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EDITORIAL

New Orleans is a Lesson to the Dutch

It is a sad but remarkable fact that the circumstances which led to the recent flooding disaster in New Orleans were amazingly similar to those leading to the 1953 flooding disaster in the Netherlands. In the years preceding this event, it became clear to an expert like dr.ir. Johannes van Veen that the risk of flooding in the Southwest of the Netherlands was unacceptably high. In his capacity as responsible manager of Rijkswaterstaat for navigation and safety in this region, he started to realize that the exceedance probabilities of flooding were as high as 1 in 100 to 1 in 200 years. As his knowledge about extreme water levels grew due to the routine registrations of water levels that he initiated right after the ending of WWII, his concerns nearly became an obsession. He warned his superiors for years, but they were not open to his unwelcome message. In this case, there was also an external reason; in the postwar period, all government budgets were needed for economic reconstruction. At one stage, he was even silenced by his superiors. Needless to say, after the disaster in which nearly 2000 people lost their lives, he was called upon, and his respect was restored.

More generally, it is fair to conclude that historically—nearly without exception—flood protection was only improved after the occurrence of disasters. In the history of the Netherlands, there are many more examples, and we trust that the flooding event of New Orleans can be looked upon as past history for the United States in a few years from now.

Protection against Floods and Other Natural Disasters

The level of protection against natural disasters is a socio-political choice. The necessity of making choices is forced upon us by the enormous technological advances, allowing high levels of protection. Reducing risks to practically nil, which may seem an obvious choice, is not possible because the higher the level of protection, the larger the economic costs. Hence, this is a socio-political dilemma. How much money does a society wish to spend on decreasing the probability of a disaster with appreciable damage? This is not an easy issue, because the consequences of a disaster do not concern only weighable components, like material damage, but also non-weighable components like loss of lives and cultural heritage. The level of (flood) protection and the corresponding investments should be balanced with the societal value that needs to be protected. Modern governments should be expected to implement better protection when the risks are becoming too high. Such protection, in the form of higher flood defenses or earthquake resistant buildings, reduces the probability of serious damage. Hence, risks, being the product of probability and damage, become smaller if the investment in safety is increased.

The disaster of New Orleans illustrates what the consequences are when a modern city that lies meters below mean sea level is flooded. The United States chose to defend this city against hurricanes of Category 3 with an occurrence probability of about once in 30 years (http://www.nhc.noaa.gov/HAW2/english/basics/return.shtml), showing an enormous difference with the levels of protection in the Netherlands (see below). It was to be expected that a Category 4 hurricane like Katrina would cause flooding.

The Netherlands has developed a new flood defense approach after the 1953 disaster. The so-named Delta Committee, with Johannes van Veen as a secretary, was installed to advise on the measures to be taken. This led to the Delta Law establishing storm surge design conditions and the master plan for the world-famous Delta Works. The committee weighed the investments in flood defenses against the reduction of the material risks (VAN DANZIG, 1956), as also explained above. At that time the economic damage was estimated at 24 billion Guilders (≈10 billion Euros) for the province of South-Holland, the economic center of the Netherlands. The result of this economic evaluation led to an acceptable flooding probability of 1/125,000 per year. The Delta Committee did not find it feasible to account for the loss of lives. The resulting political choice was to design the flood defenses on a storm event with a probability of exceedance of 1 in 10,000 years. The probability of failure during such a storm should be small, *viz.* 10%. Hence, the flooding probability for the province of South-Holland is 1 in 100,000 years (coastal provinces with less economical value have a design storm event of 1 in 4000 years). Later on, safety standards were derived for other areas, taking into account the economic value of these areas, and the type of flood threat (river or coastal). Figure 1 provides an overview of safety standards for different dike ring areas in the Netherlands. A dike ring is an area enclosed by flood defenses (dikes, dunes, hydraulic structures) and high grounds.

It is interesting to speculate about the reasons behind such a large difference in protection level between the Netherlands and the United States. One factor is the important role that returns on investment play in a country like the United States. A high rate of return requires a shorter time horizon and thus leads to lower protection levels. An interesting illustration of this is the building policy on the many beach barrier islands along the US East coast. Wooden houses on poles can be situated very near the coastline, accepting a high probability of damage. The return on investment is considered so high that damage or devastation is acceptable even on time-scales lower than the economic lifetime.

A second factor that also plays a role with the building policy on the barrier islands is the larger responsibility that the US society places with the individual, so that the government car-

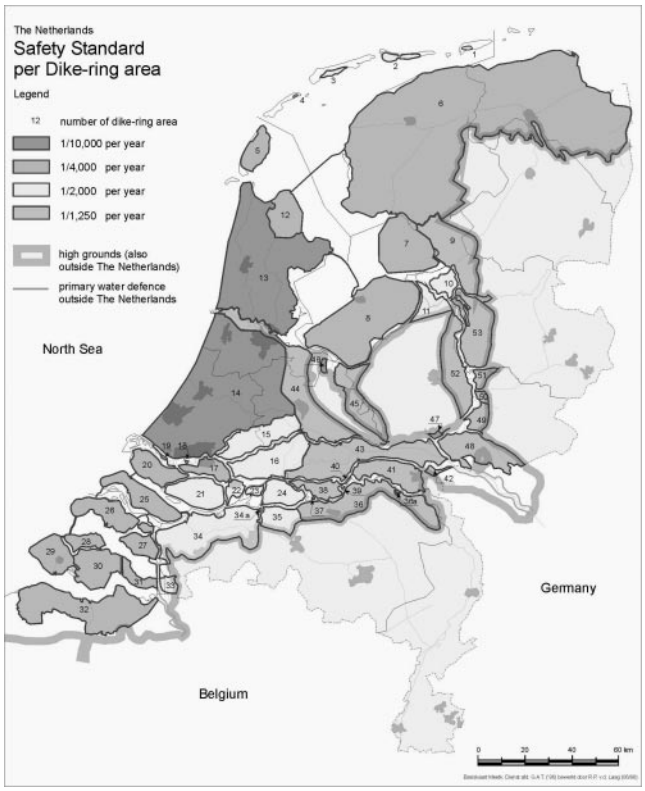

Figure 1. Current safety standards in the Netherlands. For color version of this figure, see page 1191.

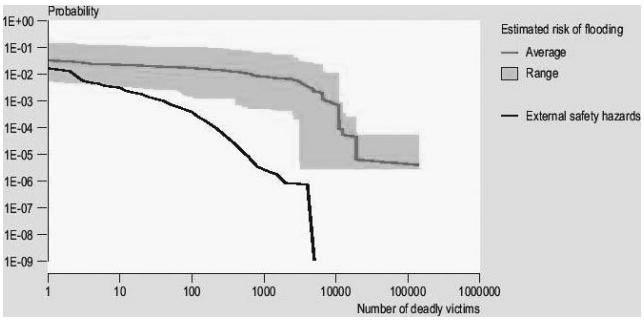

Figure 2. Societal risks of flooding in the Netherlands compared to the sum of external safety risks (RIVM, 2004).

ries less responsibility. This creates a strong impulse for flexibility and economic growth, but in case of disasters, however, this model shows its weak side. The authorities do not choose for collective protection against flooding (*e.g.,* by building flood defenses from taxation based funds), but rather chooses to reduce individual risks (*e.g.,* by means of insurance).

A third factor is the assumption of the authorities that people will take the personal initiative to leave the flood-prone area (*i.e.,* in the case of New Orleans, the city) to save their lives, leaving behind their properties. The less well-situated people that stayed behind have been hit hard. They especially live in the more vulnerable areas. Due to a lack of information and the lack of transportation, they could not evacuate.

Conclusion

It is important that the Netherlands closely study the experiences of New Orleans, since more than half the surface area of the Netherlands lies below mean sea level. Because of the absence of coastal flooding since 1953, the general public considers flooding a historical cliché and many people, including the responsible authorities in our country, have lost sight of the disastrous consequences of large-scale flooding. Current Dutch policy appears to be heading toward the US model of mitigating the consequences instead of strengthening the flood defenses, *e.g.,* through insurance mechanisms and improving evacuation procedures and disaster mitigation methods. Prevention of floods has received relatively less attention in the latest policy developments.

Present safety standards of Dutch water defenses were established 40 years ago. Since the original work of the Delta Committee, the economic values requiring flood protection have increased by a factor of 6. The protection standards have not evolved with these changes. A recent policy evaluation (RIVM, 2004) has highlighted these important issues. Moreover, the RIVM study indicated that the societal risks associated with flood defenses on a national scale are larger than societal risks in other domains in Dutch society, such as the external hazards from chemical facilities and airports (Figure 2). Societal risk is expressed as the probability of a large accident with N or more fatalities. Societal risk is often represented graphically in a FN-curve. This curve displays the probability of exceedance (F) as a function of the number of fatalities (N), on a double logarithmic scale. It is noted that differences in risk acceptance between activities need to be related to risk perception.

Given these issues and future developments (sea level rise, increasing river discharges, economic growth) a fundamental debate on the required safety levels of Dutch flood defenses is needed. At this moment, the Dutch government is making a detailed assessment of the flood risk levels for 16 of the 53 dike rings in our country. Results will give more realistic estimates of the probability of flooding and the potential consequences in terms of economic damage and loss of life. We predict that the results of this study will lead to difficult, but necessary choices.

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