

# Flood management in The Netherlands

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## Introduction<sup>1</sup>

In December 1993, continuous and heavy rainfalls in France and Belgium caused a flood in the province of Limburg, situated in the southern part of The Netherlands. Thirteen months later, in January and February 1995, flooding struck the province again. This flood covered more territory, and rescue operations had to be undertaken in six provinces. There was also a difference between the threat to the province of Limburg and the threat to the other provinces in the Netherlands. While Limburg actually flooded, the risk of dikes breaking in other provinces led to nearly 250,000 people being evacuated from their homes.

Not only the basins of the large rivers in Western Europe were flooded. Regions in Southern Europe were also affected, such as Valencia, Athens and, very recently, Sicily.

The floods are partly a result of human behaviour. Because of an increasing population, pressure in already densely populated areas, residential zones and industrial sites is becoming greater in areas that are already facing a flood risk. Floodplains are now being used for housing and agriculture. Furthermore, different measures have been undertaken to canalise the rivers. The surplus of water cannot be stored temporarily in natural floodplains and instead runs directly to the sea, leading to situations where the water rises more quickly in downstream areas than in the past.

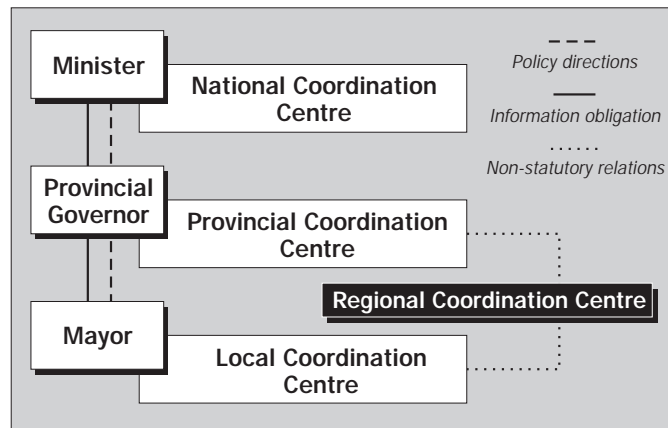
This article deals with several aspects of the floods that occurred in 1993 and 1995. A brief outline is given of the formal system of disaster management in the Netherlands. An overview is provided of the events that took place during both floods. The specific situa-

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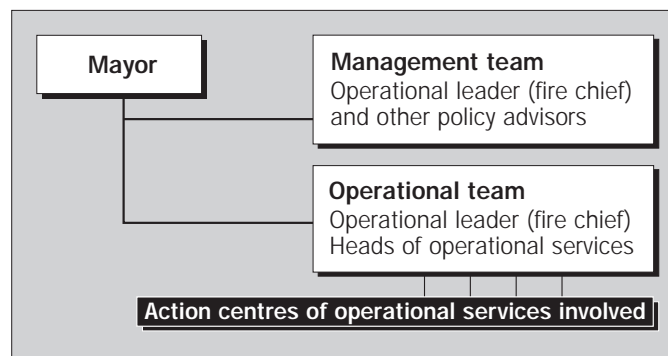
tion in Nijmegen region during 1995 will be examined by the fire chief in charge of the operations. Finally, flood management during the period of high water will be reconstructed on the basis of two themes: warning and evacuation.

This conceptualisation of disaster reflects the prevailing principles of disaster management in the Netherlands. A very general notion of the social and economic disruption of the community is combined with an explicit demand for governmental activity and for coordination between governmental agencies. The Dutch emergency management structure is characterised by different levels of government being involved i.e. central government, twelve provinces and several hundred municipalities (see Figure 1).

Local and regional fire brigades are the most important operational services involved in emergency planning. As the Disaster Act dictates, the local fire chief has the primary responsibility for on-site coordination of local disaster responses. Generally, local emergency management coordination centres and operational centres are established. In addition to these centres, so called 'action-centres' become active. Here teams composed of members of specific divisions perform tasks in fields such as public relations, civil services, public works, and environmental services. In recent years, some executive agencies crucial to disaster management, such as the fire brigade and the police, have switched nationwide from a local to a regional mode of organisation—with the precise boundaries of the regions differing markedly across organisations. In doing so, an extra



Relations between State, province(s) and municipalities in case of a disasters (where municipal boundaries are transcended)



The organisation of emergency management at local level

Figure 1: Organisational Structure of Emergency Mgt in The Netherlands.

## Disaster management in the Netherlands

In 1985, the Dutch parliament passed a new Disaster Act, which defines a disaster as an event endangering life and health of a large number of people, or causing severe harm to material interests, and which requires coordinated efforts from various fields of expertise.

## Notes

1. Part of this paper is based on comparative research (on assignment of the European Commission) that studies the 1993 and 1995 flood from the perspectives of France, Germany, Belgium and The Netherlands. The Crisis Research Center has also been asked by the Ministry of the Interior to study the consequences of the evacuation of the 1995 flood. The goal of this study is to draw lessons for the future.

level in the formal emergency management organisation was created.

In the preparedness phase of emergency management, local authorities are often the key actors, which shows the essentially decentralised approach envisaged in the Act. However, when the situation becomes more serious or transcends the boundaries of one municipality, provincial or even national authorities (especially the Ministry of Home Affairs) may decide to coordinate or otherwise intervene. More specifically, under the circumstances that mayors at the regional level do not succeed in their joint efforts or their decision-making is contrary to supra-municipal interests, the provincial governor may give indications for administrative action. A similar situation may occur between provincial governors and the minister of the Interior when a disaster transcends boundaries of one province<sup>2</sup>.

The Directorate-General of Public Works and Water Management, part of the Ministry of Transport and Public Works, is responsible for communications about the water-level of the Dutch rivers. The Directorate-General of Public Works and Water Management (RWS) has a decentralised structure. Every region has its own section. RWS operates in close cooperation with the Institute for Inland, Water Management and Waste Water Treatment (RIZA)<sup>3</sup>. Communication about water-levels is done through the Regional Coordination Centres.

### **The 1993 and 1995 floods**

#### **The 1993 flood**

Before a more thorough overview of the events in 1995 is given, a brief insight into the flood of 1993 is valuable. During that period, nearly one-fifth of the province of Limburg was flooded by the river Meuse.

The water level of the river Meuse started to rise on Saturday 18 December 1993. The rising water was caused by continuing rainfalls in the northern part of France and the Belgian Ardennes. On Monday 20 December it became clear that the water level of the Meuse was reaching a threatening height. Emergency services were warned in several parts of the province of Limburg. Shortly after the alarm had been given, several parts of the villages of Borgharen and Itteren, situated on the Dutch-Belgian border very near to Maastricht, were invaded by the incoming water. Emergency services and citizens were

surprised by the speed and magnitude of the flood. During Tuesday other villages along the Meuse were flooded. The situation deteriorated further on Wednesday 22 December.

The water left a trail of destruction. Infrastructure utilities started to fail, farmers saw their cattle drown and some businesses feared bankruptcy. Ten thousand people had been evacuated and thousands of hectares had been flooded. The hard-hit area was officially declared a national disaster on Christmas day.

On Tuesday 28 December, the water-level of the Meuse finally started to decline. The province began with an audit of the damage. Registration forms could be collected from the province. From Wednesday 29 December, emergency services started to reduce their staff levels. The total amount of damage was over 100 million ECU.

#### **The 1995 flood**

Heavy rainfalls in France and the Ardennes gave rise to anxiety in the province of Limburg. Although RWS declared that the water level was not going to reach the height of 1993, people were not willing to take any risks. On Monday 23 January, villages along the Meuse were taking necessary measures to prepare themselves for a new flood.

On the Tuesday the water-level was still under the 1993 height. Nevertheless, crisis centres were being set up in case a new flood might occur. On Wednesday 25 January RWS made an alarming prognosis for the coming days. It seemed the water level would now exceed that of 1993. This was the definitive sign for action. The mayor of Maastricht advised the inhabitants of Itteren, Borgharen and another part of Maastricht to evacuate. These calls for evacuation seemed to be ignored by most of them. Ministers and members of parliament visited the province and showed their sympathy with the population.

Over the week, the situation deteriorated quickly. Inhabitants of Limburg were trying to save their belongings from the rising water. Every village along the Meuse had set up its own crisis centre. In several villages, a 'state of emergency' was declared. This gave the mayor the authority to force the inhabitants to leave their homes. On Friday 27 January, the provincial coordination centre reported that about 2,630 people had been evacuated so far. More than 13,000 houses were flooded by the water.

Not only the river Meuse gave problems, but water levels of rivers such

as the Rhine and the Waal were also rising. This meant that other provinces would be in trouble as well. The situation in the province of Gelderland seemed especially alarming. This area, called the 'river-area', is situated between the rivers Rhine, Meuse, Waal, Lek and Neder-Rhine. The bad state of some of the dikes in this region led to the danger of them breaking through. If the dikes burst, some of the polder-land would be flooded with water within a few hours. In contrast with the province of Limburg, this could lead to a life-threatening situation for the inhabitants of this area.

On Saturday 28 January, the polder-boards, responsible for the maintenance of the dikes, declared that the situation in the 'river-area' was alarming. They thought that the prognosis of RWS was too optimistic and presumed that the situation would deteriorate during the weekend. They based their opinion on the situation in Germany, where heavy rainfalls and snowmelt caused the water level of the Rhine to rise further. In the evening, RWS gave a new prognosis which confirmed the opinion of the polder-boards.

In the meanwhile, preparations in the 'river-area' were being made in case an evacuation was necessary. The next day, Sunday 30 January, a crisis meeting was held in Arnhem between the provincial governor and the three coordinating mayors within the provinces of Gelderland, Nijmegen, Arnhem and Tiel. During this meeting, it was discussed whether an evacuation of the first part of the region (Ooijpolder and Land van Maas en Waal located in the area of Nijmegen) would be necessary. A representative of the polder-board, in which this area was situated, stated that from Tuesday they would not take any responsibility for the safety of the dikes. The participants all agreed that an evacuation was unavoidable. The final decision would be made in the regional coordination centre of Nijmegen in which all mayors, who are primarily responsible for public safety and order in their municipality, were represented.

On Monday 31 January, the regional management team in Nijmegen decided to evacuate part of the region. When the

#### Notes

2. Commission Boertien, December 1994, p. 2-1.

3. The Institute for Inland Water Management and Waste Water Treatment (RIZA) is the research and advisory institute of the RWS for fresh water in the Netherlands and a national knowledge centre for integrated water management.

provincial governor advised people to leave their homes, most of them were already on their way. The warning signals from mayors, representatives of polder-boards and the provincial governor had resulted in the voluntary evacuation of a great part of the population in this region. From Tuesday 9.00 a.m. onwards, nobody was allowed to enter or leave the evacuated area. Until that moment, everyone had the chance to move their belongings to safer places. Farmers were able to evacuate their cattle until Tuesday 9.00 a.m. Hospitals and old people's homes were evacuated on Monday. Assistance was provided from all over the country. Over the following days, the provincial coordination centre decided to evacuate other areas as well. In some cases, an emergency evacuation had to take place, because a sudden problem in the dike made a breach possible. Eventually, nearly 250,000 people had to leave their homes.

Problems occurred regarding farmers, commerce and industry. Special plans were not available and it seemed that the lead time for these groups to evacuate needed to be much longer. For example, for one corporation it would take about fifty days to move their stock to another place. Other examples showed that farmers and directors were reluctant to leave their business. They declared that they would take the risk. The economic damage would be too high for them. Despite these problems, the evacuation went well.

The situation remained critical, although the water level did not rise any further. The length of time during which the water level was high, meant that dikes were saturated. Therefore, the risk of a breach of a dike was still possible. However, people were getting anxious to go back to their homes. The provincial governor and the Minister of Home Affairs stated that this would not be allowed.

On Thursday 2 February, there were rumours that people might be allowed to go back the next weekend. The decision for this return would be made within a few days. From that moment on the Minister of Home Affairs had decided to use his authority to intervene in the decision-making process. Every decision concerning the return of the people should be discussed with him first.

On Friday the third of February, the water-level of the rivers dropped rapidly. The general opinion was that it would

only take a few hours before the population could enter the evacuated areas again. Nevertheless, the decision was postponed until Saturday. A conflict arose about the timing of the message for the people to return. The provincial governor wanted to communicate the message as soon as the decision had been taken, while the coordination centre in Nijmegen insisted on waiting until the population could actually return. This would prevent chaos on the roads. In the end, it was decided that the people would be told the moment it was actually possible.

In a press conference on Saturday morning, the minister stated that the people could return to their houses. This started on Saturday 4 and Sunday 5 February. Just as with the evacuation, the return went well.

#### **A case-study: the region of Nijmegen**

In the region of Nijmegen, a well-prepared disaster relief and evacuation plan combined with good coordination between authorities, made for an efficient and smooth evacuation of thousands of people and cattle. An advantage, however, was that the Dutch authorities could anticipate the problems and prepare well in advance of the possible high water levels. In Southern Europe, floods are more of a sudden nature and effective emergency plans are necessary for the safety of human beings.

#### **The disaster relief plan**

The region of Nijmegen is bound by the river Waal, which is on the north side, and the Meuse, which is on the south side. These are the natural borders of the region. On the east side, there is the German border. There is a difference between floods in polders and in the areas without dikes, for example along the river Meuse in the province of Limburg. In areas without dikes, there will be instant flooding by the rising of the waterlevel in the river. However, there will be no flooding in areas with dikes (mostly polders) unless the dikes are broken or the waterlevel in the river is higher than the top of the dikes<sup>4</sup>.

Because of the possibility of floods and the threat of a dike breach, a disaster plan was drafted for the region of Nijmegen in the early 1980s. After the flood of 1993 from the river Meuse and the fact that there appeared to be real threat of weakening and breaching of the dikes along the river Waal, the board of mayors from the region decided to update the plan.

The question that had to be answered in the plan was 'would there be enough time for evacuation in the case of a dike breach, and in what order should measures be taken?'

Eventually, there should be a plan for each polder. In every polder, there is more than one municipality, which means there could also be a co-ordination problem. In the Netherlands, the mayor is responsible for disaster management. If more than one municipality is hit, and more than one mayor is involved, there could be a problem. This was solved by introducing a co-ordinating mayor, the 'super-mayor'. In this region, this was the mayor of Nijmegen. His task is to achieve consensus of opinion between all the mayors concerned.

The expected water-level and the safety of the dikes are important factors underlying organisational preparedness. To prepare the organisation for full emergency response, four stages were distinguished.

1. Technical measures must be taken.
2. The local disaster staff must be operational.
3. The regional disaster staff will be operational including all elevated services. At this stage there could be the danger of breaching the dikes. All measures must be taken and responsibilities according to the Disaster Act are now in operation.
4. A dike breach occurs and an urgent evacuation must take place.

In the disaster planning, all services related to this kind of disaster are involved. Special issues dealt with by this plan, which was accepted in December 1994, were:

- inundation scenarios
- evacuation planning for persons
- evacuation planning for animals
- communication plan
- information for the population.

#### **Inundation scenarios**

During the recent floods large areas had to be evacuated, which has shown that large-scale evacuation is an essential part of scenarios that had to be considered. Besides the evacuation, experience has shown that the flood causes enormous social disturbance. Not only do people

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#### Notes

4. The situation in the Netherlands differs from that of Germany, because the so-called bath-tube effect of the Dutch polders is more severe than those in Germany. The water level in a flooding polder can reach a depth of 4–7 metres. The risk for the population and the cattle is great.

experience great mental pressure, cattle suffer as well. Furthermore, economic consequences are tremendous, not only the cost of the operation, the care for refugees and loss of income, but also loss of production and damage to means of production, cattle, agriculture and horticulture.

All this is sufficient reason to consider decisions about an evacuation extremely carefully. This is made more difficult by the shortage of key data. This data, on which decision-making can be based, concerns the range of areas to be evacuated and the times when evacuation should take place.

During the recent floods, only cursory means of support were available, namely the criteria and inundation scenarios that the emergency management team had drawn up. The inundation scenarios are based on assumed water heights (based on probability calculations) and provide an insight for a limited number of periods only (the time-bar, moreover, is rather extensive, viz. 24, 75 or 175 hours). Further, details of the time-bar as well as adjustment to present water levels could already provide a much clearer picture.

If there is more insight into how an inundation takes place in relation to the time needed for the evacuation of the area, it is not only possible to define more accurately the moment of evacuation and the range of the area to be evacuated, but it may be possible to render preventive evacuations completely unnecessary. This fact is also relevant if strengthening of the dikes in the polder has taken place. The increased quality of the dikes will expel potential dangers similar to those at the beginning of 1995. A dike breach, however small the chance may be, will remain a possibility (although a remote one).

That is the reason that the region of Nijmegen together with the region of (Kreis) Kleve and the Road and Hydraulic Engineering Division from the Dutch Ministry of Public Works and Water Management have proposed a pilot project to the Commission of the European Union for an 'SDSS for evacuation of inhabitants and cattle out of a flooding polder' (for the proposal see box above).

### The flooding of 1995

Only a few weeks after the latest plans were accepted a new flood took place on 25 January 1995. While our region was the only one with new plans and the discussion about the contents had just

### Proposed Pilot Project

On the basis of a prototype model developed for the Ministry of Public Works and Water Management in 1992, it is possible to improve policy assessments. As neither geographical nor population data have been stored into that prototype model, it is not ready for practical use yet. In order to develop the model into a fully usable program, it is necessary to store data in cooperation with an actual region (the region Nijmegen together with the Kreis Kleve will be that region).

Previous to, during and after an expected disaster caused by inundations consequent to a breach of the polder dikes, operational insights and information are built up around processes that will appear in polder areas. This will be based on a spatial- (physical) and attributes-related (socio-economic etc.) description.

Those operational insights and information are supported by knowledge concerning:

1. *Hydraulics*—new knowledge and experiences acquired during the recent evacuation and disaster management activities in the Nijmegen region and other polder areas.
2. *Applied spatial informatics*—spatial decision support system (SDSS) approaches in case of disasters, as currently described for both natural and human caused disasters, especially with the aid of geographical information system tools integrated in such SDSS.

ended, it was possible to put the plans into practice in a short period of time. The mayors of all the cities involved were informed about the main issues of the plans. This made discussions about the process much easier. The necessary decisions could take place more easily, because everyone knew the consequences and the next steps to be taken.

While the water level was still rising, the 'water authorities' brought attention to the possibility of a breach of the dikes. At a certain moment, there was a point of no return when the water authorities no longer accepted any responsibility in our region for the safety of the dikes along the river Waal.

At this point the responsibility for the safety of the whole population and cattle in the polders of Ooy en Maas en Waal was in the hands of the mayors

3. *Disaster mitigation*—disaster management, risk reduction and relief can be supported by research and evaluation studies carried out for other crisis management circumstances, e.g. industrial and other public emergency situations. The development of the SDSS will be reached by:

1. Spatial descriptions of polder and adjacent areas, with maps, statistics and data listings ready to support decision makers with highly needed information.
2. Knowledge concerning the following relevant process: water behaviour and flooding, start and progress of connected disasters, relief, evacuation and opportunities for fast physical repairs of protecting devices such as water barriers and dikes.
3. The simulation of processes and consequent effects are 'managed' by parameters. One example is the average costs for one evacuating inhabitant. Another concerns the acceptable minimum time span between the start of the evacuation and the moment of estimated dike breach. A reduction of this time span causes extra risks and an extension may cause serious financial consequences.
4. Knowledge about organisational issues: available personnel to guide the evacuation, available materials for transport, available reception centres, food, communication between crisis centres.

involved. They could not in any way take this responsibility. How could they justify any decision of passivity should a burst ever occur? Eventually, this led to the decision to evacuate all the people in the threatened areas (30 January).

Fortunately, it was foreseen that this could happen. Therefore, the evacuation plan for the areas involved was already prepared. When the board of mayors took the decision to evacuate, all the planning had occurred and the total amount of required personnel and materials were ready.

Because the region of Nijmegen was the first to decide to evacuate in the province (together with German neighbours from the Kleve region), this worked as a snowball for the rest of the province. It was acknowledged that after the decision, other regions would soon

follow. So, the Gelderland Province and the Home Secretary were informed. A great part of the population (90%) decided to evacuate voluntarily using their own means and staying with family or friends elsewhere in the country. The evacuation of cattle however was more difficult. Apart from the great transportation problem, housing and feed were difficult.

After the evacuation had taken place, the area was abandoned and had to be guarded by the police and the fire-brigade. However, there was continuous pressure by farmers and industries to temporarily return to their property to reduce damage and to maintain their equipment. This was a difficult problem for the authorities and not every authority acted in the way that they had been agreed in the board of mayors.

Following its natural course, the water level began to fall. After some time, the 'water authorities' could guarantee safety again. Everybody could return to their properties. After the return of the population, all kinds of technical measures had to be taken, for example electricity, gas and telephones had to be restored.

An extra effort to guard the area was necessary and only the people who lived there could return. This operation was successful because a 'Plan for Return after the High Water' was drawn up. This plan contained, besides some statements, the measures for guarding the area, rules for accessing the area, transportation for people and cattle, public utilities and information. The return of the population was very successful. Nevertheless, in the evaluation afterwards, some lessons were drawn (see box below).

#### Lessons drawn

- A study is necessary to determine the consequences of constructing compartments in the polder.
- A spatial decision support system (SDSS) is needed for operational management of civil protection by polder evacuation and disaster mitigation in case of flood.
- The rules for entrance to the abandoned area have to be settled, despite the needs of individual municipalities, in a way that is realistic for the police, who have to enforce them. This also applies for the people who stay home.
- The evacuation of cattle should be more clearly described for a more practical execution.
- Before a new decision about evacuation is taken, more needs to be known about the economic issues regarding the farmers, the trade and the industry.
- there should be clarity about the damage payment from the government. Everyone should know what they can expect in future cases.
- The information to the population can be improved.

#### Flood management: warning and evacuation

In regard to the warning process, the difference between the 1993 and 1995 floods was remarkable, with some major consequences for the response.

#### Warning: a comparison of 1993 and 1995

In 1993, southern Limburg was taken by surprise by the sudden increase in the influx of water. Different aspects can explain a late and incoherent reaction.

Firstly, the authorities and inhabitants had not considered a situation like this ('it cannot happen here'). In earlier years high water had occurred frequently (the last time was at the beginning of 1993!) and the problems were always minor. But even though the situation was different this time, authorities and inhabitants did not expect the flood to become a major threat.

Secondly, the 1993 situation highlighted the lack of communication between the Belgian, French and Dutch instrumentalities involved (water boards and local authorities). Since there was no contact between the Dutch and Belgian authorities, South Limburg was warned at a relatively late stage. A researcher in Delft stated this quite firmly: 'For the Netherlands the Meuse (and measurement of high water) started at the frontier<sup>5</sup>. Due to this lack of communication, authorities and public were surprised by the sudden high water situation.'

Thirdly, in 1993 the preparations and planning for high water were not impressive. When the situation became critical the operational services started to look for things like boats, sandbags and pumps. The degree of preparedness

was insufficient to combat the flood. The difference between the high damage in 1993 and the comparably low damage in 1995 can almost be totally explained by this lack of preparedness.

The other regions in Limburg, and other parts of the Netherlands, had more time to prepare for and inform the public about the coming threat. Due to the slow onset, the water took three to five days to rise in these areas. Therefore, there were no particular problems concerning the warning of flooding. The information was nevertheless very important for the next stage in the process, the evacuation.

#### Evacuation

One of the central issues of the 1995 flood was the massive but smooth evacuation of nearly 250,000 people. With respect to this evacuation two questions could be posed. First of all, the decision to evacuate a large number of people put a burden on the responsible decisionmakers. The first question deals with the reasons for evacuating this part of the Netherlands. Secondly, many people wondered what made the evacuation such a successful operation.

#### The reasons for evacuation

- *A life-threatening situation.* In a way this question about the reasons for evacuation looks superfluous. People were evacuated because it was life-threatening. Of course, this is the main and to a large degree the only reasonable answer. Both the authorities and the people directly involved were convinced that there was a high-risk situation. Large sections of different dikes were 'old fashioned' and in bad shape. For a number of reasons the safety of the river dikes had been a non-issue during the last few decades.

Although plans for maintenance were ready, the lack of priority gave no urgency to implement them. When it rained for days in the river basin of the Rhine and the water level rose, the old dikes became a problem, because the sliding or collapse of a dike can endanger large numbers of people.

- *No guarantee.* Although the situation was more severe than in other years, there had been similar situations in the past (1988, 1993). This time the water rose higher and this time the polder-boards, responsible for the maintenance of the dikes could no longer guarantee that the dikes would keep the water out.

Notes

5. *De Volkskrant*, 30 January 1995.

This was a new experience for the responsible authorities (mayors), who subsequently became responsible for the safety of their inhabitants. There was no other solution than to evacuate, after the experts withdrew their guarantees.

For the 'water authorities' the evacuation of such a massive number of people was, in a way, a blessing in disguise. It was a great opportunity to improve the quality of the dikes. After the evacuation, everyone was aware of the deplorable state of the dikes and a consensus existed for the need for rapid repairs.

• *An ongoing process.* Scanlon argued that the 1979 evacuation of Mississauga was a process with some psychological aspects<sup>6</sup>. The evacuation started close to the affected area, but in the hours and days that followed, broader circles around the disaster were evacuated. The evacuations continued not only because of the increased risk, but also because the initial evacuations were so successful. There was no reason for the police to stop, they just continued their job. In the balance between staying and evacuating, the latter became more popular.

To some degree there was a similar pattern in the 1995 flood evacuation. The successful evacuation in the Nijmegen area made the decisions of the water authorities and the public authorities further down the river much easier. The risk and uncertainty of a flood were, after the first successful evacuation, greater than the problems and risks from an evacuation. In other words, this process made it difficult for authorities to decide not to evacuate.

### The success of the evacuation

Despite some minor problems during the actual evacuation, everyone agreed that the operation was a success. The population was praised for their disciplined behaviour. But was this behaviour the only reason for this outcome? There are other reasons that can explain the success of the evacuation.

• *Preparation.* Most of the people involved believe that preparation helped a lot and made the evacuation process smoother<sup>7</sup>. After the high water in 1993, the province of Gelderland and especially the region of Nijmegen were convinced that the development of a special emergency 'high water' plan in case of a flood was necessary. The first efforts for such a plan were undertaken in the beginning of 1994 by the region of Nijmegen. This plan served as a model for other regions in the province. At the end of 1994 this model was accepted and

sent to other regions in the province. Although the other regions had not formally accepted this plan before the 1995 flood occurred, most of the regions could use it as a guideline for their response to the flood.

As soon as the flood occurred, preparations were undertaken in Nijmegen. Two days before the decision to evacuate, a special team of police in charge of the evacuation was formed to develop, on the basis of the emergency plan, a more specific evacuation plan. Some days later, these preparations were useful during the evacuation.

It could be argued that it was rather fortunate that the region that was best prepared for a flood was also first hit<sup>8</sup>. The successful evacuation of Nijmegen (about 60,000 people) must have given confidence to the other regions that an evacuation of a large number of people was possible. Also, a positive side-effect of the first evacuation was that people in other areas were convinced there was an actual danger for the population in the province. This gave them a good example ('they were evacuated yesterday, we may be evacuated tomorrow').

• *A real threat.* The appearance and severity of the threat were clearly visible. The slowly-developing threat gave the responsible authorities enough time to convince the population of the danger. It started with the 'wet-feet situation' in the southern part of the Netherlands. After that, pictures were shown of the situation in Koln and Koblenz (with large parts of the cities under water). Eventually, people saw the high water-level in their own region. These pictures seemed to have a major impression on the perceptions of the population. It did not take too much effort for the authorities to convince the people that there was a threatening situation. Probably, this was the most fundamental explanation of the success of the whole evacuation<sup>9</sup>. Most of the people of the evacuated areas were convinced of the threat of the situation. The visibility of people leaving made others evacuate.

A survey conducted by the Crisis Research Center confirmed that a majority of the people evacuated far in advance of the official dead-line. Results of the survey also show that nearly 90% thought that the evacuation was justified and about 80% would evacuate again next year if a similar threat occurred<sup>10</sup>.

This argument gains strength when the situation in southern Limburg is considered and how it differed completely. Here people were reluctant to

leave their houses. Although flooding took place, a life-threatening situation did not occur. This was also the main reason that mayors decided not to force people out of their houses.

• *Slow onset.* Urgency is one of the common features in crises. The amount of time and the presence of urgency do not only influence decisionmakers, but also affect people involved. Lack of time, and more importantly the feeling that there is a lack of time, is a key factor in the possible presence of panic-like behaviour<sup>11</sup>.

The people in the province of Gelderland had enough time to prepare themselves for the flood. Measures were taken to protect their belongings in case a flood occurred. Furniture was moved and kitchens were disassembled. As soon as these measures were completed, there was no reason for them to stay any longer. In addition, the large number of policemen which were present in the area gave them the idea that everything was well protected. The long lead time was an extra reason for the people to react calmly to the message to evacuate.

• *A 'three-stage rocket'.* Authorities communicated to the public about the evacuation in three different stages. This started with information about the coming threat, which made the people conscious about a possible flood. Then, a governmental three-stage 'evacuation rocket' was launched. The first stage was the advice to the public to prepare for an evacuation. The second was the urgent message to evacuate before a certain time, and the third and final stage was the deadline posed by the local government. This communication strategy

### Notes

6. See Scanlon T.J. 1989, 'Toxic chemicals and emergency management: the evacuation of Mississauga, Ontario, Canada', in U. Rosenthal, M. T. Charles and P. 't Hart (eds), *Coping with Crisis: The Management of Disasters, Riots and Terrorism*, Charles C. Thomas, Springfield, pp. 303-322.

7. This is based on interviews done by the Crisis Research Center in relation to the study that is currently been done.

8. Of course, this is not a coincidence. Due to the fact that the Nijmegen area was threatened most in 1993 and the area with the highest risk, the first preparatory measures were undertaken in this area (see also end of this paper).

9. This confirms the results from studies done in the field of disaster-sociology.

10. This survey was set up to study the reactions of the population to the recent events. About 500 persons in the province of Gelderland were questioned by the Crisis Research Center.

11. Panic is one of the myths: everyone would expect panic, but research has shown that this is hardly ever the case.

appeared to be successful. This method was only possible because of the long lead time available. This is again confirmed by the survey. It showed that about 75% evacuated 24 hours or more before it was obliged<sup>12</sup>.

• *Self-regulating behaviour.* After the flood was over, the authorities and chiefs of operational services were positively surprised by the co-operation of the people. Nearly all evacuees left and returned to their homes without any support. The authorities planned for almost 25% of the people needing to be transported by public means (ambulances, buses). During the evacuation, only 3% had to use these means of transportation. The same goes for temporary accommodation—expected usage was 10%, the effective use was less than 3%.

There are some explanations for this discrepancy. The authorities over-estimated the numbers and were not aware of the results of international research in this field. Secondly, due to the amount of time, almost 10% of the people who had no means of transportation were picked up by relatives or friends. Finally, there were no special problems that authorities had to deal with. The composition of the population was rather homogeneous. No attention had to be paid to special groups like for instance immigrants.

• *Co-operation from the media.* Afterwards, authorities showed their surprise at the massive presence and role of the media. For days, the town of Nijmegen was besieged by foreign reporters. The flood was an important news item for almost ten days. It is certainly interesting to see that the local and regional broadcast organisations played a central role during the flood. Before the evacuation in Gelderland took place, information was obtained from regional and local radio stations. Afterwards, the survey showed that the people were of the opinion that the regional radio station was the most popular and trustworthy<sup>13</sup>. This conclusion also applies for some municipalities in Limburg. In Venlo for example, the local radio station was the primary source for the local people.

To conclude, it can be stated confidently that the whole evacuation process went well.

### Concluding remarks

It is impossible to present a complete picture of the floods of 1993 and 1995 and the warning process in such a short

article. For that reason, a number of interesting aspects have been left out or only dealt with briefly. This is the reason this article ends with 'concluding remarks' instead of 'conclusions'. These remarks focus on the subjects that were amongst some of the most interesting issues of the 1995 flood.

### Authorities and responsibilities

This article started with an introduction to legislation of emergency planning in the Netherlands. During and after the 1995 flood, on-going discussions have been held about the subject of authorities and responsibilities.

Central questions were: Why did the Minister of the Interior intervene in the decision-process? What was the role of the provincial governors and what is their relation with the so-called 'super-mayors'? Are municipalities the right level to combat a flood or take decision like an evacuation? From what level should operations be coordinated?

To answer these questions would take another twenty pages. Still, we want to make some statements about these issues. It is interesting to note that there is a discrepancy between the way authorities work together and their reaction afterwards. The authorities worked well during the critical situation, but conflicts occurred when responsibilities were discussed in the aftermath. One of our respondents stated: *'from the moment the water-level was decreasing, there was an increase in conflicts about responsibilities'*. The tendency towards centralisation during the decision-making has been discussed thoroughly. Certainly, there are various reasons for such centralisation of decision-making. Decisions about evacuation and return of people over a large area always supersede the level of the evacuated areas. However, people go outside the area, so other areas become involved.

Another interesting subject concerns the role of the so-called 'super-mayor'. There is still discussion about the position of this person. The discrepancy with the formal system of emergency planning (there is no formal status for this person) was also an important stimulus for the discussion about the structure of Dutch government (the scale and number of provinces or a fourth layer of government).

### If ... then tensions

One of the interesting and frequently mentioned issues about the information, warning and evacuation process is the

exemplary function of decisions and preparations. When a director of an old people's home, hospital or prison decides to prepare for an evacuation, this immediately has effect on the behaviour of the population in the neighbourhood. The same goes for the police or fire-fighters who start to move belongings to a safer place, while neighbours are still ignorant about the coming events.

Another example is the differences in return. Some people had to wait one or two days, while others were already returning to their homes. These sorts of phenomena were visible during the evacuation process in 1995. This led to foreseen and unforeseen processes such as a snowballing effect. In some cases, it took authorities quite some time to inform the people of the decisions that were taken.

### Broader lessons

What can be learned from this successful operation? Most people, including us, are reluctant to translate the success of this operation to future occasions. Each crisis and disaster has typical, but also atypical features. It is, in this respect, dangerous to translate these experiences too easily to other situations with perhaps other features (less warning time, other organisations involved and another agent, for instance chlorine instead of water).

On the other hand, some general lessons from the disaster literature have been confirmed during the flooding. The self-regulating behaviour of people is the most important aspect. In a sense, the success of the operation can for a great part be ascribed to the behaviour of the people in the Netherlands.

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### Notes

12. See note 7.

13. See note 7.

### Further explanation of term 'Polder'

Polders and Polder-lands are areas that have been reclaimed from the sea, surrounded by dykes. Polder-boards are regional water authorities, run by elected bodies, with responsibility for flood safety. A polder-board may also be called a water board, because they do not only exist in polders. When the Dutch started manipulating water systems, a need arose for some collective action to protect land and property against flooding. This was institutionalised in the 12<sup>th</sup> or 13<sup>th</sup> century in the form of water boards. There are about 120 polder boards and their responsibilities also include water-quality management. The focus of the boards is now less on hard engineering solutions, and more on 'working with nature'. They are the 'practitioners' at a local or sub-regional level and fairly independent from national, provincial or local governments.