Risk policy for the transport of hazardous substances in the Netherlands

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Abstract

A risk management tool for the transport of dangerous goods has been developed in the Netherlands. Risks in the direct vicinity of routes are charted using a figure-based approach. This approach is meant to decide on subjects concerning so-called "external safety." The approach is location-specific, which means that the decision on prevention or repression of risks is made per defined locations. The aim of the risk policy is to arrive at a well-considered positioning of physical planning for such locations on the one hand and of the risks of the transport of dangerous goods on the other.

With such a figure-based approach, three kinds of decisions can be made by the Ministry of Transport. 1) It is possible to make an inventory and analysis of important locations; 2) one can decide on certain measures or alternatives; 3) general risk criteria have been developed to decide on locations with relatively high risks. The approach using risk criteria is based on the consequences of such a policy for the whole country--for transport by road, by railroad, on water, and with pipelines. For a certain location, these criteria are used to decide on measures including routing, traffic safety., zoning, and emergency planning.

Until now, the risk policy in the Netherlands was developed for external safety only. Although there is a difference in the perception of risks, the so-called "internal safety" measures--traffic participants, passengers of trains and ferries etc.--is now the subject of discussion.

To address these problems, a logical solution to the lack of space and the necessary protection of the environment may be achieved by bringing infrastructure underground. It is however obvious that new safety problems and policy problems are thus introduced. The transport of dangerous goods and freight transport in general may cause more serious risks for people on the road or in a passenger train due to the probability of a fire, an

explosion, and/or a toxic cloud.

This presentation will cover the developments of all mentioned subjects. Examples will be given and future strategies for risk management when transporting dangerous materials will be discussed.

1 Introduction

This Dutch contribution is concerned with risk policy for the transport of hazardous substances.

Why Risk Policy?

Thinking and making decisions in terms of risks facilitates the discussion of the concept of 'safety' in a rational form. It is better to think in terms of risk factors based on standard calculations rather than use expressions such as 'safer' or 'unsafe,' as this allows risk-bearing situations to be compared with one another more easily. Politicians are invited to comment on the level of risk criteria on the basis of their estimated consequences. Reducing a risk (increasing safety) costs money, although such costs are limited.

Risk Policy for Transport

The risk policy for transport in the Netherlands is applied to several policy fields. A distinction is made between so-called 'small chance large consequences' accidents and 'ordinary' accidents due to inadequate road safety levels. Another distinction is made between so-called external safety (safety for non-road users--residents, holiday-makers, etc.) and internal safety (safety for drivers and passengers, etc.).

These distinctions are made due to the fact that each individual policy field may necessitate its own specific risk concepts and risk criteria--i.e., each policy field has its own characteristic package of measures. Another important fact is that the risks in each policy field are experienced in a different way (thus there are differences in perspective).

Contents of This Contribution

This contribution is exclusively concerned with 'small chance large consequences' risks in goods transport, most notably the transport of hazardous substances, by road, water, rail, and pipeline. The issue at hand can roughly be divided into two topics: existing external safety policy and the internal safety policy under development.

External safety policy

An external safety policy has been developed for the transport of hazardous substances in the Netherlands, following the standard external safety policy for stationary installations. External safety is concerned with the safety of non-road

users. Experience has been gained in relation to the policy and instruments have been developed in order to execute its large-scale nationwide implementation.

Internal safety

At present, increasing emphasis is being placed on matters of internal safety in the Netherlands, in particular the safety of drivers and passengers. The intention to cover in-transport infrastructure more and more in the vicinity of urban areas, or to build tunnelled roads, raises questions in relation to risks to drivers and passengers. Not only hazardous goods are a risk in terms of 'small chance large consequences,' but experience also teaches us that an 'ordinary' fire in a truck can cause extensive damage if it occurs in a tunnel. A number of considerations for this future policy will be mentioned.

2 External Safety Policy

Risk Criteria

The external safety policy on the transport of hazardous substances was developed in 1995. This policy is described in a government policy document, 'Risk Criteria for the Transport of Hazardous Substances' [1]. This policy for the transport of hazardous substances shares many similarities with the earlier policy on stationary installations.

By definition, external safety policy is concerned with 'small chance large consequences' risks, in which 'consequences' are taken to mean the effects (fatalities) for non-road users. Two risk concepts are used: individual risk and societal risk.

Individual risk

Individual risk, in effect a local risk, is used as a primary zoning instrument. At a certain level of individual risk (the individual risk norm), a minimal distance is maintained between the source of the risk and vulnerable destinations such as residential areas, on the basis of calculated risk contour lines.

Societal risk

The calculated societal risk is used as an indication of the severity of possible calamities for surrounding areas. A test of this societal risk addresses the issue of whether this risk-bearing situation remains desirable and to what extent.

Handling Risks: an Integral Consideration

An important advantage of external safety policy is that more integral considerations lead to a more sophisticated approach to risks. After all, in determining risks all factors are given the utmost attention. This means it is easier to estimate how such risks can be limited.

Risk of accident

The extent to which the means of transport is well-equipped, the person at the wheel, the quality of the packaging material, and the degree to which the route of

transport can be considered safe, are all taken into account in considering causality. An estimate of the likelihood of a serious accident is based on this assessment.

Consequences of an accident

The nature and quantity of the hazardous substance, the distance from vulnerable destinations, the number of people within a potential damage area, and the typical weather conditions as well as the environment in which the accident occurs are all determining factors for the risk level.

Cost-benefit Analysis

Thinking and calculating in terms of risks demonstrates where and how the greatest safety benefits can be obtained at the lowest costs. External safety policy also indicates the mutual responsibility of transporters, road managers, spatial planners, and emergency services. Decisions are founded on the calculation of measures and alternatives in terms of risk reduction or increase. The rational decision-making that forms the basis of international legislation on transport of hazardous substances can be further improved. Current discussions are still in their infancy, but a discussion memorandum has recently been drawn up for the OECD [2].

The Most Important Issues

- The discussion on preconditions for land use (spatial planning) is particularly important with regard to external safety issues. In the Netherlands, land is a scarce and hence expensive commodity. Many factors play a role in spatial planning, of which safety is but one. Taking into account the advantages of land use along waterways, or the desire for multiple land use along roads or railways, it becomes difficult to keep vulnerable destinations at a distance from the source of risks. In the future, a legal basis may be required in order to enforce the policy.

- Thus far, external safety policy has the status of a government policy document, and thus not of law. Policy may be enforced by means of an appeals court, but in practice this is often dependent on the cooperation of all parties (business and municipal, provincial and national government). Investigations are ongoing to determine whether it is feasible to grant legal status to external safety policy on stationary installations.

- Risks are calculated according to standard methods. However, calculating the safety benefits of specific measures is not always a simple matter. It may be clear that a measure can bring about qualitative benefits (for instance, better training for drivers), but it is often difficult to quantify such measures in terms of risk reduction.

- Another issue is the link between chiefly prevention-oriented external safety policies on the one hand and the repressive policy--the emergency services--on the

other. It is clear that a quantified risk on the basis of potential fatalities is not the most suitable measure for determining the deployment of emergency services for aid to victims. In addition, measures in relation to emergency services are not easily translated into quantitative factors in the risk analysis.

- In addition to the typically probabilistic approach, supplementary use is made of more deterministic principles in order to better integrate safety policy and the emergency services. This currently takes the form of ALARA measures (As Low As Reasonably Achievable).

Communication

The experience obtained from external policy on stationary installations made it clear that a good policy description requires more than simply one policy document on which representatives of all parties are able to agree. New issues of external safety arise frequently all over the country--during the construction of a new transport route, a new zoning plan, a larger than anticipated increase in traffic density, etc.

This is why it is extremely important that all parties understand the 'rules of the game' with regard to policy. This becomes even more relevant if one considers that expertise on risk analysis and risk handling is hard to come by. For this reason, external safety policy for the transport of hazardous substances has been worked out at several levels.

General guide on external safety for the transport of hazardous substances

In addition to the policy document mentioned in which specific policy pertaining to the use of risk criteria is described, a general guide has been issued for representatives of all organisations that may become involved professionally in this policy. In this guide, issues of risk are dealt with in depth using examples. An important supplement to this guide gives a numeric representation of potential risks based on the size and nature of the transport and the location of the route in relation to built-up areas. These figures indicate which transport situations require special attention and which situations will comply with the criteria in advance. A similar guide exists for external safety policy on stationary installations.

Risk atlas

Special risk maps for the transport of hazardous substances either exist or are being drawn up with the aim of providing direct insight into any 'hot spots' in the Netherlands. These maps clearly indicate that external safety problems have to be given attention in advance in the case of new zoning plans close to transport routes.

External safety for the transport of hazardous substances brochure

A brochure has been published for all interested members of the public describing policy in an easily accessible manner.

Calculation chart

It is important that risk analysis calculations for external safety policy are standardised. For this purpose, a so-called "risk calculation chart" has been made. This is a software package that enables the risks of transporting hazardous substances by water, rail, road, and pipeline to be calculated. Fixed standard calculation packages for more specific calculations are currently under development. The software is freely available in the Netherlands at minimal (reproduction and help desk) costs. An English language version has also been released, intended as an example for international discussion. This package is translated in English and can also be obtained at low cost (without help desk support, but with a manual) [3].

Effect guide

This booklet, specially published for municipal governments, provides global insight into all 'small chance large consequences' risks that may occur within a municipality. The transport of hazardous substances takes a prominent place in this booklet, which is intended as an easy access indication of such risks to municipalities, primarily from the perspective of the emergency services.

UN document

The UN has drawn up a so called "techdoc," containing Dutch expertise, for countries that wish to give attention to safety issues related to hazardous substances (both stationary and transport) for the first time. The areas/situations of greatest risk in a large industrial complex, for example, can be traced and selected using the method described in this techdoc. It is intended as a first step in obtaining knowledge on similar activities in a specific area and making a first selection (setting priorities) of further steps to be taken in order to manage these risks [4].

3 Internal Safety Policy

Multiple land use is becoming a popular method in the Netherlands for managing the increasing shortage of land. The idea is to use space for multiple functions and to improve the living environment by removing unpleasant activities from residential and recreational areas. In this context, the possibilities of underground transport are being explored in order to save space and improve the residential and recreational environment on the surface.

Basic Forms of Underground Construction

Several forms of this kind of vertical construction can be distinguished.

Pipeline transport

- Liquids and gasses
- Containers with piece goods etc.

This is actually only a question of normal external safety issues, given that few drivers and passengers are involved. This form of transport may have great promise in the future, not only as a response to the shortage of land but also as a way of reducing road congestion and adverse effects on the environment. Unfortunately, such alternatives are expensive and require the flow of transport to meet certain conditions (large bulk, same destination, and permanent).

Tunnels and Coverings (in various forms)

-Sunk , drilled

- Tent, awning, bunker etc.

These forms have their own specific risks, namely those to drivers and passengers who may become trapped at the moment of an accident, fire, poisonous cloud, or explosion. These constructions reduce accessibility for emergency services and limit the opportunities people have to help themselves. In terms of open field transport, these constructions increase safety problems involved in transporting hazardous substances. The nature of such constructions (the longer and deeper they are) may reduce external safety issues and benefit land use, but have the adverse effect of increasing internal safety issues and high costs.

Suspended constructions

This form of building constructions high above roads has a negative impact on external safety. Vulnerable objects are built above the transport axis. There is no longer a safety zone and emergency services have virtually zero accessibility to such objects.

Internal Safety of Transport

Globally speaking, particular attention is being given to road safety. This has less to do with 'small chance large consequences accidents,' generally focusing on accidents in which one or more cars are involved or collisions with cyclists or pedestrians. In general, this specific social risk is measured in terms of numbers of victims at national level annually. As a cumulative number of victims is involved, the actual impact of these accidents is much larger than that of 'small chance large consequences' accidents. The social perception of these 'small chance large consequence' accidents is striking--there is a very strong aversion to them, partly as a result of media coverage. For this reason, large accidents are given proportionally greater political significance.

The national picture of this type of accident is not representative either, if only because of the small chance of several accidents like this occurring in one year. It is more an issue of such accidents being tolerated--at a certain location, with a certain mode of transport, or as a result of a certain construction. Accordingly, the approach is far more location- and situation-specific than the approach to 'normal' issues of road safety.

'Small chance large consequences' risks in relation to internal transport safety issues can be observed in various areas:

- Open road situations with a high density of hazardous substances transport, meaning that drivers and passengers run relatively high risks.
- Tunnelled and covered road and rail transport stretches (fire) and more specifically their use in the transport of hazardous substances (fire, explosion, poisonous cloud).
- Passengers in trains, busses, and metro systems (collision, derailing, fire).
- Passengers on a ferry (shipwreck).
- Airline passengers (crash).

Developing an Internal Safety Policy

As mentioned above, the discussion on 'small chance large consequences' risks in the Netherlands has been given an extra dimension as a result of resolutions (and several projects already under construction) to build underground. It does go without saying, however, that a consistent policy is demanded, which means that the discussion on a risk norm for internal safety cannot ignore other situations in which these issues arise.

For this reason, the current approach is as follows: In the first instance, attention is given to the risks of goods transport with the aim of developing risk criteria as soon as possible. This principally concerns the first two situations indicated in the list in the preceding section (transport of goods). Risks in these situations are estimated as accurately as possible and the consequences of possible criteria mapped. Wherever possible, links are sought to external safety policy, though it is evident in advance that the concept of individual risk cannot be applied here as drivers and passengers cannot be considered a local or place-bound risk.

Other situations from the list in the preceding section are also concerned with issues of internal safety policy under analysis, aimed at comparing the risks of different transport situations in order to determine whether policy can continue to include these forms of 'small chance large consequences' risks in the future. In future discussions, a risk norm will continue to be not an end in itself, but merely an abstract, a politically relevant tool to confront such risks socially.

The Most Important Issues

Several important issues have been indicated in advance. Of great importance, and thus the desired result of the investigation, is the desired level of the risk norm. To a large degree the preconditions for this norm have already been set as a result of earlier policy and political statements.

- First, it is important that the norm is limited by the values determined for external safety. There is no clear need to be more stringent on road users than on

third parties (residents in surrounding areas). The opposite is possible, however. This is done in other sectors of risk policy, such as different radiation criteria for citizens compared to radiation laboratory assistants. But there are limits to the acceptance of 'small chance large consequences' risks. This issue was debated in Parliament in the framework of external safety policy for stationary installations. It is argued that criteria for internal safety risks could be no more than a factor 10 less strict than for external risks. Thus, the conclusion can be drawn that the range for internal safety risks has already been determined accurately.

- It is clear in advance that internal safety for flying cannot be measured effectively by expressing risks per kilometre of flight. This means that risks related to flying cannot be expressed in the same way (according to the same dimensions) as the risks of goods transport. It goes without saying that this requires separate research and entails a specific communication problem.
- A further issue in the separate consideration of matters of internal and external safety is the degree to which this information can be made available in a more integrated manner for calamity procedures.
- In the development of internal safety policy, most notably in relation to emergency services, it is also important that the emphasis is not only placed on a purely probabilistic approach (risk analysis and criteria) but also on the determinist perspective (ALARA principle).

4 Conclusions

- To a large extent, external safety policy in the Netherlands has already been developed. A similar policy is also being developed for airports.
- Intensive discussions are ongoing on internal safety criteria, triggered in the main by recent developments in underground construction in the Netherlands.
- Time and again it becomes apparent that discussions on risk policy must be held with those who are responsible for spatial planning--i.e., in the Netherlands the local governments. The issue of land use in the Netherlands is so prominent that it threatens to subvert the entire discussion on safety.
- From an international perspective, it is important to integrate risk policy with general legislation on the transport of hazardous substances.
- Extensive supplementary efforts must be made to ensure that policy is clear to everyone and to enable construction of a set of instruments to aid the full application of policy in decision-making.

5 References

[1] Document 'Risk criteria for the transport of hazardous substances' February 1998, year of sitting 199501996 24611 no. 1. Dutch Government
This policy document indicates risk criteria for external safety (individual risk and societal risk) for the transport of hazardous substances. Guidelines are set forth on applying criteria and the consequences of these criteria in terms of costs and use of space.

[2] Discussion memorandum for the OECD
October 1997
The Netherlands:
United Kingdom:
This document is intended to form a link between international legislation on the transport of hazardous substances on the one hand and risk policy on the other.

[3] Software package "IPO calculation chart"
June 1997
The joint national and provincial governments and the Dutch Railways.
This calculation chart enables the user to calculate the risks of transporting hazardous substances by road, rail, waterway, and pipeline. Standard calculation methods are used as agreed between parties (government and private sector).

[4] Manual for the classification and prioritisation of risks due to major accidents in process and related industries.
November 1996
Interagency programme of IAEA UNEP UNIDO WHO
This document (techdoc 727) published by the IAEA is intended as a first step towards formulating risk policy for the Transport of hazardous substances and stationary installations.