

# Federal Aviation Agency



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AIRPORTS

EFFECTIVE :

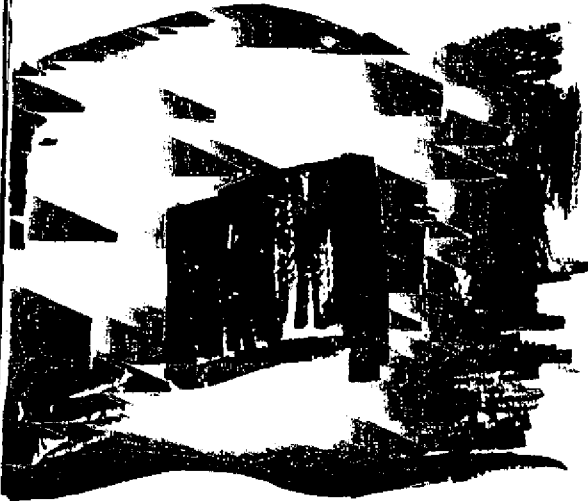
7/22/65

**SUBJECT : NOW'S THE TIME TO PREPARE FOR HURRICANES**

1. **PURPOSE.** This advisory circular transmits to the civil aviation industry a copy of a report, "Now's the Time to Prepare for Hurricanes," dated August 1956, from Factory Management and Maintenance.
2. **GENERAL.** The attached report provides valuable information to industry on organizing for effective action for the reduction of vulnerability to hurricanes, floods, windstorms, and other disasters. While this report is not directly addressed to aviation disaster control problems, its guidance is nonetheless germane, and its use by the civil airport industry would prove most effective in the reduction of damage to hangars, terminals, maintenance facilities, warehouses, and the safety and health of the aviation public.
3. **DISTRIBUTION.** Due to the limited supply of the attached report, only the original distribution of this advisory circular will be made, and additional copies will not be available.

  
Cole Morrow, Director  
Airports Service

Attachment



*Don't wait until the storm flags fly.  
That will be too late. Better act now to  
protect your plant and your people  
against high winds and flood.  
Here's what you can do today  
to prevent damage and  
save lives.*

*Now's the time  
to prepare for*

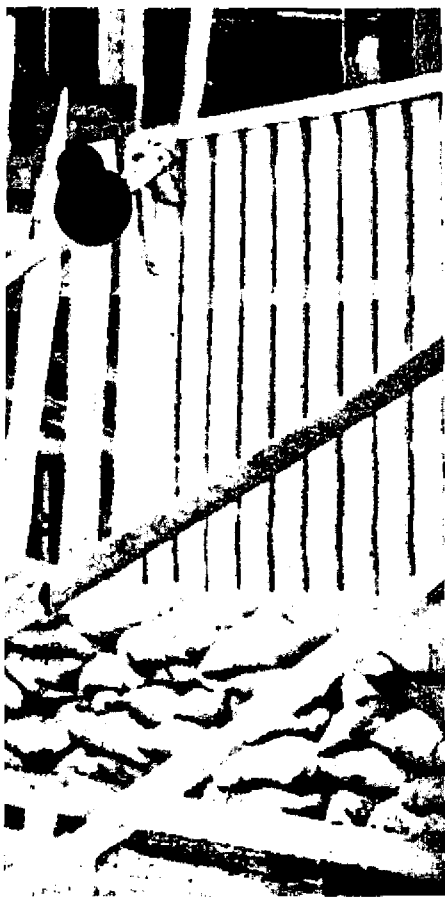
# HURRICANES



By organizing now for action before the storm hits...



...you may save your plant from this kind of beating!



United Press



Business Week

*Now's the time  
to prepare for*

# HURRICANES

*You can't afford to wait till the sky gets black and the trees start shaking. There's a lot you can do now that will save time, worry, trouble—maybe lives—when the storm does come. Here's help in helping yourself.*

**HAS THE HEAVILY** industrialized eastern third of the United States become a "hurricane alley" as a result of changing weather conditions? Some experts say *yes*. Others say *no*, but admit an unusual number of hurricanes have been striking farther north in recent years.

But the "hurricane problems" for industry are not limited to the August-September storms-from-the-tropics referred to as hurricanes. You'll find winds of hurricane-force (75 mph. or more) in almost every section of the U. S. You'll find wind-driven, extra-heavy rains (a typical hurricane symptom) in most areas. In fact, more than half the states, containing more than two-thirds of the industry, were hit by wind-and-rain storms of disaster proportions in the single year of 1955. (That does not include tornados—they're a special breed of cat. See page 86.)

Protecting plants during major wind-and-rain storms and getting them back into operation afterward can look like (and sometimes can be) an impossible task—unless you've done a lot of preparing for such an emergency. But remember this: Although you can and should make many preparations weeks and even months in advance, you can't maintain 100% disaster readiness at all times without hamstringing your business. So don't ever expect to.

The seven sections of this report will help you make plans *now* to see that necessary activities are carried out before, during, and after a storm. But the report can only help. It won't give you specific answers to each of the specific questions you should raise about your plant.

The experience of FACTORY's staff both as operating executives of plants that have lived through hurricane and flood, and as reporters of similar recent disasters, leads to this conclusion:

**The important task for operating executives is not "finding answers," but anticipating the problems they will be likely to face.** Once the problems are known, answers can be found with relative ease.

This report, therefore, is not a list of *answers*. It's a list of *problems* you may face, depending on local conditions. Use it as a means of suggesting to yourself and to your fellow plant operating men the problems to which you will need answers. Then work out the answers that best apply—and do it while you have time, not when the storm warnings go up.

*Turn the page*

# WHAT YOU CAN DO TODAY TO KEEP



## GENERAL PLANNING

No matter what the job may be, the basic problem is deciding (1) *what* has to be done, and (2) *who* is going to do it. The job of preparing for a hurricane is no exception. Let's start with the *who*:

**Organizing for effective action**—It's too late, when the storm is actually on its way, to decide which people are going to do which jobs. Now is the time to decide exactly what steps you'll take before the storm and during the storm, and to assign the responsibility for each of those steps.

All the rest of this article is devoted to suggesting jobs that have to be attended to. They encompass all phases of plant operation—buildings, electric power, plant services, employee relations, health, safety, and so on. And these basic problems are the same in any size plant, in any industry. The major difference in handling these problems lies in the number of men that are assigned to a specific responsibility.

In small plants, one man may have to be responsible for several functions; a big plant might establish a separate "task force" with different personnel for each of the major areas of responsibility.

No matter how the total responsibility is divvied up, all the responsibilities and jobs suggested below will have to be shouldered by someone. And they should be pre-assigned to avoid costly oversights and wasteful duplication.

To nail assignments down, draw an emergency organization chart. Keep it simple. Distribute it widely throughout the company and to interested municipal and disaster personnel. Then no one will have to rely on memory. Everyone will know where responsibilities lie and where to look for authority. Identify on the chart the executives authorized to put the emergency organization into effect.

**Decision-making**—In any emergency, there will be a lot of decisions—some costly and far-reaching—that will have to be made in a hurry. So, in setting up an emergency organization, make clear the amount of

extra authority that will be delegated to plant operating people and supervisors during emergencies. Be sure to spread enough authority among enough people so that there will be no needless delays even when a particular man can't be found.

**Organizing "what to do"**—Because of the mass of unfamiliar jobs that have to be done before, during, and after a storm, there's only one way to make sure they all get done: *Put 'em in writing*. Simple checklists will be a lifesaver. Best plan is probably to make up a separate checklist for each major area of responsibility (for each task force).

## CONTROLLING EMERGENCY OPERATIONS

The "headquarters operation" of the emergency organization will have special problems of its own—problems that are foreign to normal plant functions or responsibilities. Here are suggestions for making up your first checklist:

**Emergency headquarters**—You need a place from which you can direct operations during the storm. Should be safest possible location with a sure means of escape if the going gets too rough. You'll have to assume loss of power and tele-

phone, so be sure there's a gas-powered generator hooked up, and if possible a two-way radio set-up for communication.

**Stock there now:** copies of emergency organization chart, all job checklists, copies of assignments for men on duty, duplicate prints of locations of key utilities and fire-fighting equipment, lists of emergency equipment and its location. Plus a during-the-storm log (discussed later) small enough to jam in your pocket if you have to leave.

**Temporary offices**—If your plant takes a real beating, you may not be able to set up shop back in the plant right away. So locate now several alternate places

for temporary offices. (A small company might use an executive's house.) Pick one as "most likely." Shouldn't be too Spartan—you may have to do a lot of business from there. **Principal needs:** file space, a few desks, telephone service. Find out now how fast you can have a phone installed, consider having one put in now. Ask the phone company to assign your regular number to this office if the plant is put out of action.

Store emergency kits of routine office supplies at

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### TORNADOS AREN'T LIKE OTHER WINDSTORMS

They are highly localized—usually 200 yards to one mile wide on a path 5 to 50 miles long. They move at high speed—often 30 to 75 mph. And the winds in a tornado are too violent to have ever been recorded accurately—but they are estimated at 400 to more than 500 mph.

You seldom get more than a few minutes' warning of a tornado. Best you can do is tie in with the Weather Bureau's tornado warning service. (You'll be put on the alert whenever general conditions are the type that are likely to spawn tornados.) Then put a watcher on the roof of your plant. If he sees the characteristic black funnel forming or moving toward your plant, get all personnel under cover—fast.

You'll have a couple of minutes at most, probably only seconds. Don't waste time trying to save anything other than human life. Take to the basement if you have one. At least get away from windows, get under something that will protect you from flying debris.

There is literally nothing you can do beforehand to protect a plant from a tornado as you can from other winds. But "standby" disaster plans, made well in advance, will speed the clean-up.

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# HURRICANE DAMAGE DOWN

your temporary office location, and have a good petty cash fund somewhere that's quickly accessible—the banks may be put out of action, too.

**Information center**—In advance, decide on some spot (away from both the plant and the temporary office—you want to minimize traffic and milling around at both those places) where employees can go to deliver reports, check in for assignment, inquire about schedules, pay, and the like. Then make sure every employee knows where it is. Just in case normal communications are down for a long time, assign several employees to report there for messenger service when the emergency organization goes into effect.

*Key activity for the center:* Compiling a list of temporary addresses and phone numbers of all employees, and keeping it up to date.

**Transportation and traffic control**—After the storm (and perhaps even during it) you'll be plagued with sightseers. Find out *now* what roads you have authority to block, and assign personnel with necessary ropes and barriers to block them when the emergency arises. In areas that are obviously dangerous (because of weakened structures, washouts, and so on) assign someone to establish blocks whether you have the technical authority or not—until the police can take over. Keep the traffic-control personnel constantly advised as to what types of passes are to be honored.

**Passes**—During disasters in past years, perhaps no phase of emergency activity has been so badly handled as issuance of passes. Looks simple. But, unless you've preplanned and coordinated with local groups, you'll find that other plants, police, fire department, Civil Defense, and others will all have issued different passes. And will refuse to honor anyone else's—at a time when it's impossible to find anyone with the authority to issue a pass. Start now, and spend whatever time is necessary, to find out how you can avoid this kind of snafu. (First point of contact: in most areas, the local Civil Defense office.) Otherwise, if storm is a bad one, you'll have a nightmare situation with key employees locked out, urgent messages delayed, deliveries of essential supplies stopped—all without any way of receiving word on what's happened.

**Storm records**—At the very least do these two things: 1) Keep notes of decisions made and action taken in a "Storm Log," and 2) be ready to take pictures right after the storm for record. "Before" pictures will be an invaluable aid in rehabilitation work, insurance and tax claims, possible law suits.

**Building records**—Prints and records of building structure and utility lines can be lifesavers during the storm. Now's the time to collect a complete set, put 'em in a safe spot (the emergency headquarters). If they're not up-to-date—detail the savviest guys in the company to correct them fast.

**Operating records**—Figure out which ones you simply can't afford to lose, and put one set (or a microfilm copy) in a safe place away from the plant. Move the rest to the safest spot in the plant at the last moment.

**Record salvage**—Be ready for a major salvage operation if records get rain-soaked or flooded. Locate in advance a blueprint or photographic drier that can be used for mass drying. If you anticipate flooding, lay in a supply of anti-fungus agent for the wash water.

**Purchasing**—After a storm you'll need a lot of supplies and services fast. So now's the time to stash a duplicate list of key suppliers in your emergency headquarters and temporary office location. Remember you'll be buying for fast delivery, so earmark the suppliers that are closest to you (not all too close—they may be hit, too).

**Mail**—Opening mail after a storm will seem a useless burden. But there may be a few pieces of great importance. Only way to make sure those few get to the right man is to open 'em all. Assign someone—with sufficient background—to decide which pieces to put aside for later (perhaps marking them with an A-B-C priority for later handling), which pieces to deliver.

**Employee relations**—If you're badly hit, you'll have some tough decisions to make in this area. There are some basic policies you can establish ahead of time—such as premium pay for duty during storm, pay for time not worked because of storm or storm damage, premium pay for clean-up or rehabilitation work, when and how to pay workers, pay advances or loans to workers, other assistance to employees.

**Manuals**—Many of your people will be on temporary assignment to unfamiliar work. Look over your existing manuals, see which would be useful in their present form or with slight adaptation. Then put a supply in a safe but accessible spot.

**Training**—"Crash" training of some men in emergency work may pay off. You haven't time to get fancy (and if you don't have a storm you'll have wasted your time.) Checklists may give you a hint as to what types of training, if any, might be worth while.

**In-plant publicity**—You'll need complete cooperation and understanding from employees in any major disaster. They will want to know what's cooking—and why. So use every possible channel to keep them advised of emergency plans and the part they'll be asked to play. Answer questions fully and frankly.

Remember, at the height of the emergency you may have to make unpleasant decisions, issue rough orders without taking the time to explain them. If you explain this in advance, you'll get quick compliance at a time when it's vitally important.

During and immediately after the storm, you'll be too busy (and your facilities will be too limited) to continue a major information-for-employees program. But don't try to be "cozy." Give out as much information as you can in any way that's feasible under the conditions of the moment.

**Civil Defense liaison**—In many communities the local Civil Defense Administration is prepared to function as the key community-wide coordinating agency in time of disaster. Your top disaster-planning official should make contact with CD immediately—get to

## “... *decide what to do, who's to do it*”

know the CD people, let them know him, size up the job CD is likely to do in your area, and decide to what extent you can rely on CD, to what extent you'll have to operate independently, let CD know what you're planning. In any case, don't get disgusted with it. In the 1955 New England flood, some “weak” CD areas performed superbly as the result of industrial initiative.



## BUILDINGS AND GROUNDS

One of your primary concerns will be plans to minimize damage to plant buildings, the site, and any equipment or structures on it. Here are suggestions:

### THE BUILDING ITSELF

**Roof.** Greatest single type of wind damage is lifting of roofs. *Reason:* Force is exerted not only by positive pressure of wind against roof and sidewall and under eaves, but also by negative pressure or suction on other side. Flat roofs (slope less than 30-deg.) largely escape positive pressure—but upward suction pressure on them often exceeds positive or velocity pressure

(action is similar to “airfoil lift” on a plane's wings). If a door or window blows open on the windward side, wind builds up additional pressure under the roof and against inside of leeward walls.

There are two principal areas for action:

... *Anchoring the roof* (if roof was wind-anchored when built, skip down to next heading). In most cases, anchoring consists of bolting one end of a strap, plate, or rod to the roof and the other end to outside walls (not curtain walls, of course) or to interior columns. Columns must also be bolted to foundation—they can be lifted along with the roof.

Doing an effective job of anchoring takes considerable time—often several weeks. The work can usually be done by your own maintenance people, but you'll need a competent structural engineer (from your staff or a consultant) to work out the design details.

... *Preventive maintenance.* A sound and aggressive policy of preventive maintenance can probably do more to prevent minor damage (and sometimes major damage) than any other one thing. Here are some items you'll want to be sure are in top condition:

- 1) Edging strips, gravel stops, flashing at walls, expansion joints, fasteners.
- 2) Felt membranes, tar-and-gravel or slag covering. Watch especially for bare spots, tears, or blisters; for dried-out or cracked felts on smooth-surface coverings. Large blisters or open seams call for major action.
- 3) Fastenings on eave gutters (attach to deck or beams, not roof covering) and cornices or other pro-

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## How One Industrial Community Has Prepared

Every major industrial employer in Evendale, Ohio (there are 27 of 'em), is a member of a voluntary organization to provide mutual aid in disaster.

It all started back in 1951. At that time, Evendale (an industrial suburb of Cincinnati) had no fire department, and the companies wanted to set up some sort of protection over and above what each could supply for itself. G-E might have been able to fend for itself, but the smaller companies in the community would have been in real trouble.

Sparked by Mayor Clarke McGrew and key men from G-E, a formal pact was signed in 1953, pledging all companies to mutual cooperation in the event of fire, flood, hurricane, tornado, explosion, industrial accident, or enemy attack.

The pact was carefully drawn to avoid placing any legal responsibility on the companies. It's strictly voluntary and non-binding. All activities under the pact are carefully coordinated with those of the Civil Defense Administration.

So far, there has been no disaster in Evendale to test the organization. But every company responded, made a huge success of a surprise drill last year.

Experience at Evendale would seem to indicate that there are five key points in organizing any area-wide disaster activity:

... *Work through one man at each company.* He should be someone who knows his company from A to Z. He'll be in complete charge if mutual-aid forces come to his plant. And he'll be responsible for men and equipment sent from his plant to others.

... *Enlist the aid of community authorities.* The mayor, police chief, fire marshall, and Civil Defense coordinator should all be in on the mutual aid plan. They may also assume vital roles in communication.

... *Establish a central person or agency as dispatcher.* His job will be to receive a disaster call, notify other plants. He must be sufficiently experienced to recognize equipment needs, send right men and materials to scene. The dispatcher keeps two files—one by company, listing available manpower and emergency equipment at each plant; the other by equipment, listing the companies from which each type of equipment is available.

Adequate telephone facilities for the dispatcher are obviously a *must*, and two-way radio communication is highly desirable.

jecting roof sections (remove if they cannot be anchored satisfactorily). Check for rotting of wooden deck.

4) Glazing, flashing, and bracing of skylights and monitors, penthouses, vents, signs, stacks. Pay special attention to corrosion—it means weakness.

5) Calking around doors, windows, and joints of metal-clad sidewall. Consider installation of extra bracing or framing at doors and windows to permit quick "boarding up" when storm hits. Where you have large panes of glass, provide for bracing with struts or trusses. And lash all awnings.

**Emergency materials**—You won't be able to get fast delivery just before or after a storm, so check and be sure you have adequate supplies of tarpaulins, water-proof roofing paper, asphalt, flashings, calking compound, glazing, and lumber. Be sure that lumber intended for bracing is of good quality—cracked, rotted, or beat-up boards will be weak, give way easily, and probably add to the havoc. And lay in a supply of sandbags—probably palletized.

**New construction**—If you have a building or addition under construction, it's especially vulnerable to damage, will probably require special bracing. Secure piles of lumber with steel strapping or stout rope.

**Prospect of floods**—Additional factors to consider:

... *Foundations will need protection* against undermining, especially at corners, pipe entrances, etc. Tank and loading dock foundations are a particular source of danger. Consider trying to divert water with sandbags or temporary bulkheads—maybe you can anticipate course of the water flow, work in advance.

... *Floors usually take an awful beating*; wood block floors can literally float away. You can't really get back into the plant until floors are restored, so be ready to move fast.

## for Trouble

... *Pool disaster training*. Company coordinators, plant protection men, and volunteers can be scheduled into programs with men from other plants. With each company responsible for the type of training it is best equipped to handle, the level of training can be high, at reasonable cost.

... *Each company should plan its level of cooperation in community-wide disasters*. No company in Evendale is expected to send unlimited help to others when its own plant is in peril. Which points up the one potential danger in any voluntary plan: If everyone suddenly failed to look beyond his own nose, the organization could fall apart when it's needed most. But Evendale executives feel that enlightened selfishness will prevent this if the test comes.

*About insurance*: Companies entering this type of plan should check with carriers about sending men or equipment off the premises. The idea might be vetoed. But Evendale experience indicates that most insurers see a plant as part of a complex, view a sound mutual-aid program as an improvement in risk.

... *Doorways and sill openings* can be a major source of trouble if water rises only a little against solid sidewalls. Sandbagging or channel irons at sides of frame on outside in which to drop heavy bulkhead timbers can be a big help.

... *Boiler rooms and pump houses* will be essential in post-flood clean-up. Give 'em all protection you can.

## YARD EQUIPMENT AND STRUCTURES

Trees are so obvious they get lots of attention. Move inside all loose objects such as drums, yard tools, benches, and so on. But there are other trouble sources:

**Stacks**. These are perhaps the biggest single yard problem. Certainly they should be included in your preventive maintenance program—there's very little you can do on a last-minute basis. Points to check:

... *Guy cables*. Adjust tension (normal recommendation: sag of 6 inches per 100 feet). Be sure cable clamps are secure.

... *Anchors*. Parapet walls, roof beams, wall columns, tank structures are inadequate even for light stacks. Buried timbers or steel beams might be okay for these, but big stacks need a concrete pier. Be sure anchor bolts are tight and nuts free of rust.

... *Bolts in flanged sections*. Vibration in wind can loosen 'em—they need locknuts or similar device.

Remember that the most frequent cause of collapse of metal stacks is internal corrosion at joints of upper section or at guy cable fastenings.

**Other high structures**—Water tanks or standpipes, guard towers, etc., should get the same treatment as stacks. Don't forget the flag poles.

**Lower structures**—Overhead pipelines, yard-lighting poles, horizontal tanks, etc., usually need far less protection. But a steam line you hope to keep in operation is an exception; insulation is likely to blow off.

**Yard clean-up**. Couple of general rules to remember: If any power lines are down, don't send the crew into action until you're sure power is off. If a tree, tower, etc., has been loosened and looks as though it *might* topple, don't take a chance—take it down.

(See section on materials handling equipment for yard cranes, etc., p. 90.)



## SAFETY & HEALTH

If you have enough warning, send home all people not assigned to emergency-organization jobs. Then you won't have to worry about them, and they won't have to worry about their wives, kids, and homes. And if the plant is flooded, you won't have a parking lot jammed with wrecked cars. Then make provision for the people you're keeping on.

**Food and water**—Get in extra food that can be eaten without cooking. And remember you can't expect people to work long without water. If you get your plant supply from wells, remember that loss of power



# “... biggest task is to anticipate your problems”

will be the end of the supply. Wind alone probably won't affect the city supply, but if there's any flooding, you may not be able to use it. Consider laying in a supply of containers, assigning someone to fill them if it looks as though your plant is going to be hit.

**First aid**—Men working on unfamiliar jobs (like boarding up broken windows) are liable to suffer more than a normal number of injuries. Have your supplies checked with this in mind. If you can, keep your nurse on duty—and maybe the plant doctor (though he may feel his duty is to the community as a whole).

**Playing hero**—In making emergency assignments, emphasize to the men that they are not to take unnecessary risk to repair damage at the height of the storm. Emphasize to supervisors that they should keep men away from windows if debris is flying, allow no one outside. And alert them to any real danger spots.

**Fire protection**—The danger of fire during hurricane, and particularly if flooding results, is great. Hazards include broken power lines, shorted electrical equipment, gas from broken mains, flammable liquids from tanks and broken lines, and the like. Add unusual hazards—for example, textiles that have been flooded will start to get hot from spontaneous combustion within 24 hours after the water has receded. And don't forget that your sprinkler system may be knocked out. It adds up to stringent fire precautions that should be set up in advance. *Suggestion:* Assign responsibility for cutting power, shutting off gas and other utilities as soon as they become a fire hazard. Protect chemicals and flammable materials from water. Absolutely prohibit smoking. Move tank cars to high ground. Assign someone to anticipate unusual fire hazards now. Get them on the emergency checklist.

**Guards**—You'll probably need more than the usual number, and they'll require extra supervision because of the many problems they'll meet requiring “management” decisions. Assign young men to do this job, and brief them well in advance. *Note:* If you have classified government contracts, check with the security office—a downed fence can pose major problems.



## PRODUCTION EQUIPMENT

About all you can do to protect production equipment and materials is to figure out how to keep them from getting wet, rehabilitate them if they do.

**Machine tools**—A little water, from flooding or wind-driven rain, does a lot of damage. Have tarps to cover machines near windows that break. Have enough millwrights on hand to tear down immediately any machines that do get wet. You'll need cleaning agents, rags, lube oil, rust preventive, tools, equipment manuals.

**Motors**—Need special care (see Electrical Services on facing page).

**Gages and instruments**—Shouldn't be left lying around when work force leaves. Make it one man's emergency job to round up most valuable and hard-to-replace gages (he should have a complete list of them), bring them to a safe spot.

**Materials**—Decide now what special precautions you should take to protect any easily damaged, hard-to-replace, or especially valuable materials.

## MATERIALS HANDLING EQUIPMENT

**Outdoor bridge cranes**—They'll be your major worry. Though you've got to assume the craneway will stand, precautions should be taken to anchor the bridge. If your crane did not come so equipped, consider installing one or more of the following devices:

... *Service brake.*

... *Locking bars.* Heavy, lever-operated bars attached to bridge that lock into slot on craneway girder.

... *Latches.* Hooks on trucks of bridge that engage stops at end of craneway.

... *Crane trap.* Heavy drop plates attached to bridge girder, that ride up slope and drop behind stop lug bolted to runway.

... *Chains.* Can be secured around bridge trucks and runway track (don't fasten to craneway A-frame).

... *A solid bumper* at end of craneway is a good idea.

**Emergency trick:** Run bridge up against bumper at windward end of craneway. Lower crane hook and lead it out to windward as far as it will go. Anchor it to ground.

Anchoring huge gantry cranes (that run on rails set in ground) is tough—needs expert advice. If you get caught, you can run cables out from crane sills in both directions.

**Mobile equipment**—Any handling equipment in yard should be moved inside the plant or to some other protected spot.

Thereafter, there's probably little more you can do. But do have on hand supplies for emergency maintenance in case equipment gets flooded. Include solvents, oil, grease, kerosene (for flushing engines).

**Miscellaneous**—Remember that one of your first jobs after the storm will be clearing an access road into the plant for trucks. You'll need at least one heavy truck or tractor, plus axes, saws, and the like. Remind men assigned to this job to keep well clear of fallen wires.

If you think you may need mobile equipment, find out which employees have pick-up trucks, tractors, etc. Put the list at emergency headquarters.

Assign someone to clear shipping dock after storm—to facilitate deliveries and removal of refuse.

If you anticipate major flooding, try and move tank cars and freight cars, particularly empties, from your siding. If you can't, consider filling them with water, anchoring them as tightly as possible. A floating car is a dangerous affair.



## ELECTRICAL SERVICES

**Personnel**—Just as with other maintenance activities, you'll need extra men and extra supervision. But you'll have to hand-pick them. Electrocutions are all too frequent with greenhorns on emergency electrical jobs.

**Main power supply**—A difficult question that always comes up is, when to pull the switch. You'll want to keep the power on as long as it's safe—and you can only determine that in the light of local conditions at the moment. But be sure to observe these rules:

1) If service to your plant fails as a result of a general disruption throughout the community, kill all mains coming into the plant. Then, when power is restored unexpectedly, you won't electrocute someone working on a "dead" system.

2) As soon as power fails in a portion of the plant, open the circuits to that area.

3) If you are ordered to evacuate the plant, the "last man out" should shut off the power, so it will be electrically safe to re-enter after the storm.

**Plan for rehabilitation**—Equipment may be damaged. If flooding follows, it's certain to be. To be prepared for the clean-up, do these things now:

... **Build a library** of data on renovation of damaged equipment. Most manufacturers have bulletins available on this subject. Write for 'em.

... **Who does the work**—your own crew, manufacturer, or outside repair shop? Figure it out ahead of time, so you'll know what sort of help you'll need.

... **Line up outside help**. Find out how much work each can take from you, whether they can send men to your plant, etc. After the storm, everybody will be banging on their doors, wanting the same thing.

... **Use non-toxic cleaning solvents**. If you have to use carbon tetrachloride, remember: *Its fumes can kill*. Wear masks, and ventilate well.

**Removing equipment**—Most electrical equipment has to stay put and take it. But you may be able to move out some hard-to-replace special equipment. Decide which items call for this treatment, assign the men to do the job at the last possible minute.

**Emergency equipment and supplies**—Be sure you have plenty of flashlights, batteries, portable emergency light, rags, tags, solvents, oil for transformers and filters, meggers, air blowers, wire, fuses, etc. Add to the list. On inexpensive items (especially those you can use later in normal operation), the only safe rule is: *When in doubt, buy some*.

If, by any chance, you don't have a portable generator, get one (or more).

**Storm precautions**—There will be a thousand things to do in a few hours just before a storm. Be sure you prepare a checklist. Include:

... **Incoming power lines**. Double-check to be sure routine maintenance has replaced or braced weak poles,

crossarms, nangers, and other supports. Fell any trees that might bring down wires.

... **Emergency lighting, pumping**. Make operating tests on all equipment.

... **Auxiliary equipment**. Start steam-, gas-, or diesel-driven standby generators, pumps, etc.

... **Incoming city water**. Lines leading to cooling tanks or processing equipment that discharge into sumps should be shut off.

... **Air conditioning equipment**. Shut it down to prevent short-cycling after power is restored.

... **Critical sumps**. If possible, hook up spare steam injection or gasoline-driven pumps.

... **Fire pumps**. If regular pumps are electrical, hook up standby generator or gasoline-driven pump. If no alternate power for fire pumps is available, notify the fire department of this fact at once.

**If you expect flooding**—even a small amount of it—you'll want to take these additional precautions:

... **Potheads or terminal or junction boxes** should be raised above expected flood stage or replaced with waterproof types. Applies to telephone as well as power cables.

... **Electrical equipment** should be shut down just as soon as you're sure it's going to get wet. Cooler it is, the less water will be sucked into windings.

... **Cable boxes** can be given added protection by plastering with roofing compound. They'll still leak some, but this way you can keep out a lot more dirt and debris.

... **Battery cables** should be disconnected and vent caps tightened as soon as the water starts rising.



## MAINTENANCE ACTIVITIES

**Personnel**—You'll probably want more than the normal complement of maintenance people on hand. Well ahead of time, decide which of your production people you'll assign to emergency maintenance crews. A little rush instruction on their emergency job might pay off. And be sure they know how you're going to contact them, when the storm is imminent.

**Supervision**—The special crews will require more than normal supervision. Straw bosses should be selected in advance from your leadmen, multi-skilled maintenance workers. Give these temporary supervisors a good briefing on their assignments.

**Maintenance shop**—Unless it's in a well-protected spot, establish a secondary headquarters from which to operate during and after the storm. Put here, well in advance, duplicates of key records (names, phone numbers, assignments of maintenance personnel, utility layout drawings, etc.)

Try and pick an emergency spot big enough to set up equipment and tools, in case your regular shop is flooded or badly battered.

**Hand tools**—plus shovels, rakes, and the like—will be indispensable, and next to impossible to buy after

# “... don't wait till the storm warnings go up”

the storm. Check your supply, buy replacements now; then stash 'em away in your emergency shop area. Portable power tools will be vital. And they're easily damaged. Assign someone to round them up when the emergency comes, take them to a safe spot.

**Emergency equipment**—If the maintenance department has a steam jenny, portable generator, portable sprayer, salamander, or other similar equipment, now's the time to make sure they're in working order. Then put them where they'll be accessible during the storm.

**Supplies**—If floods invade your plant, you'll have a tremendous cleaning job. And even wind-driven rain can create a real mess. So stock up on soaps, detergents, disinfectants. Fuller's earth or other adsorbents can be a lifesaver as a drying compound.

You're also likely to need drinking water containers, rust preventives, buckets, paintbrushes, rope, cable, wire, extension cords, waterproof tape, waterproof paper, greaseproof paper, wiping rags, squeegees, tarpaulins, raincoats, rubber boots. Now's the time to check your stock.

*Often forgotten:* When power goes, so do all motorized gasoline pumps. Assign someone to fill all plant vehicles. And you may want to store away emergency supplies in properly sealed cans.



## PLANT SERVICES

**Fire protection**—The danger of fire during a storm or flood is great, and you may not be able to count on outside help. A few points to remember:

... *The sprinkler system* may be broken (by roof lifting or heaving, for example). To minimize water damage, you may want to station a man at the main control valve, with instructions to close if a break occurs. (But not before—you want all the protection you can get.) And have men ready to restore the system as quickly as possible by isolating the damaged section. They'll need caps and plugs, pipe tools.

... *Sounds silly, but check the water tower* to make sure it's full.

... *Don't use fire-fighting equipment* for non-fire-fighting duty if you can possibly help it. If you must, be sure your in-plant firemen know where to locate the equipment you've borrowed for other duty.

... *Check self-contained fire-fighting equipment.* Make sure extinguishers are charged, hoses free of cracks and frozen nozzles, mobile equipment fueled.

... *If you anticipate flooding*, decide now how you can protect sprinkler pipes, risers, dry pipe valves, and the like, from floating debris. Consider mounting extension wrenches on sprinkler valves so that they can be operated even if under water. Erect markers on indicator post gate valves so you can find them if they go under.

**Utilities**—One of the first things you'll want to restore after the storm. Better assign your crack workmen to the job. If possible, have them spend some time in advance figuring shortcuts to restoring at least one pump, one compressor, one boiler to service. Other men should check all lines for breaks, making emergency repairs or bypassing damaged sections.

... *High-pressure steam.* For obvious reasons, this is a hazard whenever pipes are likely to be broken. You'll have to decide when to shut down this service. Don't wait till someone gets cooked.

**Pipelines**—Because of the hazard involved in broken lines carrying fuel gas, process gasses and chemicals, lubricants, coolants, and the like, you'll again have to consider when to shut them down. Authority to do so should be delegated in advance.

**Gas tanks**—All mountings and supports for pressure storage tanks should be checked in advance, repaired or braced if necessary. Consider filling empty or near-empty tanks with water to add stability (applies to above- and underground tanks). Assign someone to check for leakage before re-using.

**Ventilating systems**—Anchoring vent hoods, exhaust louvers, and other roof structures is tough—they may be ripped off. But consider blocking openings before the storm, at least securing louvers.

**Instruments**—Protecting plant-service instruments is important because most are fairly delicate, quite expensive. Consider how to protect the most expensive, those associated with key processes.

# INDUSTRIAL SURVIVAL PROGRAM

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## WHY?

TO SURVIVE THE EFFECTS OF ATTACK OR OTHER DISASTER.

## WHERE?

WITHIN INDUSTRIAL PLANTS, INSTITUTIONS, AND OTHER LARGE FACILITIES.

## WHO?

Emergency Planners, Civil Defense Coordinators, and Security Officials in Industry,  
—Should Do These Things In Cooperation With Local Government Officials:

## WHAT?

1. ORGANIZE AND PLAN FOR SELF-PROTECTION—by enlarging such services as communications, the plant fire brigades, medical and first-aid facilities, rescue teams, and warden, welfare, and police groups.
2. SET UP SECURITY PLANS—for protection against sabotage and espionage.
3. PROVIDE SHELTERS—by designating safe areas in existing buildings and by including protective features in the design of new construction.
4. PLAN FOR EVACUATION—including the reception and care of employees in safer areas and their return to their home communities and jobs following attack.
5. PLAN FOR CONTINUITY OF MANAGEMENT—including the selection and equipping of alternate company headquarters, the establishment of personnel succession lists, and the development of emergency financial arrangements.
6. PROTECT VITAL RECORDS AND DOCUMENTS—by duplication and storage in vaults or areas safe from attack.
7. PLAN FOR EMERGENCY REPAIR AND RESTORATION—by establishing a system for quickly assessing damage and for restoring production, including alternate arrangements for manpower, equipment, warehousing, and supply.
8. ESTABLISH INDUSTRIAL MUTUAL AID ASSOCIATIONS FOR CIVIL DEFENSE—by joining up with other neighborhood industrial plants and facilities to provide assistance to each other in the form of equipment, materials, or personnel in time of emergency and disaster.
9. DECONCENTRATE PRODUCTION—by being sure that critical items are manufactured in more than one place.
10. DISPERSE NEW INDUSTRIAL PLANTS—employ the simple military measure of using space for defense of industrial plants against attack. Industrial dispersion will also result in reducing the vulnerability of our cities to attack by making them less attractive as enemy targets.

## HOW?

See your local civil defense director. Use this kit which contains general information on civil defense, and detailed information on how to carry out civil defense planning and organization within industrial plants, hospitals, schools, office buildings, department stores, and other institutions and large facilities.

## WHEN?

Do it now—After the bombs fall it will be too late!