KAMEDO Report No. 86: Explosion in the Artificial-Fertilizer Factory in France, 2001

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Abstract

On 21 September 2001, an earthquake triggered an explosion at an artificial fertilizer factory in Toulouse, France. As a result, 30 people were killed and 3,500 people were injured. Extensive damage hindered rescue services in their efforts to reach the factory; however, within several hours an assembly point with 60 doctors was established several kilometers from the explosion site. One hospital close to the scene needed to be temporarily evacuated. The disaster challenged rescue teams on many levels; for example, there was a question of toxicity, as well as communication difficulties due to the damaged telephone lines and clogged mobile networks.

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The Event

On the morning of 21 September 2001, a powerful explosion occurred at an artificial fertilizer factory in the city of Toulouse, France. It later was found that a chemical reaction had occurred in a hangar where sensitive industrial wastes were stored, which mostly were residual products containing ammonium nitrate.

The explosion was triggered by an earthquake measuring 3.4 on the Richter scale and resulted in a powerful pressure wave, which led to serious damage. A cloud of dust and smoke formed. At first it was not known if this cloud was toxic. Later, it was confirmed that the explosion had left a crater nearly 5 meters deep and 50 meters in diameter.

The event caused the loss of 30 lives. The Toulouse Prefecture estimated that about 3,500 people were injured as a result of the explosion; 50 of them were injured seriously. During the first day, 862 patients were taken to hospitals. Afterwards, about 40,000 damage claims were submitted to the insurance companies.

The Site of the Disaster

The alarm system at the factory never activated. Major traffic problems quickly arose around the site after the explosion. Despite this, the first rescue team was on-scene 13 minutes after the explosion. They encountered a stream of dusty, injured persons fleeing the industrial area on foot. Many industrial buildings were demolished, and nearby residential buildings were

in need of immediate evacuation. Rescue work began even though no risk assessment for the rescuers had been performed. Only after 30 minutes did measurements show that the cloud of dust and smoke caused by the explosion had a "low" toxic content.

A major disaster alarm was triggered in Toulouse 20 minutes after the explosion, signaling for a rescue effort to commence. Within 12 hours, 1,046 firefighters from 13 different fire prevention districts were on-site. It quickly became clear that the number of rescue staff exceeded requirements, but this made it possible for them to relieve each other.

After a few hours, 60 doctors were present on-scene. Most of them performed their duties at an assembly point a few kilometers away from the source of the explosion. Nearly 300 injured persons were provided medical care at this assembly point.

The Hospitals

The two largest hospitals in the region—the University-linked Rangueil and Purpan Hospitals—received >1,500 injured persons. Interestingly, the disaster plans at both hospitals were undergoing revision. At first, it was not clear whether it was possible for Rangueil Hospital to be used. It is the hospital closest to the site of the disaster, and it was damaged by the explosion. The hospital was evacuated temporarily, but it was possible for work to resume following a brief inspection. Repair work began the day of the explosion.

Soon after the doctors returned to the hospital, the disaster alarm sounded and the injured began streaming in. Rangueil Hospital received 435 injured persons; more than one-quarter of them were admitted for medical care. In addition, 50 people, who were injured at the hospital when it was damaged, also received care.

In order to cope with the influx of injured persons, the staff at Purpan Hospital improvised, and conducted initial triage at the main ambulance entrance, where they allocated the injured to various injury sectors in the hospital. During the day of the explosion, they received 1,048 injured persons; one-quarter of them were admitted.

Three-quarters of the injured who were received at Rangueil and Purpan Hospitals were able to leave the hospital the same day. Of those remaining at the hospital, 25 had suffered injuries, some of them serious. Four people were evacuated to other hospitals. Injured victims also presented at 24 other medical units, several of them private, or presented to their private general practitioners. Few injuries that could be attributable directly to pressure wave injuries were confirmed, e.g., injuries to the ears and lungs.

Experiences of Observers

1. By staffing ambulances with doctors who are on constant stand-by duty, medical experts can reach the site of a mass-casualty incident quickly. This initiative was easily staffed, but it was hindered by the fact that initially, there was a shortage of material resources and means of transportation.
2. When events that produce toxic clouds occur, the injured may be contaminated. In such circumstances, decontamination of those exposed may be required to prevent the medical staff from also being exposed to dangerous substances.
3. When there is a large number of injured persons, setting up one or more casualty collection point can help to buffer the initial rush of injured persons to the hospitals. These collection points should be included in the disaster plan.
4. Managing a mass-casualty incident requires a good communication network. The public telephone network often gets overloaded. It is important to have access to other established means of communication between hospitals, such as direct telephone lines that do not use the usual network and radio connections.
5. When a mass-casualty incident occurs, the need for patient transportation must be determined quickly. Most of the injured will be transported in private vehicles or ambulances. Helicopter transportation seldom is used, and usually, air transportation is not available until hours after the precipitating event.
6. During an event that produces a large number of injuries, all of the hospital resources in a town or region must be utilized. This should be considered when establishing disaster plans.
7. Emergency medicine now is an established specialty in many Western countries. This means that emergency doctors play a crucial reception role at hospitals during mass-casualty incidents.
8. The premises used for the reception of a large number of injured persons should be adequately sized. Other areas also must be available to be utilized if needed.
9. Registration, identification, and localization of the injured victims is simplified if a sufficient supply of case records is available. In the future, computer technology will facilitate other possibilities.
10. Disaster supplies at hospitals also should include large signs that can show the way to the various sectors mentioned in the disaster plan, e.g., the sectors for the injured, the relatives, and the press.
11. Looking after worried relatives often is difficult. Thus, it is important to quickly gain access to social workers, counselors, psychologists, and/or psychiatrists.
12. It is important that the deceased be managed correctly. Precise guidelines for this process should be included in all disaster plans.
13. Regardless of their strength, the damage caused by explosions can vary considerably. The nature of the surroundings at the detonation site is crucially import. The most common injuries will be those caused by flying objects or people being thrown by the force created by the explosion.
14. Pressure wave injuries, principally to the lungs (blast injuries), can be confirmed or excluded using computer tomography, measurement of blood gases, and several hours of observation.