Chapter 6

Emergency Response, Recovery, and Training

Without a preparedness plan, such as that described in chapter 5, an emergency can quickly become chaotic. Unfortunately, no emergency will "go by the book." A good example of this is the treatment plant fire documented in the video *Planning for Emergencies* (NEWWA 1990). In this case, the system's emergency-preparedness plan had accounted for the loss of the treatment plant due to an earthquake, but not for a fire. When a welding spark started a fire, the treatment plant soon was engulfed in smoke and flames.

Although the system had to improvise an emergency response, much of the preparedness planning could be used. For example, the valves designated to isolate the plant in case of an earthquake were used in the fire emergency. Also, the system implemented a prearranged agreement with an adjacent system to provide a cross-tie source of potable water.

The following case study presents an example of a small system's emergency-preparedness response and recovery.

EMERGENCY RESPONSE AND RECOVERY

The following steps are generally recommended to be completed in order when an emergency strikes a system.

Step One: Analyze the Type and Severity of the Emergency

Rather than jumping right into action, analyze the type and severity of the emergency. The results of the analysis should provide the correct and most effective response. The analysis may also reduce the number of injuries or damage to system components.

Case Study: Hurricanes in Hawaii

There are three phases that encompass a disaster event. The first phase includes things that you do before an event. The second is the event itself. And the third phase includes things you do after the event. What you do during all three phases is very important.

Before It Happens — Preparedness

In most cases you won't know when a disaster or emergency will occur. You get called after it happens. A tree falls and takes out a power line. Someone backs into a fireplug. The power company drills one of your water mains while trying to plant a pole. These things happen every day, and we react to them with a certain degree of preparedness. A similar degree of preparedness will help you when a big disaster occurs, such as when Hurricane Iniki blew.

Common sense prepares you to handle some emergencies. That is why we stock repair clamps, pumps, emergency lighting, generators, and so forth. If you don't prepare for emergencies, you will have a disaster on your hands.

So what has this got to do with hurricanes? You should be prepared for emergencies to some degree every day; that is what I call preparedness. You should have a certain amount of emergency gear, know where you can get more, and have people that you and your crew will follow. That philosophy helps you to make decisions and helps your crews to make decisions when you're not around.

There are really two types of preparedness. The first is a general preparedness. General preparedness ensures that you have a certain amount of emergency gear on hand and that your people are trained to use it.

The second type of preparedness is specific to the impending event. It begins with a warning. You start to kick this in when the weather reports indicate that a tropical storm or a hurricane is developing and may be heading your way. When a watch is issued, we start assembling the emergency gear. We also start to discuss our specific plans. Most of the emergency gear is just ordinary equipment that we use every day and misplace every day. Where are the chain saws, the abrasive saws, the generators? Get all the trucks and equipment fueled up. Check the domestic water emergency generator. Is the emergency radio link to corporate headquarters operational? Put a generator in the repeater shack. Put it in the shack beforehand because you may not be able to drive there later.

While It's Happening

Only foolish people drive around with video cameras during the storm or go to the beach to look at the storm surge. These people only get themselves into trouble. They usually expect others to save them when they get into trouble. Get in a safe, sheltered area and stay there.

When It's Over — The Work Begins

Our instructions to our employees are for them to report to work as soon as they and their families are secure.

For us on the sugar plantation, not much is done until the next morning. During Iniki, we did make some plans on the radio, but we decided to keep off the roads and spend the time handling our own problems.

What happens after a disaster event are largely recovery activities, but before this happens a few top-priority things need to be done. One of the most important things is to get your communications system up. The second is to get the domestic water system going. The third is to get some power at key installations so that work can be done. The fourth is to assess damage and to try to prevent further damage from occurring.

At McBryde Sugar Company, radio communications are essential. It seems that nothing much gets done unless we can talk about it on the radio. We run a multichannel VHF synthesized frequency radio that allows us to talk over our repeater as well as a couple of simplex frequencies (radio to radio). The system also allows us to monitor the National Oceanic and Atmospheric Administration (NOAA) frequencies, police, county government, Kauai Electric, and anyone else operating in the VHF frequencies.

From the earlier Hurricane Iwa, we learned that off-island communications are a must during the recovery effort. Commercial telephones would not be working. Shortly after Iwa, three operators using ham radio techniques and gear found three VHF repeater sites that fulfilled certain criteria. Each of the sites would need to be company controlled and each of the sites would have to be easily accessible. The objective was to provide communications between A&B in Honolulu and its subsidiaries on Kauai and Maui. The sites selected included McBryde's existing repeater site on the south side of Kukuiolono Park, the Matson's

Case Study: Hurricanes in Hawaii (continued)

Terminal on Sand Island, and a leased site in someone's backyard in Kula. All of these sites are easily accessible, even if roads are blocked.

Recovery — Insurance

With emergency systems operating, the task of putting things back together began. Before you can fix anything you need to find out what's broke. With major damage to our hydroelectric plants at Wainiha and Kalaheo and to our Koloa factory, we began a program of equipment testing after discussions with our insurance people. We also had major damage to our coffee-processing facility, shops, warehouse areas, irrigation pumping stations, and about 30 miles of power lines. Virtually everything was broken or bent.

We formulated some plans and discussed our proposed actions with our insurance adjustors. We think that developing a good relationship and understanding with your insurance company is a critical aspect of any recovery effort. Develop a work philosophy that is mutually agreeable and follow it. Discuss any deviation before doing it. Work with the insurance company.

We initiated a program of testing all electrical gear before energizing it. If it tested bad, we set up a program to repair or replace the item with the insurance adjustor's approval. Recovery work at McBryde included the resheathing of our Wainiha Hydro building, rewinding of the two generation units and the exciters, replacing most of the meters and relays, and replacing the circuit breakers. Our Kalaheo Hydro building also required a new roof, rewinding of the generator and exciter. and rebuilding or replacement of all meters, relays, and switch gear. Insurance paid for the replacement of the transformers

The Koloa factory was extensively damaged Electrical repair work included replacement or cleaning of many of the motor control centers The mill control panels were also replaced. Many sections of roof are also being replaced.

Recovery still continues and we expect to be busy with recovery work for another year.

Cooperation With Others

The period immediately following the disaster is the period when a lot of emergencies are being handled, and all stops are being pulled to help and to get help from others. It's important to cooperate and help others because you will probably need their help in return. It's nice to drive up to a reported pipe break and find a water department crew there fixing your leak. In return, when they need a backhoe, you send one. Kauai Electric used a section of one of our circuits to feed Kalaheo. These relationships are not developed after the disaster but long before in everyday business

Source. Randall J Hee, McBryde Sugar Company, Ltd

The analysis should be based on the hazard summary and vulnerability analysis of the system. The system should first determine the status of the critical components, rather than responding to the first report of a leak in the distribution system. It may be more important to first isolate a storage tank or start power generators.

Step Two: Provide Emergency Assistance to Save Lives

The next priority is to perform those immediate actions required to save lives. For example, if flooding or an earthquake has damaged a reservoir dam and failure may be imminent, the system must work to evacuate people in the flood path. A similar situation could be the result of a chlorine leak or damage to a water tower.

Step Three: Reduce the Probability of Additional Injuries or Damage

When situations threatening immediate danger of injury or loss of life have been eliminated, repairs or temporary mitigation actions should be taken. These actions are the most critical in reducing further damage. Examples of such actions could be

Case Study: Flooding in New Jersey

Initiating Disaster Procedures

After an 11-in. (28-cm) rainfall on Friday and Saturday, Aug. 27 and 28, 1971, the Raritan-Millstone Filter Plant of the Elizabethtown Water Company, Elizabethtown, N.J., with a capacity of 150 mgd (568 ML/d) was inundated and completely inoperable.

Late Saturday afternoon, all neighboring water suppliers were contacted and arrangements were made with them for substantial water supplies during the emergency. The principal water suppliers dependent on the Elizabethtown Water Company for all or part of their water supply were contacted and asked to switch to their own supplies or to others' during the emergency. Service from the company's wells, which were not seriously affected by the flooding, were also increased as much and as soon as possible.

During the course of the night on Saturday and into Sunday, August 29, the operating and planning departments worked continuously to arrange for the help that would be needed as soon as personnel could regain access to the plant. Besides alerting the company's crews and supervisory personnel, arrangements were made during the night for (1) electrical technicians from as far away as Connecticut and Pennsylvania; (2) equipment (such as generators, bulldozers, pumps, and heaters) and operating personnel from contractors; (3) stone from a local quarry for road washouts; (4) diesel fuel to replace fuel affected by the flood; and (5) miscellaneous parts and other supplies. All were to be available as near dawn on Sunday, August 29, as possible. All other maintenance employees were sent home to rest. They would report back to work at 5:00 a.m. to complete the task ahead. By virtue of this planning, the employees were able to start work immediately when they were physically able to enter the plant at 5:00 a.m.

Also, on Saturday night, August 28, after talking with members of the State Department of Environmental Protection, the company's executives decided to recommend that all customers throughout Elizabethtown Water Company's system boil their drinking water until further notice. This determination was made as a precautionary health measure to avoid any possible problems that could arise from negative pressures in flooded areas and from the fact that the company's clearwells at the Raritan-Millstone plant were flooded.

From 8:00 p.m. on August 28, until approximately midnight, telephone calls were made to all police departments and health and sanitation officers in each community served. These community representatives were asked to inform the public by the most expeditious means possible that drinking water should be boiled until further notice as a precautionary measure. At 8:30 p.m. on August 28, radio releases were issued directly to every radio station serving the area, major radio stations in metropolitan New York, the Associated Press, and United Press International. The outlets were asked to inform all residents in the Elizabethtown Water Company service area of the boil-water order. These messages were also carried on television, in local newspapers, and announced at church services on Sunday morning.

Restarting Facilities

When the plant was reentered at 5:00 a.m. on Sunday, 190 tons (173,000 kg) of stone were required to rebuild the road to the low-lift station before any repairs to equipment at the station could begin. All engines (including diesels) were inoperative. They had to be dried and have some parts replaced before any service could be restored at this location. Similar problems existed at the high-lift station to a slightly lesser degree. Repair work took place at both locations simultaneously.

At about 3:00 p.m. on Tuesday, three days after the flooding, the Department of Environmental Protection, in conjunction with the company's laboratory, agreed that almost all customers would no longer have to boil their drinking water. A radio release to this effect was sent to all radio stations. There was one local area that, because of its elevation, was subject to a greater possibility of negative pressure and thus residents there were advised to continue boiling water until further testing. During the afternoon of the following day, laboratory results indicated that boiling would no longer be needed in this area. At that time a release was issued to the radio stations reaching those areas and the appropriate municipal officials were also notified.

By mid-morning of Wednesday, September 1, the Raritan-Millstone plant was producing 90 mgd (340 ML/d). This was more than adequate to provide complete service to all retail customers served by the company and to begin service to other water utilities ordinarily served. With the

Case Study: Flooding in New Jersey (continued)

90-mgd (340-ML/d) production, the storage reservoirs were refilled and pressures built up to normal.

Communications

Throughout the entire emergency, the company's switchboard was manned continuously, and at no time were calls backed up to a point that personnel were not able to answer in a relatively normal period of time. Most of the calls were from residents wanting to know whether or not they would still have to boil water and, if so, how long to boil it. Other calls, received to a lesser extent, had to do with low water pressures and questions concerning a lack of water service. As the situation improved, the number of calls regarding the taste of chlorine or discolored water increased somewhat. During the period from 6:30 p.m. on August 28 through 5:00 p.m. on September 3, 9,346 phone calls were handled.

In addition to the commercial office, the executive offices were continuously manned as a command center throughout the emergency. There was always at least one corporate officer available to talk with the press and with officials of the communities regarding their specific problems. Throughout this period, these executives were in constant communication with the health officers and police and fire departments of the communities served.

Source: Ring (1973).

to open outlet valves to lower a reservoir if the dam is weakened, or to cut off power to downed electric lines. The public should be informed of boil-water orders or other emergency notifications. The case study beginning on page 82 describes an emergency response to flood damage and the communication process with the public about boiling water.

Step Four: Perform Emergency Repairs Based on Priority Demand

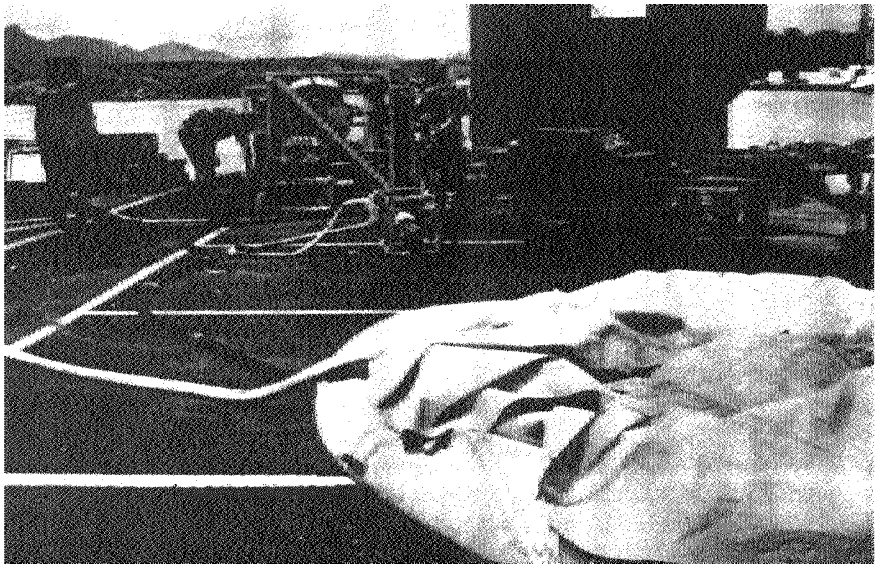
After reducing the probability of additional injuries or damage, the next step in emergency response is to perform those repairs or other actions that will provide service to priority customers or meet priority demand. Usually, these are at the locations of fires, medical facilities, potable water distribution points, or other locations related to system recovery priorities. Figures 6-1 and 6-2 show emergency water supply methods.

Step Five: Return System to Normal Levels (Recovery)

When possible, perform less-urgent repairs, completing them in order of priority. Lift the boil-water or use-reduction orders only when absolutely sure of the quality and quantity of the water supply. The state or provincial department of health may have the final approval.

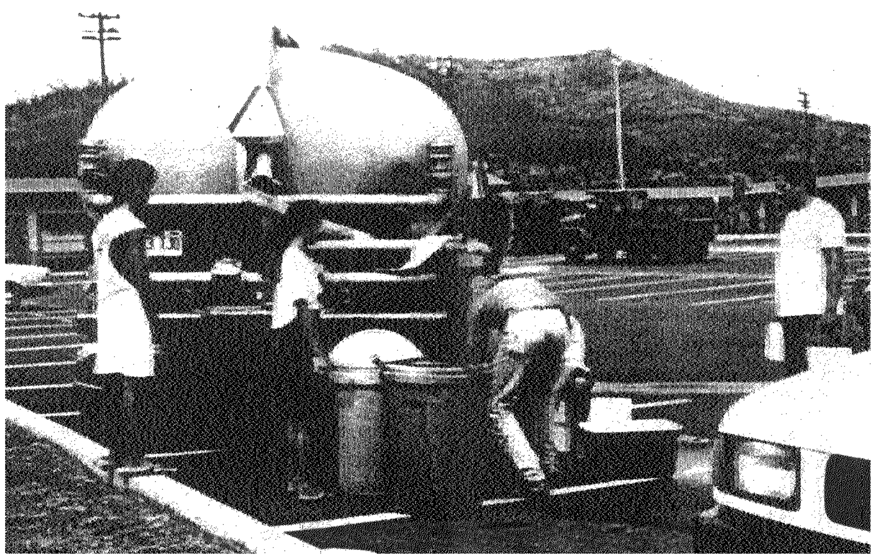
Long-term recovery considerations include the following (Pickett et al. 1991):

- repair options, such as abandonment or replacement at another location
- redundancy of pipelines and other facilities
- relocation away from newly observed fault areas
- rate structure change reflecting cost of mitigation activities
- personnel training and procedures for recovery
- review and update of communications systems and standard designs that are no longer appropriate



Source Ray Sato

Figure 6-1 Portable water treatment plant filling up inflatable storage in Kauai, Hawaii



Source: Ray Sato.

Figure 6-2 Emergency potable water provided by tanker truck in Kauai, Hawaii

- shared use with other agencies, such as emergency equipment and laboratory facilities

Step Six: Evaluate Response and Preparedness Plan

The system should review its response to the emergency continually during the event. The planned actions may not be going as smoothly as planned, and changes could be made. When the emergency is over and the system is operating at normal levels, a complete evaluation of the response should be made.

Step Seven: Revise Plan as Necessary

If changes to the preparedness plan are indicated by the evaluation, they should be made promptly.

TRAINING

A training program must have a purpose, appropriately selected trainee personnel, and proper instruction and supporting materials. Training can be in-house and/or through outside sources.

Purpose

The purpose of emergency-preparedness training is to increase the knowledge of system personnel about disaster hazards and effects on the system, and to practice disaster response.

Trainee Personnel

The personnel who can most benefit from a specific training course should be the ones attending the course. In other words, do not make every person attend a course if the training does not apply to their positions. The exceptions are for cross-training and for such general-interest courses as home safety or disaster response. Keep track of the types of training each staff person has received.

Training Courses

Before beginning in-house training courses, find out what courses already exist. Engineers could enroll in courses in facility design and analysis, protective construction, and environmental engineering. Operations personnel could take courses in cardiopulmonary resuscitation (CPR) and first aid, and response to chlorine leaks. Chemists could take local college courses about hazardous substances or toxicology. The American Water Works Association (AWWA), through its training programs, offers regional courses on emergency preparedness and safety.

When personnel take these courses, have them provide summaries that apply the information to their system. Distribute the summaries to appropriate personnel or have them use the information at an in-house training session.

A training program need not be time-consuming; a few hours per week over a period of one or two months is sufficient to train one group of employees. The elements of the program depend on the following factors:

- system size
- probable disasters
- complexity of the system or component
- type of staff

- critical nature of system operation
- availability of existing training programs
- type of instructors available
- education and experience of staff
- joint-training with neighboring systems and other area governmental agencies

To conduct a training program effectively, a system should have the basic components of a classroom environment. The components generally consist of the following:

- a training room or facility that can be used for lectures and classroom activities. The facility should be equipped with tables so that maps and drawings can be viewed by the trainees
- a blackboard or large drawing tablet
- a videocassette player and monitor
- a 35-mm slide projector
- maps showing the layout of the water utility
- drawings showing in detail the elements of the system, with the major components clearly identified
- handout materials

Training aids would consist of the system's emergency-preparedness manual and materials available from other sources, such as the local fire department, AWWA sections, or AWWA headquarters in Denver.

Training Exercises

Training and practice are essential for an effective emergency response. As an example, suppose a pumping station has been flooded. According to the emergency plan, a repair crew proceeds to the field to carry out maintenance. However, the flooding may also block the usual access road to the pumping station. In an emergency, an alternative route would be much easier to find if, as a part of a training exercise, the crew had already explored the alternative routes.

Training exercises allow personnel to practice emergency response, recovery, and evaluation. Training exercises can be conducted with just the system personnel or can be a joint exercise with other emergency-response agencies The exercises can be tabletop or on-site. A tabletop exercise is a good way to practice "what if" scenarios. Personnel gather around a table with system maps and facility diagrams. An example of such a scenario is: "What if a magnitude 6 earthquake hit at 3 a.m. and took out the main transmission line, damaged the water treatment plant, caused several main breaks in the older part of town, and knocked out power?" Another training tip is to practice with the assumption that a key staff person or persons is not able to respond. This method allows you to see how successful your cross-training efforts have been.

On-site exercises usually involve more specific activities, for example, running emergency generators, practicing communications, and isolating parts of the system. Experience with safety programs at water and wastewater systems indicates that, even though safety equipment is available and clearly marked, many staff members are unaware of where the equipment is and how it should be used. Part of the training exercises should be to correct these deficiencies with hands-on training. Have personnel actually locate and operate a fire extinguisher or a respirator.

Often training exercises will point out problems or gaps in the emergency-preparedness plan. Incorporate corrections or additions into the next update of the plan.

Ongoing Training

Training should be ongoing to reinforce previous training and introduce new staff to the program. As soon as training ends, people begin to forget what they have been taught. Also, staff turnovers decrease the number of trained personnel, and new problems, new techniques, and changes in equipment dilute the readiness of the system to deal with emergency situations. The ongoing training program could consist of something as simple as a monthly luncheon seminar, a monthly bulletin, or perhaps bringing in outside speakers to reinforce certain elements of the training program.

REFERENCES

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