Sanitary Engineering in "Operation TULIP"

By HARVEY F. LUDWIG, M.S.

AN EXTRAORDINARY combination of physical conditions—very high tides together with very high onshore winds—produced the flood of February 1953 along the southwest coast of the Netherlands. In this disaster, one of the worst natural disasters of modern times, more than 1,700 persons were drowned, and the entire economy was disrupted in an area making up one-fifth of the country. Extremely low temperatures and poor visibility greatly increased the damage caused by the inundation of the land.

Even more extraordinary than the physical conditions, however, and equally important in determining the damage done, was the attitude of the people subjected to the flooding. Although living their entire lives below sea level, the people, mostly farmers deeply rooted to the area, seemed to have become virtually oblivious to their danger because no natural flood of significance had occurred for more than 400 years. The statistical once-in-hundreds-of-years combination of wind and tide was apparently more than matched by a once-in-hundreds-of-years psychological setting. The people did not believe themselves in real danger and hence failed to heed initial signs of danger. Consequently, they failed to alert either themselves or the outside world to prepare for emergency aid.

The first major dike breaks occurred early Sunday morning, February 1, shortly after Saturday midnight. The telephone system—almost the only communication with the mainland—soon failed. Not until Sunday night did the seriousness of the situation become known, and, according to the American military personnel who first arrived on the scene, even then there was almost complete lack of intelligence on details. During the subsequent emergency relief operations, most of the critical intelligence had to be developed on the spot by the relief workers themselves. Relief operations

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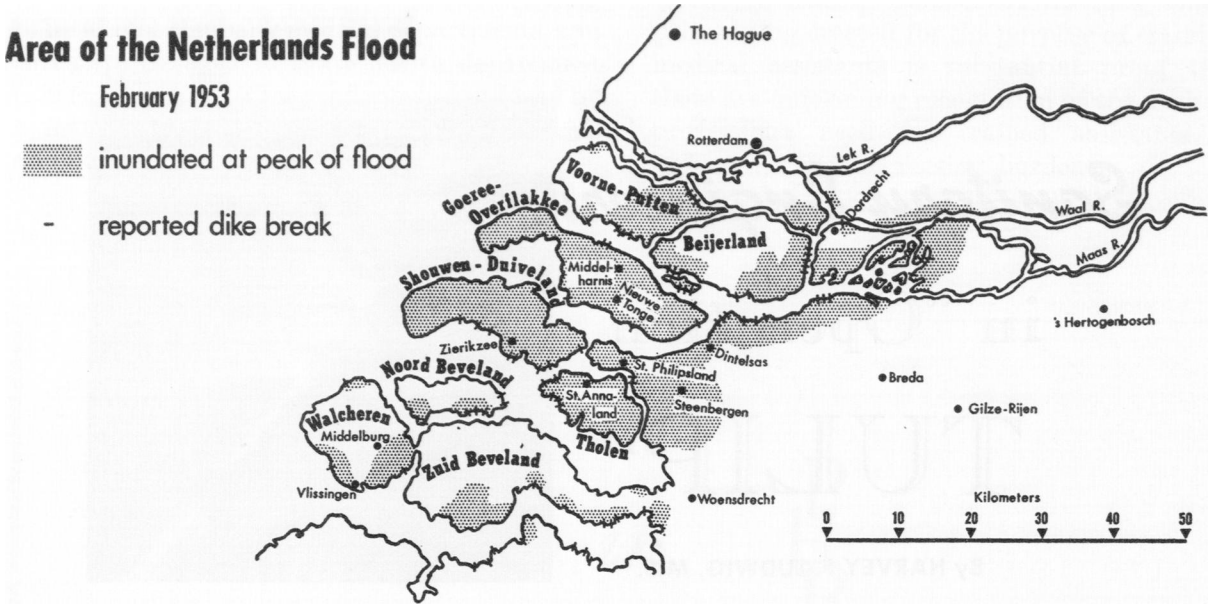
Mr. Ludwig is the engineer consultant for health emergency planning, Office of the Surgeon General, Public Health Service. *This paper is based on information Mr. Ludwig collected in April and May 1953 as a member of a team sent to Germany and the Netherlands, by the Committee on Disaster Studies of the National Research Council, to study the role of the American military forces in the Netherlands disaster relief operation. It was presented at a meeting of the National Research Council's Committee on Sanitary Engineering and Environment on December 15, 1953. A complete report of the team's study, known as Operation Tulip, is available from the Committee on Disaster Studies.*



were further hampered by the fact that there were few—if any—plans for coping with such an unexpected emergency.

Organization of American Participation

American military assistance was provided, on request, to the Dutch military forces, which, in turn, were assisting the Dutch civil authorities in charge. An American military relief headquarters (AMRO) was established at The Hague on Monday, February 2, to maintain close liaison with the Dutch authorities. At the same time, an American field operations headquarters was established at Breda, close to the flooded area, and the commanding officer of the 39th Engineer Construction Group at Ettlingen, Germany, was placed in charge of the field operations. The American forces, totaling about 2,000 men, were principally engineer troops from the 39th Engineer Construction Group (Ettlingen), the 795th Engineer Dump Truck Company (Kaiserslauten), the 1279th Engineer Combat Battalion (Höchst), and the 8540th and 8542nd Engineer Amphibious Truck Companies (Bensheim and Rüsselsheim). Air Force cargo planes, Army and Air Force helicopters, and a group of Navy vessels from the Rhine River Patrol, also gave important assistance. Some rescue operations were commenced Tuesday afternoon, although the bulk of forces were not in action until Wednesday.

The critical emergency period—when people were drowning—extended through Wednesday evening. The American rescue forces were able to participate, unfortunately, only during the very end of this period. Even so, their facilities—especially the helicopters and amphibious trucks (dukw's)—were of vital importance since virtually no other type of equipment could reach the victims. The critical or rescue phase was followed by major engineering operations, mostly dike repair or strengthening, in preparation for an anticipated second flooding forecast for about February 16. Although this second emergency never developed, its expectation gave the engineering operations much more of an emergency character than otherwise would have been the case.

Health Aspects

In the health field, sanitary engineering operations, especially emergency water supply and treatment, were of major importance from the point of view of American military participation. All medical problems of the Dutch were handled by the Dutch Red Cross, with American military medical units (including one mobile surgical hospital) serving only to support the American troops. There were no epi-

An American H–13 helicopter departs on a rescue mission.

demics or any significant incidence of communicable disease.

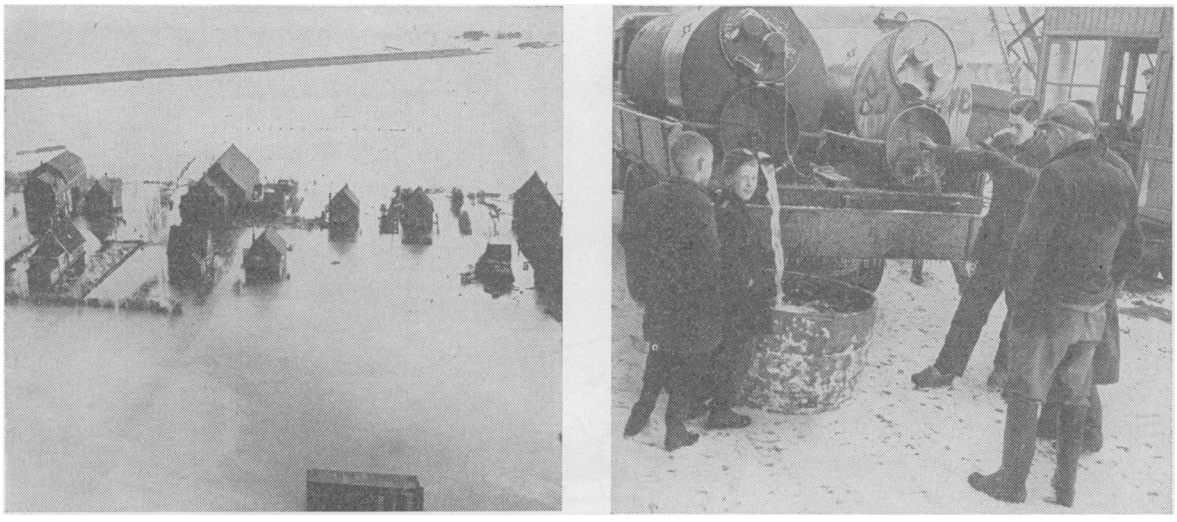
An Army sanitary engineer officer from American military headquarters (USAREUR) at Heidelberg, Major C. R. Lewis, was from the outset a member of AMRO. He represented the Chief Surgeon, USAREUR, Major General Guy B. Denit, for all of General Denit's interests, medical as well as engineering. General Denit made this selection in anticipation that the critical needs would be in emergency sanitation rather than in casualty care.

Although the American military were instrumental in furnishing various emergency sanitation and emergency mortuary supplies to the Dutch authorities, and, incidentally, in locating some of these supplies from sources within the Netherlands, provision of emergency water supplies was the only significant health problem with which they were concerned. For this purpose, 29 mobile water purification units were sent to Breda, 19 of which were deployed for action. Because of the intense cold, there was no vector control problem, despite the many thousands of dead farm animals and approximately 1,700 humans who were drowned. Although some attempts were made to dispose of dead animal carcasses by burning, the Dutch preferred to and did salvage many of them by converting the carcasses to fertilizer.

Two Navy patrol boats (PR's)—the fastest boats on the scene—were helpful to the Dutch Red Cross for emergency evacuations, delivering medical supplies, and dispatch purposes.

Emergency Water Supply Problems

Most of the local water supplies for the communities in the flooded area, as in all of western Holland, are derived from sand dunes, which act like blotters to collect and store rain. Some of the island communities have no local sources



Left: At Nieuwetonge on Overflakkee Island 2 weeks after the area was first flooded, the water has partially receded. Right: A water tank brings drinking water to the people on Schouwen Island.

of water but are supplied from the mainland by transmission lines or, in a few instances, by boat. The flood caused the breaking of transmission lines, contamination of dune supplies or of trenches delivering water from the dunes to the towns, and flooding of pumping equipment.

The emergency situations on the islands were met by two methods: by hauling water from the mainland by boat and by use of the mobile purification units. For boat hauling, the Dutch employed primarily water tankers normally engaged in supplying shipping in the Rhine River, but also a number of other tankers which had to be cleaned for water use. Tanker capacity became increasingly available as the emergency continued, and the need for the water purification units decreased accordingly.

The 19 purification units deployed to the flooded area saw action principally at communities on Walcheren Island and at the relatively large port city of Dordrecht. Two units were used in support of the American troops, one at Breda and the other at Steenbergen, an advance field post serving as coordinating point for the dukw companies. On February 12 seven of the units were sent to 's Hertogenbosch, the Dutch military field headquarters, where they were used for training Dutch soldiers in the techniques of operation and maintenance.

On the morning of February 3, a sanitary engineer from the Dutch Government Institute of Water Supply at The Hague was dispatched by the institute's director to Walcheren Island to review an emergency situation at Vlissingen, a town being used as a staging area for people collected from isolated points. This town is normally supplied with water through a dual system: a transmission line from the mainland, which had broken, and a dune system of limited capacity which becomes brackish if overpumped. Vlissingen itself is the source of supply for Nadorst, a large Indonesian refugee camp on the island, but under the circumstances, it was unable to furnish water for the camp.

About noon on February 3, the engineer from the institute learned from The Hague that American mobile units might be available, and, through the Dutch military headquarters, he promptly requested units for Vlissingen. The first two units arrived at 6 p. m., and two more later that evening. They were sent from Breda to the island via Belgium, without any border-passing difficulties. One of these units was assigned immediately to Nadorst, where it supplied the water needed for washing and other purposes except for drinking (drinking water was supplied by boat). Brackish ponds were the raw water source.

On February 10, the three units remaining in Vlissingen were transferred to Domburg, another town on Walcheren Island where the normal supply was out due to a broken transmission

line. The units furnished 75,000 gallons of water a day, taking raw water from a pond in a bomb crater on a golf course. On February 16, the units were withdrawn as part of the general American plan for withdrawal of aid, since it had by then been determined that the emergency period had passed. The withdrawal order alarmed the people of the community, who had not much confidence in the emergency repair which had been made on the transmission line, and they threatened to oust the town burgomeister if the units were removed.

At Dordrecht, on the mainland, emergency assistance was requested when the pumps boosting water from the main reservoir into the distribution system became flooded. Here eight of the mobile units served from February 6 to February 9 as substitute pumps. Beginning February 9 they also undertook filtration and chlorination when excessive drawdown on the reservoir made the water turbid. The units were on hand at Dordrecht a full day before they were placed in use—a period when they were badly needed. The delay was due to the fact that the municipal officials were overwhelmed by problems they considered to be even more immediate.

Emergency Water Supply Techniques

Several interesting lessons were learned from the use of the mobile purification units during the Holland flood disaster. It was found that requests for assistance received through the formal channels were generally unreliable or out of date as to details. Accordingly, the officer in charge of the mobile units adopted the practice of sending a two-man reconnaissance team to the sites reportedly needing aid, to ascertain that the needs did exist and that the mobile units could meet them. Some of the requests were based on the mistaken belief that the units could remove salt from seawater. In all reported instances, however, it was possible to locate fresh or brackish water ponds or ditches suitable as a raw water source.

Some difficulties were experienced in communicating with various units assigned to various sites. Reliance had to be placed on either messengers, local telephones, or incidentally available military radio. However, the difficulties were not considered sufficient to warrant placing organic radio equipment on the units.

A minor problem developed in regard to chlorination. In general, the communities in the area do not practice chlorination and object to it. The operators of the units, of course, produced water having a chlorine residual of 2.0 p.p.m., in accordance with the instructions given them through Army channels. This conflict did cause difficulties, but the people's opposition became insignificant when actual use of the product showed no ill effects. At Domburg, the Americans did reduce the chlorine residual, from 2.0 to 1.5 p.p.m., in response to complaints. An important factor in maintaining public confidence was the certificate of competence carried by each unit crew. The burgomeisters accepted these certificates as positive proof that the operators knew their business.

Evacuation Problems

Some of the experiences in the evacuation operations are also of interest to health authorities. The people living in the area were often extremely reluctant to leave their homes and communities even, in some instances, when danger of drowning seemed imminent. Many refused to leave without taking along their farm animals. Others feared that, if they did leave, their homes would be looted or that, if not flooded, assigned by the Government as temporary billets for other persons. At one town (Zierikzee) it was necessary, despite pleas delivered in person by Queen Juliana and Prince Bernhardt, for the Government to agree to post guard before the people permitted themselves to be evacuated. Scarce transport facilities had to be assigned to supply persons refusing to be evacuated.