CONCEPTUAL CHANGES IN APPROACH TO THE WARNING SYSTEM OF POPULATION IN THE NETHERLANDS – EXPERIENCE WITH IMPLEMENTATION

Peter A. A. BAIJENS

Abstract

The paper presents experience with the introduction of a new concept of emergency population warning system in the Netherlands where the practice of past 25 years has been evaluated. In this paper there are reasons that led to decision for major changes in subject field, than the description of a process of creating requirements for a new warning system and the introduction of measures necessary for its installation.

Besides the description of experience with implementing policy changes there are also basic parameters of warning system and a brief description of its daily operations. The framework of national supplementary warning system, which was put into operation in 2012, is another part of this paper.

Key words

Emergency warning, sirens, warning and information, warning signal, warning system.

Reasons for adoption of conceptual changes in warning system

In March 1990 the Dutch Council of Ministers decided that a network of civil defence sirens of 1950 will be replaced by a new system of electronic warning devices. For this political decision following four basic reasons were identified.

Above all it was the opinion that for information how to behave in imminent danger it is insufficient just to attract citizens´ attention for communication with them. Besides warning which aims to provide rapid warning of an impending or emergency event by public warning signal, subsequent communication of additional emergency information which the current system has not allowed is also necessary.

The second reason was a need for a new method of technical matter. The existing network with approximately 3,800 electromechanical sirens was outdated. In addition, the costs for maintaining technical viability of the system at the minimum level, was still high. Finally, from technical reasons, it was necessary to carry out acoustic tests which raised worthless noise troubles and this was not always accepted positively by population.

The third element influencing the adoption of decision to redesign the warning system was the need for selective use of individual components of the system in very different situations of crisis specifics. The existing sirens could be activated only in groups in minimum 25 buildings and therefore selective warning process was inherently impossible and the existing network was no longer able to meet societal demands. This often meant a certain degree of "overspreading" during warning action and an obstacle with the use within current warning system.

The final reason for replacement of warning system was just formal. The existing network no longer corresponded to the former requirements of SEVESO Directives. Specifically, it was not possible to secure a requirement so that people in residential risk areas with more than 300 inhabitants were able to hear the siren signal. It was necessary to fill gaps in the area signal coverage which was about 80%. Moreover the network of civil defence sirens

were created on the experience from the Second World War and its basic characteristics was a collective use in case of air attacks.

Thus the need for a new social concept of warning system which is capable to remove these shortcomings while qualifying preserve functionality even in case of military conflict arose.

Requirements for a new system

To obtain a clear idea of changes in approach to the implementation of the warning system is the best way to make a comparison concerning the most important technical, operational and functional characteristics of the old and a new system. Compared areas include technology, signal coverage and the ability to use programming of a new signal.

Above all, it is necessary to be emphasized that the new system was designed with the intention of using it in all kinds of threats of anthropogenic and natural origin and no longer exclusively in the event of armed conflict or specific air attacks threats. Considering this change in attitude it was decided to create a new signal which would exclude the automatic unilateral association with war threats.

In terms of comparison of the technical characteristics it is possible to specify the switch from electromechanical to electronic equipment and so the change of activation method by using telephone lines to the wireless radio activation. To succeed sirens activation was intended by the radio signal by means of one of shared network of fire services organizations. The simplex radio channel in the frequency range of 440 MHz was designed for application. The entire start-up process of transfer and real sound generation was designed with regard to its hardened security. Batteries for situations when disruptions of energy can occur, was also another part of the requirements.

The newly proposed method of coverage was also very different from the old system. Standard for coverage was determined in accordance with Seveso Directive requirements when one siren for concentration of 300 or more persons within risk areas and for 1,000 inhabitants or more outside these areas was designed.

Sirens in a new network were designed for individual activation and in every required combination to simplify responsible subjects alarming only those groups of citizens who are at real risk of accident or disaster consequences. Sirens groups can be determined by the characters of information equipment of control station. When the group is selected and activated, each siren is in principle addressed individually. Likewise, sirens groups can be detected in a selection process. In this case the sirens in a group will be activated by a single group address, thereby activating will be faster.

Another part of the requirements for information equipment of control devices at a siren location was to create a "sound library" where alarm signals would be defined. The signals had to be designed in such way so that to choose them could be possible by using of simple codes detectable in control device at the place of a siren. On the basis of these codes, the signals would subsequently be chosen from "Sound Libraries" and routed to a synthesizer. The outputs from the synthesizer would then be routed to the amplifier power. Since the signals are determined by the information equipment they can be very easily changed if necessary (e.g. when defining new alarm signals). A silent alarm test that would allow testing the network without disturbing the public was another requirement for the signal library.

Summary of compared basic indicators is shown in table No. 1

Table 1
Comparison of conceptual solutions of warning systems

THE OLD WARNING SYSTEM	THE NEW WARNING SYSTEM
electromechanical siren	electronic siren
activation by phone	activation by radio
group use	individual or group use
designed for war	designed for all sorts of anthropogenic and natural disasters
coverage only at concentrations of over 1000 persons	coverage at a concentration of 300 persons within high-risk areas, outside the risk area at a concentration of 1,000 persons
loud test every month	silent test, loud test is a part of a campaign to inform the public
power from a grid	power from a grid, in addition emergency battery power
a sole signal	programmable signal

Process of changes preparation and planning system installation

Before starting the installation of new sirens it was necessary to carry out a series of preparations at the national level and also at the level of each region.

First of all a plan of coverage for each region of the fire service in the country (at that time there were totally 40 regions) was elaborated. In this context it was necessary to create an overview of important risks and to choose correct method of coverage in relation to the regional specific circumstances. The regional plan of coverage was a result of these steps.

Based on the theoretical plan of regional coverage some suitable locations for the sirens were subsequently evaluated and other steps to obtain permission to install them in these locations were initiated. This resulted in a regional plan of sirens and a set of agreements with owners of chosen locations.

Then, with respect to approved sites, the installations of sirens were technically secured. The installation plan for each device was the main result of this stage.

The last step, but a very complex process, was obtaining the necessary construction permits for each site from local administrative authorities. This part of process involved performing a vast agenda covering environmental issues, location architecture, construction methods and others. In the end all construction permits for each installation were obtained.

The whole preparation process lasted approximately one year for each siren; therefore it was necessary to organize the preparation method when processes could proceed simultaneously.

In November 1992, under a contractual procedure and in accordance with the rules of the European Community and the General Agreement on Customs and Trade an order for the supply and installation of a new system of the Siemens Nederland could be assigned. The Siemens has been designated as the main contractor.

Allocated funds for the project were approximately 160 million Dutch guilders[1] with about 78% of the sum for development, production, installation and project management and 12% for maintenance within 20 years.

The new system was built at 45 regional control stations and approximately 3,500 sirens. It was installed between 1993 and 1996. At first approximately 350 sirens in two chosen areas - in region of Zeeland and in area of Rotterdam - were located to obtain sufficient

experience in relation to necessary administrative preparation and in process of technical installations. Installation in remaining regions began in early May 1995. After fitting sirens in the place and their verification the regional networks were taken into operational use by regional and local governments.

The Siemens Nederland under its contractual arrangements has been provided networks service since 1997 (for the period of 20 years).

Basic parameters of a new warning system

While addressing the functionality of warning system it was necessary to be based on the regional structure of public administration. In terms of administrative division the Netherlands is divided into 12 provinces.

Besides, in context of public administration in the field of security there are 25 so called security regions [2]. It is a specialized regional public administration, where also fire regions are included, fully corresponding with the division according to security regions. The fire service is established by municipality.

Map of the administrative division of country with regard to security regions is shown in Fig. No. 1

Fig. 1
Security regions in the Netherlands

Depending on local conditions and requirements for coverage of various regions with a signal there is a possibility to use following three types of sirens with different levels of sound performance:

- type 1: 108 dB,
- type 2: 114 dB,
- type 3: 120 dB.

The choice of siren type is mostly influenced by an optimal relation between the requirements imposed to cover of warning signal and criteria of selectivity.

For a new system it was established that the siren can be placed on a 15 or 18 m high pylon, or on a top of building. The result of determining process of what sirens type and what constructions are best was always under cooperation among stakeholders, i.e., the Ministry of Interior as the owner of the system, the regional fire service organizations as the operating system makers, local authorities as the end users of the system and the main party of the Siemens Nederland as the technical leading body of the system and the implementer of that matter.

As the new sirens network was designed for fully decentralized structure, sirens can be activated exclusively from control and operational centres according to the relevant regional organization of the fire service. Each region has its own control centre from which it is possible to run the sirens. The power to decide whether and when the system will be used is based on a concept of delegation. The final decision about who will turn the system on always depends on urgency of the situation.

After adopting the decision on use of sirens the encrypted datagram or group datagrams from a personal computer in the regional and control centre is transmitted to selected siren installation by using one of regular radio networks of the fire service organization, so-called "Network 3A". In case where the warning action is deemed necessary, the network 3A is temporarily interrupted and switched from his regular mode to this special scheme of transmission means for warning system.

The whole transmission path from the control box in control centre up to the actual siren place is fully protected against activation or interruption by unauthorized parties. This protective principle is based on two conditions:

- each datagram must be a unique characteristic (signature),
- datagrams must be incomprehensible to third parties.

The first condition is met through individual identification code for a control centre in combination with time information. The control unit of siren detects the control station characteristic (signature) to which it belongs. In case of incorrect signatures the siren does not respond.

The second condition is met by using certain algorithms and coding by a triple algorithm for data encryption (DES).

Special batteries ensure a system operation also in case of interruption of regular mains supply. Their total capacity provides sufficient power for no less than ten alarms.

Operation of the new system and its everyday practice

The new concept of the population warning system included also introduction of a new warning signal. The signal was developed in close cooperation with the relevant research and development institute and extensively tested in terms of its effectiveness and acceptability within the public. Requirements for a new signal included achievement the maximum degree of

public attention on one hand and the minimum of misleading association with a war and air attacks on the other hand.

After introduction of new networks in regions the sirens were tested "loudly" for six months of operation, every first Monday in the month. The reason for it was to give the public enough time to get accustomed to a new signal. Introduction of the new system was accompanied by massive information campaigns at the regional, local and as well national level.

After this six months´ introduction the reduction of "loud" testing periodicity once a year at the national level was temporarily proceeded. On regional requests it was possible to perform these tests in specific areas more often.

Days of nationwide "loud" tests were accompanied by massive information campaigns aimed at strengthening skills associated with provision of self-protection and mutual aid. This method of intensive communication was the way how to create and keep an adequate level of public understanding regarding to behaviour during disasters. Currently the system of loud tests which run every first Monday in a month at 12 o'clock is again applied. The test signal is transmitted within 1:26 min.

To achieve a common approach in use of sirens during threat a standard procedure for consultation and decision was formulated and issued as the guidelines for operational and administrative authorities at the local and regional level.

The installed system is a state property. Technical maintenance is provided by the main contractor, the Siemens Nederland and the regional organization of fire service is responsible for appropriate coverage. The actual use within emergency situations is in hands of local authorities as the first responsible subjects for local rescue operations during disasters.

Supplementary warning system

In addition to the above warning system the nationwide supplementary warning system NL-ALERT [1], based on principle of providing targeted information for individuals via short messages sent to mobile phones, was in 2012 proceeded to launch in all 25 security regions. The Netherlands was the first country with nationwide use of such a complementary way of warning and informing population.

Principle of the system using consists of sending information on threats and subsequent referral how to protect and act in relation to an actual threat. The report is automatically sent to all mobile phones in affected area provided that a phone is switched on, has activated channel NL-Alert and has the possibility of its income. This is not a common text SMS message but the communication transmitted via cellular radio network. The information is sent via a transmitter mast of cell phone providers. Thus, NL-Alert can operate continuously in the event of network congestion. The service does not need to be activated and its provision is free.

Currently more than half of all mobile phones are able to pick up the NL-Alert message which means that over 11 million mobile phones are able to receive the NL-Alert information. This number will increase in the coming years.

Conclusion

It has been 25 years since a new concept of emergency population warning system was adopted. The intention to create a system which is capable effectively respond to a broad portfolio of possible emergency situations was determined. Experience with its fulfilment

demonstrated the validity of this decision. The current system has proved to be fully functional in dealing with emergencies of both anthropogenic and nature character.

When identifying requirements for the new system it was primarily necessary to analyse the current way of warning, focusing primarily on operational and technical characteristics and assessment of claims for functional usability. Detected outputs served for initial orientation of the new conceptual solutions draft. To remove existing faults and propose such a system solution that would be able to reflect even anticipated future requirements was the main purpose of it.

A number of necessary preparatory steps were following by the implementation of policy decisions. First it was necessary to create an overview and risks analysis in different regions and to consider a proposal to adapt coverage of the area with warning signal. Subsequently, measures necessary for the system installation, covering a wide range of activities from identification of locations for sirens installation to obtaining all permits and their introduction were adopted. When booting the gradual application some test operations in exposed areas, particularly in regions of Zeeland and Rotterdam, were proved. The experience gained there were then generalized and applied to other parts of the country.

When evaluating the experience with above mentioned implementation of the intention and with consideration to the total time of full operation of the system it is necessary to responsibly note that the requirements for setting functionalities were in the early nineties formulated correctly and still meet the current needs. During almost 20 years of operation has not been noted any serious technical faults.

Current dynamics of the security environment development and related change in character of some threats led to take a decision to introduce even so called supplementary warning system. It is based on principle of sending warning messages to individuals in affected regions. In this way it complements the basic concept of the emergency population warning.

NOTES:

[1] On 1. 1. 1999 the Netherlands joined the euro area, conversion factor to euro was determined for 2,20371.

Literature

[1] NL ALERT: Direct Informatie bij een noodsituatie [online]. [cit. 2014-11-3]. Available at: http://www.nl-alert.nl/

[2] Veiligheidsregio´s [online]. [cit. 2014-11-11]. Available at: https://www.nctv.nl/onderwerpen/veiligheidsregios/index2.aspx