND LIGHT ENDS AREA

| PROCESS OPERATION | Job Title: Stillman | Ass't. Stillman | Helper | — |
|---|---|---|---|---|
| | Number of Positions: 37 | 52 | 60 | — |
| | % of Personnel Qualified | | | |
| Catalytic Cracking Unit | 32 | 32 | 50 | — |
| Alkylation Units | 35 | 56 | 77 | — |
| Isomerization Unit | 30 | 46 | 46 | — |
| Light Ends Recovery Units | 89 | 82 | 87 | — |

## CRACKING PLANT AREA

| PROCESS OPERATION | Job Title: Stillman | Ass't. Stillman | Helper | — |
|---|---|---|---|---|
| | Number of Positions: 26 | 67 | 49 | — |
| | % of Personnel Qualified | | | |
| Combination Units | 100 | 100 | 100 | — |
| Visbreakers | 100 | 100 | 100 | — |
| Gas Oil Cracker | 100 | 100 | 100 | — |
| Central Pumphouse | 69 | 48 | — | — |

Date: _____

Signature: _____

Title: _____

APPENDIX "R"

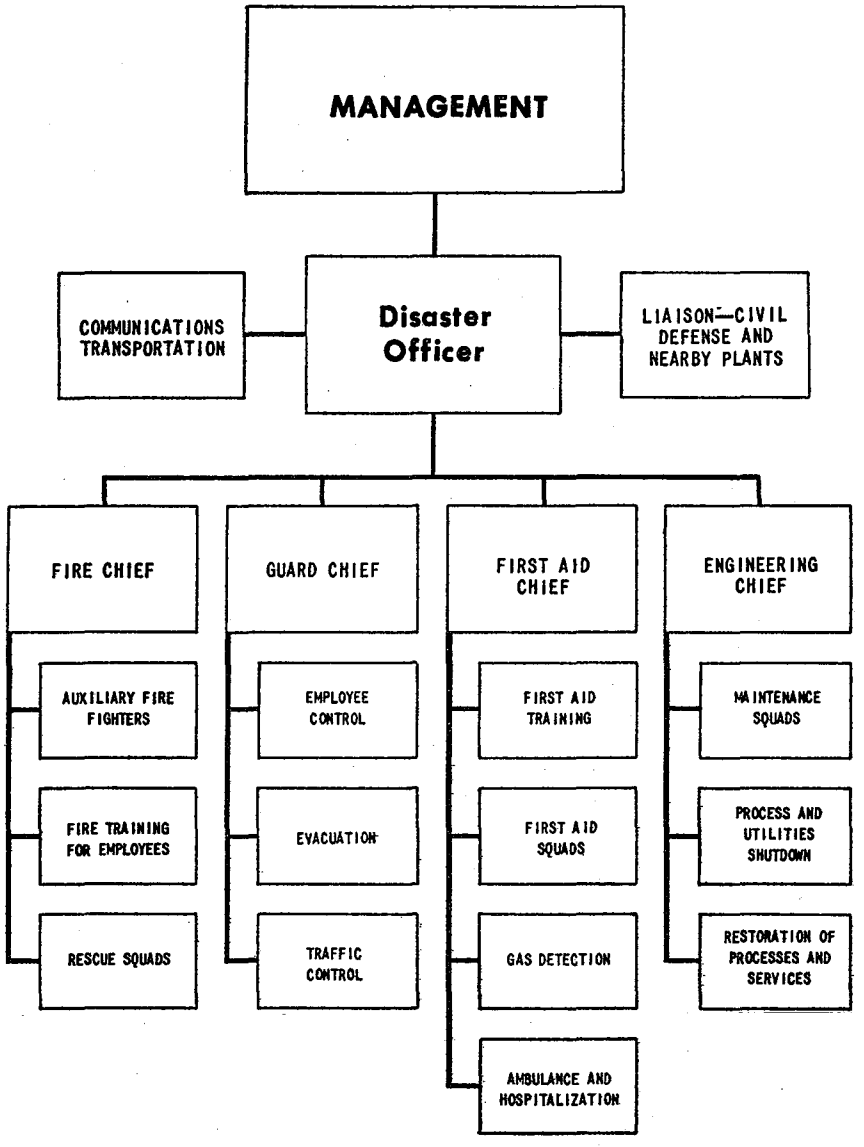
(From Page ii & 28)

# THE DISASTER CONTROL ORGANIZATION AT PLANT LEVEL

In the manual "Emergency and Disaster Planning for Chemical and Allied Industries,"[1] much emphasis is placed on the structure and functions of the plant Disaster Control Organization. Check lists of duties are set forth for (1) Pre-disaster Planning, (2) Emergency Operations, and (3) Post-disaster.

Concerning the Disaster Control Coordinator, they state that he " . . . is the man who keeps the plan going. HE IS THE OFFICIAL WHO APPRAISES ANY EMERGENCY SITUATION AND WHO DETERMINES THAT THOSE CONDITIONS WARRANT THE IMPLEMENTATION OF THE EMERGENCY AND DISASTER PLAN." Concerning the organizational set-up, they state: "The detailed form of that organization will vary, depending upon the size and type of the plant." Their suggested organization shown below would probably apply in a medium size or large refinery. Other organizational measures would probably have to be devised for marine terminals, gasoline extraction plants, pumping stations, etc.

(1) *Emergency and Disaster Planning for Chemical and Allied Industries,* November 1953, U. S. Department of Commerce, Washington, D. C.



**APPENDIX "S"**

**(From Page 30)**

# CHECK LIST—RADIOLOGICAL PROTECTION

***Radiological Survey Plan***

In writing? Authority and responsibility spelled out for management? for survey director? for medical department? for nuclear specialist? Operating headquarters and alternate provided? Procedure for initiating survey? Integrated with over-all disaster plan? Provide for alternate survey director? Procedures when radioactivity found? When not found?

***Survey Monitor Teams***

Organized? Routes determined? Monitoring procedure spelled out? provide for 100% coverage of plant? seven-day 24-hour staffing? Testing instruments? personnel monitors at hospital? Technical monitors:—for decontamination? for testing food—air—water? for discriminating between alpha, beta, and gamma radiation? For measuring rate of decay? for measuring and recording shrinkage of contaminated area? for collecting samples? for assessing hazards during shutdown? Work in pairs? Rescue and repair procedures—monitors keep record of exposures? act as guides? Standards set for allowable exposures?

***Monitoring Instruments***

Number on hand? Both high-range and low-range types? Periodically tested? Aural as well as visual reading? Safe storage? Spares? Continuous air monitoring instrument? Indicators for position of burst?

***Dose Meters***

Number on hand? Spares? Range? Safe storage? Periodic testing? Reading devices?

***Decontamination Monitors***

Accompany decontamination crews? Keep log of exposure? Test air? Locate safe paths? Locate hot points or areas? Test effectiveness of decontamination?

***Decontaminating Crews***

Protective clothing available? Gloves? Overalls? Shoes? Respirators? Protective spectacles? Arrangements for decontaminating personnel and clothing? Personnel exposures recorded and evaluated by Medical Department?

***Decontamination Procedures***

Provide for classifying plant units as to degree of radioactivity? for disposal of highly radioactive piece of debris? for disposal of general waste? for isolating hot areas? for wetting them down? for monitoring incoming and outgoing streams?

***Training***

Who gets training? How many people? Length of instruction? Cover self-protection? methods of detecting? kinds of instruments? doses and tolerances? Monitoring organization and plan? use of instruments? protective clothing? routes of survey? marking devices? normal and emergency communication? field practice? rescue operations? decontamination and reactivation—time of decay? Permissible dose standards? area for management decisions?

Reference materials available on monitoring? On decontamination?

(From Page 33)

## EMERGENCY REPLACEMENT TABLE (1)
### OF BASIC REFINERY EQUIPMENT COMPONENTS (2)

| KEY FUNCTIONAL AREAS (3) | | EQUIPMENT | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | | | | | ELECTRICAL | | | | | | | | | | | | | | | | | | | | | | | |
| | | PUMPS | EXCHANGERS | COMPRESSORS | FURNACES | TOWERS | DRUMS | BLOWERS | MOTORS | TRANSFORMERS | SWITCH GEAR | GENERATORS | CABLE | INSTRUMENTS | PIPING | TURBINES | TANKAGE | BOILERS | STRUCTURAL MEMBERS | COOLING TOWERS | CENTRIFUGES | FILTERS | DRYERS | AGITATORS | COMBUSTION MOTORS | | | | | | | |
| DIST-ILLATION | ATMOS. PIPE STILL | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | VACUUM PIPE STILL | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | LIGHT ENDS FRACTIONATION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | GAS COLLECTION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CATALYTIC CRACKING | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| THERMAL CRACKING | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| CATALYTIC REFORMING | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| POLYMERIZATION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ALKYLATION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| HYDROGENATION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| FUEL PRODUCTS TREATING | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ISOMERIZATION | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| UTILITIES | STEAM | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | ELECTRICITY | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | COOLING WATER | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PRODUCT BLENDING | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| ASPHALT | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| LUBE | DISTILLATION & TREATING | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | BLENDING | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| STEAM CRACKING | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| COKING | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| PACKAGING | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |
| | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | | |

**LEGEND**

*INDICATE TIME IN WEEKS (4)*

← DELIVERY TIME (5)

← INSTALLATION TIME (6)

**NOTES**

(1) TABLE ASSUMES IDENTICAL REPLACEMENT TO PROVIDE FORMER CAPACITY.

(2) PROCESS EQUIPMENT IS EITHER MENTIONED SPECIFICALLY OR CAN BE MADE UP OF SEVERAL OF THESE COMPONENTS, e.g., REFRIGERATION EQUIPMENT FROM COMPRESSORS, EXCHANGERS, AND PIPING.

(3) PETRO CHEMICAL PROCESSES HAVE BEEN CONFINED TO THOSE BASIC TO THE PRODUCTION OF SOURCE MATERIALS.

(4) REPLACEMENT PERIOD ESTIMATE IS BASED ON ITEM WHICH IS CONSIDERED MOST CRITICAL. ONE PARTICULAR PUMP, e.g., MAY HAVE A LONGER LEAD TIME THAN ANY OTHER PUMP IN A PROCESS.

(5) ASSUME SUPPLIER STILL EXISTS AND CAN FULLFILL ORDER ON PEACE TIME BASIS.

(6) ALSO HELPS REFLECT APPROXIMATE TIME FOR OFF SPEC. REPLACEMENTS CANNIBALIZED FROM OTHER UNITS, PROVIDING LESS THAN DESIGN CAPACITY.

# EMERGENCY REPLACEMENT TABLE OF EQUIPMENT

## INSTRUCTIONS

1. In the use of this form, it must first be assumed that utilities and offsite feed and product facilities are normally operable.

2. Then process personnel are to consider the categories of equipment which apply to their operations.

3. In each category, process personnel should identify the specific items which would result in complete shutdown of the functional area considered. For example: critical pumps in the atmospheric pipe still area would include cold feed pumps, tower bottoms pumps and overhead reflux pumps. This information may be listed on the sample work sheet shown on this side of the form.

4. Equipment procurement personnel should determine, from the lists compiled (3) above, which single item in each category is the most critcal from a replacement standpoint (i.e., long lead time). This information will be used to fill in the appropriate block of the table on the other side of this sheet. The completed table will thus represent the most critical item in each category for a key functional area.

## INFORMATION

Numerous steps may be taken by management to reduce delay in reconstruction of damaged units. Some are mentioned below:

1. In multi-plant companies, determine whether identical or similar process facilities exist in two or more plants. Cannibalizing of duplicate parts from damaged equipment would be speeded by advance knowledge of such information.

2. Identical or similar process installations in other companies should be determined and recorded for possible emergency transfer of vital parts.

3. Spares needed for critical equipment can be determined by use of this form. Management should then decide which should be procured and stored.

4. Storage of spare parts for critical equipment should be at a distance, to avoid damage in the same disaster which damages the original.

5. Identical or similar process installations in multi-plant companies may justify creation of a company central-storage pool for critical materials common to two or more plants.



**SAMPLE WORK SHEET**

**FUNCTIONAL AREA NAME**

THE SPACE BELOW AFFORDS A MEANS FOR LISTING THE TYPES OR ITEMS OF EQUIPMENT IDENTIFIED AS CRITICAL IN THE ABOVE FUNCTIONAL AREA.

| PUMPS | TRANSFORMERS |
|---|---|
| 1. | 1. |
| 2. | 2. |
| 3. | 3. |
| 4. | 4. |
| **EXCHANGERS** | **TURBINES** |
| 1. | 1. |
| 2. | 2. |
| 3. | 3. |
| 4. | 4. |
| **COMPRESSORS** | **BOILERS** |
| 1. | 1. |
| 2. | 2. |
| 3. | 3. |
| 4. | 4. |
| **BLOWERS** | **GENERATORS** |
| 1. | 1. |
| 2. | 2. |
| 3. | 3. |
| 4. | 4. |
| **ELECTRIC MOTORS** | |
| 1. | 1. |
| 2. | 2. |
| 3. | 3. |
| 4. | 4. |
| **INSTRUMENTS** | |
| 1. | 1. |
| 2. | 2. |
| 3. | 3. |
| 4. | 4. |
| **PIPING** | |
| 1. | 1. |
| 2. | 2. |
| 3. | 3. |
| 4. | 4. |

APPENDIX "U"

(From Page 35)

# CHECK LIST—REHABILITATION

### *Engineering Planning*

Blueprints, specifications safeguarded? New facilities dispersed? Have built-in protective features? Protective construction available or planned for personnel? For critical equipment? Critical equipment identified? Spares provided? Designs simplified? Plans to substitute standard equipment for long-lead time items?

### *Procurement for Reconstruction*

"Ghost" orders? Alternate sources of supply explored? Replacements available on other unit? From other plant? From competitor? Replacements stored at remote location? Inventory records protected from blast or fire? Duplicate records complete on critical spares?

### *Utilities Preparation*

Protective shields planned? Provided? Alternate sources of light and power: tie-in with neighboring plants or communities? more than one generating station? stand-by units? portable generators? lanterns? Alternate source of water:—river? lake? wells? reservoirs? tanks? tie-in with neighboring plants or communities? Canned drinking water? How long reserve expected to last? Separate systems for fire, process, drinking water?

### *Cleaning and Repair*

Possible salvage areas designated? Sub-contracting arrangements made?

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