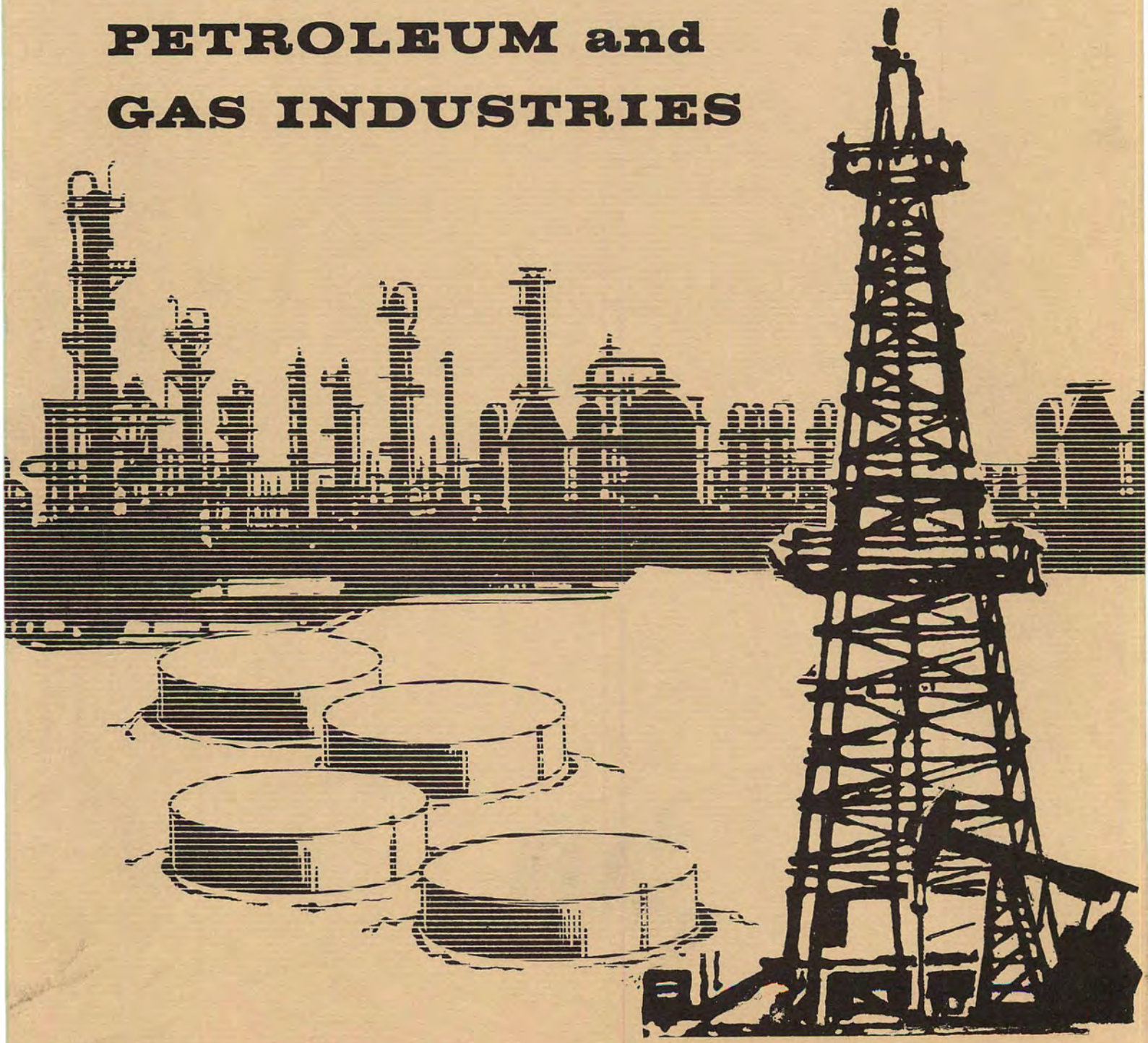
Volume I - Principles and Procedures

CIVIL DEFENSE and EMERGENCY PLANNING for the PETROLEUM and GAS INDUSTRIES



PREPARED BY THE NATIONAL PETROLEUM COUNCIL 1964

NATIONAL PETROLEUM COUNCIL

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and to the

OFFICE OF OIL AND GAS

Prepared by the

National Petroleum Council

in response to a request of the

Department of the Interior

and as a

Service to the Petroleum and Gas Industries and

All Others Who May Find

This Manual Helpful in Their

Emergency Planning Programs

Civil Defense and Emergency Planning

FOR THE

PETROLEUM AND GAS INDUSTRIES

Volume I—Principles and Procedures

March 19, 1964

Prepared by the
National Petroleum Council's
Committee on Emergency Preparedness
for the Petroleum Industry

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Preface

The purpose of the National Petroleum Council is solely to advise, inform, and make recommendations to the Secretary of the Interior with respect to any matter relating to petroleum or the petroleum industry submitted to it by, or approved by, the Secretary.

The Secretary of the Interior, by Executive Order 10997, is charged with the preparation and development of plans and programs designed to provide a state of readiness in petroleum and gas with respect to all conditions of national emergency, including attack upon the United States.

In March, 1963, the Hon. John M. Kelly, Assistant Secretary of the Interior for Mineral Resources, advised the National Petroleum Council that it would be of assistance to the Department of the Interior if the Council would undertake to (1) produce a prototype company survival plan which would serve as an example of what preparations a petroleum or gas company should undertake to achieve mobilization readiness in event of a national emergency, and (2) review and revise, as necessary, both the Disaster Planning and Security Principles manuals for the petroleum and gas industries, originally published by the National Petroleum Council in May, 1955.

Pursuant to this request, the Council's Committee on Emergency Preparedness for the Petroleum Industry, with the assistance of its Subcommittee for Company Survival Plans, has prepared two manuals. The revision of the Council's previous Disaster Planning and Security Principles manuals appears separately in the one manual, herein, Volume I, entitled "Civil Defense and Emergency Planning for the Petroleum and Gas Industries—Principles and Procedures." Volume II encompasses an emergency planning guide and three sample survival plans for a petroleum or gas company.

The Committee gratefully acknowledges the interest, cooperation and assistance of the petroleum and gas industries; the Office of Oil and Gas, U.S. Department of the Interior; the Office of Civil Defense, Department of the Army, and other Government agencies in the development of these manuals.

Introduction

This manual, one of two volumes, is intended to review in detail the many problems to be considered in planning for emergencies—either natural or man-made—and to suggest solutions. Sabotage and espionage, as well as civil unrest, may occur at any time and especially during a national emergency. Hence, security measures to control access to plants and otherwise to safeguard against these threats are included. Civil Defense and Emergency Planning for the Petroleum and Gas Industries, Volume II, contains a guide and sample company plans based on the principles and procedures contained in this manual.

Every executive in the petroleum, gas, and petrochemical industries realizes that his company is subject to peacetime disasters—fires, floods, earthquakes, hurricanes, and explosions; each must also recognize the existence of a new and greater threat: enemy attack. Great loss of life among employees and widespread destruction of industrial facilities are highly possible.

In World Wars I and II, continental United States escaped 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.

If a war should occur in the future, the enemy may put forth tremendous efforts to destroy our vital installations. The most devastating weapons known would presumably be used to accomplish this purpose. Therefore, we must anticipate that attack, should it come, might involve not only nuclear warfare with its blast, heat, and radiological effects, but also biological or chemical warfare. The best answer to these problems lies in thorough peacetime planning by the petroleum and gas industries themselves in cooperation with Federal, State, and local government emergency planning. Under our private enterprise system, each company has the privilege and responsibility to discharge its obligations to its stockholders, its employees, and the general public as a privately owned and privately operated facility by engaging in such emergency planning and execution as it deems necessary to fulfill these obligations.

Each company, therefore, should act promptly to insure the continuity of its management, protect employees, safeguard property, and provide such plans for post-attack rehabilitation as are reasonable under the prevailing circumstances.

These problems are considered in this manual. Individual companies may either apply the solutions suggested or develop solutions most appropriate to their particular situation. This manual is intended as a guide, subject, of course, to the judgment of the management of each company as to the amount of money and effort it wishes to spend to achieve the purposes of its particular program.

Management's most important step is to accept responsibility for emergency planning and to assign men who have the necessary imagination, ability, and authority to initiate and carry out such a program for the company.

The National Plan for Emergency Preparedness provides that control of the petroleum and gas industries would be exercised by the government during periods of national emergency. When situations of that nature are over, such controls should terminate.

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Planning assumptions

The purpose of these assumptions is to provide a framework within which emergency plans can be developed for use in the event of national emergency. National emergencies may range from international tension to nuclear war. While the latter is not the most probable contingency, it is treated at greater length because its potential destructiveness presents enormously difficult and unprecedented planning problems. Although other contingencies may also be unprecedented, they would usually allow more time for making decisions and would be less disruptive of national systems.

These assumptions are abridged from the National Plan for Emergency Preparedness, as revised August, 1963. Assumptions not related to petroleum, gas, or petrochemical emergency planning have been omitted. Continuing developments in technology of weapons systems and other factors may affect the validity of these assumptions in future years.

Cold war

Tension and indirect conflict have generally prevailed over the past decade of the cold war. Potential enemies have attempted to gain their objectives by means that, in their judgment, will not precipitate general nuclear war or create grave danger of leading to such a war. Techniques for accomplishing their objectives emphasize espionage, subversion, economic penetration, propaganda, "wars of national liberation," guerrilla activities, sabotage, and other political, military, and economic actions in which risk can be localized and controlled.

While this condition poses a serious and continuing threat to United States interests and security, the requirements of national defense can probably be met and progress made toward the objective of a peaceful international community without creating pressures that call for extraordinary security measures or emergency actions.

Limited emergency

A limited national emergency might be created by developments such as the involvement of United States forces in limited war. It might also result from other international developments short of actual hostilities.

For limited as well as unlimited national emergencies, the mobilization and effective application of the Nation's resources to meet the demands of balanced national security require careful planning and extensive advance preparation.* There are many common elements. Plans for increasing strength for the continuing cold war will help to cope with limited and unlimited emergency situations. Similarly, satisfying the requirements for meeting an unlimited national emergency will often meet the requirements for limited emergencies.

General nuclear war

The calculated initiation of general nuclear war by any present nuclear power is considered unlikely. Nevertheless, as long as the world's nuclear war-making capability exists and spreads, nuclear war could possibly occur through accident, miscalculation, irrational act, or the unplanned escalation of limited war, as well as by a deliberate attack.

The actual occurrence or imminence of nuclear attack would require the immediate implementation of comprehensive emergency measures to mobilize the Nation's resources for the defense, survival, and eventual recovery of the United States. Action would be necessary to conduct military operations, perform the wartime functions of the Government, protect and care for the population, stabilize and manage the economy, maintain law and order, protect essential facilities, control and allocate all essential resources, and implement other programs necessary to national survival and recovery.

Weapons capabilities

An attack on the United States could involve many hundreds of nuclear weapons, with yields varying from a few kilotons to 100 megatons (although probably only a very few weapons of this latter size could be delivered). The weight of attack might total several thousand megatons. Chemical and biological warfare agents, conventional weapons, and sabotage could be selectively employed. Psychological warfare by propaganda and other

* The national emergency proclaimed by the President on December 16, 1950, (Proc. No. 2914) remains in effect.

means would be likely before, during, and after attack in an attempt to confuse the national effort and undermine the public will to resist.

Means of delivery

A variety of delivery systems could be used in an attack. Intercontinental and sea-launched missiles will be increasingly relied upon for delivery of nuclear weapons. Manned bombers, however, will continue to be useful. Risks of detection make unlikely a large-scale attempt to introduce nuclear weapons by clandestine means.

Targets

While any target can be destroyed if an enemy expends sufficient weapons on it, no nation has the capability of destroying all rewarding targets in the United States. In choosing targets, an enemy would probably give initial priority to destroying retaliatory facilities and command centers. Additional targets might well include other military, governmental, supply, transportation, industrial, power, and population centers.

Warning

Nuclear attack could come at any time of the day or night in any season of the year. Warning of a nuclear attack on the United States might range from several days to a few minutes. The possibility of an attack occurring without warning cannot be completely discounted. However, the first strike would serve to warn other areas.

Strategic warning is the indication of a possible attack before it is launched. It might range from verified information of an enemy's intention to attack at a given time to an accumulation of many interconnected actions and reactions indicative of an enemy's probable intention to attack in the near future. It is unlikely that strategic warning would ever be so definite as to warrant the institution of all protective measures. Yet there might well be evidence of such a high degree of probability of attack that it would be prudent to take certain steps to implement emergency plans in military, civil defense, economic, and political fields, including obtaining additional emergency authority and funds as necessary and appropriate. In such circumstances, the Federal Government would then indicate the proper actions. The value of strategic warning is so great that preparations at all levels should be flexible enough to take advantage of it.

In an ICBM attack, any tactical warning (that is, warning of an attack already launched) would not likely exceed 15 minutes for initial targets. Other parts of the country would have a further but indeterminate period in which to take protective action. Tactical warning of a manned bomber attack could be as much as 3 hours for initial targets.

Duration of emergency

If a nuclear war should come, hostilities might be prolonged, with possibly repeated attacks on this country. To continue to exist as a sovereign power, the Nation must be able not only to withstand an initial nuclear assault and any continuing hostilities, but to restore its social, political, and economic systems. This entire survival and recovery period would probably last for several years.

Post-attack conditions

A nuclear attack, even one limited to military and command targets, would cause widespread death and destruction from blast and heat effects with heavy fallout probable over much of the country. In a large-scale attack, any point in the United States could be damaged or contaminated. Nevertheless, the amount and degree of devastation would vary greatly, and many areas would be completely free from these effects.* Loss of life and property would be great, especially in an attack on population centers, although shelter and other protective measures would save many lives. Whatever the kind and degree of attack, casualties, hardships, and suffering would constitute the most serious immediate problem.

Effects on resources

In addition to population losses and displacement and property destruction, the most immediate economic results of a general nuclear attack would be a substantial loss of the Nation's capital assets and wealth, disruption of the financial and credit structure, and shortages and maldistribution of manpower and materials. These conditions would require effective economic controls at all levels.

There would be severe shortages of health resources—manpower, materials, and facilities; and needed health and sanitation services would be disrupted or nonexistent for extended periods in some areas, requiring individual, family, and group self-sufficiency in maintaining health and in caring for the sick and injured.

In some cases, the number of casualties would tend to balance losses of resources and productive capacity. Thus, under some attack conditions, the national supply of certain resources might be ade-

* See Bibliography for "The Effects of Nuclear Weapons."

quate to meet the over-all demand. But the surviving resources might not be in the right place at the right time. The loss and denial of agricultural and industrial productive capability and the impairment of transportation and communications, particularly by fires and the fallout hazard in the early post-attack period, would require rigid conservation measures and control over distribution.

Because of the geographical interdependence of the economy, losses in damaged areas would be felt in undamaged areas. The supply-requirements situation in regard to any one resource can be realistically assessed only by keeping in mind the inter-relationship with all other resources.

Effects on systems

Normal systems of distribution, communication, transportation, production, power supply, finance, welfare and other services, law enforcement, and government aid could be disrupted in many areas for periods ranging from days to months. Hence, survival and subsistence in such affected areas would depend for varying periods on local self-sufficiency.

Radiation hazard would probably make some areas unusable and uninhabitable for a long period. This and other damage would restrict mobility between and within some localities and even regions. Most areas affected by fallout would, however, be accessible after roughly 2 weeks.

Disruption of communications might delay for several days even a gross assessment of the post-attack situation for the entire country. Regional and national detailed surveys and assessments of population and resource status might not be feasible for some time. This would not, of course, prevent local damage assessment by direct observation and on-the-spot analysis.

In some areas the damage might be so severe and the radioactivity so persistent and intense as to require decisions whether to rebuild damaged cities or relocate them.

Ecological effects

All living things are related to each other and to their environment. The introduction of high radiation levels would change these relationships. Adequate shelters can greatly reduce human casualties from fallout; however, little of the total environment in which humans live can be sheltered.

The most immediate requirements for human survival in the post-attack period would be food and water. Studies indicate that usable supplies of these would be adequate post-attack for supporting life.

Other considerations

It is impossible to assess statistically such intangible human factors as the psychological and sociological impact of attack and post-attack conditions on the efficiency and enterprise of the survivors. The speed of the Nation's recovery and of the restoration of the economy to the level then needed would depend on these intangibles at least as much as on the over-all physical effects on people and resources.

In spite of the uncertainties inherent in any planning for nuclear attack, this much can reasonably be counted on: There will be surviving resources —human and material—to apply constructively to the pursuit of fundamental goals and values. Yet the constructive application of these resources is dependent upon prudent emergency plans and preparations now.

Natural and man-made hazards

Natural hazards

A thorough knowledge of the natural hazards which may be confronted in any locality must be attained by the responsible management. Such natural hazards might include earthquakes, hurricanes, tornadoes, floods, snow and ice storms, lightning, fires, explosions, or other physical phenomena. Emergency plans to deal with such hazards are usually part and parcel of modern, everyday management. These plans have been created because of the continued recurrence of these hazards. Management has learned that preparedness does minimize damage. An expansion of these plans in breadth and depth can cover all other emergency situations.

Operating hazards

Management must recognize that a protective program is not confined to meeting the most hazardous situations; it is a continuing activity beginning in peacetime and expanding to meet the particular hazards of formal hostilities. Increased production for national defense emergency naturally intensifies routine hazards. Specific hazards to the petroleum and gas industries depend on such variables as industrial process, the type of facility, facility layout and construction, the level of the organized protection and prevention program enforced by management, location, topography, climate, etc.

Private organizations such as the American Petroleum Institute, American Gas Association, the Na-

tional Fire Protection Association, and others have issued information pertaining to these hazards.

It should be recognized, moreover, that the evaluation of risks should not be limited to physical plant equipment but should include the risks and hazards to personnel. A continuing and vigorous safety program for all employees involved in production, manufacturing and service operations will do much to minimize the losses in these areas and oft times will give an extra bonus in pointing out potential risks to physical equipment which might otherwise have been overlooked.

Espionage

Espionage includes the collection of information which contributes to an evaluation of the Nation's war potential and which may be used to advantage by an enemy in subversive activities and armed force attack. The very nature of the petroleum and gas industries makes it difficult to conceal many phases of their operations. In spite of this, it is desirable that these industries use discretion during a period of national emergency in the release of information that might be useful to the enemy, even though such information may already be considered common knowledge. The enemy will not risk trained men, expensive equipment, and costly munitions unless the destruction of the targets selected will appreciably decrease our ability to wage war. The enemy will be continuously endeavoring, long prior to an actual armed attack, to ascertain where and what these targets are. Even after the initial attack, he will further endeavor continuously to obtain such information in order to mount additional attacks to destroy the most rewarding targets.

Most system and facility personnel are generally acquainted with the type of espionage carried on by professional spy rings. Such espionage, while glamorous and effective for limited purposes, does not produce for a potential enemy the vast mass of detailed, accurate information concerning the vital petroleum and gas facilities of this country which is necessary if the enemy is to destroy systematically our means of production. These data may already be developed piecemeal through contributions of many agents whose fragmentary reports fit together like pieces of a jigsaw puzzle to complete a precise picture of the petroleum and gas industries and civilian war structure.

Espionage agents specifically seek information such as the following: (1) Capacity, rate of production, industrial mobilization schedules, and details of orders on hand. (2) Specifications of products. (3) Test records of newly developed items or equipment. (4) Sources of raw materials and components. (5) Destination of completed products and transportation routes. (6) Data on production methods. (7) Critical points and possible methods of effective sabotage. (8) Measures in force for security to prevent sabotage, such as, frequency of inspection by guards and their dependability. (9) Names of dissatisfied employees and non-employees who might be susceptible to and utilized for subversive plans.

Espionage agents may be expected to use great ingenuity in obtaining information by: (1) Infiltrating into plants as employees, visitors, inspectors, or by other means. (2) Obtaining information from employees by stealing, purchasing, or encouraging them to "talk shop." (3) Stealing information from records or other sources, and reporting personal observations and studies of production operations, test runs, or classified materials. (4) Using various means of reproducing documents, products, processes, equipment, or working models. (5) Using "fronts," such as commercial concerns, travel agencies, import-export associations, scientific organizations, insurance agencies, businessmen's groups, and other organizations to obtain confidential information or pertinent statistical information which can be translated into strategic information. (6) Using threats of danger to friends or relatives of an employee to obtain information. (7) Using blackmail techniques by threatening to expose intimate and personal details concerning an individual. (8) Skillful extraction of information from members of the family or close friends of an employee. (9) Picking up information at social gatherings. (10) Personal observation of production operations, test runs, shipment of finished product, or confidential papers. (11) Securing information from waste and carbon paper and other discarded records. (12) Increasing the susceptibility to recruitment for the cause by playing on the emotions such as love, hatred, desire for power, etc.

In general, espionage may be rendered ineffective or made more difficult by the application of protective measures such as: a careful loyalty check of personnel, particularly before employment; prevention of unauthorized entry to the premises; special guarding and handling of classified material; restriction of movement within the system or facility; and security education and training of employees and others who have information on the system or facility's activities.

Sabotage

Industrial sabotage is a very effective method to apply against a national defense emergency effort.

The fact that very little damage in the last war was directly traceable to enemy sabotage might well be attributed to the lack of ingenuity exercised by the enemy in the direction of sabotage and the selection of sabotage methods rather than to his failure to appreciate the necessity of this form of warfare. The highly effective results which may be accomplished by the skillfull employment of sabotage, and the known existence of substantial groups within this country available and willing to undertake such work places this hazard higher upon the list of risks confronted by our industry than at any time in the history of this country.

In terms of trained manpower, equipment, and munitions risked, a sabotage operation involves only negligible expenditure by the enemy, but the profit may be enormous if the target has been strategically selected. The disastrous consequences of an act of sabotage, such as the destruction of a critical refinery, may be grossly disproportionate to the manpower, time, or material devoted to the act. It is only realistic, therefore, to assume that the outbreak of a formal attack on this country may be accompanied by one or a series of well-planned major sabotage efforts. In addition, however, throughout the period prior to the initial formal attack and thereafter, tremendous loss may be occasioned by a multitude of small acts whose cumulative effect may have greater significance than an initial or subsequent major sabotage plan.

Methods

The tools and methods of sabotage are limited only by the skill and ingenuity of the saboteur. A major sabotage effort may be undertaken after thorough study of the physical layout of the petroleum and gas system or facility and its production processes by technical personnel fully qualified to select the most effective vehicle to strike one or more of the most vulnerable parts of the system or facility. Sabotage may, on the other hand, be improvised by the saboteur relying solely upon his own knowledge of the system or facility and the materials available to him.

The petroleum and gas industries are well aware of the sabotage possibilities inherent through the use of products available in the normal facility operation of the industries themselves. Examples of this are the sometime-availability on the site of explosives intended for industrial purposes, product and process contamination by the use of additives and spoilers, incorrect cycle time phasing, tampering with control devices, operating equipment, etc. The saboteur, in such a case, may or may not possess or need a high degree of technical knowledge. Hence, the device or agent selected for sabotage may range from the crude or elementary to the ingenious or scientific.

The methods of sabotage may be generally classified as follows: (1) Mechanical—breakage, insertion of abrasives and other foreign bodies, failure to lubricate, maintain and repair, omission of parts. (2) Chemical—the insertion or addition of destructive, damaging, or polluting chemicals in supplies, raw materials, equipment, product, or utility systems. (3) Explosive—damage or destruction by explosive devices or the detonation of explosive raw materials or supplies. (4) Fire—ordinary means of arson, including the use of incendiary devices ignited by mechanical, chemical, electric, or electronic means. (5) Electric and electronic—interfering with or interrupting power, jamming communications, interfering with electric and electronic processes. (6) Psychological—the fomentation of strikes, jurisdictional disputes, boycotts, unrest, personal animosities, inducing excessive spoilage and inferior work, causing "slow-down" of operations, provocation of fear or work-stoppage by false alarms, character assassination; on a larger scale, the instigation of false political and economic public issues and the dissemination of inflammatory propaganda so as to break morale.

Objectives

The objectives of the saboteur in a particular system or facility may include one or more of the following: (1) Damaging buildings and equipment. (2) Damaging power, communications, water, and sanitation systems. (3) Tampering with testing devices. (4) Tampering with drawings and formulae. (5) Infecting or polluting water and foodstuffs. (6) Tampering with ventilating systems or polluting the air supply. (7) Tampering with personnel safety devices and equipment and otherwise creating conditions which would injure personnel. (8) Damaging, spoiling, or destroying the product of the plant. (9) Sabotaging manpower by use of psychological methods discussed above.

A definite distinction must be made, however, between manpower sabotage by psychological means, such as the fomentation of strikes, "slow-downs," and the like, and legitimate labor activities. Manpower sabotage of this nature is extremely difficult to detect. One disloyal employee engaged in psychological sabotage may influence others who will thereupon, believing in good faith that a labor grievance

exists, engage in strikes and other activities resulting in loss of production.

Panic may be a threat to the national emergency defense effort. As a weapon, it may be used to our detriment. Panic is the result of fear, and unreasoning fear is usually the result of insufficient knowledge or lack of confidence in leadership. Psychological defense may be achieved in three major steps: (1) preparation, (2) collection and dissemination of information, and (3) action. It is the building and maintaining of morale that counts: informing employees of threatened dangers, how they may be recognized, what protective measures are available, and what defense should be utilized. Employees must have faith in these measures themselves, and in the company leadership.

Physical sabotage is generally an inside job, or requires the assistance, knowingly or unknowingly, of someone inside. Under some situations, however, sabotage may be committed by parties working entirely outside the organization.

The saboteur is not necessarily a foreign national or of foreign parentage. He may be a highly trained professional or rank amateur. He may be a laborer, a machinist, a foreman, a top-flight engineer, or even a member of management. He may be anyone. But one thing is certain—he may be one of the least-suspected members of the organization.

His motives may be as varied as his personality. He may work for love of his foreign native land; for pay; for hatred; for sincere, if misguided, devotion to a cause; for revenge; to settle a real or imaginary grievance; or under threat of blackmail or fear of reprisal against relatives in the enemy country.

Hence, the principal protective measures must be designed to limit the entry or continued presence of saboteurs or their assistants.

Direct enemy attack

At the outset of any future war and thereafter, it is probable that in addition to sabotage, the enemy will also attack the vital petroleum and gas systems and facilities of this country with the most effective weapons available to him. Obviously, the responsibility for preventing or minimizing such direct attack rests primarily with the Armed Forces.

While the system or facility personnel cannot know in advance the nature or capabilities of the enemy's striking force for this type of attack, it is reasonable to anticipate that such attack may proceed initially or from time to time after the outbreak of the war along any of the following possible lines: nuclear attack, chemical attack, biological warfare, radiological warfare, high explosive bombs, and incendiary bombs.

Nuclear attack

A nuclear detonation produces three basic effects: blast, heat, and nuclear radiation (initial nuclear radiation and residual radiation—fallout). Blast, heat, and initial nuclear radiation are essentially instantaneous and vary little whether the bomb is a kiloton weapon or a thermonuclear one of many times that power; the intensity and area increase in proportion to the increase in energy yield of the explosion. Residual radiation, although in no sense exclusive to high yield thermonuclear detonations, becomes a matter of major concern when the weapon is exploded at or near the surface because it produces a longer-lasting hazard over a wide area.

A nuclear weapon may be detonated as an air burst, in which the fireball does not extend down to the surface; or a surface burst, in which the fireball does extend down to the surface; or a subsurface burst where the explosion is beneath the surface of the earth or water. In any type of burst, the surface may be either land or water.

In the distribution of energy released by a nuclear explosion, approximately 35 percent is expended in heat, 50 percent in blast, and 15 percent in the two types of nuclear radiation. These percentages may vary with the type of burst—air, surface, or subsurface.

All types of burst produce blast effects which differ according to the type of burst and the medium through which the blast or shock wave is traveling.

Virtually at the moment of the explosion, a characteristic ball of fire begins to take form and emits thermal (heat) radiation at the speed of light. A fraction of a second after the explosion, the blast (direct shock wave) begins to move outward from the ball of fire with a velocity equal to the speed of sound for the atmosphere and temperature conditions existing in the shock front. The shock front creates a tremendous increase over and above the normal ambient atmospheric pressure. Normal atmospheric pressure at sea level is 14.7 pounds per square inch. This increase in pressure is referred to as the positive or pressure phase of the blast and is measured in pounds per square inch (p.s.i.). Winds of hurricane velocity follow in the wake of the shock front. These winds create the phenomenon referred to as dynamic pressures.

After the shock front and dynamic forces have traveled outward for some distance, the pressure

behind them falls to less than normal atmospheric pressure. This creates a partial vacuum into which air tends to rush, producing the phenomenon described as the negative phase of the blast (shock wave).

Ordinarily, it may be expected that the positive or pressure phase of the blast (shock wave), as represented by the shock front and dynamic forces, will do most of the damage; but the effect of the negative phase is considerable and must also be anticipated.

One of the important ways in which a nuclear bomb differs from a non-nuclear (TNT) bomb is in the large proportion of the energy of a nuclear explosion released in the form of thermal radiation. The principal characteristics of thermal radiation are that it travels at the speed of light, travels in a straight line, has very little penetrating power, can be easily absorbed or attenuated, can be scattered, and can be reflected. Because of the enormous amount of energy liberated per unit mass in a nuclear bomb, very high temperatures are attained—as much as several million degrees, compared with a few thousand degrees in the case of a TNT explosion.

From the standpoint of this radiation, the fireball in a nuclear explosion resembles the sun in many respects. The radiation in each case is made up of ultraviolet rays of short wave length, visible light of longer wave length, and infrared radiation of still longer wave length. Thermal radiation travels with the speed of light, i.e., 186,000 miles per second. Although the light and thermal radiation from an explosion arrive simultaneously at a target some miles away, the nature of thermal radiation effects is such that a person in the open, perceiving the light of an explosion, has a few seconds to duck behind protective covering before suffering burns.

The thermal rays from the ball of fire, like the sun's rays, are attenuated as they pass through the air. The amount of thermal radiation from a particular nuclear explosion that will reach a given point depends upon the distance from the burst and upon the condition of the intervening atmosphere. Just as with sunlight, much of the ultraviolet radiation is absorbed in the air, so that the thermal radiation received, at distances of interest from a nuclear explosion, lies mainly in the longer wave length, i.e., visible and infrared regions of the spectrum.

Although blast is responsible for most of the destruction caused by a nuclear air burst, thermal radiation will contribute to the over-all damage by igniting combustible materials, e.g., finely divided or thin fuels such as dried leaves and newspapers, thus starting fires in buildings and forests. These fires may spread rapidly among the debris produced by the blast. In addition, thermal radiation is capable of causing skin burns on exposed individuals at distances from the nuclear explosion where effects of blast and of the initial nuclear radiation are not significant.

It is not within the scope of this review to set out in detail the many facets of damage from a nuclear blast, but in general terms a 20-MT (megaton) weapon, the equivalent of 20,000,000 tons of TNT, would produce complete destruction for a radius of 5 miles from ground zero, severe damage from 5 to 10 miles, moderate to light damage from 10 to 15 miles, and light damage from 15 to 20 miles. Topographical and meteorological conditions and the type of construction exposed will have a great influence on the extent of damage incurred.

Initial nuclear radiation—emitted within the first minute after a nuclear explosion—is produced by all types of burst. It consists of alpha and beta particles, gamma radiation, and neutrons, and is generally confined to the area of blast damage.

Residual radiation is the radiation emitted later than one minute after the burst. The target elements receiving initial nuclear radiation receive the total dose at once. On the other hand, the target elements subjected to residual radiation receive it continuously, accumulating a total dose over a period of time.

Fallout is of two types: local fallout (early) and world-wide (delayed).

Local fallout is that which occurs in the general region of the detonation, that is, within several hundred miles at most and within a few days. This will comprise more than 50 percent of the total fallout.

World-wide fallout is produced by the fine particles which ascend high into the troposphere and stratosphere, are carried by the winds around the earth, and descend over a long period of time. Tropospheric fallout descends within about 1 month in a more or less banded region of the same general latitude as the detonation. Stratospheric fallout is more delayed, occurring over a period of a few months to a few years.

The radioactivity of the fallout particles decreases with time, and this is known as radioactivity decay. The decrease in the gamma radiation, the one of greatest importance in fallout, is very rapid during the first few hours after attack but slows down later. As a rule of thumb, the dose rate will decrease by a factor of ten with an increase in time by a factor of seven. For example, a dose rate of 1000

roentgens per hour at H + 1 (1 hour after a nuclear explosion) would decay to 100 r/hour at H + 7 hours, and 10 r/hour at H + 49 hours.

Chemical attack

Chemical warfare is the intentional employment of toxic gases, liquids, or solids to produce casualties, and the use of screening smoke or incendiaries. Toxic gases are used against personnel to produce effects ranging from temporary psycho-disorientation and discomfort to quick death. Smokes are employed to hide shore facilities, ships, and personnel. Incendiaries are utilized to destroy flammable supplies and structures as well as to kill, disable or demoralize personnel.

Although chemical agents are not extensively utilized to poison food or water, contamination incidental to chemical warfare may be expected. The effects of chemical warfare can be widespread because it can be used to produce casualties, concealment, and destruction by fire anywhere within the range of weapons and aircraft.*

Biological warfare

Biological warfare is the military use of living organisms, such as pathogenic bacteria, viruses, and their toxins, in order to cause disease or death of personnel, animals, or plants. The term biological is preferred to bacteriological because it includes not only the use of germs but also the use of insects and other destructive pests as vectors or carriers.

Primarily, biological warfare is directed against people, but it may be used against animals and plants. It acts on living matter only and does no structural damage to inanimate objects. The objectives of biological warfare are to: infect large numbers of personnel, resulting in either their incapacitation or death; destroy food sources, including livestock and agricultural products; reduce the desire to wage war by lowering national morale.*

*The following is the current official position of the Department of Defense on the subject of Biological Warfare and Chemical Warfare:

"Studies conducted for the Office of Civil Defense indicate that the threat to the United States posed by chemical and biological agents is relatively less significant that that posed by the nuclear one. Chemical agents are not considered a major strategic threat as they are effective mainly if used against tactical targets of limited area. Although the possibility of employment of biological agents against U. S. population centers cannot be ruled out, neither a chemical nor biological threat against the Continental United States warrants, at this time, the attention and priority given to defense against the effects of nuclear weapons. However, research on methods of detecting, identifying, reporting, analyzing, and defending against biological agents will continue while the potential threat is kept under constant review."

Radiological warfare

Radiological warfare is a type of warfare in which radioactive materials are spread, either directly or from high explosive bombs, to deny an area to the enemy or to force evacuation of an enemy-held area. An RW attack is not usually attended by a nuclear explosion, although the large contaminated area resulting from the surface burst of a large-yield nuclear weapon might be considered a form of radiological warfare.

RW agents are usually single radioactive elements rather than a mixture, as in the case of fission products. The decay of a radioactive element is expressed in terms of half-life—the time required for the radiation dose rate to fade to one-half its initial amount. For instance, an RW agent with a half-life of 3 months would, after 3 months, have a dose rate one-half the initial dose rate. Six months after attack, the dose rate would be 25 percent of the initial amount; at 9 months, 12.5 percent, etc.

An enemy could use any of a number of radioactive elements, with half-life from a few days to many months. An RW attack using an element of very short half-life would not result in an operational recovery problem because the dose rate would decay swiftly. However, personnel would need good shelters in the emergency phase when the dose rate was very high. On the other hand, use of an RW agent with a long half-life (e.g., several months) would create a difficult operational recovery task because the RW agent would decay very slowly. After an RW attack, samples of the RW agent would have to be checked by laboratory analysis to determine the half-life.

High explosive bombs

High explosive bombs produce the blast and fire damage involved in an atomic bombing but on a lesser scale. A study of bombing results in Europe indicates that a tremendous weight of bombs was required to destroy completely a factory building. Generally, damage was greater to wall bearing buildings than to buildings of steel or reinforced concrete frame construction. In addition, such bombs were responsible for destructive fires, particularly where the explosion caused leakage of gases, oils, and other flammable material. When used in large number, the over-all effect may be roughly comparable to that of an atomic bomb so far as fire and blast damage are concerned.

Incendiary bombs

Incendiary bombs during the last war caused much greater fire damage than high explosive bombs. In

an incendiary attack, fires start concurrently in buildings over a large area, and in a mass attack may produce "fire-storms" and "conflagrations."

The phenomenon of the "fire-storm," occurring in areas of high building density and in the absence of a strong ground wind, is caused by the self-generated inward draft of air at ground level to feed the fire. This inrush of air from all directions toward the fire center reaches high velocities. In such fire storms, temperatures of all combustible materials in the fire area are raised to the ignition point and a complete burn-out occurs. The fire-wind itself, however, confines the fire and thus limits its spread. Fire-fighting cannot be effective within the storm area but is effective on the perimeter of the storm.

The second type of mass fire is the "conflagration." In the presence of a strong ground wind, a potential fire storm will become a conflagration. The conflagration will wreak even greater havoc than the fire storm for an extended wall of fire will sweep before the wind until it has engulfed all combustible material within reach. Fire-fighting can be effective on the windward and parallel sides of a conflagration.

Government plans

National Plan for Emergency Preparedness

The National Plan for Emergency Preparedness promulgated by the President in 1963 governs the role of industry including that of the petroleum, gas, and petrochemical industries in preparing for a possible emergency. This plan is supported by Presidential Executive Orders and by plans and official orders of the State and local governments throughout the entire United States.

The National Plan states that industry, by virtue of an inherent obligation to support the common defense, is jointly responsible with government at all levels for the emergency preparedness of the Nation. Leaders of industry are enjoined to cooperate with appropriate government agencies for planning and executing measures designed to assure the continued functioning or rapid restoration of the essential elements of the national economy.

The broad and far-reaching powers for actions prescribed in the National Plan are derived from the authority vested in the chief executives of Federal, State, and local governments by their respective constitutions, statutes, local charters, and ordinances and, specifically, by defense emergency legislation at all levels of government. The extent to which these powers are exercised, their effectiveness, and the degree of compliance will depend largely upon circumstances. Nevertheless, in a national emergency our chief government executives have what amounts to complete power to control and direct the total manpower and material resources within their jurisdictions for the defense of the Nation.

The availability of petroleum, gas, and petrochemicals sufficient to meet essential requirements for survival and recovery is a key factor in national, State, and local planning. Under the National Plan, the Federal Government has the primary responsibility to assure such availability. In executing this responsibility, the Department of the Interior (Office of Oil and Gas) prepares plans and programs to achieve petroleum and gas mobilization readiness, and, during a national emergency, the Emergency Petroleum and Gas Administration will direct and control the operations of the petroleum, gas, and petrochemical industries and their facilities.

The responsibilities of industry to support the emergency requirement for petroleum and gas are set forth in Chapter 10 of the National Plan, and in complementary State and local government plans. These responsibilities are, first, protection of personnel and facilities, and, second, preparedness measures for the management of resources in an emergency. Taken together, these Federal, State, and local government plans provide for the operational direction and control of all resources, including petroleum and gas. Allocation of products and materials, production and transportation schedules, priorities in reconstruction, and even the transfer of manpower and assets between companies will be directed by emergency agencies of the government, some of which now exist in standby status.

Federal Government activities

The Office of Emergency Planning (OEP) in the Executive Office of the President and the Office of Civil Defense (OCD) in the Department of the Army are the Federal agencies primarily concerned with over-all nonmilitary preparedness for an emergency. Between 1958 and 1961, the two agencies were combined as the Office of Civil and Defense Mobilization (OCDM).

Office of Emergency Planning

The OEP is responsible for a comprehensive program for continuity of government and management of resources in time of national emergency. It includes such activities as: (1) Coordinating guidance developed by delegate agencies for the Federal

management of primary resources.* (2) Coordinating and in some cases developing plans for stabilization of the economy, including determination of over-all resource requirements to meet essential civilian military and foreign programs. (3) Providing Federal guidance for a program to assure continuity of Federal, State, and local governments. (4) Managing the multi-billion dollar stockpile of strategic and critical materials. (5) Reviewing and evaluating the total nonmilitary defense program. (6) Serving in a broad advisory role to the President in the field of tariffs, import quotas, and other economic areas affecting national security. (7) Administering the program for Federal relief in major disaster areas.

Office of Civil Defense

This office is reponsible for a comprehensive program of major civil defense activities which include: (1) Keeping abreast of the nature of the threat which the Civil Defense program must be designed to cope with and developing information on how to meet it. (2) Coordinating guidance developed by delegate agencies for State and local government control of secondary resources.† (3) Bearing a major part of the cost of certain kinds of Civil Defense activities where such sharing will stimulate State, local, and private activities. (4) Providing technical assistance through State and local channels for Civil Defense planning and activity; coordinating such plans and activities with those of the Federal Government.

The present Civil Defense program includes the following priority elements: (1) A warning system to alert the civilian population of an imminent attack. (2) A system of public and private shelters equipped and provisioned to furnish protection against radioactive fallout. (3) A system for providing information, education, and training in Civil Defense methods and techniques to public officials, Civil Defense offices and auxiliaries, and the general public. (4) A plan for the Federal Government to provide matching funds to State and local governments for certain Civil Defense purposes.

Other Federal departments and agencies

The Office of Emergency Planning and the Office of Civil Defense exercise coordinating authority affecting virtually every Federal agency. This permits them to discharge their responsibilities effectively and to enable maximum use of the regular departments and agencies of the Federal Government in achieving mobilization readiness for a possible national emergency. Among the Federal departments and agencies to receive Presidential assignments of specific responsibilities for emergency preparedness are:

AGRICULTURE DEPARTMENT. Food resources, farm equipment, fertilizer, rural fire control, defense against biological or chemical warfare and fallout affecting animals and crops, and Civil Defense preparedness of food processing industries.

COMMERCE DEPARTMENT. Fallout forecasting; centralized control of all transportation except pipelines; distribution of petrochemicals; Federal emergency responsibility for roads, streets, bridges and tunnels; assistance in industrial dispersion; and Civil Defense preparedness of about 25 industries.

HEALTH, EDUCATION, AND WELFARE DEPARTMENT. Health services (and related manpower and resources), welfare services, educational programs, and Civil Defense preparedness of drug industries.

INTERIOR DEPARTMENT. Electric power; solid fuels; minerals; *petroleum and gas* (including pipelines for their movement and facilities specially designed for their storage); *petrochemicals* (except carbon black, ammonia, and synthetic rubber) made in facilities 50% or more owned by petroleum and gas companies; and Civil Defense preparedness of these industries. The Federal Power Commission will assist Interior with respect to electric power and natural gas in accordance with a memorandum of agreement between the two agencies.

LABOR DEPARTMENT. Civilian manpower mobilization, wage and salary stabilization, worker training, and labor-management relations.

POST OFFICE DEPARTMENT. A national emergency registration system for the purpose of reuniting families and exchanging information on their welfare.

STATE DEPARTMENT. Conduct of foreign relations, mutual assistance arrangements with other nations, foreign aid, and protection or evacuation of Americans abroad and safeguarding their property.

TREASURY DEPARTMENT AND FEDERAL FINANCIAL AGENCIES. Stabilization aspects of monetary, credit, and financial system; provision of port security through the Coast Guard; and development of emergency plans for the performance of the other Treasury functions such as collection of revenue, administration of customs, manufacture and issuance of currency, etc. The Federal Reserve System, Home Loan Bank, Farm Credit Administration and Federal Deposit Insurance Corporation participate with OEP

*Primary resources comprise manufacturers' inventories and *inter*state wholesale stocks. These resources will be under Federal control unless Federal direction during an emergency is lacking.

† Secondary resources comprise *intra*state wholesale and retail stocks.

and Treasury Department in respect to emergency financial and economic stabilization measures including currency supplies, re-creation of evidence of assets destroyed, provision of liquidity to financial institutions destroyed or damaged, and plans for sharing war losses. The Securities and Exchange Commission is concerned with emergency financial controls relative to temporary closure of security exchanges, freezing of stock and bond prices, establishing ownership of securities if trading centers and depositories are destroyed, and offering of securities to establish or re-establish industries in relation to the Nation's needs during or following a national emergency.

FEDERAL COMMUNICATIONS COMMISSION. Service by wire or radio common carriers, broadcasting facilities and the safety and special radio services; assignment of radio frequencies; and the protection, reduction of vulnerability, maintenance, and restoration of facilities operated by its licensees in an emergency. Emergency plans will take into account possible Government priorities or exclusive use or control of communications.

CIVIL AERONAUTICS BOARD. War Air Service Program for essential civil air service (upon withdrawal of aircraft allocated to the Civil Reserve Air Fleet by the Secretary of Commerce for the use of the Department of Defense to meet essential military requirements).

FEDERAL AVIATION AGENCY. Emergency management of civil airports, operating facilities, and aviation services, and Civil Defense preparedness of airports and aviation concerns.

HOUSING AND HOME FINANCE AGENCY. Research and guidance on protective standards for new housing, temporary shelter in existing homes, provision of emergency housing in distressed areas, and the direction of Federal activities for the restoration of essential housing and facilities for which the agency normally has legal responsibility.

Department of Interior, Office of Oil and Gas

Of particular interest is the emergency preparedness function of the Office of Oil and Gas (OOG), Department of Interior. OOG has the responsibility for planning and directing programs to assure the emergency availability of oil, gas, and petrochemicals. In carrying out its defense mobilization activities, OOG works closely with the Office of Emergency Planning (OEP) and Office of Civil Defense (OCD) and, through field representatives, provides the regional offices* of these agencies and State Civil Defense organizations with advice and guidance in the integration of petroleum, gas, and petrochemical planning with National, regional and State emergency plans.

Government planning for the mobilization of the petroleum, gas, and petrochemical industries requires that companies in these industries individually and in cooperation with other industrial units plan for the continuity of their operations after nuclear attack, and that industry personnel largely man whatever emergency agencies government must set up so as to meet essential requirements for their products.

Building on the experiences of close industry-government cooperation during World War II and the Korean crisis, the Secretary of the Interior has established a stand-by Emergency Petroleum and Gas Administration (EPGA)* which would begin to function immediately on declaration of a national emergency. Its field offices,† if cut off because of lack of communications, would operate autonomously pending re-establishment of communications with higher authority. If fully activated, the agency would have a national headquarters and appropriate field offices throughout the United States. The function of EPGA, its relation to other agencies of government and industry, and other information covering mobilization of the petroleum, gas, and petrochemical industries are set forth in Chapter 10 of the National Plan. Staff of this emergency petroleum agency would be provided principally by industry through the Petroleum and Gas Unit of the National Defense Executive Reserve.

Executive Reservists become full-time government employees and proceed automatically to predetermined locations in event of emergency. When accepting an invitation to join the Petroleum and Gas Executive Reserve, prospective members agree to serve if needed and to receive training and orientation designed to improve their capability to function in an emergency situation.

Two types of situations are visualized in which EPGA would assume varying degrees of control over petroleum and gas operations in the United States: (1) A period of increasing international tension leading to a limited war such as the Korean conflict, and (2) a general war, possibly involving nuclear attack on the United States.

In the first situation, controls of petroleum and gas industry operations would probably resemble those imposed by the Petroleum Administration for

* See map of OEP-OCD Regions (Chart I), pg. 14.

* See chart of National Emergency Petroleum and Gas Administration (Chart II), pg. 15.

† See chart of typical field EPGA (Chart III), pg. 16.

Defense (PAD) in 1950-1954. It is likely that little more than the EPGA national headquarters would be activated; State and local governments would not become directly involved. The supply-demand balance would be closely watched, however, and industry would be requested to deliver petroleum products and gas when and where needed. Various agencies of government would be requested to arrange for transportation, manpower, and materials required to sustain the necessary level of operations and to keep prices and wages in line.

During a general war, with or without nuclear attack, controls would be more stringent and might be complete. It is expected that some or all of the following actions would be taken:

The national headquarters and strategically important field offices of EPGA would be activated. The Federal EPGA would be responsible for direction and control of all primary supplies and inventories of crude oil, petroleum products, and natural gas (i.e., production, processing, pipeline transmission, petroleum manufacturing, and storage at major terminals, large bulk plants, and refineries). EPGA would allocate all available primary supplies to essential uses. In the case of petroleum and its products, such allocation would be down to the secondary inventory level, and in the case of natural gas, down to the "city gates," (i.e., local distribution input points).* Liaison arrangements between EPGA and State and local governments, and with individual oil companies, would go into effect.

State and local governments would control secondary inventories—products in small bulk plants and stocks of jobbers and filling stations. They would direct distribution from these secondary inventories to retailers and consumers, reserving available supplies to meet the needs of emergency vehicles and essential community services. EPGA State offices would respond to State requests to replenish these inventories and move products to places of greatest need.

At the same time, regional offices of EPGA would be issuing orders and instructions, communications permitting. Typical effects would be to: divert to safe areas, petroleum, gas, and petrochemicals in transit; allocate petroleum products moving from primary inventories to points of distribution; direct transmission of gas to "city gates;" assess bomb damage and report on capability of surviving facilities; recommend repairs and estimate requirements for materials and personnel; direct operations of existing plants; and provide the EPGA national headquarters with a continuing report of petroleum and gas operations so as to facilitate nationwide coordination with other regional resource programs.

Simultaneously, national headquarters (whether at Washington or relocated because of bomb strikes) —communications permitting—would be: (1) Collecting information from the regional offices on which to allocate available supplies nationwide. (2) Developing programs for the restoration of petroleum, gas, and petrochemical facilities. (3) Assessing needs and presenting claims to other Federal resource agencies for allocation of materials, manpower, transportation, and other requirements of the petroleum and gas industries. (4) Issuing directives to regional offices regarding management of petroleum and gas operations. (5) In consultation with the State Department, administering programs for the mobilization of foreign petroleum and gas resources, including assistance to meet requirements in foreign areas and assistance from foreign areas to meet domestic U. S. requirements.

Pending the time when mobilization plans are complete, and even in the early stages of a period of increasing international tension, the Office of Oil and Gas, together with its field representatives in the OEP-OCD regions, will function as the nucleus of the Emergency Petroleum and Gas Administration capable of rapid expansion to required strength.

State and local government activities

The Governor of each State, Territory, and possession is responsible for the Civil Defense and resource management activities of his jurisdiction and its political subdivisions. The State Civil Defense and emergency planning director, or his equivalent, is the Governor's chief of staff for Civil Defense and resources management. He coordinates and directs the Civil Defense and resource management program of the State for the chief executive.

In local governments, the executive head of each political subdivision is responsible, under applicable laws and regulations of the States, for the Civil Defense of his jurisdiction. A local Civil Defense director, or his equivalent, coordinates and directs the program at his level much as his counterpart does at the State level.

Civil Defense organizations have been established down to local community, city, and county levels with programs for: (1) Warning and communications systems to alert the public and to disseminate information received from the Federal network. (2) Radiological monitoring system to measure and identify the degree of radiological hazards.

* See chart of typical movement of oil (Chart IV), pg. 17.

(3) Fallout shelters. (4) Police, fire-fighting, rescue, and medical and other Civil Defenses services by assigning emergency functions to existing government departments normally concerned with these functions. (5) Training in Civil Defense activities.

In many States, however, the organization for management of resources is in a more formative stage. Industry committees or task groups are being developed within the States and are preparing plans for resource management. In an emergency, the industry committees probably will become operating staffs of State and local governments to carry out resource management plans.

In a "cut-off" situation, if the Federal Government is unable to exercise its responsibility for resources management, State and local governments would be expected to assume the entire management of both primary and secondary resources within their areas, until the Federal Government can resume this responsibility. Whenever possible, however, Federal agencies charged with responsibility for various resources will continue to manage such resources for all periods of any emergency including the immediate post-attack period.

The Office of Emergency Planning has defined four immediate objectives for State and local planning. To insure capability to manage resources in the absence of Federal direction, each locality must be prepared to: (1) Allocate and control production, distribution, and use of essential resources such as food, medical supplies, petroleum, electric power, and other vital materials. (2) Manage and provide essential transportation and communication services. (3) Stabilize the economy and control and preserve the monetary and credit systems. (4) Administer a consumer rationing system and other measures for distribution of essential items to consumers.

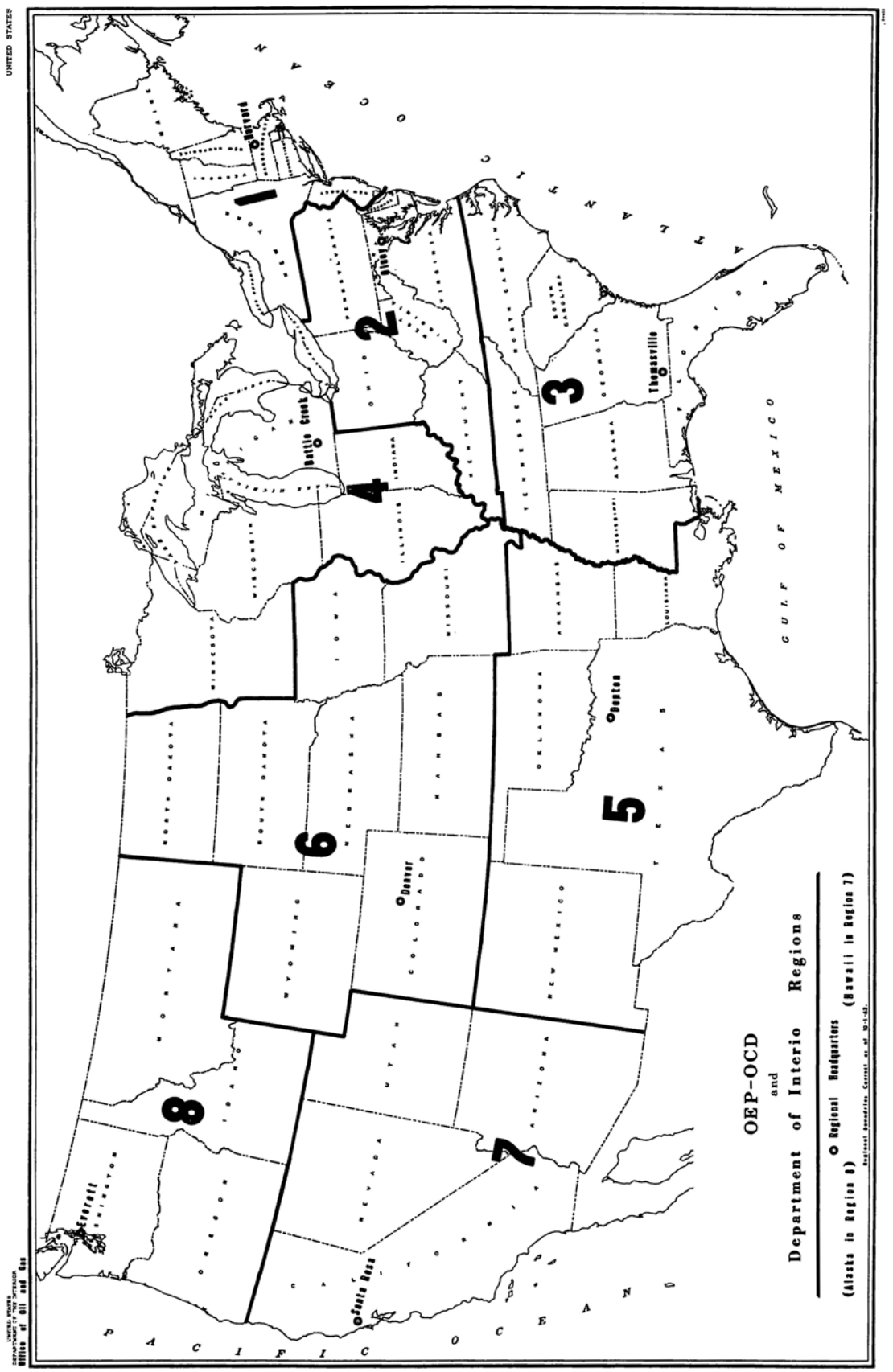
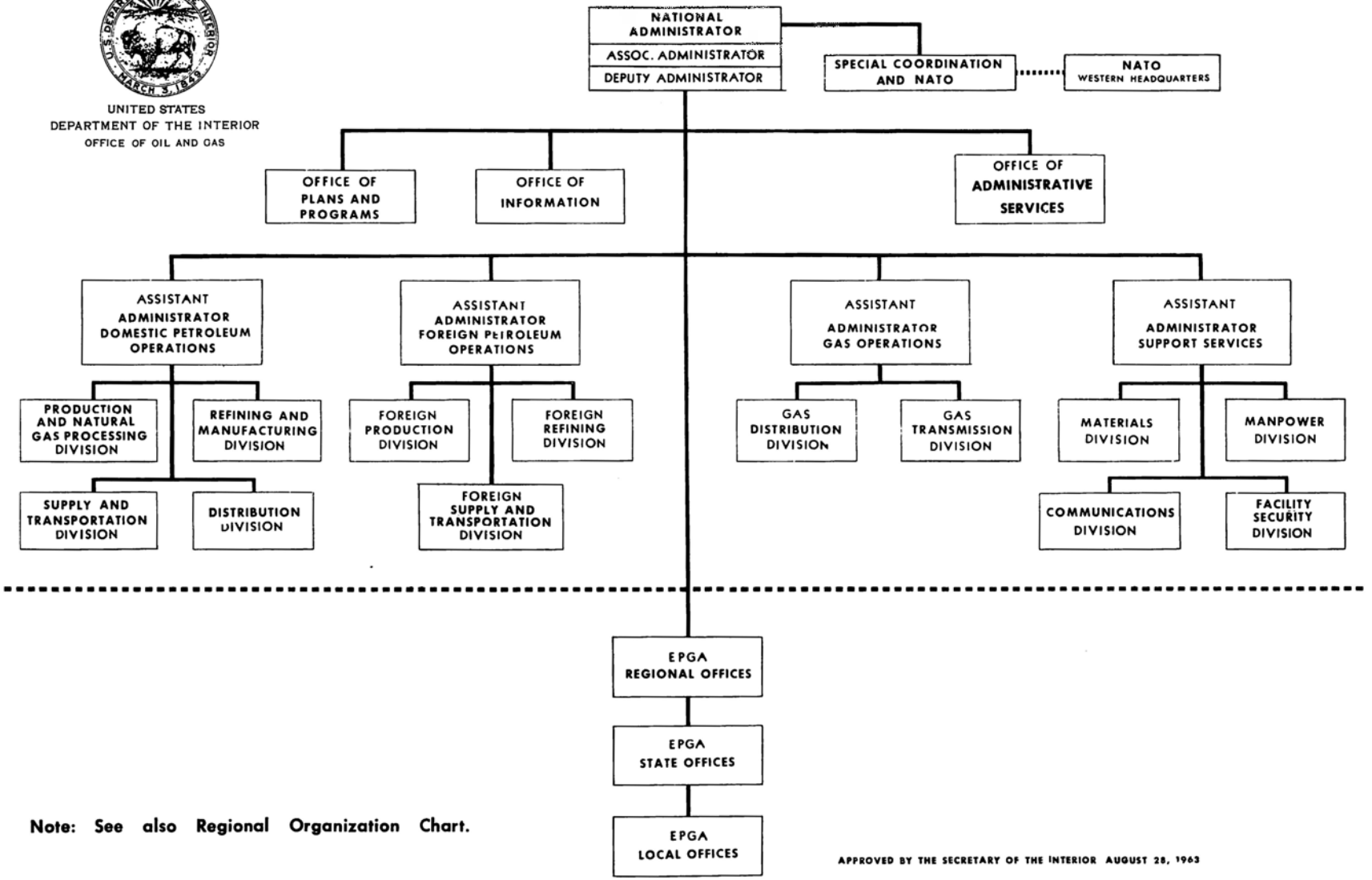

OEP-OCD
and
Department of Interio Regions
Regional Headquarters
(Alaska in Region 8)
(Hawaii in Region 7)
1
2
3
4
5
6
7
8
Portland
Battle Creek
Thomasville
Denver
Santa Fe
Olympia
GULF OF MEXICO
PACIFIC OCEAN

CHART I

CHART II

HEADQUARTERS AND FIELD ORGANIZATION - EMERGENCY PETROLEUM AND GAS ADMINISTRATION

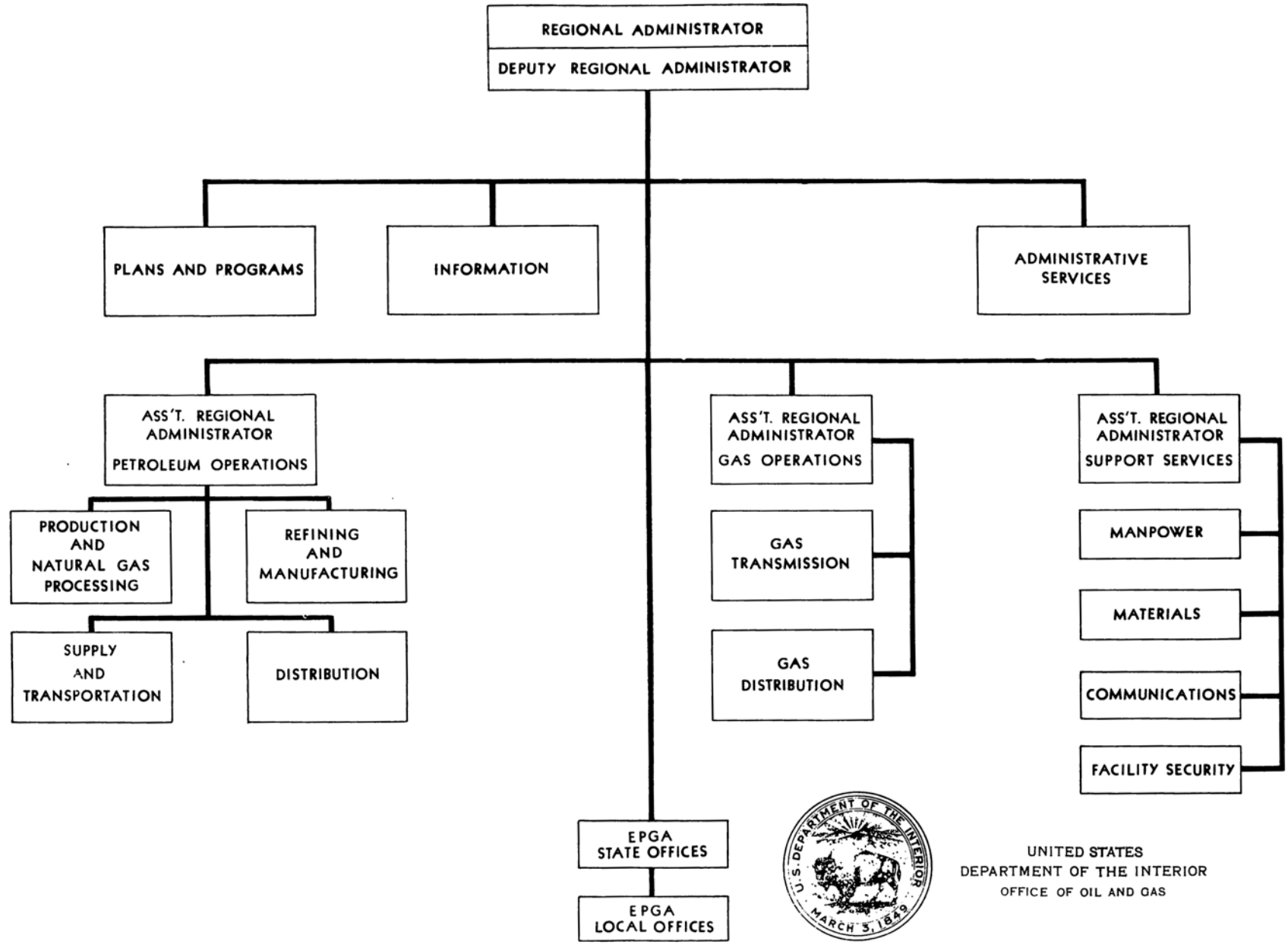
UNITED STATES
DEPARTMENT OF THE INTERIOR
OFFICE OF OIL AND GAS



Note: See also Regional Organization Chart.

APPROVED BY THE SECRETARY OF THE INTERIOR AUGUST 28, 1963

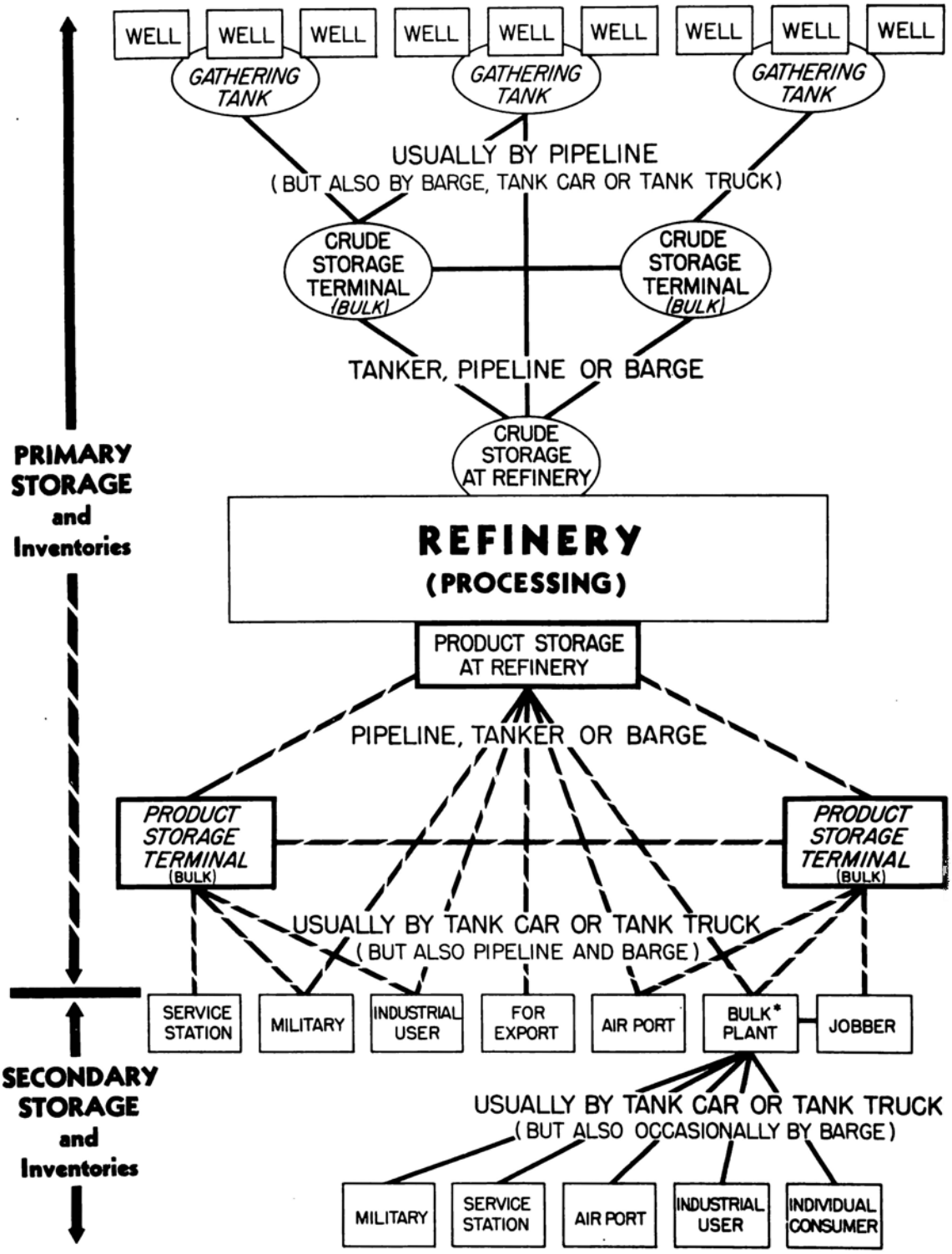
REGIONAL ORGANIZATION — EMERGENCY PETROLEUM AND GAS ADMINISTRATION



APPROVED BY THE SECRETARY OF THE INTERIOR AUGUST 28, 1963

CHART III

TYPICAL MOVEMENTS OF OIL FROM WELL TO ULTIMATE CONSUMER



*Including bulk plants at refineries

CHART IV

Part II—Establishing the company emergency program

General

Responsibility of management

Line management at all levels of an organization must accept the responsibility for achieving a state of emergency preparedness. Furthermore, the acceptance of this responsibility at the top must be made clearly known to all managers. Since the contribution of emergency planning to the operational effectiveness of the organization is indirect at best, little progress will be made unless the top officers of the corporation give direction and support to the program.

Each division and department head and each field unit manager should understand that he is responsible for developing a *built-in emergency capability* for the organizations and activities under his management. This responsibility includes but is not limited to the following: (1) Knowledge of national, State, and local government plans, preparedness measures, and organization as they affect his management responsibilities. (2) Joint participation with other company representatives and with government officials to develop plans and preparedness measures for Civil Defense and defense mobilization as they concern the company. (3) Establishing (or recommending the establishment of) plans and preparedness measures in conformity with national, State and local government plans. (4) Periodic review of the plans and preparedness measures for adequacy, operational readiness, and conformance with the National Plan and other Federal guidance.

Responsibility of staff

Staff work required in developing plans to be recommended for adoption by management can be organized in different ways. Most companies have already established patterns in which staff work for planning is organized and which can be readily applied to emergency planning.

A number of companies have found that a corporate security committee can successfully coordinate emergency planning under a broad directive from top management. Such a committee should have reporting to it a staff which can do research and prepare written plans at the committee's direction. If committee coordination of this type is adopted, it should be made clear to managers that the existence of the committee does not dilute their responsibility for results.

Other companies have found that the assignment of emergency planning staff responsibilities to an existing staff department, such as a Security Department, is successful. In such cases the staff department conducts the research and, in consultation with management at various levels, prepares plans which are then recommended to the appropriate level of management for adoption.

It has also been found of great value to assign staff responsibilities in this field to an individual at each plant or major division office. This staff appointment might be called Emergency Planning Coordinator and would include these duties: prepare detailed emergency plans for the local unit, select and order emergency equipment, conduct training, and develop an expert knowledge of Civil and Industrial Defense.

Outside consultants, in certain cases, represent another possible approach to the problem of staff work. If a company believes that the scope of its problems does not justify the assignment of full-time personnel to the planning phases of operational preparedness, it may prefer to employ a consultant who could prepare plans, conduct training, recommend supplies and equipment, etc. A number of consulting organizations are qualified in this field. Further information is obtainable through the Office of Civil Defense, Department of Defense, or the National Institute for Disaster Mobilization, 475 Fifth Avenue, New York, N. Y. 10017.

Concepts of emergency planning

The fundamental concepts of emergency planning include the several responsibilities of management mentioned above.

Of primary importance is the idea of built-in emergency capability at all management levels. This means each manager's job should be structured to include in its normal duties those which would reduce to a minimum the impact of a national emergency. For example, he would take measures to: (1) provide for his own succession; (2) protect employees through shelters and programs for train-

ing and information; (3) safeguard property by assessing the criticality of his installations and reducing their vulnerability;* (4) provide for the continuation or restoration of operations under emergency conditions; (5) keep in contact with national, State and local government officials concerned with emergency planning and Civil Defense; (6) foster mutual aid associations comprising the industrial community in which he is located; and (7) test the operational readiness of his organization in the same manner in which a prudent plant manager tests the readiness of his fire-fighting teams to cope with a major fire.

If, by directive of its top management, a corporation will require each manager at each level to examine his own responsibilities and take steps to develop this built-in emergency capability within his organization, then the objectives of emergency planning will be easily reached.

When faced with the need to spend money for staff time, for equipment, and for improvement of facilities, in a program for which no cash return can be calculated, management faces a dilemma. Experience has shown, however, that much can be accomplished at little cost. Survival training can be integrated with safety training, and shelter construction and improvement can be phased in with new construction. Plant security improvements may pay for themselves by the reduction of other risks, such as thefts, vandalism, accidents, and fires.

Each corporate management will clearly realize that the value of emergency planning to the survival of the United States depends upon the level of overall industry preparedness. Each company, therefore, should pace its development in this field to conform to national policy and to general industry progress. If these principles are kept in mind, annual costs of the program are not likely to be burdensome.

Continuity of management

Corporate continuity

Providing for effective continuity of management is an essential part of industrial preparedness. Plans must be developed and adopted in advance to assure the maintenance of leadership and direction even though many, or even most, of the business leaders are unavailable in the immediate post-attack period.

Assurance of a functioning Board of Directors

The Board of Directors represents the owners of the corporation. Its members are charged with responsibilities which normally cannot be delegated. The key measure to be taken, therefore, is to assure that the Board can operate even though most or all its members may be dead, injured, or otherwise unavailable for meetings.

It is relatively simple to establish emergency by-laws to provide for an operating Board of Directors. Corporations should define the emergency circumstances under which such by-laws become effective. Furthermore, in States which have statutes governing emergency by-laws, companies should take care to draw up their by-laws so they do not conflict with State laws.

Generally, emergency by-laws define the conditions under which the quorum may be reduced, vacancies filled, and emergency alternate directors appointed. For example:

(1) The quorum number may be authorized as a percentage of the total Board, or a specified number of members. Some companies have set the minimum number at one.

(2) An emergency by-law may permit a special quorum (usually a majority of the surviving Board members) for the purpose of filling vacancies.

(3) Alternate or successor directors may be designated. This requires the peacetime appointment of certain top operating officials to serve as directors in an emergency, often only where required to make up a quorum. Many companies hesitate to appoint such alternates during pre-emergency periods, fearing that such appointments might be misunderstood.

Emergency Management Committee

Several companies assure direction and leadership through appointment of an Emergency Management Committee. Such a committee may serve as a final backstop to emergency by-laws mentioned above or may simply replace a Board in the event no quorum survives or is able to act. The committee may be composed of those directors able to attend an emergency meeting, if any, plus such other individuals as may be specified in the by-laws.

Sample by-laws, one designed to assure continued functioning of the Board by quorum reduction and backed up by an Emergency Management Committee (By-Law A) and one designed to create an Emergency Management Committee to operate in case a Board quorum does not survive (By-Law B), appear on the following page.

* Information on vulnerability of various locations throughout the United States can be obtained from the Office of Civil Defense, Department of Defense, Washington, D. C. 20310.

BY-LAW A

An Emergency By-Law to Assure the Continuity of a Board of Directors

ARTICLE II

Board of Directors

Five of the Directors shall constitute a quorum for the transaction of business; except that if the number of Directors be reduced to less than eight by reason of vacancies caused by death, resignation, or otherwise, a majority of the remaining Directors shall constitute a quorum for the purpose of filling vacancise in the Board of Directors and among the elective officers. If at any meeting of the Board there be less than a quorum present, a majority of those present may adjourn the meeting from time to time without notice other than by announcement at the meeting.

The Board of Directors, by resolution of a majority of the whole Board, may appoint three or more persons to constitute an Emergency Management Committee or otherwise designate the manner in which the membership of such Committee shall be determined. To the extent provided in said resolution, and subject to the provisions of the certificate of incorporation and these by-laws, such Committee shall have and may exercise all the powers of the Board of Directors in the management of the business and affairs of the Company but only during any period when the Board of Directors shall be unable to function by reason of vacancies therein caused by death, resignation, or otherwise and there shall be no Director remaining and able to fill such vacancies pursuant to Section 3 of this Article II and until a Board of Directors shall have been duly constituted. Such Committee shall, during the time it is authorized to function as provided herein, have power to call special meetings of stockholders, to elect or appoint officers to fill vacancies as circumstances may require, and to authorize the seal of the Company to be affixed to all papers which may require it. Such Committee shall make its own rules of procedure. A majority of the Committee shall constitute a quorum. Any vacancy in the Committee caused by death, incapacity, resignation, or otherwise may be filled by the remaining members though less than a quorum, and any member so chosen shall serve until a Board of Directors has been duly constituted.

BY-LAW B

An Emergency By-Law Providing for an Emergency Management Committee in accordance with New York State corporation law.

ARTICLE III

Section 9. EMERGENCY MANAGEMENT COMMITTEE

The Board of Directors, by resolution, may provide for an Emergency Management Committee and appoint members or designate the manner in which membership of the Committee shall be determined. The emergency powers granted hereunder shall become effective immediately upon the ordering of the effectiveness of emergency by-laws by the State Defense Council pursuant to Subdivision 17 of Section 12 of the New York State Defense Emergency Act and shall remain in effect until the said Council declares the end of the period of attack. Said Committee shall have and may exercise all of the powers of the Board of Directors in the management of the business and affairs of the Company. It shall act only during such period of attack and so long as the number of Directors able to act shall have been reduced to less than five, and until a Board of Directors has been elected by the stockholders. Such Committee shall meet as promptly as possible after the occurrence of the event herein described which would activate the Committee and at such subsequent time or times as it may designate until a Board of Directors has been duly elected. Such Committee shall, as the first order of business, elect an Executive Committee from among its members and a chairman thereof, who shall be the chief executive officer of the Company. Such Executive Committee shall function in the same manner and possess the same powers as the Executive Committee of the Board of Directors, as provided in Article V of these by-laws, and shall have so many members as shall be provided by resolution of the Board. Such Committees shall make their own rules of procedure except to the extent otherwise provided by resolution of the Board. A majority of the members of the Committees able to act shall constitute a quorum. The physical presence of a member shall not be required if his vote on an action to be taken can be obtained by available means of communication. Any vacancy occurring in said Committees caused by resignation, death, or other incapacity may be filled by a majority of the remaining members of the Emergency Management Committee and any member so chosen shall serve until a Board of Directors has been duly elected.

There are two schools of thought as to how emergency appointments are to be designated—by office or name. Each has its advantages and disadvantages. If name appointments are used, the list must be maintained current at all times. Most companies keep office or name lists confidential.

Preservation of vital corporate records

Special care should be taken to see that records vital to the corporate existence are made a part of the records preservation program. Among such records are: stockholders ledger, minutes of Board meetings, minutes of Executive Committee meetings, corporate charter, records of ownership of other corporations, and major agreements relating to mergers, stock transactions, etc.

Management relocation

Alternate headquarters

Industrial defense planning, as practiced by many major industrial concerns, provides for one or more emergency headquarters in remote locations. They are so designed and equipped that, in an emergency, senior management personnel or their alternates can carry on the corporation business with a minimum of disruption.

Many companies make provision for transfer of executives to their alternate headquarters in the event the world situation should become ominous. Thus they presumably would be in a safer location and able to carry on operations in event of an attack.

Such facilities should include feeding, sleeping, and working accommodations. Emphasis should be placed on the necessity for good communications (see chapter on Communications).

The alternate company headquarters should be selected from the standpoint of security, accessibility, communications, and accommodations. It should be equipped with information and records necessary for the continuity of operations. Its functions would include contacting all surviving members of top management and requesting those needed to proceed immediately to the new headquarters, filling important vacancies caused by casualties, completing the transfer to headquarters operations, assessing damages, providing for production transfers, and making arrangements for meeting payrolls. Study may show that company-owned facilities at satisfactory locations could be used for alternate emergency headquarters.

Emergency operating centers

As an amplification of alternate management headquarters, many companies have selected certain of their field locations and designated them as emergency operating centers. They usually provide emergency coordination for all operations within a specified geographical area. Such regional centers ought to be provided with facilities similar to an alternate headquarters, with emphasis on communications. Emergency operating centers may be designated as dispersal points in a management dispersal plan.

Field units and plants

Many field units have set up several reporting centers apart from their plant but within reasonable travel distance for plant supervisors. If communications are available between the reporting centers, one of them will be identified as the functional center to begin rehabilitation measures as soon as it is safe to travel. Certain records, such as organization charts and employee address lists, should be maintained current at each location.

A field unit consisting of a number of plants and offices, such as a Marketing Division, might be treated as a small company. This would call for an alternate headquarters, a communications plan, and a designated successor to the person in charge at each location.

In event of a disaster, it is unlikely that headquarters' supervision or advice will be readily available to field units. All field units should be informed in writing that each executive, management, or supervisory employee is responsible for taking all actions necessary under disaster conditions to protect employees, assets, and business. Such employees should be delegated full authority and powers to accomplish the above responsibility, again in writing.

A clear and concise procedure should be established concerning continuity of management in event the ranking supervisor is unavailable or incapable of taking necessary action. Usually a succession list for the top job at a location is all that is needed because a new top man can designate his chief subordinates from among those available.

Protection of personnel

The great difference between our republican form of government and a communist state is the value placed on the individual. In our free enterprise system, individuals have the right and the responsibility to make choices and decisions in their own behalf which means each individual is a value in himself. Furthermore, tools are productive only when they are in the hands of qualified people. For

these reasons, in any emergency planning program, the part pertaining to the protection of personnel has particular significance. Our industry has repeatedly affirmed the principles of the free enterprise system and the value of the individual, and in planning for emergency situations including enemy attack, we have again the privilege of reaffirming them.

The protection of personnel includes planning for and establishing the physical facilities and organization required to preserve the life and health of the maximum number of people. It includes provisions against natural hazards as well as those of a national emergency. The survival of a corporation, and indeed the survival of the country as a whole, depends on retaining enough people with specific skills, training, and disciplines to reconstitute normal operations after the emergency has passed.

Since government agencies, in particular the local Civil Defense authorities, have a responsibility for protection of the populace as a whole, any program for the protection of plant people should be reviewed with the local Civil Defense authorities and, if feasible, coordinated with their program.

Emergency control and communications center

The purpose of an emergency control and communications center is to provide an on-site location from which the direction of warning, damage control, rescue, relief operations, mutual aid, and coordination with Civil Defense authorities could come. Its over-all goal is to maximize protection to personnel and minimize the loss of plant assets. In short, it is the command headquarters for a single plant or a group of plants forming a complex facility. Only through central control can the greatest benefits of an emergency program be achieved.

The emergency control center should be located in a shelter zone, preferably in a basement or the center core of a building. This should give maximum protection from the immediate and residual effects of a nuclear attack. It should be suitably located with respect to key facilities, communication requirements, and equipment. It should meet the minimum government standards of a fallout shelter, both in protection factor and in self-sufficiency (food, water, medical supplies, sanitation, etc.).

The organization and staffing requirements will vary depending on the size and complexity of the installation. For a small facility, the plant coordinator of emergency plans and a telephone switchboard operator would suffice. A larger facility may need additional staff for maintenance, medical service, decontamination, fire-fighting, guard and rescue services, mutual aid, and messengers. Strict regulation of admittance to the center must be enforced to insure effective operation and to avoid interference.

The communications equipment required will vary from installation to installation depending on needs for adequate external communication with other segments of the company, Civil Defense authorities, and mutual aid association members, and internal communication with key areas of the facility and the practical maximum number of employees. The specifications of physical equipment to realize these objectives should be developed by a competent communications engineer. (For further information, see pages 53-55, Communications.)

Equipment might include an alternate power source (e.g., spare batteries), pre-recorded tape messages to be used at the time of initial warning to ensure calm and accurate delivery of information, and control switches for activating warning sirens, if such are required to give full plant coverage, particularly in outlying areas. Wall-mounted layout maps of the plant and other information pertinent to the emergency plans should be available. Such information may include organization charts for emergency operation, a complete outline of the emergency plans for the facility, and names, addresses, and phone numbers of employees. Since the control center should be adequate as a fallout shelter, the normal stock of supplies should be included.

Shelters

It is estimated from studies by government agencies that 50 to 60 million people could be saved if shelter programs were placed in effect. This illustrates dramatically the importance of giving high priority to the establishment of suitable shelters in the community, in the plant, and, if possible, in the home. Even with the tremendous damage which would result from a thermonuclear attack, great areas will remain undamaged and others will suffer only minor damage. However, people in these areas as well as in those with severe damage would be subject to radioactive fallout which could be crippling or fatal. The greatest benefit of a shelter program would be protection against this radiation. Blast and thermal effects would also be reduced, however. Since providing additional blast and thermal protection would require

only marginal expense in many cases, this should always be considered.

Community shelters seem to be an appropriate approach to the over-all problem. However, private industry, in its own self-interest, would want to provide protection for its employees and, particularly, for the shut-down crews who will be required to bring about an orderly and safe cessation of plant operations. Within the plant, a shelter large enough to accommodate all the plant personnel may be at a central location, or there may be several small shelters located at various centers of operations throughout the plant. In the latter case, suitably constructed control rooms might serve as shelters since control instruments are available for a safer and more orderly shutdown. A combination of community shelters and individual plant shelters would, without doubt, be the best arrangement. An employee would be much more willing to stay with his unit and accomplish a successful shutdown if he knew that his family was taken care of in a community shelter and there was a plant shelter available for his own protection.

The National Fallout Shelter Survey and Marking Program has been designed to establish shelter facilities in public and private buildings for use by the general public. This program is under the Office of Civil Defense, Department of Defense. In general, a building can qualify for the program if it has (1) sufficient space to accommodate at least 50 people; (2) a minimum of 10 sq.ft. per person with normal ventilation, and an additional 1.5 cu.ft. per person for storage of supplies; (3) under average conditions, a fresh air supply of 3 cu.ft. per minute per person; and (4) a protection factor of at least 40 (indicating that the intensity of radioactivity inside is 1/40 of that on the outside).

If a building meets these requirements and the owner is willing to license its use, the government will provide food, water, sanitary facilities, medical supplies sufficient for a 2-week occupancy, and a set of radiological monitoring instruments. Arrangements for a survey of buildings may be made through the local Civil Defense office.

For many safety or security reasons, it may be impractical to use buildings within a plant as a public shelter. However, these buildings may be adequate or revised to become adequate for company personnel. A survey of existing plant buildings should be made by experts in fallout shelter requirements to determine if they are suitable or if they could be made suitable by economical alterations.

Because of international complications and tensions, shelters will probably be needed for many years to come. Therefore, fallout shelter protection in all new construction should be considered. By incorporating additional mass of concrete, ventilation, underground construction, or other protective measures in the design of new structures, necessary protection can be achieved at an incremental cost. Furthermore, should a decision be reached to build a fallout shelter per se, it could be planned with alternate uses in mind, e.g., cafeteria, conference room, recreation room, or library.

Successful operation of a fallout shelter will depend on the organization established to take over leadership and authority under emergency conditions. Shelter managers should be chosen in advance so they can gain experience by operating the shelter under simulated conditions. Shelter capacity, layout, equipment, and supplies will dictate the extent of the organization required. However, functional requirements are generally the same regardless of size.

The shelter manager is the keystone of a successful shelter operation. He should be the final authority in shelter policy and operations, aided by his staff and advisory council made up of shelterees. He should be given the necessary authority to exercise his responsiblity for the physical and mental well-being of the shelter occupants. He should be experienced in working with people and have the ability to command their respect and confidence. His decisions should be sound and based on good judgment and experience. He should have good physical health and be willing to undertake a difficult job which will offer no reward except the satisfaction of having contributed to the common good.

Besides the manager, shelter operation requires personnel for special functions: information and training, operations, and maintenance and supplies. The deputies who will head these three functions should form a chain of command under the shelter manager and should be named in a certain order to act in his place should it become necessary.

The information and training group should be responsible for keeping the shelterees informed of the current situation within the shelter and conditions at the local, State, and national level, as advisable and to the extent possible. This group should provide training to help shelterees adjust to shelter living and prepare for the post-shelter period. In addition, this group should establish recreational activities necessary for the health and well-being of the shelterees and re-

ligious activities for those who want them. It is important to conduct a diversified program appropriate to both sexes and all age groups represented. Desires of the occupants should be given as much consideration as possible.

The operations group should have the responsibility for radiological monitoring, communications, safety, and health and sanitation.

Radiological monitoring will require people trained in the proper use of instruments to detect radiation and measure dose rates. Such monitoring will obviously be required within the shelter as well as outside when such is possible. This group should have responsibility also for all decontamination within the shelter. They will place shelterees in the areas within the shelter that show the least radiation, will indicate when emergency excursions from the shelter may be feasible, and will determine the time to leave the shelter. This group would also survey areas for rehabilitation to insure that the radiation level does not exceed safe limits.

Communications includes the operation of all telephone and radio systems as well as any public address system for the shelter itself. This will require people experienced in making necessary minor repairs to equipment. Outgoing communications and public announcements within the shelter should be approved by the shelter management.

Safety covers the prevention of accidents within the shelter, a fire-fighting crew with equipment for use within the shelter, and a security force in the shelter to restrain personnel should this become necessary under emergency conditions. A rescue team familiar with construction and building practices should be responsible for rescue operations necessitated by building failure or blocked exits.

The health and sanitation function comprises all medical attention including first aid, operation of sanitary facilities and the establishment of sanitary practices, supervision and direction of feeding, including schedules and allocation of the amount of food and water, and the establishment of sleeping quarters and schedules.

The maintenance and supply group. The maintenance function includes service and repair of all physical equipment in the shelter and should be directed to insuring a livable environment for the shelterees during their stay. The supply function includes inventory of the initial supplies and keeping accurate records of the remaining supplies after each day's use. In this way, conservation of limited supplies can be achieved.

Setting up shelter operations begins with the arrival of the shelterees. The management objective during the entering phase is to get procedures and activities started in an orderly manner. As soon as possible, the manager should introduce himself, show his credentials of authority, and quickly proceed to the organization of the group. Shelterees may be divided into groups of about 10 each, and each group should remain as a unit for the duration of the stay. Each group should select a representative who would be a member of an advisory board to the manager, giving counsel and advice and being the voice for suggestions or protests from members of the units. Each person should fill out information sheets listing experience, special skills, and interests. These are then used by the manager, his deputies, and the advisory board in selecting personnel to perform the functions outlined above. If permanent deputies have not been pre-selected, the manager must fill these posts after reviewing the information sheets. With the functional groups thus organized, the shelter routine can be successfully established.

The length of stay in the shelter will depend on the radiation level outside, the conditions within the shelter, and the availability of adequate housing within the community. There need not be a set time for everyone to leave the shelter, and, depending on conditions, it may be an intermittent rather than an all-at-once procedure. Short forays from the shelter may be necessary from time to time for additional food, water, medical needs, or other supplies before complete safety is assured. With proper decontamination of clothing and other effects after such excusions, a higher standard of shelter living may be maintained. The manager should keep the shelterees fully informed of the hazards involved, and every attempt should be made to keep the shelter intact until outside safety is assured.

A list of necessary shelter supplies and equipment is best obtained from the local office of Civil Defense. Improvements are constantly being made in this area, and a listing in this manual would become out of date in a short time. Normal storage will require a minimum of 1.5 cu.ft. per person, and the weight of all the supplies will be about 40 pounds per person.

Emergency services

Since some emergency plans are normally developed for petroleum and gas operations, these can be made the core of emergency services to cover all natural

and man-made emergencies. For example, every operating plant has made provision for fighting fire, for certain security measures to protect company property, for first aid and medical assistance, and, in some cases, for assistance to personnel under severe conditions resulting from catastrophe. Head Office groups have made similar emergency provisions. These existing groups, therefore, already provide an excellent start toward complete emergency services.

The organization of emergency services should be geared to the size and complexity of the facility involved and should be kept to a practical minimum. In most cases, the duties can be assigned to the regular line organization which not only minimizes the cost but also contributes to greater efficiency of operation because line employees have practical knowledge of the facility.

An emergency planning coordinator should be appointed at each facility to give direction to the program and to place responsibility at a definite point. He should command respect and attention from all departments in the plant and should be adept at organization and the art of working with people. He should be responsible to the manager of the facility for this activity and have direct access to the emergency planning officer for the whole company, to the Civil Defense officers at the local and State levels, and to the regional office of the Office of Oil and Gas, Department of the Interior.

Each emergency service discussed below should be directed by a deputy to the coordinator. (In certain circumstances, some of these services may be combined.)

Communications

An organization's accomplishments depend on the transmission of information; thus, a failure of communications can cause a breakdown in the organization's power to get things done. The greatest urgency for getting things done exists during periods of emergency. It is essential, therefore, that each petroleum and gas facility make advance preparation to assure the flow of communications at all necessary levels under any disaster condition.

This preparation includes the planning, installation, and operation of all communication systems selected—telephone, telegraph, teletype, radio, micro-wave, and siren warning facilities. A control center should be established as discussed under "Emergency control and communication center" on page 22 of this manual. The types of equipment desirable for an adequate system are discussed under "Communications" on pages 53-55. Auxiliary equipment needs for emergency operation also should be considered. Communications will be at the heart of any plan which is effective in protecting people and conserving assets. Every effort should be made to insure a workable and reliable system. The use of capable engineers is, therefore, essential.

Engineering (maintenance and rescue)

Under emergency conditions, the functions of the engineering group are to maintain all vital equipment and utility services and rescue trapped persons. The leader of this group should be a competent engineer; his emergency staff should be made up of people with special mechanical skills. The normal supply of spare parts, tools, and maintenance equipment should be adequate for their needs; however, periodically this inventory should be reviewed carefully.

Fire-fighting

Most operating plants already have a fire-fighting force, although some depend primarily on city or community fire departments to furnish this service. Under conditions of nuclear attack, it will be doubtful if community services will be available, and each management should study the local situation with the possible view to providing his own organized fire protection system. Trained crews are absolutely necessary for safe and successful operation under emergency conditions. The equipment provided must be adequate and maintained in excellent shape. In the petroleum industry, fire-fighting has been one of the most productive and valuable of all emergency services.

Guards and wardens

The functions of guards are to prevent all untoward activities which could endanger life or the physical assets of the company; to control traffic, both vehicular and personnel into and out of the facility; to enforce visitor and employee identification; to make regular and spot-check patrols and inspections of the premises; and to undertake preventive and precautionary measures as necessary to insure the security of the facilities.

Wardens, usually supervisory personnel, are desirable under some organizations. Their functions may include assistance in traffic control, particularly in the movement of people to shelter areas, and in helping to maintain order. In office installations where no plant facilities are involved, the wardens might be the primary emergency organization.

Information

Employees should be kept informed on matters pertaining to the emergency planning program. In the pre-emergency period, an information program serves to arouse the interest of employees and gives specifics about the program that will be useful in the execution of the plans. After an emergency, the information service should provide up-to-date news from the local authorities, gather and disseminate information regarding family survivals, and, in general, keep employees informed on all matters which would improve their well-being. This service will be required in a fallout shelter operation. (More on employee information appears on page 54.)

Medical

The primary purpose of the medical service is to quickly provide first aid to the injured, thereby contributing to a prompt recovery and, in serious cases, even preventing death. The application of skilled first aid treatment can be the greatest reassurance that could be given an injured person. In serious cases, first aid treatment must be sufficient to care for the patient until full medical assistance can be provided.

The medical service should be built around the facility doctor or nurse if one is employed. Additional personnel should be added to the group; estimates indicate that 10% of the total personnel might have to be assigned to this activity.

First aid training courses should be arranged, and all employees encouraged to attend. This training is a necessity for all those assigned to the medical service.

Medical service must arrange for an adequate inventory of medical supplies which should be periodically checked for completeness. They may also initiate special information programs to better insure good health under shelter conditions and to remind employees they should have a supply of any special medicines required.

Radiological, chemical, and biological service

Contamination from radioactive fallout could be a major danger following a nuclear attack. 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. Chemical warfare is the use of toxic gases, liquids, or solids to produce casualties. The use of screening smoke or incendiaries is also a chemical warfare procedure. Toxic gases are used against personnel to produce effects ranging from temporary psycho-disorientation and discomfort to quick death. Biological warfare is the military use of living organisms, such as pathogenic bacteria, viruses, and their toxins, to cause disease or death of personnel, animals, or plants.

The functions of the radiological, chemical, and biological service group are to monitor for radioactive fallout following an attack and for residual radioactivity before rehabilitation activities are started, to detect the presence of toxic gases, and to be alert to evidence of the presence of biological agents. This group will have a primary function in the operation of a fallout shelter.

To detect radioactivity, this group must use radiological monitoring equipment which may be obtained commercially or through the Civil Defense organization.

Transportation

All transportation equipment including cars, trucks, tractors, scooters, and even non-powered carts should be made available for assignments during an emergency. Each piece of major equipment should have written instructions placed adjacent to the driver's seat setting forth its particular assignment. Most equipment may be needed to transport fire-fighting equipment, but some should be held in reserve for special duties. The transportation services group should function to direct the utilization of equipment. They should also develop plans for the transportation of personnel to community shelters, if these are available, and for the movement of casualties to first aid stations or hospitals. Correlation of services with adjacent plants under a mutual aid agreement can be an additional important function.

Welfare

A man-made or natural disaster will immediately impose a serious welfare problem in the stricken area. Individual survivors will need to be supplied with food, financial aid, lodging, clothing, counsel, information about their families, and similar services which are essential for the restoration and maintenance of civil morale.

It is suggested that every large plant consider the organization of a welfare service as an integral part of its emergency planning program. This may be headed by a welfare director, assisted by such selected plant personnel as may be required.

Small industrial facilities will probably find it impractical to establish complete welfare services, but they may appoint special welfare representatives who would help disaster victims through liaison with the welfare service of the regular Civil Defense agency in the local community.

The work of the welfare service will include a variety of duties following a natural disaster or after a fallout shelter stay has been completed. They are: (1) feeding, a major operation if employees are not able to return to their own homes, (2) emergency lodging in temporary housing or makeshifts such as tents, tarpaulins, or other similar shelters, (3) emergency clothing for employees who have lost their clothes through radioactive contamination or physical damage, (4) individual and family service, a counseling program for employees with disturbing personal and family problems resulting from a disaster, and (5) registration and inquiry to locate relatives and family units by working with the local Civil Defense office charged with this responsibility for the community as a whole.

The extent to which the plant's emergency welfare program will be activated will depend upon the situation at the plant and in the surrounding community and also upon the decision as to whether or not the plant is to continue in operation during the emergency. However, planning ahead will provide maximum benefits for those who may need help.

Sanitation

The primary function of this service is to provide emergency sanitation requirements should the lack of normal water supplies, electric power, or other exigencies make the regular system inoperative. The health of the employees in a local facility could be impaired by inadequate facilities. Alternate sources of water and power should be earmarked, and the use of temporary facilities, such as chemical tanks, should be reviewed. Disposition of kitchen refuse and normal trash should be provided for, and good housekeeping practices insisted on throughout the facility.

Employee reporting centers

If enemy attack rendered the normal operating facility or office unsuitable for continuation of business, surviving employees would be needed by the company to reconstruct and re-establish the business. Arrangements must be made in the emergency plans to provide rallying points or employee reporting centers where the surviving personnel can report, thus creating an inventory of available employees. In addition, the centers become the points where information and instructions from the company may be given to the employees.

The reporting centers which should be widely dispersed in the employee home areas, can be company-owned facilities, supervisory employee homes, or other convenient locations. The number of centers required and the number of people assigned to each center will depend on the concentration of the employees and the distances involved. The number assigned to a single center may be up to 200 or 300 employees. Because of fallout dangers after a nuclear attack, the centers may not be in operation for 2 or more weeks after the initial emergency.

Each center would require a simple organization primarily to register people reporting and to inform and help employees as much as possible. In a small center located in an employee's home, the employee himself might do the whole job. In a large center, two or three persons may be needed, particularly when telephone communications are re-established. Each center should determine the organization required and have it ready for operation.

Registration information will include the employee's name, address, telephone number, department in which he worked, and any special skills which he might have. It also would be pertinent to record any injuries sustained by the employee or his family, general condition of his living quarters, and any other information which might affect his ability to take a job assignment.

Since the primary purpose of the reporting center is to establish an employee inventory, communications with the emergency regional center (discussed in "Management relocation" on page 21) should be maintained in order that assignments of those reporting can be made and company information may be given to employees. The communications link could be telephone wherein special arrangements for priority had been worked out with the telephone company. In some areas, mobile radio units may be possible with FCC approval. Messengers may be required if all other means of communication have broken down.

Records of the employees expected to report at a particular center should be stored in a suitable file cabinet there. These records, which might be kept best in a card file, should include name, address, telephone number, department, classification or job title, family status, special skills besides those used in normal job assignments, any critical medical limitations, and other data deemed important under the circumstances of the area or particular facility. In addition, telephone numbers and addresses of other nearby reporting centers, emergency regional centers and emergency company headquarters should be on hand as well as the telephone numbers and addresses of the local Civil Defense offices.

If the company has made provisions to give employees financial assistance, a supply of checks made

out in denominations of $25 to $100 should be available. In this case, the reporting center manager should be authorized to sign the checks and an audit record must be established to prevent any abuse. The checks should be marked "Good only after a nuclear attack" or some similar wording to prevent their use in normal times.

The equipment and supplies needed in a reporting center may include telephone, battery-powered transistor AM-FM radio, radiological detection and monitoring equipment, file cabinet to store records and supplies, flashlight, extra batteries for radio and flashlight, and stationery.

Each employee should be provided with a billfold card which would have the addresses of the reporting centers listed on it. Space for other vital information, such as the blood type of the individual and drugs to which he is allergic, might be included. By keeping the card with him at all times, the employee would never be in doubt as to where he should report. A similar card for the wife or husband of the employee also should be considered.

Information program

One of the most difficult goals to achieve in an emergency program is employee awareness of the potential danger of enemy attack. The understandable reluctance to contemplate nuclear war is aggravated by other factors. Experts may vary in their opinions on the imminence of attack and its nature. Occasional friendly gestures from the enemy tend to be disarming. Constant drumming on the need to be prepared can lose its effectiveness.

Fortunately, there is an alternative to preparedness based on a barrage of pamphlets, drills, pep-talks, and animated cartoons. And it is not self-made blindness. It is recognition of a two-fold principle: (1) Managers, because they are leaders, must be more aware than employees of the details of the emergency program and have a clear notion of what to divulge to employees on an "if and when" basis. (2) Protection against natural and operational hazards, already known to management, provides the logical base on which to build.

The information on hazards in "Natural and man-made hazards," pages 3 to 9, should be carefully studied by responsible management. How much of this information should be imparted to employees, and how, will be a function of (1) the amount of time, money, and effort any given company will wish to put into its information program, and (2) local Civil Defense activities which can be substituted for all or part of a company information program.

Employees should be informed that three principal agents will work to protect them from danger in case of emergency: themselves, the company (through actions and facilities provided for under the company emergency plan), and the Office of Civil Defense.

The degree to which any employee will want to prepare for an emergency (to build a fallout shelter, for example) must be left up to him. However, the company can inform employees of local Civil Defense programs, distribute Civil Defense literature, show films, etc., to encourage employees to take reasonable precautions.

It almost goes without saying that any company which draws up an emergency plan will want to inform those concerned regarding their respective emergency roles within the context of the plan. As parts of the plan are implemented, e.g., the adoption of emergency by-laws or the creation or designation of a shelter area, these facts, too, should be disseminated.

Means for disseminating information to the individuals might be house organs, special bulletins, letters to employees, display boards, messages over public address systems, movies, group discussions, newspapers, magazines, and radio and television programs, to mention a few. The information service should be headed by one who has special talents and experience in this field and its program must be timely, accurate, interesting, factual and stimulating. Details of the information program will be determined by the requirements of the emergency plan itself.

Company initiative in informing its employees of Civil Defense plans can range anywhere from simply announcing the address of the nearest local Civil Defense office where information is available to acting as an agent of the Office of Civil Defense. The extent of a company's activities must be a top management decision. In any event, it is wise to enlist the cooperation of the Office of Civil Defense. For publications and film lists, write: Public Information Officer, Office of Civil Defense, Department of Defense, Washington, D. C. 20310. For local activities, contact the Civil Defense office in your community or, if there is none, the State Civil Defense Director in the State capital.

Selection and training

Emergency assignments

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 emergency 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 Emergency Planning Committee, with the work done by the individual company units.

The manpower study made in July, 1963, by the National Petroleum Council contains a petroleum job description code and should be helpful in the analysis of jobs.

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 job title; time in job; time in same type work with other companies; experience in other jobs within the company; other jobs with other companies; hobby skills useful in an emergency (e.g., amateur radio operator); military background; educational background, including engineering training, apprenticeships, or any other formal job training ever obtained; leadership potential; and 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 records storage centers, with the appropriate inventory of jobs, to aid in emergency mobilizing of employee resources.

Rotation of personnel

During World War II, 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 emergency operating 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 if desirable, and offered re-employment.

Contracts and outside assistance

Company personnel provide the most reliable source of manpower for continuity of operations. 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 to be an obstacle to the efficient organization and use of manpower during rehabilitation. In a disaster, however, loyalty and patriotic spirit should prevail over reluctance to perform work normally assigned to a specific craft.

Many employes 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.

Training

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 emergency training director. The same choices exist for each plant emergency con-

trol coordinator when there is no training organization at plant level.

Organization and training manuals for company and plant level should be drawn up containing appropriate information on: type, purpose, and scope of each course; facilities required; length of courses; size of classes; type 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.

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, and (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 emergency control efforts: prevention of sabotage and espionage, survival of people and facilities, reconstruction of equipment and the organization, and resumption of operations. Any contemplated emergency 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.

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. 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 30-hour program. The Office of Civil Defense operates instructor training schools and encourages industrial management to send trainees. Information may be obtained from the Office of Civil Defense, Department of Defense, Washington, D. C. 20310. In addition, there are Civil Defense training manuals available on the individual subjects of fire-fighting, police activities, and rescue procedures.

An excellent training course in emergency planning is given by the Provost Marshal School, Fort Gordon, Georgia.

Civil Defense courses are conducted by some colleges, particularly in technical specialties, such as radiological defense and industrial fire-fighting. 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 emergency 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 rescue") 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. Pre-planned and pre-announced at first, they should become surprise drills when the organization appears ready.

Combined operations. Mutual aid members should occasionally conduct general emergency exercises to improve the effectiveness of their combined opera-

tions. 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 emergency 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) pre-assignment 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 handling 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, 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."*

* "Business Survival in the Face of Atomic Attack," by Mervin Molloy, Systems and Procedures Association of America, P.O. Box 96, Madison Square Station, New York, N.Y. 10010.

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.

Unit shutdowns. In an impending attack, most processes will probably be shut down hurriedly. Training for emergency shutdowns will help in such instances and in non-emergency 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 a 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 of 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 or officer with a tabulation showing the percentage of process employees capable of filling the critical operating positions at each level. The goal is 100% flexibility, i.e., each employee is to be trained to perform satisfactorily in all equivalent jobs on all units in his area.

Records preservation

An emergency plan must include a system to protect vital documents necessary to the continuity of the company and its operations. Such a system can be made simple if a minimum of records are classed as vital, if a sustained program of replacing old documents with current ones is carried out, and if a microfilm policy within economic limits is established.

A sound protection program requires planning. The first step is to set up an organization to carry it out. This may consist of only one full-time individual, provided he can obtain the cooperation on a part-time basis of other corporate employees who are familiar in detail with departmental records and have the authority to decide which are vital.

A proper records program consists of four elements: what records are to be protected, in what form they are to be safeguarded, where they are to be located, and how long they should be kept.

Detailed methods of protecting records in wartime are described in 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; send either the duplicates or the originals to storage, preferably underground in non-critical target areas; and establish a disposal schedule.

The total expense of a records protection program is 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. This may be accomplished by automatic dispersion through the normal course of business or by planned dispersion at selected intervals.

Selection of records

There are two basic types of documents which should be designated for protection: (1) Records which are essential for emergency operations of the physical plant and financial activities on a day-to-day basis (for storage at alternate corporate headquarters and emergency operating centers). (2) Records which are essential to the preservation of company assets and legal and contractual rights of stockholders and employees (for storage at a remote safe depository).

Each company should make its own determinations of specific records. The listing must include the certificate of incorporation, by-laws, minute books, stock records and those of accounting, contracts, patents, insurance policies, securities, research, engineering drawings, and basic operating data and specifications.

Form of retained records

Careful consideration should be given to the form in which the vital records are stored. Original copies of some records may be required by State laws for any legal usages. Other hard copies may be made by the conventional reproduction methods; these have the advantage of being available immediately without any delay for process printing. Microfilm may be very desirable where space limitations are important, but it has the disadvantage that viewers or photo enlargement equipment with adequate quantities of photographic paper are required to reproduce the record. Records may be put on magnetic tape which also requires less storage space than hard copies. Machines are required to "play back" the tape from which hard copies can be made by manual typing. An analysis of comparative costs of the various systems should be made, taking into account the storage space requirements and the equipment required to put the record in storable form and reproduce it. Humidity and temperature conditions of the storage area are also important; these should be compatible with the copy materials to insure long life.

Storage location

For storage locations, 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. To be useful, the vital records should be accessible to the emergency headquarters and operating centers of the company.

A schedule for the delivery of records to storage should be established on a daily, weekly, monthly, or other regular interval.

Disposal schedule

To keep the space provided for records protection at a minimum, a disposal schedule or program is neces-

sary. The importance of certain records changes as time goes on, and many records which are vital today may have little or no value a year hence. Therefore, definite schedules should be established to discard certain records after a fixed period of time or at least to re-evaluate the importance of the document. In this way, retained records will be of practical value.

Protection of installations

Organization

The protective security organization for a petroleum or gas system or facility will depend almost entirely upon its size, criticality, and vulnerability, the number of employees, and the added cost which may be assumed for this operation.

Successful protection depends upon the interest and skill of those who devise and administer the program. It requires complete coordination between management and workers, and between the system or facility and the community and government. The peacetime organization of the system or facility should be adapted to meet the requirements necessitated by a national defense emergency and should: (1) Analyze the criticality and vulnerability of the system or facility and community to determine how great are the hazards and where the hazards are most likely to develop. (2) Analyze the existing protection system to determine its adequacy in the light of hazards involved and to establish any necessary additional protective measures. (3) Train employees to observe protection regulations and to understand the purposes of the various regulations. (4) Train key personnel in protection functions so that they may organize and direct workers under them in emergency. (5) Establish and maintain cooperative procedures between management and workers to secure suggestions and information from workers. (6) Establish coordinated working relationships with the entire community Civil Defense and law enforcement organization.

Emergency Planning Coordinator

The vital importance of emergency planning to management and workers requires that the responsibility for protection be placed in a person of top level authority so that safety and security problems will receive equal consideration with production, sales, and other management functions. Whether this person is assigned full- or part-time depends upon the size and nature of the system or facility. His title could be "Emergency Planning Coordinator."

The program for which the Emergency Planning Coordinator is responsible should be based upon existing programs maintained as part of the normal business practices of the system or facility involved. If an emergency or disaster function has no counterpart in existing system or facility programs, the Coordinator must develop the necessary emergency or disaster services for the protection of employees and property during and after direct attack.

In establishing the emergency or disaster protection program, full use should be made of existing service departments, such as fire, medical, repair, and guard organizations. In normal times, the departments should continue to function as usual, coordinated and guided by the Emergency Planning Coordinator; in emergency or disaster, they should operate as a unit of the emergency and disaster program under the full administration of the Coordinator. The personnel of these units should be augmented as necessary and trained to cope with all types of emergencies and disasters.

Companies should establish procedures whereby plans for new construction are reviewed by the Emergency Planning Coordinator who can consider the possibility of dispersion to achieve these objectives: (1) separation of similar but critical process units so they won't all be lost at once, (2) separation of large industrial units so that targeting is made more difficult and less rewarding, (3) separation of processes so that peacetime explosions and fires will not spread, and (4) development of a spread-out work force and fallout shelters so that manpower losses are less likely to be crippling.

Dispersion implies location in a non-target area. Some locations are probable target areas for non-industrial reasons (military or governmental). Information as to current thinking on this subject may be obtained from the Office of Emergency Planning and the Office of Civil Defense, Department of Defense.

New industrial facilities afford an opportunity for security provisions which cannot be equalled later. In addition to dispersion recommendations, the Emergency Planning Coordinator can make suggestions on structure and equipment itself. Reductions in vulnerability can be made at little cost when the installation is in the design stage. This is the time to eliminate windows in control houses, to specify heavier supports, and to insert extra cut-off valves. Such changes may well pay off in making peacetime disasters easier to control. Installation of proper fences and other perimeter barriers will save on the cost of extra guards in a time of tension.

Employee and public relations

The formulation, activation, and application of protective measures for any petroleum or gas system or facility are the responsibility of the employees as well as of management. Operating personnel are in an excellent position to plan and implement essential security measures.

There should be a clear line of responsibility from the chief executive to the manager or supervisor in charge of each property with defense protection. Each manager or supervisor should be given appropriate authority to adopt such protective measures as may be necessary to discharge his responsibility, especially in event of an emergency.

The full and active cooperation of employees and organized labor must be obtained to assure an adequate protective program. They should be informed that protective measures are established for their protection and safety and to safeguard their livelihood.

In addition, the general public should be kept adequately informed so as to bring about thorough understanding and support. To this end, all communication media should be fully exploited to explain the industry's role in national defense and to recommend actions that private industry and the general public should take to implement the protective program in normal and emergency periods.

The cooperation of owners of property traversed by pipe lines should be solicited, where this is considered feasible, to keep pipe line operators advised of any unusual occurrence which the property owners may observe.

Management of service organizations (railroads, trucking companies, utilities) should be told what will be required of their employees before they are admitted to restricted areas.

Inspections and reports

Management should perform frequent inspections and receive reports to assure itself of the sufficiency of the security programs. This will help maintain efficiency and continuity through program revisions required by changing conditions and will create and maintain interest.

When it is necessary for authorized governmental agencies to make a security inspection, they should first arrange with top management to review the over-all program and decide which facilities should be inspected. A representative of top management should accompany the inspector.

Any reports prepared by the inspector should be in cooperation with management, which should be furnished a copy.

Personnel precautions

Subversive elements generally recruit espionage and sabotage agents by such considerations as: (1) ability to withstand a background investigation; (2) free access to the vital information or facility to be sabotaged; (3) susceptible to recruitment by ideological appeal, play on the emotions, promise of money or material reward, promise of prestige or power, or appeal to the spirit of adventure; (4) no objectionable personal characteristics that would invite attention; (5) possibility of exercising complete control over the individual after recruitment; and (6) possessed of special skills or training.

The proper application of personnel security measures will reduce the calculated risk. Personnel investigations serve as a deterrent and a screening process to uncover unfavorable information on applicants and employees.

While management is primarily responsible for the safety of its property, employees have an even more vital and personal interest in protecting themselves from injury, loss of life, or loss of livelihood through the activities of subversives. A successful protection program must have the cooperation of employees and organized labor.

Screening applicants

Employees are in a very favorable position to commit espionage and sabotage. Therefore, care should be exercised in the screening, investigation, and clearance of job applicants.

There are four general categories of potentially undesirable applicants or employees in addition to the known subversive, namely: (1) those susceptible to recruitment by subversive elements (the most difficult category to determine), (2) habitually dissatisfied or disgruntled employees, (3) individuals exhibiting habitual criminal tendencies, and (4) accident prone or careless individuals whose acts or failure to act may have the same results as an act of sabotage.

Management should exercise careful judgment in the employment of aliens. An alien holding first citizenship papers is still an alien within the intent of the law.

A list of all aliens employed by the system or facility should be maintained with a record of their alien registration numbers. Records should indicate the type of work individual aliens do and whether or not they have applied for, or received, first citizenship papers.

In certain cases, Government contracts provide in essence that no alien may be employed on classi-

fied contracts without written permission of the Government agency having jurisdiction.

Adequate application forms should be completed by every applicant for employment. The information included in the personnel security questionnaire should be sufficiently detailed to facilitate investigation and elimination of undesirables who may have access to vital information or restricted areas.

A responsible management official should conduct the investigation of the applicant's character, associations, and suitability for employment. The following sources may be helpful in obtaining data: State and local police, former employers (it's helpful to learn if responsible Government agencies conducted previous investigations and gave clearances), references other than those furnished by applicant, public records, credit agencies, and college or university professors.

In requesting data from any of these sources, the investigator should furnish the following minimum information, as appropriate, to minimize errors in identity: full name and other names or aliases used; personal description; date and place of birth; present and immediate previous address with dates; employment, present and last; and Social Security number.

Personnel investigations can also be arranged by contract with reputable private investigative organizations.

In either event, the period covered by a background investigation should be the latest 10 years. However, the period may be extended to verify or further develop any unfavorable information which is disclosed.

An honorable discharge from the armed services permits the investigation to exclude the period of military service.

The responsible management official should review the investigation results for such things as: unfavorable information, the need to further investigate reported information, completeness of investigative coverage, discrepancies between the information included in the personnel security questionnaire and the investigative reports, and supporting reasons and details to permit proper analysis of information reported.

When investigative reports are adequate, the responsible management official must decide on security clearance in a manner consistent with traditional American concepts of justice and rights of citizenship. This decision is an over-all, commonsense judgment made after considering all the relevant information. If it is determined that the common defense or security will not be endangered, the security clearance should be granted.

Investigating employees

All employees having access to vital information and restricted areas should be investigated and cleared. The same procedures as those outlined for applicants should be followed.

Clearance considerations are different for employees than for applicants. Management may simply refuse to hire an applicant who is considered a security risk. For a risky employee, management may choose to do one of three things: discharge the employee, using administrative reasons as the explanation; transfer the employee to a position where he will not have access to vital information or restricted areas; or get a job for the employee in another industry or commercial enterprise which is not vital to national defense. Any doubts should be resolved in favor of security.

Assurance of loyalty, important in peacetime, is even more important in time of national emergency. Accordingly, self-sufficient procedures for loyalty determination must be incorporated into standard personnel policies. Some help may be secured in personnel investigations and clearance from Government agencies when the system or facility is engaged in classified contracts.

Company investigations should be limited to employees having access to vital information or restricted areas involving critical operations. The techniques for limiting the number of people requiring investigation and clearance have been discussed previously.

It must not be assumed that the Federal Bureau of Investigation will, either directly or indirectly, inform management or the security director of subversives or suspected subversives employed in the system or facility. If the FBI is informed, however, it will investigate suspected espionage or sabotage activities.

Positive identification, the most important requisite to personnel investigation, requires fingerprinting. Although the Federal Government will not process fingerprint records for private industry, some assist ance may be obtained from other law enforcement agencies and private investigators, and it is recommended that duplicate sets of prints be obtained. Fingerprint Cards, U.S. Government Form No. 16-63416-1, may be obtained for this purpose from the U.S. Government Printing Office, Washington, D.C., for $1.50 per hundred. In this connection, it is most important that fingerprint impressions be properly and legibly made. A pamphlet entitled "How to Take Fingerprints" can be obtained at no charge from the Identification Division, Federal Bureau of

Investigation, Department of Justice, Washington, D.C. 20535.

It is exceedingly important that questionnaire answers be complete and full signatures obtained.

Controlling non-employees

Non-employees desiring access to a restricted area may not need investigation if they are duly authorized and accompanied by responsible escort. Special cooperation should be given to Federal Bureau of Investigation agents desiring access to restricted areas for official business.

Non-employees may include union officials, contractors' personnel, sub-contractors' personnel, outside maintenance personnel, vendors, business visitors, manufacturers' representatives, delivery personnel and consultants.

Access of non-employees to restricted areas is to be discouraged except for those with legitimate business reasons.

Guard service

Guard forces are normally charged with the following duties: (1) Implement and enforce the system of personnel identification and control. (2) Observe and patrol designated perimeters, areas, structures, and activities of security interest. (3) Apprehend unauthorized persons or vehicles entering security areas. (4) Make sure designated depositories, rooms, or buildings of security interest are properly locked or are otherwise in order during other than normal working hours. (5) Report to supervision, as a matter of prescribed routine under normal conditions, and as necessary in the event of unusual circumstances. (6) Perform essential escort duties. (7) Implement and enforce the established system of control over the removal of documents or material of security interest from security areas. (8) Respond to protective alarm signals or other indications of suspicious activity. (9) Act to protect personnel and property in the event of situations affecting security, including nuclear attack, fire, industrial accidents, internal disorders, and attempts to commit espionage, sabotage, or other criminal acts. (10) Direct people to shelters when the "take cover" alarm is sounded, exercising panic control, and providing guard services in shelters. (11) Generally safeguard data, materials, or equipment against unauthorized access, loss, theft, or damage.

Guard forces are required where access must be controlled. However, the need for guards is roughly in proportion to the scope of activities, the number of employees, and the size of the facility. As these factors increase, the safeguards provided by individual employees tend to decrease, resulting in the need for a guard force. Guard forces are seldom required at facilities of individual consultants and small laboratories involving only a few individuals. There, documents or materials can usually be adequately safeguarded by appropriate depositories and by personal custody of cleared personnel using such material in their work.

Stand-by facilities essential to continued production or service may require guards to control access and protect against malicious or accidental damage.

It is impractical to guard the entire length of all pipe lines; consequently the emphasis here should be on ways to repair pipe lines as quickly as possible.

The assignment of guards to individual wells in most cases is neither economical nor practical.

Where the industrial security program of a facility includes a guard force, it is the most important single element in the program. At the same time, the continuing cost of guarding a facility represents the largest item of security expense. Therefore, the use and deployment of a guard force should be carefully planned and frequently reviewed so that the most efficient utilization of manpower may be obtained.

All guards should be investigated and cleared. Guards occupy a position of high trust. By the very nature of their duties and responsibilities in the security program, they may through necessity or the inadvertence of others, come into knowledge or custody of vital information, other classified matter, or material of high strategic or monetary value. Therefore, unquestionable loyalty and integrity are essential requisites for all guards.

If a facility requires a guard service, the following elements should be considered:

Organization

Guards may be employees either of the facility owner or of a contractor.

Advantages of employee guards include: direct supervision by security supervisor, greater company loyalty, and possible employment of younger men in view of promotional possibility.

Advantages of contract guards include: less employee-guard familiarity, lower cost through employment of older persons such as retired police, flexibility in number of guards used, and supervision by those experienced in law enforcement.

If contract guards are used, it must be remembered that the quality of service will be no better than the quality demanded. Any shortcomings in guard performance must be immediately reported to the contractor.

Guard forces should be organized under the direction of the security director and operate directly under the supervision of a Chief of Guards. One individual should be placed in charge of each shift of the guards. In small facilities, the Chief of Guards may assume this function on one shift and subordinates on the other shifts. Clear and definite understanding should exist as to seniority and who is in charge of the guard force.

Guards may be organized by fixed post deployment, patrol deployment, response to calls for assistance, or any combination of these.

A list of telephone numbers for emergency use should be in guard headquarters. Written records covering all orders and assignments should be maintained.

Guard shifts should be so scheduled that they will not coincide with employee shifts.

The posts of guards should be varied, and they should never know in advance to what post they will be assigned when coming on duty.

Written reports on guard activities should be required. These should be made up at the time either by the guard himself or by the Chief of Guards, prepared from oral reports made to him by individual guards.

Guards should clearly understand their relationship to employees. They have certain duties to carry out, but poor employee relationship can result in guards becoming officious and assuming powers which are not rightfully theirs.

Guards who are assigned to fixed posts should have some designated method of securing relief if required. Where fixed posts do not permit the guard to move at all, such as guards in watch towers, arrangements should be made so they may leave their posts at least every two hours.

A simple but effective plan of operation should be worked out for the guard force to meet every foreseeable emergency. Practice alarms (like fire drills) should be run from time to time to test the plan's effectiveness and guard force understanding. Such plans should be particularly designed to prevent a ruse at one point in the facility drawing off the guards and distracting their attention from another section of the facility where unauthorized entry may be made.

Guard instructions

General and special orders should be issued in writing covering the duties of each post and assignment. These should be carefully and clearly worded to include all necessary phases of each assignment. They should be reviewed at least monthly to be certain they are currently applicable. Periodic inspections and examinations should be conducted to determine the degree of understanding of and compliance with all orders.

A guard manual or handbook setting forth policies, organization, authority, functions, procedures, and miscellaneous operating information should be prepared and distributed to all members of larger guard forces. Each guard should be held responsible for full knowledge and understanding of its contents.

These instructions will normally cover such duties as enforcement of the pass and identification system, observation of designated perimeter barriers to prevent unauthorized entry, and other duties related to the protection program in general.

Guard qualifications

Guards should be loyal; between 21 to 55 years old; reasonably intelligent; physically qualified to perform the required duties; dependable; cooperative; and possessed of good judgment, courage, alertness, tact, self-reliance, of even temper, and the ability to maintain good performance.

Military experience is valuable to guards. Discharge papers usually show the individual's mental aptitude score on his Army General Classification Test. Generally, a score of 100 would indicate sufficient mental aptitude to perform guard duties.

Training

Each member of a guard force should be required to complete a course of basic training and, thereafter, periodic courses of in-service or advanced training. All such courses should include necessary phases of on-the-job training before initial or new assignments and appropriate supervision and follow-through afterwards. Appropriate subjects for guard training courses are: general orientation; purposes and principles of security; security as applied to the local installation; organization of the guard force; functions of the guard force; specific duties of the individual including sufficient "breaking-in" training; authority of the individual guard, with special reference to searches; guard orders, general and specific; discipline; employee and public relations; instruction in the use, safety, and maintenance of side arms; weapons qualification and firing on practice courses; self-defense; communications facilities and procedures; elementary first-aid and fire protection; operation and care of motor vehicles; report writing; riot control; traffic control; and operation and use of special equipment.

Special and advanced training for selected guards and guard supervisors should be required at all in-

stallations where guard force duties are more varied and complex.

All guards should receive training in procedures necessary for the implementation of emergency and disaster plans formulated for such facilities. Training should include periodic practice alerts and rehearsals. It should include coordination with outside agencies which may be called upon in the event of emergencies beyond the capabilities of local security forces. This may involve civil law enforcement agencies or mutual aid groups composed of teams from other companies.

Guard weapons

Guards should be armed when on duty during periods of tension or emergency. The .38 caliber revolver is in wide usage for police and guard service which makes it easy to get ammunition and to interchange weapons and parts. At key posts of critical facilities, semi-automatic weapons, riot guns, and other emergency weapons may be provided. Such weapons and ammunition should be available at strategic points, properly controlled, and maintained in operating condition for emergency use. All members of the guard force should be legally authorized to carry firearms in the performance of official duties and in the areas where such duties are performed. If guards are armed, the question of bonding should be thoroughly explored by the employer. Guards may be deputized by local police departments to make arrests, if necessary, in the vicinity of the facility.

Guard uniforms and equipment

Guards should wear a uniform when on duty. All guards should be equipped with a flashlight, police whistle, notebook, and billy, in addition to side arms.

Communications

Adequate communications are essential to the operation of the guard force during normal periods and especially in the event of an emergency. The type and comprehensiveness of a communications system will vary considerably depending on the importance, sensitivity, size, location, etc., of a facility.

Supervision

Supervision of a guard force is necessary to assure effectiveness. The morale and efficiency of the individual guard is largely dependent upon the quality of his supervision.

Supervision is required whether the guard force is contracted or directly employed. Especially with contract guards, the quality of performance will depend upon the quality demanded.

At facilities where guard forces of several men per shift are engaged, full-time personal supervision is needed. The ratio of supervisory personnel to guards at larger facilities and elsewhere, should not exceed 1 to 12. Supervisors should (1) inspect each guard under their supervision before he reports to duty each shift and give any necessary special instructions or orders, and (2) contact each guard post or patrol personally at least once per shift to determine that personnel and the system in general are functioning properly.

Various means and devices may be utilized as supplements to personal supervision, or in the case of small facilities or remote areas, as substitutes for personal supervision as a means of assuring that necessary areas are patrolled and that other functions are performed. These include: (1) Recorded tour systems, under which guards record their patrols or presence at strategic points throughout an installation by use of portable watch clocks, central watch clock stations, or other similar devices. These systems provide an "after the fact" type of supervision. (2) Supervisory tour systems by which a signal is transmitted to a manned central headquarters at the time the tour station is visited. These are useful at the most vital facilities to supplement personal supervision or at facilities with small guard forces, to supplant personal supervision. They provide instantaneous supervision of the guard, plus a means of detecting interference with his normal activities and initiating an investigation or other action.

All guards should be required to report regularly to headquarters by usual means of communication.

Records of tours and reports to headquarters should be carefully checked. Failure on the part of a guard to record a visit at a designated station or to report to headquarters as required, or other deviations from established reporting procedures should be immediately investigated.

Use of other security elements

The efficiency and over-all effectiveness of the guard force will be increased by such measures as the most effective location of barriers, adequate protective lighting, properly designed guard shelters, use of protective alarm devices where practical, adequate communication facilities, appropriate emergency procedures, etc. These measures, used properly, will help to keep the size of the guard force to a minimum.

Location of guard posts

All guard posts, foot patrols, and guard shelters should be located in the darkened areas behind the

protective lighting screen. Consideration may be given to providing at least one guard post located at some high point within each vital area. This post should be provided with a high-powered rifle or similar weapon, a manually operated searchlight, and protection from small arms fire.

Guard shelters

Guard shelters should be designed to provide temporary protection from severe weather. The design should include space for one guard only; facilities such as heat, ventilation, storage space for essential guard accessories, and lighting which will not expose the guard; good visibility in all directions; windows which can be opened and used as gun ports; and provision for adding barricades such as concrete slabs to make the shelter bullet-resistant when necessary. Guard shelters should be painted to render them inconspicuous.

Limitations of guard functions

Guards should have no fire-fighting or other duties. Such emergencies offer an excellent diversion to cover the entrance of a saboteur. Consequently, during such times, guards should be more than normally alert in the performance of their guard duties. It cannot be too strongly emphasized that guards are intended for guard duties and should not be given other functions.

Auxiliary guards

The fastest way to upgrade the security of a facility in an emergency is to increase the guard force. Therefore, a reserve force of auxiliary guards should be selected, organized and trained so that they can be called to duty on short notice. They should be selected from among operating and maintenance employees and should be trained and equipped as the regular guards. They should be so selected that, with a minimum of overtime payment, their duties can be covered by others on each shift. Such auxiliaries should participate in drills so that their ability to provide needed protection is proven.

Union affiliation of guards

Labor laws permit guard forces to be excluded from bargaining units composed of production and maintenance workers. Guards may have their own union, or be non-union. Management should ensure that guards are not represented by production unions since protection of vital facilities must be as unaffected as possible by labor disputes.

Restricted areas

Establishment

Segregation or compartmentation may be accomplished by establishing restricted areas. Restricted areas are established after determining: critical areas, facilities, and portions of facilities; which individuals require access to these critical areas to perform their normal functions; the type of information that should be protected; the location of individuals requiring this type of information; the degree to which the establishment will unreasonably hinder or delay personnel or operations; the possibility of regrouping individuals and facilities or portions of facilities into one clearly defined area; and the possibility of using existing or parts of existing fences, barriers, protective alarms, protective lighting, etc., to provide adequate security.

The following basic security measures are required for all restricted areas: a clearly defined perimeter barrier, a personnel identification and control system, all points of access or egress guarded or under automatic alarm protection, consideration of protective lighting, security and administrative arrangements for determining the need for access and the method of approval for access to the area, and escort procedures.

Access control

When it becomes ncessary to establish restricted areas, a system controlling access to them is required.

The control system employed should provide a means of identifying people authorized to enter, help control admission of personnel, help control egress of personnel, and provide a visible means of easily recognizing any limitations to access within restricted areas.

Identification and control arrangements should not only help prevent unauthorized entry but should also take into consideration the efficiency of facility operations. They should be workable, understandable, and as simple as possible and at the same time effective.

PASS AND BADGE SYSTEM. Small areas employing not over 30 persons per shift who know each other and have a low rate of turnover may be controlled by personal recognition. Where the area is large or where the number of employees is more than the guard or supervisor can personally recognize, a personal identification system is essential. The most practicable means is an authorized pass or badge.

Where a pass or badge is used, it should be of "tamperproof" construction. (In general, metal-rimmed or plastic-envelope devices are not con-

sidered tamperproof.) Laminated or embossed passes and badges meet this requirement when they incorporate the following features: (1) A distinctive and intricate background design which is difficult to reproduce by normal photo-copying. (2) A clear photograph, at least 1 inch in its smallest dimension, and a legible serial number. Where both passes and badges are employed, the photographs should be made from the same negative. Individuals should be re-photographed when necessary to reflect any significant physical changes in facial appearance and, in any event, not less frequently than every 5 years. (3) Inks or dyes on some part of the face of the device which are so affected by heat or erasure that it would be necessary to relaminate or alter the device. (4) Additional information on the pass to identify the person to whom it is issued, usually including name, signature, and thumb print. (5) Where applicable, code denoting area for which a badge is valid. (6) Signature (or facsimile) of validating official. (7) Sturdy in construction. (8) Resistant to fumes inherent in the industry. (9) Some secret characteristic known only to management.

It is recognized that practically any badge or pass can be altered or reproduced by determined individuals sufficiently skilled in printing, engraving, and photography. However, badges and passes made in accordance with the above are sufficiently difficult to alter or reproduce to be acceptable as a deterrent. Additional protection against forged credentials may be afforded by exchange systems and by exercising rigid control and accountability over the valid media.

Badge manufacturers can supply information concerning special materials which make the counterfeiting of badges extremely difficult.

EMPLOYEE IDENTIFICATION AND CONTROL SYSTEM. Arrangements to identify and control employees at a facility should include: (1) Designation of the various restricted areas involved. (2) Description of the various identification media involved and the authorization and limitations placed upon the wearer. (3) Mechanics of identification at times of entering and leaving each restricted area, as applied to both employees and visitors, including off-shift hours. (4) Details of where, when, and how badges shall be worn. (5) Procedures to be followed in case identification media are lost or damaged. (6) Procedures to recover employee badges on termination of employment. (7) A procedure to reissue new identification media when 1 per cent have been lost or unaccounted for.

VISITOR IDENTIFICATION AND CONTROL SYSTEM. For the purpose of this manual, the term "visitors," in addition to its normal connotation, is defined as including employees and others who require infrequent access to a restricted area or to whom permanent employee-type identification for such area has not been issued.

The primary responsibility for the control of visitors to and within restricted areas rests with the official directly responsible for the facility.

Arrangements to identify and control visitors should include: (1) Positive method to establish the authority for admission of visitors, as well as any limitations relative to access. (2) Positive identification of visitors at the facility or restricted area (to be visited) by means of personal recognition, visitor permit, or other identifying credentials. Employee to be visited should be contacted to ascertain validity of visit. (3) Visitor registration forms and records which list identity of visitor, time and duration of visit, and other pertinent control data. (4) Visitor passes—numbered serially and indicating bearer's name, area or areas to which access is authorized, escort requirements if any, time limit for which issued, and signature (or facsimile) and title of validating official. (5) Procedures which will insure supporting personal identification in addition to a check of visitor badges or passes at restricted area entrances. (6) Escorts for visitors who, even though conspicuously identified, could acquire information for which they are not authorized. (7) Controls to recover visitor passes or badges on expiration, or when no longer required.

APPLICATION. To be effective, it is essential in an impersonal identification system that guards at control points carefully compare each badge to its wearer and, where a badge-exchange arrangement is utilized, that guards make a three-way comparison of the badge, the pass, and the individual. Close administrative supervision and follow-up of personnel charged with checking identification media are necessary to keep an identification system from becoming careless and ineffective.

Make-up and issue of identification media should be carefully controlled to minimize the possibility of counterfeiting or theft, to insure return and destruction upon termination of employment, and to promptly invalidate lost, mutilated, or defective badges. Badges should be recorded and controlled by rigid accountability procedures. As an operating practice, a lost badge should be replaced by a new one of different number or otherwise different from

the one lost so that the lost badge may be effectively invalidated.

Badges should be of such design and appearance as will permit guards and employees quickly and positively to recognize the authorizations and limitations applicable to the wearers.

Contractors' employees performing work in a restricted area should be provided with and be required to wear a distinctive badge.

Safeguarding classified security matter

Classified security matter includes information, data, documents, material, products, etc., which must be safeguarded in the interest of national security. Security matter should not be confused with personnel records, high-level company decisions, unpatented processes, etc., which are given a confidential classification by management for purely administrative reasons.

A responsible government agency assigns the appropriate security classification. Federal Statutes, Executive Orders, etc., govern the procedures for safeguarding classified security matters. These procedures are basically the same as have been in effect in the various branches of the Federal Government for many years.

References: Industrial Security Manual for Safeguarding Classified Matter, Department of Defense, Munitions Board, December 13, 1951; and Executive Order 10290, September 24, 1951, "Prescribing regulations establishing minimum standards for the classifictaion, transmission, and handling, by department and agencies of the Executive Branch, of official information which requires safeguarding in the interest of the security of the United States."

Physical facilities for security

In analyzing the need for type and extent of the security measures required at a facility, the following factors, among others, should be considered: (1) Classification of information, data, activities, and strategic value of matter located therein. (2) Importance of the facility to continued production or service operations. (In evaluating this factor, alternate facilities which could be utilized in an emergency and stockpiles of materials produced by the facility under consideration should be analyzed.) (3) Vulnerability of vital equipment or materials to damage or theft. (4) Location, size, and arrangement of the facility, and numbers of employees involved. (5) Need for integrating adequate security measures with operating requirements, and other local considerations. (6) Probable duration of operations. (7) Possible or probable expansion, retrenchment, or other changes in operations. (8) Cost of alternate methods of providing adequate protection.

After analysis and evaluation of these and other pertinent considerations, a program should be designed in accordance with measures set forth below.

Fences and other anti-personnel barriers

Fences and other anti-personnel barriers are the physical media by which restricted areas are physically defined for protection and control.

The fundamental purpose of physical barriers is to keep unauthorized persons from entering security areas by: (1) Defining the perimeter of security areas. (2) Creating a physical and psychological deterrent to innocent entry or to persons attempting or contemplating unauthorized entry of security areas. (3) Delaying intrusion into security areas, thus making more likely the detection and apprehension of intruders by guard forces. (4) Facilitating effective and economical utilization of guard forces. In addition, physical barriers serve the purpose of directing the flow of personnel and vehicles through designated portals in a manner which permits efficient operation of the personnel identification and control system.

There are two general types of physical barriers: natural and structural. Natural barriers include rivers, seas, cliffs, canyons, or other terrain difficult to traverse. Structural barriers are man-made devices such as fences, walls, floors, roofs, grills, bars, road blocks, or other structures which deter penetration. Physical barriers will delay but will not stop a determined intruder. Therefore, such barriers can be made more fully effective if augmented by guard personnel.

Physical barriers which are as manproof as economically feasible should be established around all restricted areas. The type of barrier used should be determined after a study of local conditions. In evaluating the respective merits of chain-link fencing and other types of barriers, consideration should be given to the better visibility provided by a chain-link fence and thus the probability of earlier detection by area guards of external approach.

In establishing physical barriers, special consideration must be given so that operating efficiency will not be sacrificed through lack of planning and essential barriers will not be sacrificed for operating expediency.

In some instances, the temporary nature of the security interest makes the construction of costly

physical barriers impractical and unjustifiable. In such cases, the security interest must be protected by other means such as additional guard forces, patrols, and other compensating protective measures.

In cases of extreme criticality and vulnerability of a facility, it may be desirable to establish two lines of physical barriers at the perimeter. Such barriers should be separated by not less than 15 feet and not more than 150 feet.

The outer boundaries of a facility should be fenced or posted as is appropriate to establish the legal boundary. If a fence is used, a secondary type such as two or more strands of barbed wire with "No Entry" signs attached will suffice. This definitely defines the perimeter, provides a buffer zone, facilitates control, and makes accidental intrusion unlikely.

Clear zones on both sides of the perimeter barrier of the restricted area should be maintained in order to provide an unobstructed view of the barrier and the adjacent ground and should be kept cleared of vegetation, equipment, or other objects which would offer cover or assistance to someone seeking unauthorized entry. Chemical weed-killers and defoliants will control vegetation along the barrier.

An interior road should be provided along the barrier around large areas to facilitate patrols.

In establishing any perimeter barrier, due consideration must be given to providing emergency entrances and exits in case of fire.

Water approaches to restricted areas present special security problems. Such areas should be defined by appropriate signs, buoys, booms, etc. Boat patrols may be required at some installations. In inclement weather, such patrols cannot provide an adequate degree of protection and must be supplemented by other means such as foot patrols.

Where fences are utilized for the physcial barriers of restricted areas, they should be:

(1) Chain-link design of not larger than 2-inch square mesh of No. 9 gage or heavier wire (American wire gage) with twisted and barbed selvage top and bottom. Plastic- or aluminum-coated fence should be used in maritime locations.

(2) Eight feet high topped with 3 strands of barbed wire 1 foot high, making a total of 9 feet. Where 6-foot fences have been installed, extra care should be taken to avoid objects assisting climbers. Frequency of guard patrol may be increased.

(3) Drawn taut and securely fastened to rigid metal posts set in concrete with additional bracing as necessary at corners and terminals. Braces must be on interior side of fence.

(4) Extended within 2 inches of firm ground. In some areas, fencing should extend below ground to compensate for sandy or shifting soils. Culverts, troughs, etc., should be provided where necessary to permit carry-off of excessive surface drainage and small streams. Any opening larger than 96 square inches should be provided with a physical barrier equivalent in protective capabilities to those of the perimeter barrier.

(5) As straight as practicable, with due consideration to terrain features and building layout, and located 50 to 150 feet from the site, building, or object of protection. Generally, the smaller the area the more effectively it can be observed during fog and other inclement weather, thereby affording maximum protection with a minimum of guard personnel.

(6) Arranged so that there is at least 20 feet of clearance between perimeter barriers and exterior structures, parking areas, or other natural or cultural features which would offer concealment or assistance to unauthorized access of the area protected. Where this is not possible because of property lines or the location of a facility or adjacent structures, perimeter barriers should be increased in height or otherwise designed to compensate.

(7) Where walls, floors, or roofs serve as barriers, they should be of such construction and so arranged as to provide uniform protection equivalent to that provided by chain-link fencing as specified. Windows and other openings in perimeters of restricted areas in any of the following categories should be protected by securely fastened bars, grilles, or equivalent structural means: openings less than 18 feet above uncontrolled ground, roofs, ledges, etc.; openings less than 14 feet directly or diagonally opposite uncontrolled windows in other walls, fire escapes, roofs, etc.; and openings less than 3 feet from uncontrolled openings in the same wall.

Gates or doors in perimeters of restricted areas should be limited to the number necessary for efficient and safe operation of the facility. Gates and doors not under guard observation or alarm protection should be of such material and installation as will provide protection equivalent to the perimeter barriers of which they are a part. Gates which are seldom used should be secured by a welded chain or bar.

All means of entry not covered by the above (sewers, air ducts, tunnels, etc.) which have a minimum dimension of greater than 6 inches and a cross-section area of 96 square inches or more should have barriers equivalent in protective capabilities to that provided by the perimeter barriers.

Fences and gates require maintenance. A periodic inspection should be made to determine the condition of wire, locks, posts, etc., and to discover washouts, digging, climbing aids, etc.

Protective lighting

The need for protective lighting depends on many considerations such as: (1) The military policy toward blackouts and dimouts. (2) The location of the facility. (3) The size, type, and character of the facility. (4) The advantages afforded which may result in a reduction of the number of guards required. (5) The advantages protective lighting affords in unguarded, isolated areas by facilitating observation from highways, water approaches, etc., by local law enforcement officials, the general public, and periodic car patrols. (6) The availability of protective lighting materials and equipment.

Some individuals contend that protective lighting pinpoints critical and vulnerable areas and thus aids a saboteur. However, a trained and properly supervised saboteur usually is familiar with details of the critical and vulnerable area before any attempt at sabotage is made.

Generally, protective lighting is inexpensive to maintain and may reduce the necessity for additional guards or provide present guards with protection by reducing the advantages of cover and surprise to a determined saboteur.

Protective lighting, as a part of the security system against sabotage, espionage, or theft of critical materials, would be required only for restricted areas. This does not preclude the use of normal industrial lighting to help prevent theft of valuable property or for other reasons such as safety.

There are four types of protective lighting systems: (1) *Continuous lighting* is the most common protective lighting system. It consists of a series of fixed luminaries arranged to continuously flood a given area with light during hours of darkness. (2) *Stand-by lighting* is a system wherein the luminaries are not continuously lighted but instead are either automatically or manually turned on at such times as suspicious activity is detected or surmised by guards or alarm systems. (3) *Movable lighting systems* consist of manually operated, movable searchlights which may be either continuously lighted during hours of darkness or lighted only as needed. These systems will normally be used to supplement either (1) or (2) above. (4) *Emergency lighting systems* may duplicate any or all of the above systems. Their use is limited to times of power failure or other emergencies which render the normal system inoperative.

Appropriate protective lighting should be employed at all pedestrian and vehicle entrances to restricted areas of all facilities where guards or other personnel are engaged to check identification.

Protective lighting should not be used as a psychological deterrent only. It should be used only where the restricted area perimeter line is under continuous or periodic guard observation, not less frequently than hourly.

Protective lighting may be unnecessary where the restricted area perimeter line is protected by an appropriate central station alarm system.

Those restricted areas located in municipalities or totally within buildings, where dependable street lighting or other functional lighting serves the purpose of protective lighting, should not require an independent protective lighting system.

Protective lighting may be desirable for those sensitive areas or structures located within the perimeter of restricted areas which are under specific guard observation. Such areas or structures include underwharf areas, vital buildings, storage areas, and vulnerable control points in communication, power, and water distribution systems.

Under certain circumstances, restricted areas may constitute an extremely attractive target to enemy forces and for that reason have been located and are operated in a manner to attract a minimum of attention. Such areas may be provided with a protective lighting system which is used only in the event of local emergencies or suspicious activity in or near the area. Normally these areas would be guarded in darkness, and so they should also have an alarm system to overcome this handicap.

Restricted areas which are sufficiently important to require manned guard towers, whether occupied continuously or intermittently, should be provided with a movable luminary or searchlight system with a light located on each guard tower.

All restricted areas provided with protective lighting should also have an emergency lighting system and a secondary source of power provided by generator equipment or batteries located within the restricted area. The stand-by power source should be adequate to sustain the protective lighting of all vital areas and structures and should be arranged to go into operation automatically in the event the primary power fails. The restricted area should further have generator or battery-powered portable and/or stationary lights at key control points for guards to use in case of a complete failure which renders even the secondary power supply ineffective.

The differences in building arrangements, terrain, atmospheric conditions, and other factors make

necessary the design of each lighting system to meet the conditions peculiar to each restricted area. Additional information on protective lighting may be obtained from the American Standards Association.

At fixed luminary installations: (1) The cone of illumination from luminaries should be directed downward and away from the structure or area protected and away from the guard personnel assigned to such protection, insofar as possible. The lighting should be so arranged as to create a minimum of shadows and a minimum of glare in the eyes of guard personnel. (2) Luminaries for perimeter fence lighting in restricted areas should be located a sufficient distance within the protected areas and above the fence so that the light pattern on the ground will include an area on both the inside and outside of the fence. Generally, the light band should illuminate the restricted area barrier and extend as deep as possible into the approach area. Adjacent waterways, highways, railroads, residences, etc., may limit the depth of the light band.

Movable luminaries located on guard towers should be so installed that they may be focused in all directions in which the guard is expected to render protective observation. This normally will be a full 360 degrees. Further, they should be located in a manner which permits the guard to operate the light without increasing his exposure and without deserting his communication facilities or emergency weapons. The intensity of illumination for protective lighting for fence or other anti-personnel barriers should meet these requirements:

Location	*Foot candles on horizontal at ground level*
Perimeter of restricted area	0.2
Entrances (vehicular and pedestrian)	1.5
Sensitive inner structures or areas ...	0.2

The power supply circuit should be so arranged that failure of any one lamp will not darken a long section of a restricted area perimeter line or a major segment of a critical or vulnerable position. Connections should be such that normal interruptions caused by overloads, industrial accidents, and building or brush fires will not interrupt the protective system. In addition, restricted areas should have feeder lines and transformers located underground, or sufficiently inside the perimeter in the case of overhead wiring, so as to minimize the possibility of sabotage or vandalism of feed lines from outside the perimeter barrier.

Protective alarm systems

Protective alarm systems provide an electrical and mechanical means of detecting and announcing the danger of intrusion into a restricted area or a facility or its components. They are utilized to accomplish one or more of the following purposes: (1) To permit more economical and efficient use of manpower by substituting mobile responding guard units for larger numbers of fixed guards or patrols. (2) To take the place of other necessary elements of physical security which cannot be used because of building layout, safety regulations, operating requirements, appearance, cost, or other reasons. (3) To provide additional controls at vital areas as insurance against human or mechanical failure.

Generally, it may be stated that there are two types of alarm systems: (1) A central station alarm system—in which the operation of electrical protection circuits and devices are automatically signaled to a central station which has trained guards and operators in attendance at all times. The central station monitors the signal end of the alarm system, responds to the signal, and supervises the functioning of the system. (2) A local alarm system—in which the protective circuits and devices are connected to a visual and/or audible signal element which is located at or in the immediate vicinity of the protected facility or component, and which is responded to by guard personnel in the immediate vicinity.

The variety of alarm equipment on the market to meet various requirements is based on three elements required in all alarm systems:

(1) A detection device or series of such devices. Most common among these are:

(a) Foils, wires, screens, and traps which are damaged or disturbed by penetration. (Usually used for protection of doors, windows, ducts, and non-substantial walls or partitions, but can be specially designed for open areas.)

(b) Photoelectric systems, whereby interruption of a virtually invisible beam of light is detected.

(c) Electronic system whereby entrance of an intruder into the field of the system is detected.

(d) Acoustic devices which detect sound and vibration.

(e) Thermal detectors, actuated by exceeding a predetermined temperature limit or rate of rise.

(2) Electrical or electronic circuits for transmitting signals from the protected area to the signal apparatus. Radio transmission is available.

(3) An alarm or signal apparatus which will an-

nounce and identify by audible or visual means any activity which the system is designed to detect.

Closed circuit television to observe activity from a different and remote location is an additional feature of some systems.

The Underwriters' Laboratories, Inc., has established Grade A and Grade B classifications for both central station and local alarm systems. Details of requirements for each type and grade of alarm system are set forth in Underwriters' Laboratories, Inc., publications "Standard for central station burglar alarm systems," "Standard for local burglar alarm systems," and "Standard for installation, classification, and certification of burglar alarm systems."

To determine whether the use of alarms in a protective program for a restricted area or facility is advisable, the following criteria should assist:

(1) The critical importance and vulnerability of certain restricted areas or facilities requires the additional control and insurance against human or mechanical failure which is provided by alarm systems. In this group are:

(a) Restricted areas or facilities which, because of a concentration of vital components, materials, or data, are attractive, high-priority targets for sabotage, theft, espionage, or other criminal acts.

(b) Critical processes and process controls.

(c) Very important restricted areas or facilities where it is desirable to have admission controlled by both guards and operational employees, or where it is desirable for operators to deny access to guards.

(2) In certain cases due to restrictions imposed by location, layout, or construction, alarms are necessary to take the place of the more usual protective elements such as fences, lighting, patrols, etc. Included in this group are:

(a) Restricted areas or facilities which, because of proximity to adjacent structures, activities, or property lines, require the use of alarms in lieu of physical barriers to limited or exclusion areas.

(b) Restricted areas or facilities which are difficult or impossible to guard effectively due to terrain conditions, personnel hazards, or atmospheric conditions and where other types of protection are not effective or practicable.

(c) Restricted areas or facilities or their components which are small or remote requiring more than safe and lock protection but not justifying a full-time guard.

(3) Alarm systems, because of their cost, are justified only where their use results in a commensurate reduction or replacement of other necessary protective elements without loss of protective effectiveness. The objective in most instances is to reduce the number of guards otherwise required. In determining the advisability of substituting alarms for other protective elements, a careful comparison of relative costs is essential. This should include consideration of the initial cost of the system as well as recurring service and maintenance charges. It should be remembered that all electronic and acoustic systems are subject to false alarms. This problem should be reviewed with the installation engineer in advance.

To afford the required degree of protection and be acceptable as a protective unit, alarm installations should meet the following requirements: (1) The system should be so designed that the interval of time between the detection of activity and the achievement of the objective of such activity is sufficient to permit the application of necessary countermeasures. (2) Central station systems should be specified for all locations where guards are not continually in the immediate vicinity to pick up a local alarm signal and make adequate response. (3) All systems should meet the Underwriters' Laboratories standards for equipment and installation.

Protective alarm systems are designed to augment the guard force, not replace it.

The advice of a competent engineer from a reputable firm dealing in protective devices and signal alarms should be obtained when considering protective alarm protection.

Fire protection

Fire is the single greatest destroyer of property. A substantial fire risk is inherent in practically all forms of the petroleum and gas industries. Even in World War II, when tremendous emphasis was placed on keeping systems or facilities operating, fire did tremendous damage.

Most fires and explosions are preventable. The major reasons why fire prevention programs are not fully exploited in all facilities are probably the following: Personal fire experience is too thinly spread to have much educational value, and fire protection in any system or facility starts with the conviction that production or service capacity is worth more than insurance dollars. Fire protection buys *time* that dollars cannot buy.

The advice of an expert on fire protection should be sought if an expert in this field is not already a part of the facility staff.

In general, however, interruptions in production or service and destruction from fire can be prevented through good housekeeping, division of values, ade-

quate physical barriers to prevent spread of fire, elimination of fire causes, ample fire first-aid, and manual and automatic fire control and extinguishing equipment where products or process materials are combustible. In addition, the organization of a system or facility fire brigade, the establishment of a fire alarm service, and the assurance of thoroughly reliable and adequate water supply are essential.

Real fire protection starts with a survey of the system or facility and with realistic solutions of the so-called "fire problems." A fire problem is a hypothetical fire that starts under adverse conditions in time and place within the system or facility. The question is how can it be stopped before it gets out of hand. The solution of such a problem is not theory or guesswork but the application of expert knowledge to a particular task.

The fire hazards created by normal production or service methods are increased in time of alert or actual hostilities by risks arising out of the national defense emergency:

(1) The pressure to get out more work creates conditions that breed fires and make them spread. Taking chances with critical systems and facilities is not only bad business judgment but bad defense planning.

(2) Fire has always been the favorite tool of the saboteur. Time-delay ignition devices give him a chance to escape. The destruction that follows hides his tracks. In addition to starting a fire in a vulnerable spot, the saboteur may effectively sabotage fire prevention devices. The saboteur counts on the weaknesses of the system or facility fire protection measures for his success. Managers of a critical system or facility must assume that the system or facility may be a target for sabotage and must realize that advice is needed from experts in fire protection. Fire protection measures visualized by the average system or facility operator will not suffice. It is not that the saboteur is smarter than the average system or facility operator, but in such a case the saboteur is a specialist working against an amateur.

(3) Fire protection planning must also take cognizance of the additional threat created by the possibility of direct enemy action.

No campaign of fire protection may succeed without the complete cooperation of all system and facility employees. Fire protection needs the help of every workman in the system or facility. The idea must be sold and interest maintained. One absolute requisite of employee participation is constant and free contact between all employees and the fire protection force.

Fire will be the immediate major threat to survivors of a nuclear explosion. Information concerning the fire-fighting function follows:

THE FIRE CHIEF. Where no full-time plant fire department exists, the emergency plant 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 (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 nonshift 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 advance planning has determined 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 flammable 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 petroleum 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:

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 manufacturing areas. Dispersion makes it less vulnerable and 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.

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. Care should be taken that the type of foam available is suitable for the flammable material involved. Foams which are suitable for oil fires may not be suitable for petrochemicals such as alcohols or ketones.

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 p.s.i. pumping from draft.

Operation. Responsibility for the operation of fire line pumps should be definitely assigned. Some pumps on the fire line should have gasoline or diesel 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, separately located, and stored in portable containers because vehicle movement may be blocked by debris.

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 gasoline or diesel 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. 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 reignited, causing an explosion more serious than the original fire. An exception to this rule applies only when extinguishing the fire will allow quick access to a control valve for shutting off the gas.

Damage control

The first step in damage control is to develop emergency shut-down procedures for those installations which cannot simply be abandoned without serious results. Many process units used in the petroleum industry would be seriously damaged if not destroyed by being left unattended, and, if subjected to any degree of blast while on-stream, would be much more seriously damaged than if shut down at the time.

Therefore, each plant manager should study his process units and develop standing instructions as to emergency shut-down, and should obtain volunteer crews to accomplish the shut-down steps. This goes for refinery units including power houses, com-

pressor stations, natural gasoline plants, chemical plants, etc.

Fire hazard in storage terminals and crude systems can be reduced by an emergency procedure of closing valves and stopping pumps.

Emergency plans should be so formulated that there is a clear allocation of responsibility to each of the 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.

One person, the emergency plant control coordinator, should be in full charge of all emergency protective activities. He should be a member of management so 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.

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, coordinating their training and providing their equipment. Each chief should have a carefully selected deputy.

Coordination of the 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 in and out of 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.

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.

The emergency plant 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.

Safety

In addition to the humanitarian aspect, injuries to personnel result in serious delays in production, destroy morale, and are expensive in time, money, and manpower. The magnitude of the accident problem has demanded aggressive organized effort. Accident prevention authorities, such as the National Safety Council and compensation insurers, have vigorously promoted programs to control and reduce personal injuries.

Accident prevention work is essentially a simple and understandable procedure. Most accidental injuries result from two causes: the lack of effective administration of the safety program and the violation of commonly adopted safe practice rules, and exposure to mechanical or physical hazards.

Accordingly, accident prevention is designed to eliminate or reduce exposure from these two hazards through employee indoctrination and physical safeguards.

Accident prevention is a well-organized and active force in the petroleum industry. Working through the American Petroleum Institute, the industry's safety engineers and supervisors have prepared guides to safe practices in numerous occupations. These recommended guides are available as API Accident Prevention Manuals:

- No. 1—Cleaning petroleum storage tanks—Section A, Crude oil and unfinished products tanks
- Bulletin 2016—Cleaning tanks used for gasoline or similar low-flash products
- No. 5—Service station safety
- No. 6—Safe practices in well-pulling operations
- No. 8—Safe practices in bulk-plant operations
- No. 10—Safe practices in drilling operations
- No. 13—Cleaning mobile tanks for the transportation of flammable liquids (Section A—Tank vehicles)
- Bulletin 2007—Safe maintenance practices in refineries

Maintenance of an adequate safety program should become a primary activity of each business.

All systems and facilities which have not already done so should expand their safety program to include: (1) An effective safety organization under existing conditions and the conditions that may reasonably be expected during an emergency or disaster. (2) An intensive education program to establish safe employee working habits and safety thinking. (3) Intensive supervision of personnel, premises, processes, and production. (4) Disciplinary control of unsafe working practices of employees. (5) Maximum use of proper protective equipment and clothing. (6) Special provision for guarding against physical and mechanical exposures. (7) Adequate first aid and medical facilities. (8) Accident records sufficient to evaluate the effectiveness of the program and the progress made. (9) More frequent inspections.

If both management and employees work wholeheartedly together in the system or facility safety program, the results will be clearly apparent in the reduction of personal injury and the consequent increase in production.

Radiological protection and defense

Buildings should be sealed as rapidly as possible after attack to prevent the entry of radioactive dust. Intact doors and windows should be shut, broken windows boarded over, and ventilating systems shut off unless equipped with proper filters.

Decontamination poses two major complications: (1) It does not neutralize the radioactivity, but only transfers it to another place. (2) 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 otherwise to 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, 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 locating isolated pieces of highly radioactive debris. They should have audible as well as visible 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 not all be destroyed by a burst. Monitors should operate in pairs for protection.*

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.

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 distinctive in color and visible at night.

Miscellaneous considerations

MOTOR VECHICLE CONTROL. Normally, employees and visitors should not be permitted to park their automobiles within the restricted area. If it is found impractical for all cars to be parked outside of the restricted area, then only employees should be allowed to park within the enclosure. In case of interior restricted area parking, the parking area should be located away from important processes and separately fenced in such a manner that occupants of automobiles must pass through a pedestrian gate before entering the facility.

A definite system should be adopted to limit and control the movement of trucks and other goods conveyances into and out of the facility area. Insofar as possible, loading and unloading platforms should be located outside restricted areas.

All trucks and conveyances should be required to enter a restricted area through a service gate manned by guards. Truck drivers and helpers, and vehicle

* Fundamentals of Radiological Defense, Navpers 10870, Bureau of Naval Personnel, U.S. Government Printing Office, Washington, D. C. 20401.

contents should be carefully examined. The guard check at truck entrances should cover both incoming and outgoing vehicles and should include:

(1) Appropriate entries on truck register, including: registration of truck, name of truck owner, signatures of driver and helper, description of load, and date and time of entrance and departure.

(2) Identification of driver and helper, including proof of affiliation with company owning truck or conveyance.

(3) Check of vehicle operators' licenses of driver and helper.

(4) Examination of truck or other conveyance for detection of explosives, incendiary devices, or other hazardous items.

Identification badges should be issued to truck drivers and helpers who have been properly identified and registered. Such badges should permit only limited access to specific loading and unloading areas.

Incoming trucks should be kept to that minimum which is essential for the efficient operation of the facilities, and vehicle escorts should be provided if vehicles are permitted access to restricted areas.

Guards should strictly supervise loading and unloading operations to be sure that unauthorized goods or people do not enter or leave the facility via trucks or other conveyances.

RAILROAD CAR CONTROL. The movement of railroad cars into and out of restricted areas should be so supervised as to prevent the entry of unauthorized personnel or goods.

All railroad entrances to restricted areas should be controlled by locked gates when not in use and should be under guard supervision when either unlocked or opened for passage of railroad cars.

Insofar as possible, loading and unloading railroad car platforms should be located outside restricted areas.

Before entry to the restricted area, all railroad cars should be inspected to prevent unauthorized persons entering the area. The contents of railroad cars should be carefully inspected to prevent the conveyance into the restricted area of explosives or incendiary devices.

Where railroad cooperation can be secured and it does not materially interfere with efficient facility operation, railroad switching should be confined to daylight hours.

The number of seals on all sealed railroad cars should be checked immediately upon arrival at the facility against the list of seal numbers which should be requested from the shipper. Broken seals or seal numbers not in accordance with advice from the shipper warrant immediate investigation.

CONTAINER CONTROL. Management of each facility should consider establishing a definite system for the control of containers entering or leaving the restricted area. Such control should be desirable as an effective means of minimizing property loss and preventing possible sabotage or espionage.

No containers or packages, except lunch boxes, should be permitted to be brought into the restricted area by employees or others unless they are opened by members of the guard force and thoroughly inspected. Employee lunch boxes should be spot checked from time to time.

As a means of safeguarding essential vital information and production tools and equipment, it is desirable to inspect all packages outgoing from a restricted area. In lieu of 100% inspection, frequent unannounced spot checks should be considered.

Empty containers to be filled with products important to the national defense effort should be inspected immediately before filling.

Employees in container storage areas should be so educated that it is second nature for them, when coming on shift, to look for any signs of disturbance or tampering with containers.

POWER SUPPLY. Protection of on-the-premises power generating stations and substations should be provided commensurate with their importance to the continued production of facilities' critical items and their susceptibility to sabotage.

The facilities' own power generating units should be established as part of a restricted area or a separate restricted area, and only authorized personnel should be permitted access.

Substations on the facility premises which supply all of the electric energy used at the facility, whether owned by the facility or by a public utility company, should also be included in a restricted area or a separate restricted area and only accessible to authorized personnel. When a facility's production is dependent on electric energy, the substations are more critical than individual transformers and should receive protection equivalent to their importance. If the substation is off-site, it should be given protection equal to that of restricted areas within the facility's perimeter. If the off-site substation is owned by a public utility company, officials of that company should be encouraged to protect the substation properly.

The electric power supply should be ample to

provide for a reasonable reserve beyond full load demands.

TRANSFORMER INSTALLATIONS. Because of their importance to continuity of production or service, transformer installations are especially vulnerable to sabotage. Their protection should be carefully studied, and all reasonable methods of protection applied.

Transformer installations located on a facility's premises should be included in restricted areas or in separate restricted areas, should be fenced or screened and openings therein locked, and should be included in the itinerary of the guard patrol. Buildings in which transformers are located should be locked, and only authorized personnel permitted entry.

Transformer enclosures should be lighted at night unless complete darkness is required to prevent detection of location.

Transformers are vulnerable to rifle fire and, when practicable and required, should be adequately shielded by sandbagging or other protective measures. When enclosed in buildings or shielded, adequate ventilation should be provided.

Transformer enclosures should be kept free of debris, weeds, and grass. Large transformers should be equipped with electric alarm pressure and temperature gauges to give warning of an injurious condition within the transformer.

Oil-filled transformers within buildings should be in safe locations, and should be well drained and provided with curbed pits for the collection of oil. Such transformer sites should be provided with a foam fire extinguisher or other suitable means of sufficient capacity to control an oil fire originating there. Oil-filled transformers outside should be at sufficient distances from buildings to minimize damage to the facility in the event of fire. Patrols should be on the alert for oil losses resulting from rifle fire and other causes.

Transformers located on the poles near the property lines or within the facility area should be under guard surveillance and their security checked by frequent patrols. If possible, these transformers should be relocated away from the perimeter.

Transformers having a non-combustible dielectric may be located at almost any convenient place within the facility property provided they are protected against malicious tampering and mechanical injury.

ELECTRIC POWER TRANSMISSION. Power lines, power terminals, and power switches and controls located within the facility perimeter should be provided adequate protection to assure the continuous and uninterrupted flow of electric energy to protect the plant.

The main switches, power terminals, and power controls should be located in restricted areas and included in the same protection plans as transformers and electric power substations since they are usually at the same location. Secondary switches located in operating areas should be readily accessible so that power can be shut off in an emergency.

Distribution lines should be properly insulated and supported. When justified economically, underground power lines should be employed.

COMMUNICATION CENTERS AND EQUIPMENT. The communication center and allied communication equipment which is essential to the operation of the facility should be adequately protected to prevent sabotage and tampering.

The telephone exchange, the teletype and/or the short-wave radio room, and such other control centers as the guard headquarters should be restricted areas. When not individually manned, each such installation should be securely locked or guarded. Dispersion within the facility of the several means of communication, such as teletype, telephone switchboard, public address system, and short-wave radio may be advisable to afford adequate protection.

Frequently, communication installation areas are used, individually or jointly, as an emergency control center; as such, they are of the most vital importance and should be adequately protected. When an emergency control station is established in a shelter area for use in case of air attack, its communication equipment should be a restricted area and protected against tampering or unauthorized entry.

VALVES, REGULATORS, AND REGULATION STATIONS. Main control valves, regulation stations, and regulators should be protected to prevent tampering and unauthorized manipulation, but should be accessible to authorized personnel for emergency use.

Main shut-off and control valve locations should be restricted areas and enclosed. If exposed, such valves should be locked in the position required for normal operations. Manholes and pits containing control valves should be secured by covers locked in place. Equipment or control valves with electric signaling devices should be considered as an additional means of protection against tampering.

Gas valves and regulators should be within a noncombustible locked enclosure, adequately ventilated to prevent accumulation of gas, and provided with vapor-proof or explosion-proof electric equipment. Gas valves used infrequently should be locked

or sealed. Guards should check the enclosures and the valves and regulators periodically.

WATER TANKS AND PUMPS. Water tanks, water pumps, and allied equipment essential to the operation and production of the facility should be afforded adequate protection to prevent curtailment, contamination, or damage of the water supply.

Water tanks, pumping stations, pumps, and equipment should be within restricted areas and checked frequently by guards. Water tanks, pumps, and equipment preferably should have an electric supervision system to check water supply and indicate water failure.

Elevated water tanks should be fenced and the gates locked. Roof tanks should be secured by screening or locked roof doors.

Pumping equipment located in a building or room should be protected by having all doors and windows of the enclosure adequately barred or locked. Pumps should have more than a single source of power for their operation.

GAS AND OIL FIELDS. Regular field operating personnel should be armed, to the extent that is necessary to obtain reasonable protection by this means.

Printed lists and locations of fire-fighting and emergency equipment should be compiled for each operating area. Each operator should have one of these lists.

A directory should be maintained of trained oil and gas well fire-fighters, equipment, and other essential information.

Insofar as practical, each operating company should keep its fire-fighting equipment, repair equipment, and supplies in or near these critical producing areas.

Where no operating personnel are present in the oil fields at night, special arrangements should be made for the prompt provision of fire-fighters when needed.

Special protective committees should be formed from among the operators in a given critical area. These committees should aim at maximum protection on a mutually cooperative basis. They should maintain close contact with the military and other organizations which may be concerned in the event of a critical situation.

Emergency protective equipment (such as stream chokes installed with casing packer, which, in case of sabotage of "Christmas trees," would shut off flow of wells) should be used insofar as they are economically and physically practical. Some special situations may warrant the sandbagging of "Christmas trees" or similar protective measures such as area patrols or armed guards.

TRANSPORTATION OF PETROLEUM PRODUCTS. Petroleum products shipped in bulk through intermediate distribution points should be tested in laboratories at such points in their handling which will most effectively detect malicious contamination.

As is the general practice in the industry, the interior of all containers, tank cars, and ship's tanks should be inspected before loading.

All loaded railroad cars should be sealed with numbered car seals and the consignee advised of the seal numbers so that he can verify them on arrival of shipment. On especially vital shipments by rail, the cooperation of the railroads should be solicited to give special protection to the shipment en route.

Tank wagons used for handling products in the category dealt with here should be protected against tampering when they are garaged. Their tanks should be inspected before filling and sealed after filling. The tank driver should never be permitted to leave a full tank wagon until its complete load has been delivered.

To the extent that it is possible, product-carrying trucks should be sealed and the seals checked at destination. Reloading of full truck loads en route should not be permitted.

The tanks on tankers and barges containing product in the category dealt with here should be sealed after filling and the seals checked before unloading.

Emergency plans covering units which operate trucks and other vehicles should contain instructions to motor vehicle drivers as to what to do in case of an alert. This should be correlated with the Interstate Commerce Commission and with local Civil Defense regulations.* In the absence of other instructions, drivers should be told to do as follows:

> *Alert:* If unloading, continue to unload; if in transit loaded, seek a parking place away from crowded centers and preferably in a sheltered location such as beside a high wall or under a stone bridge; if in transit empty, seek a parking place near a public shelter; if loading, discontinue loading and move truck away from loading rack to a sheltered location.
>
> *Take cover:* Park vehicle so as not to block traffic and proceed to nearest public shelter, leaving keys in glove compartment.

Deep water vessels will act in an emergency in accordance with pre-issued instructions by the U. S. Maritime Agency.* Companies operating such ships should become familiar with all such instructions.

Inland waterway vessels should be given instructions consistent with Coast Guard and Interstate

* See Bibliography—transportation.

Commerce Commission orders. In the absence of instructions to the contrary, these vessels should tie up or anchor in an emergency, and the crews should, if possible, seek shelter ashore.

Communications

All accomplishments of a modern petroleum organization are dependent on prompt 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. The study of past emergencies shows that authoritative direction of operating personnel is an absolute essential.

In many emergencies, the damage to communication facilities can be severe. It is essential, therefore, that each petroleum and gas facility make advance preparations to assure the minimum essential communications at all levels. Present-day petroleum and gas operations involve continuous flow; therefore, full coordination of production, transportation (pipeline, marine, and trucking), refining, and distribution is essential. Each phase depends on the others. Distances between operations may vary from a few miles to several hundred miles. Communications over a variety of distances require a separate study for each range.

There are several general categories of basic communication requirements to continue or reinstate petroleum and gas operations. Facilities must be provided: (1) between local management and local defense agencies for security of personnel and plant and for alerting civilians; (2) between top company management and field points (producing, transporting, refining, and distribution) for company regrouping and assay of conditions; (3) between petroleum officials and the Emergency Petroleum and Gas Administration (EPGA) regional, State and local headquarters; (4) between petroleum companies' various headquarters to coordinate facilities and supplies to insure delivery of the vital petroleum products; and (5) between the various operating groups on a local basis to use men and material most efficiently.

Communications requirements

The basic problem in the design of emergency communications is to determine the networks needed, based on a study of the points requiring an exchange of information and the types of information to be exchanged. In making emergency plans for the various segments, each company should give specific consideration to its communication needs under postulated emergency conditions. This should be done jointly by the affected operating personnel and the appropriate communication personnel. An analysis of this question must be made by each company, but the following guide may assist in understanding the problem. No attempt will be made here to present a technical analysis of communications media, nor will a complete presentation of Government regulations be provided.

Initial warning system

A warning system, obviously, is essential. On August 5, 1963, the Federal Communications Commission (FCC) instituted a new Emergency Broadcasting System (EBS) to supply emergency information to the public. Certain designated radio broadcasting stations in each area will be selected by the FCC to transmit this information to the public. The EBS warning system consists of two 5-second alarm tones each broken by 5 seconds of silence, then a 15-second, 1000-cycle, steady state tone, followed by a notification message. Before and after the transmission of the alarm tones from the broadcasting station, notification is given as to whether the warning is a test or an actual emergency. A regular broadcast radio receiver may be used to obtain this information; it is suggested, however, that receivers be obtained which have been modified to detect this special coding automatically.

The Emergency Radio Broadcast receiver should be located where responsible people are on duty; they should have appropriate responsibility for disseminating this information to the predetermined points within the company. Appropriate locations for such radio receivers might be the telephone switchboard, the security office, or other place with 24-hour attendance. In all cases, a continuing power source is needed.

Alternative general Civil Defense alerting alarms include the following: (1) AT&T "bell and light" (an expensive and complicated system tied to the local offices). (2) Air raid sirens. (3) Special communications radio installed on Civil Defense frequencies by special arrangement.

In any case, it is advisable to have a broadcast radio receiver available to receive official procedural instructions.

Company communication with EPGA

The EPGA has set up eight geographical regions covering the U.S.; regional headquarters are not necessarily near any of the headquarters of the major petroleum and gas companies. State and

local EPGA offices will be established in addition. Under emergency conditions, the officials of petroleum companies may be widely dispersed. Common carrier telephone facilities, as long as available, are anticipated to be used for essential communications between each company and the EPGA regional, State or local offices. *All* relevant EPGA headquarters telephone numbers should be listed at all company points where management could assemble and from which communications to and from EPGA would be conducted. Such lists should provide instructions covering the order in which attempts to reach the various EPGA offices should be made in the most probable emergency conditions. Where alternate means of communication with EPGA offices have been established, instructions should be provided for selecting and utilizing them.

Intra-company management communication

Provision must be made to coordinate top management direction with widely separated operating units and to coordinate local communications within a plant.

To meet these intra-company needs, advance inventory of existing common carrier communication facilities should be made. Advance arrangements must be made with the communications common carrier concerning adequate priority of service, priority of restoration of service, and diversity of routing. Inventory of company-owned communication facilities should include wireline, VHF, UHF, microwave, maintenance supplies, emergency power facilities, and available communications manpower. From these inventories it will be possible to assign specific communications facilities to serve each specific communication requirement under postulated emergency conditions.

Communication with employees

Employees should be advised of emergency planning through group meetings, 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. Manuals should be prepared at each facility to describe the organization and procedures of groups assigned to first aid, rescue, policing, fire-fighting, etc. Persons who are assigned to such groups should carry personal wallet-size instruction cards bearing their specific emergency instructions.

Instruction plaques may be mounted on vehicle instrument panels. Some mobile equipment can be assigned to specific functions, such as demolition work, others to radio communication posts, others to transport of fire-fighting personnel, etc. Plastic instrument panel tabs may carry the vehicle's emergency duty assignment and its activating alarm. All these measures must be used for communicating in advance of trouble; there is little value in waiting until an emergency has started before turning pages in emergency manuals.

At the time of emergency, channels may include public address systems (with pre-recorded tapes), local radio broadcast, printed bulletins, telephone or messenger relays, etc. The main point is to be sure that there is one standard channel and one or more back-up channels for reaching employees, whether on or off the job.

Inter-company communication

Under emergency conditions, several petroleum companies may be directed by EPGA to coordinate their activities. Local requirements can be handled by common carrier telephone, privately owned wireline, or radio facilities. Communications over longer distances may be handled by common carrier or petroleum microwave.

Communication facilities

Emergency communication planning should anticipate that many normal communication channels will not be available and that demands will be much more critical than under normal conditions. It is imperative, therefore, that in planning its emergency operations each company provide appropriate sections in its manual covering emergency communication. The following points should be delineated clearly:

(1) Federal, State, and other regulations to go into effect during an emergency in which the use of normal communication facilities is limited.

(2) Company-assigned communication priorities and control—who among company personnel shall be users of emergency communication facilities and under what conditions.

(3) Priorities for individual department service for use of emergency communication facilities. Also included should be priority responsibility of the installation and servicing of the communication equipment itself.

(4) A simple listing of communication problems likely to arise which might interfere with the use of regularly available and emergency communication facilities. Alternative procedures to be followed in each case should be described.

Telephone

Wherever available, telephone should be relied upon to the maximum extent consistent with equipment damage and needs of higher priority users.

A number of safeguards have been incorporated in common carrier telephone facilities. In spite of these, the possibility of severe damage cannot be ignored in realistic planning. The priority of essential leased wire lines must be established with the common carriers in advance; otherwise there is no priority of restoration. Central office trunks will be under line-load control, a system under which all non-priority trunks may be simultaneously disconnected at the telephone company exchange offices in an emergency. Under this line-load control program, each company should establish its priority with the local telephone company.

In the case of leased lines between points relatively widely spaced, arrangements should be made with the telephone company to provide diversity of routing. Thus, if one route is inoperative because of damage in a given area, an alternate route bypassing that area may escape damage.

In each of these cases, a realistic advance appraisal of the importance of the various communication needs must be made, and protection in terms of priority, diversity, etc. must reasonably conform to the importance.

At the moment, the priority which a petroleum or gas company can legitimately claim appears to be quite low. The Office of Oil and Gas is studying the problem of securing a more useful priority.

Plans should be established to include priority of restoration of privately owned wirelines. This will involve technical men and material.

Telegraph

Plans for use of teleprinter machines and circuits follow essentially the same pattern as that described above for telephone.

Radio

At the present time, FCC and OEP regulations provide for continued use of regularly licensed radio in the Petroleum Radio Service by the petroleum licensee. A statement of broad policy issued by OEP on January 13, 1963, says: "It is the policy of the U. S. Government to view the operation of privately operated communication systems (leased or wholly owned) necessary to the continuing supply of petroleum products, gas, electricity, railroad, and highway transportation service, as essential during periods of national emergency. There is no plan for the Government to take over these communication systems in the event of a national emergency."

As dependable as microwave normally is, it is highly vulnerable to damage and is largely dependent on continued availability of commercial electric power. Microwave systems, some of which are quite extensive, do not lend themselves readily to interconnection to other systems without advance planing, expensive construction, and proper licensing and operating agreements.

UHF and VHF radio units are perhaps the most valuable short-range communication devices available to the industry. Their versatility and the highly reliable mobile power supplies contribute much to this fact. Continued operation of base stations is largely contingent on continued availability of commercial power. Communication in VHF systems is essentially limited to line of sight, although limited extension of range may be obtained by careful engineering of antenna locations and equipment choice. VHF relay systems can be utilized but, of necessity, have low traffic volume capability.

The Petroleum Radio Service currently has available a few HF radio channels whose range of communication is limited to distances up to a few hundred miles, under some conditions.

Should there be extensive sabotage or nuclear bombing, resulting in the loss of all normal long-range communication systems, a serious problem would result. For a period of a few hours to many days, the area might be sufficiently occupied with its local problems so that long-distance communications might not be essential. But ultimately they would be essential, probably long before the normal channels could be repaired. Under these conditions, additional HF channels in spite of the short-comings would be vitally needed.

At the present time, use of the high-frequency part of the spectrum is restricted to communication with overseas or foreign points. Further consideration will be given to this situation in order that communication facilities of the petroleum and gas industries are adequately equipped.

Other facilities

Present national plans call for discontinuance of Citizens and Radio Amateur Radio Services in national emergencies. Local Civil Defense and other radio systems which may go into operation after development of an emergency are aimed at the protection and welfare of civilian population and, therefore, should not be considered as available for petroleum operations.

Rehabilitation

Casualty and damage assessment

If a disaster occurs, a prerequisite to rehabilitation is the identification of surviving resources of manpower, inventory, facilities, and material.

Information on this subject must be gathered throughout the entire organization and communicated as far as possible in two directions: one toward company headquarters, and the other toward the Emergency Petroleum and Gas Administration and Civil Defense officials.

A company emergency plan should make it clear that in a disaster situation, all managers are expected to evaluate the surviving capabilities of their organizations and communicate the information as above. Information should include the ability of the organization to carry out its normal function, manpower and material requirements necessary to continue or resume operations, the degree to which assistance could be offered to other units, and the amount of product or crude oil in inventory.

Emergency operating centers and alternate headquarters with continuously up-dated records on manpower, supply and distribution, etc., are recommended.

During any practice exercise, casualty and damage assessment should be high on a list of functions to be rehearsed.

Planning for post-disaster operations

Pre-disaster planning for rehabilitation may include the following considerations:

New sources of equipment

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 among widely separated service organizations.

Equipment 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, such equipment might be cannibalized right off a distant plant installation—assuming other damage there is preventing its use. Furthermore, equipment of identical or similar size and capacity may exist on several different units in the same plant. Last, 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.

Stored replacements

Scarcity of equipment, not process materials, probably would be the potential bottleneck in petroleum and gas industry recovery. Where practicable, consideration should be given to storing replacements in locations considered to be low in vulnerability.

Emergency replacement of equipment

Specifications and prints of special equipment would be needed in ordering replacements for disaster losses. Such data should be protected by the records protection program described earlier in this manual.

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 well protected from blast and fire, and the dispersed duplicate records need show only the maximum-minimum quotas established for each item. However, where critical spare parts are specially obtained for disaster purposes, duplicate records should be current and complete.

Light and power

Continuity of light and power is essential. If normal sources fail, power may be provided on a plant-wide basis, 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 substitue equipment. Permanent installation of auxiliary diesel-electric generators should be explored.

Crude oil and product inventories

In a period of extreme international tension, it may be desirable for the petroleum and gas industries to build up inventories. However, individual companies should await recommendations from the EPGA.

Determining process flexibility

It is difficult to predict which operating equipment will best survive 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 crude oils and

other feed stocks which would be available in the post-attack period, advance plans for detailed post-attack process operations are impracticable.

Pipelines

European experience indicates that little can be done to protect pipelines.* However, important control valves, regulators, manifolds, and pumphouses should be shielded. In Europe, spare piping parts were stored, and flexible hose was used to some extent in bridging damaged sections. "Hot tap" machines could be utilized to permit making line connections without interrupting vital transmission, and stocks of special alloy valves and pipe could be accumulated.

Natural gas pipeline companies should plan advance procedures for by-passing bombed out areas so as not to disrupt service elsewhere. The installation of automatic valves at strategic locations is worth considering. Use of such valves could (1) avoid the drainage which would result if sectionalizing valves had to be visited and operated manually, (2) facilitate the bypassing of damaged compressor stations, and (3) prevent the flow of gas into damaged stations.

* "Damage Control in Wartime," Business Policy Study No. 53, National Industrial Conference Board, Inc., 247 Park Avenue, New York, New York 10017.

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Emergency control of commercial transportation should be based on continuing reliance on the in-being capability of transportation industries functioning under their own managements and with minimum government direction among essential shippers, consignees, and the transportation services. State and local transportation services, including urban transit, private automobiles, local and intrastate busses and trucking, and small air and water craft will be under State and local regulatory control, subject to such general guidelines as may be established by Federal authority. State and local authorities will also facilitate and, as necessary, implement and enforce Federal control measures with respect to commercial air and rail transportation, warehousing and port facilities, and interstate motor and waterway transportation services.

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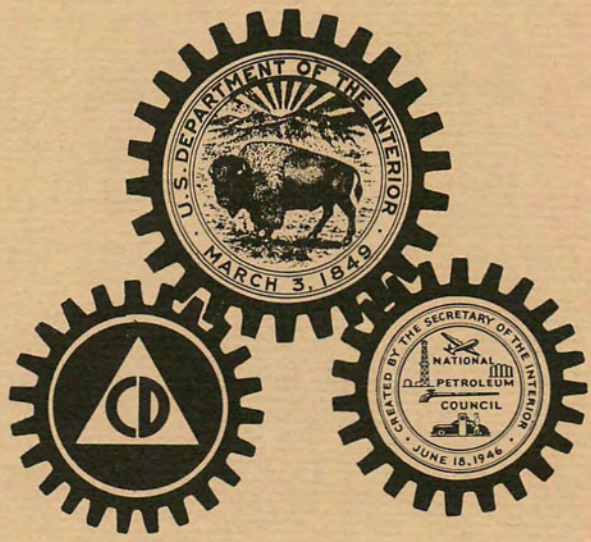

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