SECURITY WITHOUT BORDER
INTRODUCTION

The Danube-Kris-Mures-Tisa Euroregion (DKMT) covers the south-eastern area of the Carpathian Basin found in the centre of Central-East Europe. The area of the regional cooperation integrating the Hungarian South Great Plain Region (Bács-Kiskun, Békés and Csongrád counties), the Romanian West Region (Arad, Hunedoara, Caras-Severin and Timis counties), and the Serbian Voivodina Autonomous Province exceeds 70 thousand km²s, its population is about 5.4 million. Thanks to its agriculture, logistics and touristic facilities, potentials in higher education and innovation it is one of the determinant areas of Europe on the way of unification. Its strategic role in the stability on the Balkan makes its significance even greater.

The objective of the DKMT Euroregion is to support and encourage the cooperation between self-governments, local associations, participants in economy and citizens in various fields which can contribute to the democratization, the stabilization, the integration in Europe, the social and economic development of the area. The institutions of the DKMT mainly play a role of coordination; participate in elaborating and implementing Euroregional development projects and through their political and professional connections they strengthen the way of thinking on Euroregional level both inside and outside.

At the end of the 20th century both disaster recovery and civil security got a new sense. With the increase of natural disasters and terror attacks security became more and more important. Nations recognized that more effective defence can be provided in cooperation. Over and above, the number of cross border “attacks” (terrorism, avian influenza, natural disasters, and industrial accidents) has increased in the last few years. This fact proved that above national preventions and strategies international and cross border cooperation is needed to treat risks, hazards and disasters.

The main objective of the “Security without border” project – co financed by the European Commission through The Community Civil Protection Action Programme – was to ensure the basis of cross border risk assessment and risk management with the action of giving possibility for cooperation and networking of expert on workshops. The field of project and the workshop concerned to the major issues of nowadays civil protection hazards of the DKMT Euroregion such as flood, dangerous substances – storage of dangerous chemicals – industrial accidents and epidemiology – particularly avian influenza. During the workshop the experts from the DKMT Euroregion, Italy and Slovakia discussed the issues of the project and elaborated recommendations to provide basis for future development of cross-border and international cooperation.
FLOOD PREVENTION

The hydrological situation of the region and the current standing of flood defence

Report for the meeting of the Csongrád County Defence Committee

Dr. László Dobi
Director, Central Chief of Defence
South Tisa Environmental Protection and Water Management Directorate

ATIKÖVIZIG REPORT ON THE STANDING OF FLOOD DEFENSE IN THE YEAR 2006

1. A brief hydrological summary of the 2006 spring flood on the River Tisza

During the winter and early spring months, the catchment area of the River Tisza saw about 30% more precipitation than the multiannual average. While this extra amount of precipitation may not be considered outstandingly high, its distribution over time and its form (snow versus rain) proved to be decisive factors in the context of the flooding of the river. Extraordinary amounts of precipitation were experienced during the last weeks of winter and the first weeks of spring in February and March; precipitation levels 70% above the two months’ average caused an accumulation of snow during the first thirds of each of the two months, and then, in the last thirds of each of the two months, with changes in temperature, intense melting ensued. The highest amount of snow was seen in the middle of February this year, when 1.5 times the period’s average, that is, approximately 6.5 km³ of snow covered the catchment area of the River Tisza.

The first wave of spring flood was brought about by the warm weather ensuing at the end of February. This was followed by additional waves fed by the melting of the snow cover in March. These continuously increased flood levels along the Middle and Lower Tisza; as a result, the end-of-March melting, which was responsible for doing away with the greatest portion of the total snow volume, fed floods that would have to run into a riverbed already filled to its maximum capacity.

The simultaneous melting across the entire catchment area and the persistently wet early April weather joined forces to generate rather large flood waves along the Upper Tisza as well as along most of the tributaries. Yet what was truly outstanding was not the height but the long duration of these flood waves. This sustained flooding was caused by the regular arrival of additional volumes of water from upstream river sections. The rivers Bodrog, Körös, and Maros channelled their consecutive, “tailgating” flood waves into the River Tisza simultaneously, causing flood levels on the Lower and Middle Tisza to rise dramatically and almost at the same time—a phenomenon otherwise fairly rarely seen. The flood was also significantly influenced by the flooding of the River Danube, which peaked with historical record flood levels during the exact same period along the river’s Hungarian and Serbian sections. This represented a major impediment to the downstream movement of the surplus water volumes of the River Tisza.

While flood levels on the River Danube started to decrease in the middle of April, more rains followed and caused major flooding on the rivers Körös and Maros, once again about to feed into the River Tisza. The flood waves arriving from the tributaries met the very peak of the main flood wave of the River Tisza during these days, causing record flood levels never before seen on the Lower Tisza. The flood peaks (946 cm at Tiszaug on April
22, 2006; 1,034 cm at Csongrád on April 22; 1,009 cm at Szeged on April 21; and 1,062 cm at Mindszent on April 22) were 50 to 60 cm higher than the highest flood levels (HFL’s) ever experienced at those locations. Just how extraordinary the flooding on the Lower Tisza was is reflected in the fact that the highest flood levels measured at Szeged and Mindszent were persistently higher than the historical records over a period of two weeks. High flood levels on the River Tisza also caused new highest flood levels (HFL’s) to develop at the mouths of the tributaries. On the River Körös, the flood peak reached all the way to the city of Szarvas (increasing the highest historical water level by 32 cm to 986 cm), while the flooding on the River Maros only affected waters close to the mouth of the river (the 533 cm peak water level measured near Makó being only the fifth highest historical flood level).

Because of the flooding of both the River Tisza and its tributaries, and because the water yield of the upstream river sections only decreased very slowly, the incredible amount of water accumulated in the floodplains of the rivers concerned was extremely slow in moving downstream.

*Within our Directorate’s area of operation, flood protection preparedness was called off at 12:00 on May 19, 2006 concerning all river sections.*

2. A brief summary of the standing of flood protection

**Degrees of flood protection preparedness ordered during the flood of 2006:**

Because of the flooding of the Triple Körös, Grade I Flood Protection Preparedness was declared at Flood Protection Section 11.08 (the river section falling within the perimeters of Csongrád County) at 08:00 on March 13, 2006. Preparedness was called off ten days later, at 06:00 on May 18, 2006.

During the same period, that is, between March 17 and 21, 2006, Grade I Flood Protection Preparedness was also declared at Flood Protection Sections 11.02, 11.03, 11.04 and 11.05.

Hereunder follows a list of when the various grades of flood protection preparedness were declared (as there were differences amounting to a few days between the individual flood protection sections):

- March 28, 2006 – Grade I preparedness was declared
- April 05, 2006 – Grade II preparedness was declared
- April 10, 2006 – Grade III preparedness was declared
- April 14, 2006 – Extraordinary preparedness was declared
  - ○ (simultaneously with the Hungarian Government declaring a state of emergency)
  - ○ (simultaneously with the Hungarian Government calling off the state of emergency)
- May 09, 2006 – The extraordinary preparedness was called off
- May 13, 2006 – Grade III preparedness was stepped down to Grade II
- 06:00 on May 16, 2006 – Grade II preparedness was stepped down to Grade I
- 12:00 on May 19, 2006 – all flood protection preparedness was called off within the area of operation of the Lower Tisza Region Environmental Protection and Water Management Directorate.

**Interventions and events during flood protection:**

As the flood built up, we set up flood watch and flood guard duty as appropriate to the grade of flood preparedness declared.

As the flood levels rose, more and more flood phenomena were detected, including seepage through embankments, water flowing across public roads, and earthen embankments soaking through and softening up. The flood watch and flood guard teams carried out their tasks as appropriate to the grade of flood preparedness declared, keeping an eye on all these phenomena, while the management of the flood defence team made sure that the necessary interventions are made.

Along the flood protection line, the total length where water surged up from the soil on the protected side as a result of the high flood levels was as much as 191.5 km. These water surges eventually flooded 860 hectares. 32,000 seepage sites were detected along the embankments. Longitudinal cracks in the embankments developed along a total length of 1,690 m. In total, 293 boils of various dimensions were placed under flood control.
Along the defence lines managed by ATIKÖVIZIG, sandbag crest dykes were built in a total length of 52.1 km. Sandbag support ribs were built along 12.5 km of the defence line. This operation required 3.5 million sandbags and 5.3 thousand cubic meters of sand.

Extraordinary (that is, large-scale) interventions were needed at the following locations:
- Within downtown Szeged, the discharge pipes of the city’s precipitation water channels required intervention.
- Within downtown Csongrád, the main sluice of the city’s precipitation channel system ("Sárkányfarki-zsílip") malfunctioned.
- The irrigation sluice of the Makó pumping station malfunctioned.
- A slumping was detected on the slope of the Kunmátyás embankment near Dóć (between 46.350 embankment km and 47.850 embankment km on the right bank of the River Tisza).
- A slumping was detected on the slope of the embankment near Felgyő (between 70.750 embankment km and 72.950 embankment km, and between 74.600 embankment km and 74.900 embankment km, both on the right bank of the River Tisza).

In addition to the above large-scale interventions, other embankment sections, civil engineering structures, and pumping stations were also affected to various degrees by malfunctions. The total cost of urgent reconstruction works deemed immediately necessary has been estimated as approximately 4.5 billion Hungarian forints within the area of operation of ATIKÖVIZIG.

In addition to the total staff of ATIKÖVIZIG, the following parties also provided assistance from the moment of declaring Grade III Flood Protection Preparedness:
- The defence squadrons of counterpart water management directorates, such as the Environmental Protection and Water Management Directorates of the Western Transdanubian Region, the Lower Danube Valley, the Middle Danube Valley, the Central Transdanubian Region, and the Southern Transdanubian Region, as well as those of the Central Organization for Flood and Inundation Defence ("Árvízvédelmi és Belvízvédelmi Központi Szervezet Kht.").
- The Environmental, Nature Protection, and Water Management Supervision of the Lower Tisza Region.
- The Directorate of the Kiskunság National Park.
- The Directorate of the Körös-Maros National Park.
- Civil engineering and construction company SZEVIÉP Szerkezet és Vízépítő Rt.

The staffs of these cooperating organizations were delegated to participate in the defence operations, which included flood watch and flood guard duty appropriate to the grade of flood protection preparedness declared, as well as managing and guiding the technical aspect of defence operations.

Many organizations participated in flood protection operations under the operative guidance of the County Defence Committees.

The following units of the Hungarian Army provided significant support during the flood protection operations:
- Light Infantry Battalion 5/62; Light Infantry Battalion 5/3 “Bercsényi Miklós”; and Mechanical & Construction Battalion 37/4 “Török Ignác” of Hódmezővásárhely; and:
- Mechanical Brigade 37 “II. Rákóczi Ferenc” of Szentes.

All in all, these forces dedicated a total of 252.5 thousand man-hours to filling sandbags and constructing flood protection structures between April 14 and May 5, 2006.

Additional organizations providing further assistance during the flood protection operations included Nagyfa Penitentiary, the Disaster Management Directorate of Csongrád County, and civil defence and police forces.

A large number of citizens from the affected settlements also participated in the defence works under the direct management of their respective mayors, filling sandbags and building flood protection structures. The highest number of citizens involved at any one time reached 1,500 persons on April 25, 2006.

The general public also contributed to these efforts significantly by offering meals, drink and other resources during the flood protection operations.
The experiences obtained during flood protection:

During the flood protection operations of 2006, the cooperation between the various organizations involved was exemplary. In performing its defence tasks, ATIKÖZÍRIZIG enjoyed the maximum support of the cooperating organizations, who, under the management of the Csongrád County Defence Committee, contributed significantly to effective and efficient defence.

During the flood situation of 2006, Environmental Protection and Water Management Directorates could not have provided the number of technical management staff necessary to manage defence operations without relying on the staff of the counterpart directorates of other regions. This clearly indicates that, in expectation of further floods, the current number of technical management staff must be retained or increased.

The sheer scale of the defence operations needed has highlighted the importance of logistics. The tasks that lie ahead of us include raising the height of unduly low embankment sections, and reconstructing civil engineering structures affected by various malfunctions (the Sárkányfarki sluice in Csongrád and the sluice of the Makó pumping station). Because of the wet weather, the crest of the embankments was unsuitable for any traffic; accordingly, cladding the crest of the embankments is a matter of great priority. Floodplains must be cleared of vegetation slowing down the flow of water (the species with the greatest capacity to slow down water discharge are desert false indigo and fox grape).
The experiences of flood defence operations in downtown Szeged

Dr. Péter Kozák, PhD
Certified Engineer
Chief of Defence for Flood Defence Section 11.01

1. Introduction

The length of the River Tisza stretching between Right Bank Flood Defence Section 11.01 and Left Bank Flood Defence Section 11.06 falls within the limits of downtown Szeged. This paper will discuss the experiences obtained during flood defence operations performed within downtown Szeged at Flood Defence Section 11.01. This section has a total length of 31 km 512 m (measured along the embankment), with the Szeged flood defence wall stretching between 13 km 240 m and 16 km 502 m (measured along the embankment).

2. Historical background

Throughout history, the city of Szeged has always lived under the threat of floods. Its exposure to flooding has always been a key factor both in the city’s everyday life and in the elaboration and implementation of urban development plans. Szeged’s attitude to floods has borne the stamp of the devastating disaster of 1879, when the river breached its embankment at Petres, a village just north of the city, and flooded the entire city. The need for building an embankment wall defending the city from direct flooding by the River Tisza was clearly seen as early as 1880. The plans for a flood defence system offering the city both direct and indirect defence were implemented in several stages, the core element of the construction being a brick dike wall raised along the right bank of the River Tisza. The flood defence system was put to a test during the record flooding of 1970. While the floodwave was managed successfully and without any major damage, the experiences obtained during defence operations underlined the need for a comprehensive modernization of the flood defence system. During the ensuing modernization works, the flood defence sections were widened and the dike height was increased everywhere outside the downtown area. In turn, modernization works carried out within downtown Szeged included, on the one hand, the construction of spillways in order to improve dike stability, and, on the other hand, the reconstruction of the currently existing brick wall. Along approximately one third of the entire length, the existing brick dike wall was partly demolished, with the base used as the foundation for a new sloped floodwall built out of reinforced steel. Along the rest of the length, a number of “staggered” sections were built, complete with a wide flight of stairs facing the river. Along other sections of the embankment wall, the reinforced concrete sloped floodwall was erected on top of an earthen dike.

A block of buildings stretches along the embankment wall at an average distance of 15 to 30 m from the embankment wall. These buildings house several clinics and related service facilities. The appearance of high ground water levels in the basements of these buildings was documented already at the time of the flooding of 1970; however, this phenomenon did not jeopardize the operation of the healthcare institutions at the time.

3. Hydrological circumstances:

Prior to the flood of 2006, the highest ever historical water level was measured during the flood of 1970 at 960 cm. The second highest historical water level was measured during the spring flood of 2000 at 929 cm. Based on previous hydrological experience obtained in the Szeged section of the river, floodwaves originating upstream at the middle or higher sections of the River Tisza generally afforded a time advantage of 7 to 14 days, while floodwaves originating on the River Mures (Maros) afforded a time advantage of 3 to 4 days for carrying out the relevant preparatory flood defence measures. During the spring flood of 2006, high water levels developed at an exceptional rate of speed as compared to any earlier experience, and water levels above 900 cm were recorded to persist for 25 consecutive days. It was during this flood that the highest water level ever was recorded at 1,009 cm on April 21, 2006.
4. The defence operations in figures

The number of personnel taking part in implementing and managing the flood defence operations varied day to day. On any given day, a maximum of 250 to 320 persons were involved in defence operations. These figures include contractors as well as KÖVIZIG (Environmental and Water Management Directorate) employees. It must be noted at this point that a total of six employees of ATIKÖVIZIG (Lower-Tisza Environmental and Water Management Directorate) serve in the Defence Organization along this section of the river: four dike guards and two engineers shoulder the responsibility for managing defence operations. However, the additional technical and field staff provided by KÖVIZIG was also instrumental in the success of the defence operations performed. Furthermore, it is important to note that the city’s population also actively participated in defence operations. Local citizens as well as students studying in the city provided continuous support. Their numbers varied day to day. On some days, the number of volunteers reached as many as 1,000 to 1,500.

During the defence operations, sand and sandbags represented the material used in the largest quantities. A total of 250,000 sandbags and 3,400 m$^3$ of sand were used in order to strengthen the defence structure and to perform the necessary localization operations. 7 m$^3$ of pine boards and 1,800 m$^2$ of plastic film were used to block public road ramps and blockable access gates. Upon discovery of a previously unknown precipitation channel, 14 m$^3$ of ready-mixed concrete were injected into the out-of-use channel in order to block water flows.

Transporting and installing all these defence materials and transporting the defence staff required the coordination of 30 to 60 transportation vehicles and other power machinery (daily average figure).

Typically, the transportation vehicles were vehicles normally used for public road traffic; however, because of the tight spaces characteristic of dense urban areas, there was also a need for smaller transportation vehicles of better manoeuvrability.

The experiences of flood defence operations:

Performing flood defence operations along the river section falling within the limits of downtown Szeged required a number of measures that were not necessary on any previous occasion in the history of floods. As a result, our practical experience in implementing these measures was either limited or non-existent. During the defence operations, a large number of staff provided by the various armed forces – including the Army – was relied upon, with great numbers of volunteers also being used in the field operations. It was necessary to block a number of roads and to introduce certain traffic restrictions; these measures had a significant impact on the everyday life of the city.

4.1. Experiences concerning the defence structures

4.1.1. Experiences concerning the Szeged embankment wall

Interventions performed along the embankment wall were at the very heart of the defence operations carried out within downtown areas. In terms of its construction, the embankment wall is a sloped floodwall made of reinforced concrete, which has a number of blockable access gates facilitating access to the river. The lowest of these blockable access gates were built for a water level of 960 cm on the River Tisza. The embankment wall has two intersections with the public road running along Alsó-Rakpart. At the blockable access gates and at the two public road access ramps, the reinforced concrete dike wall was broken through to allow the construction of flights of stairs for pedestrian traffic on the one hand, and a sand and gravel roadbed on the other hand. The public road access ramps were also designed for a water level of 960 cm. Since the reconstruction of the embankment wall, which was completed in 1974, there has been only one occasion in the year 2000 when the water level was higher than 900 cm; that was the first time that the so-called blockable access gates were in fact blocked.

4.1.1.1. Blocking the access gates and the road access ramps

We started preparations for blocking all openings of the embankment wall well before the date for which a water level of 900 cm was forecast. Blocking the openings took approximately 10 hours of work for the 90 members of the Defence Squad, including the delivery of all necessary materials to the relevant sites. All the blockable access gates were double-boarded using pine boards with sandbags in between, and with a cover of plastic film on the water side.
Where the two public road access ramps intersect the embankment wall, sandbags were used to block water. Again, the sandbags were covered with plastic film on the water side to improve water tightness.

Following the changes in expected water level forecasts, these blocks were occasionally heightened using additional sandbags. The efficiency of these blocks was severely undermined by the fact that the gravel bed serving as the foundation for the flights of stairs passing through the blockable access gates allowed seepage under the sandbag blocks built. As a result, temporary sandbag counterpressure pools had to be built around each access gate on the protected side.

4.1.1.2. Flood safety issues related to embankment heights

When the sloped reinforced concrete flood wall was designed, it was the express expectation of the city’s leadership that the new embankment wall should not block the view even at the lowest point of the city. In compliance with this expectation, the design height of the top of the embankment wall was specified as 1,050 cm, since the lowest point of the riverbank within downtown Szeged was 960 cm. (The relevant regulations would otherwise stipulate an embankment height of approximately 1,120 cm for this section.) During the flood of 2006, the maximum water level forecast just before the flood peaked was 1,020 cm, leaving a flood safety margin of approximately 30 cm. During the preparatory phase, we investigated various possibilities for increasing the height of the sloped reinforced concrete flood wall. We came to the conclusion that increasing the height of the wall by placing several layers of sandbags directly on top of the wall would run the risk of water pushing the sandbags off laterally. Accordingly, we started to build an auxiliary foundation of four rows of sandbags just behind the reinforced concrete flood wall. Had there been a need for increasing the height of the embankment, this foundation would have been heightened to the necessary extent. Eventually, the flood peaked at a level lower than initially forecast, and the embankment wall was not heightened.

4.1.1.3. Experiences concerning thermal expansion and other gaps

It is safe to conclude that many of the thermal expansion gaps located along the full length of the flood wall failed to block water seepage. The insulation plates built into the thermal expansion gaps were often damaged; in fact, they were completely missing in some cases because of the negligence of the original builders. Temporary sandbag counterpressure pools were built to prevent seepage around all failed thermal expansion gaps. In a number of cases, the water level in the temporary sandbag counterpressure pools reached the water level of the flooding river, implying that these specific thermal expansion gaps completely failed as far as their water tightness is concerned.

4.1.1.4. Seepage phenomena along the embankment wall

During the initial stages of flood defence operations, the intensity of the seepage phenomena observed on the protected side was fairly low, but it increased steadily as higher water levels developed and became persistent on the protected side. In several cases, the intensity of the seepage was high enough for the watercourse to carry loose embankment material with it. Temporary sandbag counterpressure pools were built in order to reduce the energy of the seeping water. The size and number of these pools was a function of the intensity of the seepage at any specific site. At some sections, as many as seven consecutive pools had to be built, each at a somewhat lower elevation than the previous one. In several counterpressure pools, water levels equal to the river side water level developed, which brought us to the conclusion that the flood defence wall itself must have been damaged at those specific sites.

While a large volume of water found its way from the river towards the city through seepage, watercourses normally running from the city into the river also swelled up, producing higher than normal water levels. The combined effect of these two phenomena was that some of the lower areas of the city were in fact flooded. The ground water level in trenches around the ruins of the city’s old fired brick castle on Stefánia Promenade increased significantly, with some of the earthen trench walls actually collapsing.

4.1.1.5. Experiences concerning public utility networks

Because of its central location, the downtown section of the embankment wall is in the proximity of zigzagging public utility lines such as electricity cables, natural gas pipelines, and sewage channels. Unfortunately, the various public utility companies – each of which have reconstructed their networks on several occasions – often
installed new sections without removing the obsolete, out-of-use structures. As a result, several seepages and water flows appeared around the embankment wall, causing further identification problems after their initial discovery. As soon as flooding started, all public utility service providers were requested to mark out on site the exact location of all currently used as well as all obsolete, out-of-use underground public utility lines forming part of their respective networks. They all fully complied with this request. The largest single failure was discovered at Roosevelt Square, where water surged to the protected side through an out-of-use NA200 sewage duct. To localize the failure, an inflatable balloon provided by local waterworks company Szegedi Vízmű ZRT was used to block the duct’s downstream section leading towards the city, while a temporary sandbag counterpressure pool was built over the failed section of the duct. As the sandbag pool was filled up with water to exert the necessary counterpressure, we observed the emergence of a large amount of bubbles on the water side. This led us to the conclusion that major cavities must have formed on the water side. During the reconstruction works, we identified and explored the failure site and established that a cavity of approximately 30 m³ in volume developed under the flight of stairs resting on the riverside slope. We injected ready-mixed concrete into the cavity to fill it in. Of all public utility service providers, local waterworks company Szegedi Vízmű ZRT was the one we had to contact most often after identifying public utility structures causing problems. In the wake of the Roosevelt Square failure, the professionals of the waterworks company investigated all sewage shafts near the embankment wall using camera technology. This systematic approach helped identify another, until then unknown channel section right under the right bank chamber of the bridge. The waterworks professionals identified an NA600 channel section pointing towards the river. Luckily, water did not find its way to the city through this section; nonetheless, with the potential hazard in mind, we blocked the channel by injecting approximately 20 m³ of ready-mixed concrete into the channel. The team of experts working at Móra Ferenc Museum was instrumental in identifying this channel section. They also provided photographs, based on which the channel was determined to be approximately 100 years old.

4.1.1.6. Experiences concerning cellars running parallel to the embankment wall

During the course of flood defence operations, water flows originating from the river lead to the gradual appearance of water in nearby cellars. This phenomenon was also seen during the flood of 1970; however, it caused no interruption in the operation of the concerned institutions at the time. The majority of the problems this time concerned the cellars of healthcare institutions in Szeged’s block of clinics. Since 1970, the cellars of the clinics have been converted into electrical and other service centres and examination rooms housing valuable diagnostics equipment required for the day-to-day operation of the institutions, dramatically changing the circumstances under which flood defence operations had to be carried out. These are institutions of regional importance providing vital healthcare services around the clock; allowing these cellars to be flooded would have represented a direct threat to the lives of many patients. Unfortunately, these cellars were in an unusually poor state of maintenance; many only had a pounded earth floor. We maintained continuous contact with the management of the clinics and teamed up with their own security services to check water levels in the cellars once an hour. We had to build temporary sandbag counterpressure pools in almost every cellar concerned. Our general experience was that water first broke into the cellars on the side closer to the river, which goes to prove that the appearance of water was directly caused by high water levels in the River Tisza.

4.1.2. Experiences concerning the enclosed spillways of Szeged

The enclosed spillways built in lower suburban area Szeged-Tápé proved to be extremely useful during the flood defence operations. The amount of water removed in order to improve dike stability contributed significantly to preserving the stability of the earthen dike sections in downtown Szeged.

4.1.3. Experiences concerning development projects in process within the city

Certain sewage network development and sewage treatment plant construction works were already in process prior to the commencement of the flood defence operations. There were several construction sites where these works interfered with the existing flood defence structures. During the flood, critical construction operations were suspended; however, certain local defence operations were inevitably necessary. These operations were performed by the defence staff of ATIKÖVIZIG.
4.2. Experiences concerning the availability of human resources for defence

The number of staff available at ATIKÖVIZIG was less than enough to provide even for a Second Degree Flood Alert. The involvement of assistant technical and dike guard personnel made available by counterpart KÖVIZIG directorates responsible for other regions was instrumental. They put in a lot of work in supervising dike guard service and in managing the individual defence operations.

With a view to the classified flood defence situation, police and border guard forces provided for the security of the immediate environment of defence structures and operational areas.

The army provided major forces for performing the defence operations. On daily average, 100 soldiers contributed significantly to the success of flood defence with their dedicated work.

Csongrád County’s Disaster Management Directorate also provided much help. Their contribution of drinking water and other supplies to the flood defence staff was of great importance.

Both local citizens and the students of local educational institutions provided support during the defence operations. People volunteered in very high numbers, putting in their best efforts towards the performance of their tasks. Many restaurants provided free meals to help feed the large numbers of volunteers. Many citizens also brought and offered whatever food and water they could afford to help provide for those involved in the defence operations.

4.3 Experiences concerning the availability of materials and equipment

The sandbags needed for flood defence operations were filled at three central filling sites. An important consideration in selecting the sites was easy access for transportation vehicles as well as volunteers. One of the sandbag filling sites was selected to meet the criterion of helicopter accessibility for air transportation. All filling sites were set up within downtown areas with public lighting, which helped smooth operation during the night hours.

Another valuable lesson learned during the defence operations was the absolute importance of selecting the right type of machinery and vehicles. The narrow pedestrian promenade running along the river precluded the use of conventional public road transportation vehicles; instead, small vehicles with good manoeuvrability had to be called in.

4.4. Traffic restrictions introduced

Upon consultation with the city’s management, practically the entire waterfront was placed under traffic restriction. This included closing down the pedestrian promenade running along the river and several streets near the river. In addition, most of Felső-Tiszapart was also blocked off from traffic. With 2x2 lanes, this is one of the most important traffic routes of the city. No other occasion in the history of the city involved simultaneous traffic restriction in so many streets adding up to such a great total length. Closing all these streets resulted in intensifying traffic on all other city routes. To improve the situation, the city’s mayor issued a decree making all public transportation free of charge, encouraging citizens to reduce passenger car use.

4.5. Experiences

Hereunder follows a brief summary of the experiences obtained during flood defence operations.

4.5.1. Problems concerning insufficient embankment height:

Above all, it must be underlined that the height of the embankment wall was originally designed to a relevant flood level (MÁSZ) of 972 cm (83.42 m above the level of the Baltic Sea) which was a specification derived from the water level of the flood of 1970. Between Belvedere Palace and Móra Ferenc Museum, the embankment wall was built horizontally at a uniform maximum height of 1,055 cm (84.25 m above the level of the Baltic Sea). The joint between the parapet wall and the cope-stones used to cover it is not watertight, wherefore the cope-stones could not be relied upon in heightening the defence structure. During the flood of 2006, the peak flood level was 1,009 cm (83.79 m above the level of the Baltic Sea). As a result, flood safety was as limited as 46 cm in the lowest parts around Belvedere Palace. If the flood level had reached the 1,020 cm forecast, flood safety would have been down to 35 cm. If there had been a need to increase the height of the embankment in order to safeguard the city
by improving flood safety, the existing structure would not have been sufficient as the stationary stability of the sloped floodwall would have decreased significantly under increased lateral load. The embankment height could only have been increased by heightening the temporary sandbag defence structure built right behind the existing embankment wall. (It is estimated that building such a defence structure would require 160,000 sandbags in addition to those used for building temporary sandbag counterpressure pools.)

4.5.2. Structural problems and construction defects:

In general, it might be worth mentioning that the structural joints of the parapet wall were constructed defectively. The steel bars used for the reinforcement of the horizontal and vertical concrete slabs often stick out of the concrete. Bedding joints were also constructed negligently. In addition, the horizontal concrete slabs, only recently replaced, were laid into an incorrectly constructed bed. The defence structure originally built as a sloped reinforced concrete flood wall also has a poor track record in terms of water tightness. Several structural and contour seepages and flows were detected along the full length of the wall. Temporary sandbag counterpressure pools had to be built in two or three (and occasionally as many as seven) consecutive stages to reduce the amount of water getting through. The amount of water that got through actually soaked the substructure of the road along Felső-Tiszapart, which had to be blocked off from traffic in its entire length in order to prevent any further damage. It was established during the reconstruction works that the intensive seepage was due to two main factors: on the one hand, the bed courses run across the sloped floodwall, which is completely incorrect and counterproductive; on the other hand, the brick dike wall serving as the foundation for the sloped floodwall is in a very poor condition.

During defence operations, water flows brought about the combined presence of structural defects such as cracks and gaps and contour seepage caused major concern.

During the construction of the reinforced concrete embankment wall, prefabricated gravel-coated concrete slabs were used for formwork. These were left in place and have doubled as the external cladding of the wall. Manufactured by Szeged’s state-owned prefabricated house factory, these concrete slabs have often separated from the structural reinforced concrete because of a failure to follow the specified construction technology – use of the wrong agent for separating the formwork; oily stains or dust left on the contact surface; insufficient wetting with water prior to casting the concrete, etc. – with the combined effect of precipitation water creeping into the cracks, humidity, heat, and freezing causing further damage. As a result, any attempt to preserve the uniform aesthetic appeal of the external cladding causes additional maintenance problems.

The river side surface of the parapet wall is protected by a stone-clad dike constructed with a 1:1 slope. The top edge of this dike is incorrectly narrow; where it meets the parapet wall, it should terminate in a plateau of at least 80 to 100 cm in with.

4.5.3. Operational and out-of-use public utility structures crossing the embankment wall:

When the parapet wall was originally built, various public utility structures crossed the wall. Some of these were still operational at the time of construction; others were already out of use, but the builders failed to block them off; and yet another few have been taken out of use since construction was completed, but again, without being blocked off. These public utility structures caused emergency situations on several occasions as water found its way through the unblocked pipes and unexpectedly surged up on the a protected side.

4.6. A proposal for a complete overhaul of the Szeged flood defence wall

Based on the detailed evaluation presented under Paragraph 4.3, it may be established that the parapet wall fails to fulfil its expected functions both in terms of flood defence and static strength. No further delay in the reconstruction of the embankment wall is acceptable. When planning the overhaul, the following requirements must be met:

Design criteria:
- Safeguarding the city against flooding requires the construction of a flood defence line of sufficient height that also has the ability to prevent seepage through the lower soil strata.
- The defence structure to be designed must not block traffic off the road and other public areas stretching
along the riverbank, except during flooding. In fact, it must not block as much as the view of the river except during flooding.

- The defence structure must provide sufficient mechanical protection against the impact of drifting objects of any size during flooding.
- As the new defence structure is being constructed, any unknown and out-of-use public utility channels and pipelines currently located within the zone stretching from the existing buildings and the existing parapet wall must be eliminated. Only public utility ducts deemed absolutely necessary should be allowed to cross the new defence line, and only if such crossing points are guaranteed to be watertight.
- The structures currently existing on the Alsó-Tiszapart waterfront (such as shore safety structures, the public road, the pedestrian walkways, and the flights of stairs) must be retained to the greatest possible extent.

**Preliminary works necessary:**

- All public utility structures must be explored, investigated, and documented up to a depth of at least 10 m.
- Conduits – most typically electrical conduits, but also telecommunications cables – must be relocated to areas outside the zone of the planned flood defence structure.
- Geodetic and soil mechanics measurements and investigations must be performed within the zone of the planned flood defence structure.
- The managements of public utility service providers, the agencies responsible for the management of motor vehicle and pedestrian traffic, and the entities performing inland water transportation on the river must be consulted.

4.6.1. A description of the defence structure planned:

**Mechanical defence:**

The existing parapet wall may be retained as an auxiliary defence feature that, during floods, functions as a shore safety structure and continues to provide mechanical protection against pounding waves, ice drift, and other floating objects. Mechanical defence is a function that this type of wall construction, with the old brick flood defence parapet wall under it and with a functioning rear-wall spillway system behind it, can safely fulfil.

Two necessary interventions concern this structure:

- The vertical top part of the wall is to be demolished to the level of the new terrain or of the new walkway to be constructed on the protected side and must be provided with new capstones and rails, the latter being of a design that allows dismantling or collapsing during flood periods.

- On the river side, new panelling must be constructed, ensuring that it is both aesthetically appealing and capable of safely supporting the existing gravel-coated panels even where they have separated from the structural reinforced concrete wall.

**Flood defence and defence against seepage:**

A new defence structure should be built in a width of 2.50 m between the existing parapet wall and the row of buildings along the river. The core element of the planned defence structure would be two parallel slurry walls made of reinforced concrete at a base depth equivalent to the -0.60 m mark on the Szeged water level gauge. These reinforced concrete walls would serve as the foundation for a public utility channel housing a hose, while providing lateral stability during the construction phase, and, once construction is completed, providing mechanical protection for the watertight clay core gradually deposited in between the two slurry walls exactly at the rate the original soil is gradually removed. The clay used for this purpose must have proper test certification. During these works, the existing public utility structures that remain in place must be approached and handled with great care, while out-of-use conduits should be automatically cut through and blocked.

The public utility channel housing the continuous hose – which is folded when there is no flooding – rests on the top of the two slurry walls with a watertight joint in between the three structures. The public utility channel ensures that the inflatable dike remains in position without any movement. Corrosion-free steel frame panels would close the top of the channel. Once these are open and locked in position vertically, they would provide mechanical protection against any floating and drifting objects. When closed, the steel frame panels rest in a corrosion-free steel recess, with the top of the panels running flush with the road surface in the intersections.
Filled to heights calculated in function of flood levels and wave intensity at all times, the looped inflatable dike would ensure protection against inundation. Water drawn from the river through wells installed in advance specifically for this purpose and equipped with appropriate filters would be used to fill the hose.

Near buildings with cellars requiring additional flood protection, it would be recommendable to build a spillway on the protected side of the seepage-free defence structure. The water produced by these spillways may be discharged into the city’s precipitation channel system.

**Considerations related to the design of the structural elements:**

Wherever there are blockable access gates allowing the pedestrian walkways or the road to transverse the dike, a watertight vertical layer must be installed to ensure that water flows passing through the various structural elements of the substructure are blocked off effectively.

The riverside surface of the parapet wall is protected by a stone-clad embankment of a 1:1 slope. The top edge of this embankment, right where it joins the parapet wall, is formed incorrectly; it should terminate in a plateau of at least 80 to 100 cm in width.

Benchmarks placed onto the flood defence parapet wall should be measured using geodetic techniques to detect whether the embankment wall has sunk or tilted. At the section where the Újszeged sewage channel transverses the embankment wall, two adjoining wall panels of the parapet wall have moved relative to one another along a thermal expansion gap, as was clearly indicated by the crack appearing in the sealing of the structural gap renovated as recently as 2004.

It was our general experience that wherever there was a narrow strip of landscaped vegetation between the pedestrian walkway and the road shoulder, typically along certain sections of Felső-Tiszapart, and the bedding of the walkway did not connect directly to the road shoulder, no intensive seepage was detected. Consequently, pedestrian walkways should be designed with a narrow stretch of land (approximately 0.50 to 1.00 m in width) separating them from the road shoulder. This stretch of land may even incorporate a spillway network.

If a spillway system is installed, it should run just under the edge of the pedestrian walkway. In anticipation of increasing future spillway flow rates, the spillway system must be built in several consecutive levels, the spillway pipe laid to the greatest depth having the largest diameter, with the diameters of the other pipes gradually decreasing with their increasing proximity to the surface.
Possibilities for the establishment of a complex international flood prevention group within the framework of DKMT

Sándor Kató
Civil Defence Colonel
Csongrád County Directorate General for Disaster Management

Each human being has the right to live in a safe environment and to enjoy appropriate protection against dangers. Accordingly, each country must have a stable defense system.

Disasters destroy without discrimination, causing extraordinary human suffering and endless damage. They inhibit economic and social progress and make living conditions deteriorate beyond the tolerable.

In today’s modern world, a review of the roles played by disaster prevention and civil defense has become highly topical. The issue of safety – including civil emergency situation management and planning, civil defense, and disaster prevention – has become more important than ever before.

The comprehensive reform of state and public administration, the country's defense concept and medium-term disaster prevention strategy, and an increase in the exposure to natural and civilizational disasters require a reform of the disaster prevention mechanisms and structures serving the protection of the safety of our citizens. Similar reforms are underway in neighboring countries as well.

Disasters have no respect for historical or geographical borders. Accordingly, counties along national borders can only mitigate the effects of disasters if they cooperate and share a common determination taking the shape of joint efforts.

During intervention and rescue operations, it may happen that – for one reason or another – the affected country is unable to sufficiently manage the disaster situation. However, especially when it comes to natural disasters, more than one state may be affected by the disaster at the same time.

The experiences gathered during the floods of the past few years have strengthened the professional and technical demand for setting up a complex flood prevention group in order to increase efficiency. Flood prevention is a complex activity where the majority of the professional tasks are performed by water management directorates.

However, practical experience tells us that certain areas of defense – such as logistics security, medical and psychological aid, and water and technical rescue – require further improvement in the level of organization both in terms of equipment and training.

In order to increase joint efforts and efficiency, the establishment of a joint rescue organization and base has been envisioned with the aim of providing professional training to personnel who participate in international rescue operations on the one hand and storing the necessary equipment.

The Hungarian counties of Bács-Kiskun, Csongrád, and Békés, the Serbian province of Voivodina, and the concerned counties of Romania share the same geographical properties and predicament in case of a flood. Indeed, over the past few years, high flood waves forming on the rivers Tisza, Mures, and Kris have forced these counties to cooperate closely.

Making use of the opportunities afforded by the Danube–Kris–Mures–Tisa Euroregion, the participating countries could join forces to set up a highly effective rescue team that would not have to face the difficulties posed by national borders. The experts of the three countries and their equipment could be dispatched and deployed within the shortest possible time span, improving the response capabilities of the rescue forces. We intend to create an organizational element that has the ability to participate in rescue operations in a complex manner within just 24 hours in any situation requiring intervention in any of the affected countries, and, once they have been rescued from imminent danger, to safely relocate and provide continuous care for the people affected by the disaster. In line with the relevant professional expectations, the setting up of water rescue (divers), medical, technical rescue, and logistics teams is fully justified. We often experience in flood prevention operations that non-governmental organizations can very effectively perform certain tasks in these areas, taking over some of the responsibilities of the appropriate state agencies.
The Regional Rescue Organization of Danube-Kris-Mures-Tisa Euroregion

Mission:
- to carry out special rescue tasks during emergency situations and disasters in crossborder areas and in other inland areas of the countries affected
- to reinforce first intervention forces
- to provide for the needs of the local command posts
- to provide information and data to command
- to reinforce rescue forces with special equipment
- to provide complex logistics services

Staff:
Volunteers from the non-governmental organizations of DKMT, under the professional guidance of disaster prevention professionals. The staff consists of persons with specialized skills participating in centralized training based on uniform principles and covering a uniform curriculum.

Training:
The planning and implementation of the training of the various organizational elements, first by area of specialty and then, inevitably, in a joint format to help prepare for being deployed together, must be based on the UN INSARAG guidelines. Preparation must include familiarization with the equipment made available. The preparation phase must conclude with a commissioning exercise designed to test, on the one hand, the suitability of the control elements, and, on the other hand, the performance of the execution elements, preferably under simulated conditions as realistic as possible. Joint training affords an opportunity to set up a mixed team, which reinforces the idea of a common objectives and efforts and raises awareness of a perception of safety as something that transcends national borders within the Euroregion. Establishing such a team not only improves practical efficiency; it is also a symbol of nations joining forces for common objectives.

Deployment:
The entire organization may be deployed simultaneously, but, if the emerging situation so requires, certain elements may also form special temporary detachments. In any case, the organization always acts under the operative command of the regional (local) agencies of the country managing damage clean-up operations.

Norms:
- Domestically: At county level, deployability within three hours from reaching the state of readiness.
- Abroad: The preparation period is 24 hours; thereafter, deployability norms vary depending on the mode of transfer, the distances to be covered, and the number of times borders have to be passed.

Tasks to be performed in order to achieve the objectives:
The objectives must be defined and the system of tasks must be elaborated to most efficiently and most economically reflect the relevant intentions of the Euroregion while meeting both international and Euroregion expectations.

Well-prepared and experienced experts must be involved to elaborate a concept that specifies the future organization’s principles of operation and application, including the necessary human, technical, and financial resources.

The organizational structure of the future organization must be defined by area of specialty with the core requirement that the individual elements must be able to operate both independently and in close, systematic cooperation with other organizational elements.

The members of the future organization must be selected based on professional expertise, but the mental and physical health status of those selected must also be taken heavily into consideration.

The number of staff needed must be determined so that continuous, round-the-clock operation may be maintained either in two shifts of 12 hours or in three shifts of eight hours.

Before procuring the materials and technical equipment, the opinion of the professionals using them must be sought in order to establish suitability and applicability.

The structure to be set up may create the conditions for averting and managing the threat and – potentially – impact of civilizational, natural, ecological, or human disasters.
The effective prevention and management of disasters can only be ensured relying on human and technical resources that are well-controlled, reliable, transparent, and suitable for the purpose. Rethinking and reorganizing the tasks must be seen as a key objective; this is also key to ensuring the efficient use of the available financial resources. From a cost-saving perspective, it is not an objective – nor is it necessary – to maintain a system with a permanent number of staff; however, it is certainly an objective to ensure that the organization can be activated within a short period of time and that, thanks to advance preparation and ample exercise, it is capable of performing complex prevention and defense operations efficiently and in a harmonized manner following the same logic.

Our objective is to perform harmonized activities that respond to our changing environment, establishing a system and a set of norms within which citizens accept the moral values that help their involvement and cooperation, within a volunteer setting, in the management of emergency situations. This is in line with the community civil defense mechanism of the European Union as well as with the UN International Disaster Relief Strategy, which emphasizes the role of the civil society in order to lay the foundations for progress in the field of safety.
The inundation modeling of the flood basins of the valley of the River Tisza

László Koncsos

Budapest University of Technology and Economics, Department of Sanitary and Environmental Engineering
1111 Budapest, Műegyetem rkp. 3.
Tel.: +36 1 4633752; fax: +36 1 4633753; e-mail: koncsos@vkkt.bme.hu

ABSTRACT

The objective of this study was to elaborate the methodology of an optimal flood control strategy for the valley of the River Tisza in Hungary, a country highly exposed to floods because of its rather unfavorable natural geography. To reach the objective, a fast calculation methodology was developed. The consequences of two types of disasters were analyzed – those caused by embankment overflow, and those caused by reasons of a geotechnical nature. In order to determine the extent of damage likely to be caused by a potential disaster event, the inundation process for 30 distinct scenarios with dike-breaks at relevant disaster points was simulated using a 2D model based on the resolution of the hydrodynamic equations of the shallow-water wave, which were derived from Navier-Stokes equations. Residential, industrial, and agricultural damage functions were developed to allow the estimation of the extent of the damage sustained. The individual elements of the above model were consolidated within a 100-year Monte Carlo simulation.

The results of these inundation simulations yielded time sequences of inundation depths for the individual disaster points. The extent of the damage sustained at the individual disaster points was estimated on the basis of these time series, using geoinformatics and statistics databases in combination with the damage calculation methodologies developed. As the result of the 100-year simulation studies, the empirical damage density functions and the risks were produced for each of the scenarios.

Based on the results, it was established that should the assumed climate change scenario become reality, the expected annual risk would more than double. A similar increase has been seen when considering the assumed 100-year impact of flood deposit aggregation.

Keywords: inundation simulations, 2D hydrodynamic model, flood damage estimation.

1. Introduction

In terms of its exposure to floods, Hungary’s natural geography is rather unfavorable. Located in the lowest part of the Carpathian Basin, the country must face flood waves arriving from surrounding high mountainous catchment areas located at elevations ranging from 1,000 to 3,000 m (in the Carpathian mountains and in the Alps) and channeled across the country by the rivers Danube and Tisza and their 16 larger affluent watercourses. These flood waves can easily create flood emergencies. Nearly one fourth (21,300 km²) of the total territory of the country is exposed to flooding; this represents the highest such value in Europe (Somlyódy, 2000).

Over the past few years, the River Tisza flooded in surprise attacks after a dry period of nearly one and a half decades. These floods have prompted debates about the need for elaborating a new flood control strategy. The objective of this study was to lay the foundations for a strategy covering the entire Hungarian section of the River Tisza. As an appropriate assessment of the various alternatives requires an estimation of the extent of the damage sustained, our task inevitably included running inundation simulations. Therefore, in the case of the present study, these inundation calculations represent part of a wider and more complex task – which only goes to prove that the computing capacities available in our day and age make it possible to handle the complexity of emerging problems while covering extended temporal and spatial scales.

2. Methodology

The objective of this study was to develop the methodology for the optimal flood control strategy in the River Tisza. Within this framework, an entirely new methodology was developed, one to allow taking long-term effects into consideration. The basic principle was that the various influencing factors (such as, for example, climate
change or flood deposit aggregation) and technical alternatives (such as, for example, dike heightening or opening flood control reservoirs) must be presented in the form of implementation scenarios facilitating the choice of the optimal solution by means of comparison. However, the time-consuming planning process and the large number of scenarios pose technical difficulties: as obvious as it might seem, applying a “purely simulative” method would require massive and unreasonably time-intensive calculations. To prevent such an unmanageable situation from emerging, a so-called “regression–simulation hybrid methodology” was developed. On the following pages, the methodology developed will be discussed briefly with a detailed description of the structure and application of the inundation model that plays the central role in such methodology.

During the studies, it was assumed that flood damage incidents fundamentally happen for any of the following two reasons:

1. embankment overflows (i.e. when the flood level is higher than the level of the embankment crown);
and
2. problems of a geotechnical nature.

Accordingly, two indicators may be selected to characterize the system: in case (1), the characteristic parameter is the envelope curve of the peak level of the flood wave, while in case (2) the key factor is the extent of embankment load (this quantity is the product of multiplying flood height by flood duration).

Therefore, the corner-stones of the model to be constructed were the quick calculation of peak water-levels for given sections of the River Tisza on the one hand, and a simplified determination of the probability of geotechnical embankment failure as a function of the height of the water body. First, the regression model serving as the basis for estimating flood peak levels will be presented. This will be followed by a discussion of the procedure elaborated for determining the probability of a geotechnical disaster occurring.

2.1 Flood peak level estimation using a regression model

The regression model of peak water-levels, which was intended to help determine the envelope curve autoregressively in a top-down approach, was constructed the following way:

Relying on generated flow data series as boundary conditions, a 1D hydrodynamic model was run (Koncsos, 2001) for the full length of the Hungarian section of the River Tisza to examine the cross-correlation of the peak water-levels of sections with an available riverbed geometry. The generated flows of the upstream boundary (at least in certain scenarios) also reflect the assumed impacts of climate change; these were derived from general circulation models using Version 4.1 of the software MAGICC/SCENGEN. Applying the aggregate hydrodynamic model thus constructed, a large number (500) of Monte Carlo simulations were run to generate a statistical database of flood peak level envelope curves, which in turn provided the statistical parameters for the five-parameter linear regression interrelation elaborated (Prékopa, 1964; Lukács, 1987).

The multiple correlation coefficient examined as the indicator of the strength of the regression relationship (the correlation coefficient of the measured and estimated peak water-level values) was found to be higher than 0.99 in each case. Furthermore, Wald-Wolfowitz and chi-square tests (Reimann, 1989) were applied to prove the randomness and normality of the residue.

Using the regression model for modeling flood peak levels, the statistical representations of enveloping surface curves can be generated (starting out from the height positions of the upstream sections and moving towards the downstream values): the enveloping curve results from adding up, on the one hand, the deterministic factor obtained using the linear regression interrelation, and, on the other hand, the random factor produced by random selection from the normal distribution determined by the statistical moments of the residue.

2.2 Determining geotechnical embankment failure probabilities

In applying the simplified method it was assumed that the number of disasters brought about by geotechnical causes is a function of the flood load; the latter was obtained by multiplying the flood water-level by flood duration. Based on a long-term observation of the full length of the flood protection river section, the empirical
probability of the flood protection structures failing for some reason or another (because of embankment overflow or for geotechnical reasons) is a given \((p)\). If disasters due to geotechnical causes make up \(\alpha\) (which, on the basis of international literature, may be assumed to have a value of approximately 0.6), then the probability of a geotechnical disaster is: \(p_{\text{geo}} = \alpha \cdot p\).

This probability results as the sum of the probabilities of disasters occurring at the individual sections. Assuming that there are a total of \(n\) sections along the full examined length of the river, that the height of the flood peak level at any given section is \(h_i\) above the reference level, and that the flood at any given section \(i\) remains above the reference level for a time period \(T_i\) (both probabilities being variables), then the equation is as follows:

\[
p_{\text{geo}} = \alpha \cdot p = \sum_{i=1}^{n} p_i = \sum_{i=1}^{n} a \cdot h_i T_i
\]  

(3)

where the overscore above the quantity of the embankment load means the time average at a given section, while \(a\) is the regression coefficient to be determined. The reference level must be chosen so that the probability of a geotechnical disaster occurring is zero under such reference level.

From (3), the coefficient \(a\) may be arrived at as follows:

\[
a = \frac{\alpha \cdot p}{\sum_{i=1}^{n} h_i T_i}
\]  

(4)

Let us assume that we determine the value of \(h_i\) using the above regression model as \((i=1,...,n)\). In this case we must estimate the amount of \(T_i\) for the given flood wave. The correlation between the quantities \(h\) and \(T\) were examined along the full length of the River Tisza, finding that the correlations were rather high almost everywhere. This correlation also measures the linearity between random quantities, wherefore \(T\) may be estimated as a function of \(h\) by linear regression: \(T_i = d_i + e_i \cdot h_i\) (where \(d\) and \(e\) are regression parameters to be estimated).

Accordingly, in the case of a given flood, the probability of a geotechnical disaster occurring at a given \(i\) section (where the values \(h_i\) and \(T_i\) were determined for the specific flood wave) is: \(p_i = a \cdot h_i T_i\) \((i=1,...,n)\)

2.3 Inundation flow simulations

An economic assessment of the various flood protection development alternatives requires an understanding of the extent of damage that potential disaster events may cause. The extent of the damage caused is a function of the extent of water coverage during the flood within the affected territories. In order to arrive at well-founded damage estimates, inundation processes were simulated, each of these scenarios assuming the occurrence of a dike-break at a given so-called disaster point along the course of the River Tisza (Fig. 1), following through the development of water levels within the territory affected. It was analyzed what areas would be affected, and to what extent, by the swelling effect of the shallow-water wave in the wake of a disaster-like inundation, taking into consideration the flood localization effect of various terrain objects (roads, railroad tracks, etc.) as well.

The model used for the inundation simulations was based on the resolution of the hydrodynamic equations of the shallow-water wave, which are derived from the Navier-Stokes equations, and which represent a specialized formulation of Newton’s equation and of the law of conservation of mass (Koncsos, 2002):

\[
\frac{\partial q_x}{\partial t} = -g(h + \eta) \frac{\partial \eta}{\partial x} + f q_y - \frac{\tau_{b x}}{\rho} + \frac{\tau_{s x}}{\rho}
\]  

(5)

\[
\frac{\partial q_y}{\partial t} = -g(h + \eta) \frac{\partial \eta}{\partial y} + f q_x - \frac{\tau_{b y}}{\rho} + \frac{\tau_{s y}}{\rho}
\]  

(6)

\[
\frac{\partial \eta}{\partial t} = \frac{\partial q_x}{\partial x} + \frac{\partial q_y}{\partial y}
\]  

(7)
(where \( q_x, q_y \ldots \) stand for specific water flow values, \( h \ldots \) stands for the depth of water at rest, \( \eta \ldots \) stands for the water level difference at a given point of the lake, \( \tau_b \ldots \) stands for the sliding stress between the deposit and the water body, and \( \tau_s \ldots \) stands for the sliding stress between air and the water body).

The first two of the three equations above are so-called dynamic equations describing the spatial differences between specific water flows (in directions \( x \) and \( y \)), while the third equation is the so-called continuity equation that describes changes in the water level difference (i.e., the vertical distance measured from the resting position) over time.

In equations (5) and (6) the friction between air and water is a function of the speed of wind (\( W \)) and the density of air (\( \rho \)):

\[
\tau_s^x = \rho a C_D |W| W_x
\]

The sliding stress at the bottom may be formulated as a quadratic function of speeds \( u \) and \( v \) in directions \( x \) and \( y \), respectively, using the friction coefficient \( \lambda \) to be calibrated.

\[
\tau_b^x = -\rho \lambda u \sqrt{u^2 + v^2}
\]

The boundary conditions of the model, on the one hand, express that the flow rate component perpendicular to the interfacial surface defined by the riverbed geometry is zero, and, on the other hand, they numerically express the hydraulic relationship between the area examined and its upstream and downstream points of contact.

Because of the nature of the partial differential equations, and because of the complexity of the boundary conditions, the model can only be resolved numerically. The numerical resolution is based on approximating the differential equations with difference equations, which produces speed and water level difference values on a grid that reflects the spatial resolution of the finite difference equations.

As no appropriate measurements were available for the values of Manning’s friction coefficient, the proportional adjustment of the model parameters was not possible. Instead, estimates were used: based on values stated in the literature (Chow, 1959), it was assumed that the land use categories (such as, for example, arable land, forest, etc.) and Manning’s friction coefficient are a function of one another.

The extent of water coverage within the area affected by inundation is also significantly influenced by the extent to which water seeps into the soil. As soil generally contains air as well as water, the objective of the calculations was to describe moisture transport within the unsaturated soil layer. As the terrain is generally flat, the model used for moisture transport was limited to a single (vertical) dimension. It may be proven that the model serving this purpose can be derived from a diffusion-type equation, the so-called Richards equation, which is resolved numerically in the function of the boundary conditions. The numerical process is based on the implicit method of finite differences. Richards’ differential equation can be converted into an equation working with a flux variable in order to ensure that the liquid balance is permanent at any point in time. The procedure has a second-grade accuracy in time and a fourth-grade accuracy in space (Richtmyer – Morton, 1967), that is, \( O(\Delta t^2, \Delta x^4) \). Non-linear coefficients (speed and diffusion coefficients) are determined using an iterative procedure (fixed-point iteration). The finite difference scheme applied is an enhanced, hybridized version of the Crank-Nicholson central difference scheme. This hybridized enhancement is necessary because of the appearance of numerical dispersions (an unrealistic oscillation in the results obtained by resolving the function) in the case of advection dominance (when the Péclet number of the cell is larger than one unit, \( \text{Pe}=(U\Delta t)/(2D\Delta x^2) \)).

The equation can be resolved once the boundary conditions have been entered. The level of the ground and the level of the ground water table are the two boundary conditions; the precipitation–evaporation flux is to be entered at the higher boundary, while the vertical ground-water flux is to be entered at the lower boundary. In elaborating the model, a simplified approach was used inasmuch as the hydrometeorological characteristics (precipitation, air temperature, relative humidity) were considered constant for the purposes of the calculations.

The two-dimensional model for inundation and the vertical model for water seeping into the soil communicate with one another at calculation cell level: the calculated loss of volume attributable to water seeping into the soil and to evaporation are used to adjust the continuity equation of the inundation model.
During numerical resolution, calculations are carried out at the grid nodes of an equidistant grid, where terrain information (geodetic height data) must be available. Accordingly, when the morphological model is constructed, the geodetic height values must be determined for the grid nodes of the numerical grid. As the next step, the “cells” where flow takes place must be selected along with all those elements of the grid that comprise the surface confining the flow. Based on a consideration of the time required for performing the calculations, the resolution of the morphological model applied was usually (e.g. in the case of disaster simulations) 50m by 50m. Accurate data on the topographical location of linear terrain objects (roads, embankments) were available. The height data of these objects were specified relying on a morphological model of higher resolution (5m by 5m).

When performing the inundation calculations, a so-called internal boundary cell was introduced where the inundation volume flow was taken into consideration by adjusting the continuity equation, assuming a flow of $Q = 520 \, \text{m}^3/\text{s}$. This inundation flow was maintained for five consecutive days. During the simulation, inundation depths were saved at regular time intervals (every two hours).

![Fig. 1: Areas inundated during the simulation (disaster points are indicated by k1, k2,..., k30)](image)

### 2.4 Calculating damage functions

During the disaster simulations, the following types of damage were reckoned with: residential damage (damage in real estate and personal assets), industrial damage, and agricultural damage.

The extent of real estate damage was determined using information available in a statistical database for each municipality or small region on the number of buildings, the type of wall (fired brick vs. adobe), and building heights. The basis for damage estimation was the reconstruction cost as a function of the extent of water coverage, which is a novel approach slightly deviating from international practice (Halcrow, 1999). The reconstruction of adobe houses with fired bricks was handled by the model adaptively.

For determining the extent of damage in personal assets, the statistical database provided data on how well-equipped the households were (in terms of furniture and consumer durables). Once again, the extent of damage was estimated using replacement cost.

The extent of industrial damage was determined on the basis of the annual income produced nationally as estimated on the basis of annual profit before taxation. The geographical distribution (by county and/or type of municipality) was based on statistical data on industrial production and on the number of persons employed in industry.

The extent of agricultural damage was determined separately for the various types of plant cultures as a function of the time of inundation, using an agrotechnological and cost analysis model, on the basis of production costs and water coverage tolerance times.
2.5 The calculation of expected damage for a period of 100 years

The individual elements of the above model were integrated into a Monte Carlo simulation covering a time span of 100 years.

Within the framework of this simulation, a random value was selected from the overflow probability distribution of an upstream section (overflow meaning a water level in excess of an appropriately selected reference level) to calculate, using the regression interrelations, the peak water-levels of the downstream sections. The effects of the examined influencing factors (climate change, flood deposit aggregation, technical intervention) were taken into consideration by appropriately adjusting the regression coefficients and/or the statistical parameters.

Once this was completed, it was examined whether a disaster event occurred at any given section, moving down along the entire length of the river. It was assumed that a dike-break occurs when the peak water-level is at least 50cm higher than the height of the embankment crown, and/or when any given value randomly selected from an even distribution is higher than the probability of geotechnical embankment failure at peak water-level.

When a dike-break occurred, the inundation flow simulation results belonging to the nearest disaster point were allocated to the given section; then, with the inundation duration and/or inundation depth data being available, the extent of the residential, industrial, and agricultural damage related to the given inundation event was determined on the basis of land use information and municipal statistical data characterizing the area concerned. Finally, all damage related to the given flood wave was added up along the entire length of the section.

Following the number of flood events for a one-year period, new flood waves were simulated and the above procedure was repeated in order to calculate the extent of the total flood damage of the given year.

5,000 Monte-Carlo simulations were performed for all scenarios for the full planning time horizon (100 years). On the basis of these, the damage density function and the extent of the expected damage for a period of 100 years were determined for the given scenario; this in turn served as a basis for comparing the alternatives.

3. Results

3.1 The results of the inundation simulations

As a result of the inundation simulations, a time sequence of the inundation depths at individual disaster points was obtained. Using a simple algorithm, all relevant water coverages (water coverages exceeding the critical time or the critical depth) were selected. As an example, Fig. 2 presents water coverages in excess of 50cm resulting from an inundation at disaster point $k_5$.

Determining the inundation depths and inundation durations as described above served as the basis for calculating the extent of residential, industrial, and agricultural damage sustained.

3.2 Disaster damage estimates

With the results of the inundation simulations at hand, the extent of the losses emerging at the individual disaster points were estimated on the basis of the elaborated damage calculation methodologies, relying on geoinformatics and statistics databases. Fig. 3 shows the ranking of the disaster points according to the total loss suffered, also indicating the ratio of the individual types of damage within the total damage value.

The chart supports our initial expectations inasmuch as in the case of an area near a major city (such as, in the case of inundation point $k_{24}$, Szeged and its vicinity) the total loss value is extraordinarily high, with residential damage representing a high ratio and agricultural damage representing a rather low ratio within the total damage. In primarily rural areas (e.g. in the case of disaster points $k_6$ and $k_{21}$), the total damage value was smaller, with agricultural damage and damage in adobe buildings representing a higher ratio.

Overall, it may be established that a significant ratio of the total loss consists of damage sustained in real estate and industrial damage, while the ratio of agricultural damage is almost insignificant.
3.3 Bayes risks

As a result of the 100-year simulation study, the empirical loss density functions belonging to the individual scenarios were generated. Based on the terminology of Bayes’ decision theory, the risks of the individual scenarios were calculated as expected loss values. (It must be noted that the calculations produced values representing the total undiscounted loss of the 100-year period as projected to the individual one-year periods.)

Fig. 4 and Fig. 5 demonstrate the change of loss density functions and risks as a function of the influence of climate change, flood deposit aggregation, and various technical interventions. It can be established that taking into consideration the impact of climate change and the impact of flood deposit aggregation implies a significant increase in risk as compared to the initial level. In the case of the former, the basic risk of billion HUF 18 increased to billion HUF 38, while in the case of the latter the increased level was approximately billion HUF 41. An examination of the technical interventions designed to reduce the flood revealed that the most effective risk reduction alternative (one that reduces the basic risk level of billion HUF 18 to billion HUF 1.1) is to implement the concept that involves building 11 flood control reservoirs; on the other hand, inundating the naturally low floodplains would reduce the risk to billion HUF 4.2, while building 6 flood control reservoirs only would result in a more limited reduction of the expected risk level to billion HUF 5.6.
4. Conclusions

As a result of our study, it may be concluded that by embedding inundation simulations – which otherwise tend to be heavily time-intensive to run – into an appropriately constructed model system can ensure manageable calculation times.

Based on an examination of the composition of the damage sustained, it may be concluded that the ratio of agricultural damage is rather low as compared to the extent of residential and industrial damage. This difference is typical of all areas, but it is especially pronounced in the case of areas near larger cities and in areas of a less rural nature. Therefore if further and more detailed damage analysis should follow in the future, it would be reasonable to lay the emphasis on improving the methodology for estimating residential and industrial damage.

A comparison of the risks belonging to the 100-year scenarios examined during our analysis – such risks being defined as the expected value of empirical loss – has led to the following conclusions: Should the assumed climate change scenario become reality, the expected annual risk would more than double. A similar increase was seen when the assumed 100-year impact of flood deposit aggregation was taken into consideration. An examination of the effect of technical interventions designed to reduce flood has revealed that the largest extent of risk reduction (reduction by one order of magnitude) would be the alternative involving the construction of 11 flood control reservoirs, while inundating the naturally low floodplains, or the alternative of building six flood control reservoirs.
reservoirs, would result in a somewhat more limited reduction of the expected loss. Obviously, a final assessment of these alternatives also requires the determination of the costs each of the alternatives would imply if implemented.

Literature


EPIDEMICS

System of defence management

Mihály Kaszás
executive councilor
Csongrád County Defence Committee

The system of Hungary’s defence management was formed after the fall of the communist regime (in 1989-1990) during the crisis in the former Yugoslavia.

Initially its scope included only national defence and armed warfare, as most general issues of defence management. The comprehensive legal regulation had been designed approximately by 2000, when acts such as the 1993 Act on National Defence, the 1996 Act on Civil Defence and the 1999 Act on Disaster Management were passed.

Hungary’s accession to NATO and the 9/11 events, as well as the subsequent challenge of terrorist attacks created a new situation. The legal answer to this situation was provided by the National Security Strategy adopted in 2004, as well as the amendment to the Constitution and the passing of the new Act on National Defence, also in 2004.

What are the dangers taken into account by the Hungarian Republic?

◊ Multi-level threats may spread almost to every segment of the state, thus the answer has to be similarly complex,
◊ A military-type threat cannot be ruled out, although there is no potential for real threat within the territory of the Hungarian Republic in the upcoming 10-15 years (this had been one of the reasons for the abolishment of the system of compulsory military service),
◊ Other military and terror-type activities, such as organized crime and the negative effects of drug trafficking, pose a security threat,
◊ New phenomena occur: events destabilizing the information system, the monetary system and the economy,
◊ “Traditional” threats should be mentioned, such as risks rooting in natural, environmental and civilizational reasons, among which I would like to stress the problem of flood, inland waters, animal epidemics, as well as some recent events, such as human influenza and the possibility of a global pandemics.

What are the characteristics of the security system of the Hungarian Republic?

Maintaining security and its guarantee is regarded as an issue of national responsibility, based primarily on national funds, but the cooperation of allied countries is taken into account as well: Hungary receives and offers help.

Apart from the government institutions created for this special purpose and the possibilities of the economy, the national system is also based on the compulsory personal and property offers of the population, as well as their voluntary participation. Security management, the special from of the state and state administrative institutions have a decisive role in securing and managing the complexity of the defence system and coordinating the activities of the people involved, as well as in the enforcement of certain authority rights and civil obligations.

“Defence management – part of the public administration – is a system of tasks and an organizational system. It is an executive and dispositional activity carried out by the public authority institutions appointed for this role,
created for the management of complex defence tasks of the state, which also includes preparation for periods qualified by the constitution and preparation for situations triggering such periods; it also includes the totality of state activities in the aforementioned periods concerning tasks (including planning, organization and implementation) of national defence, civil defence, disaster management, defence economy and population supply.” (Government Decree No. 71/2006 (IV. 3.) Paragraph 2 [e])

Thus, it can be concluded that the defence system of the Hungarian Republic is solid, administered by the state, and the tasks and scopes of activities are legally regulated. Primarily it builds upon peacetime systems (institutional, operational and organizational systems), and introduces modification only to the necessary extent (it does not “militarize” the state apparatus or society). Its complexity guarantees the deployability of the system in any type of disaster, although “roles” vary according to levels of responsibility and organization. The “modul-principle”, therefore, is an important feature, which means that, on the one hand, only the part of the system that is needed will be functioning, while on the other hand it is possible to operate the individual elements of the system independently. This latter characteristic is especially important in disaster management – in line with the principle of subsidiarity.

The full explication and interpretation of the above definition would go beyond the time limits of this presentation, thus I wish to focus on its most important territorial elements. At this level the county defence committee is the defence administrative body of the complex defence preparation and management. Its tasks and powers are detailed by government decrees and resolutions.

The Committe is a board of set composition, which functions as a public administration body subordinated directly to the Government.

Its chairperson is the chair of the county general assembly, its members are the most significant civil administrative bodies (public administration office, national health office, directorate of environment protection and water conservancy, the county recorder), mayors of towns with county rank, specified managers of military and civil protection organizations (police, disaster management, replacement center) and the secretary of the committee. Participants with consultation right are professional superior bodies of Ministries, leaders of the Hungarian Armed Force and other bodies of civil defence and state administration).

The defence committee substantially has the following functions:

◊ Ensuring the management and control of state tasks; enforcement of public administration functions,
◊ Ensuring the successful functioning of and supporting organizations carrying out the main functions (independent of situation, e.g. Hungarian Armed Force, water conservancy, disaster management, human or animal health authority,
◊ Protecting the life and material goods of the population; coordinating tasks of civil defence,
◊ Mobilizing economic resources, ensuring that the economic needs are met, sustaining functionality.

The committee functions in peace-time periods as well, it holds regular meetings, it plans, controls, it calls for reports and supervises. It brings its decisions in the form of resolutions, which are binding for bodies involved in defence tasks. Its task of special importance is the management and control of the complex defence activities of local defence committees, as well leaders of settlements and mayors, functioning at the level of micro-regions.

In qualified periods the chairperson of the committee has the authority of the committee, and sets the requirements and tasks concerning the implementation of extraordinary territorial measures in a decree. (I would like to note that the period during the flood in 2000 and in 2006 was specified as emergency situation and “qualified period” regarding the region as well)

The board sets its own Organizational and Operational Code, legal monitoring is provided by the minister of defence, while monitoring regarding issues of disaster management is the role of the minister for self-government and regional development.

In ordinary situations the Committee operates a small secretariat and a team or working-group formed for the management of a specific task. Such team is, for example, the group coordinating action dealing with avian flu, or the group carrying out the assessment in connection with the protection of vital, critical infrastructure.
In qualified periods constantly operating groups become active, which include the experts of protection organizations and are prepared in peace-time periods – such are the disaster management operative working-group, the working groups on population information, on economic mobility or groups dealing with national support. The Secretariat in these periods is on duty non-stop, operating departments dealing with administrative issues, issues of information protection, issues of professional evaluative analysis and others.

In our work we primarily build upon the defence capabilities of the county. The period of the flood, which broke records last year, was a great challenge: the work and the standby activities involved 6-7 thousand people, 800-1000 items of various technical devices, 65 different organizations and a number of volunteers. This year our defence tasks have been connected to the appearance of avian flu. The professional tasks were coordinated by the animal health authority, and even the special EU committee evaluated its work as highly professional. The Prevention Committee set up a coordination group in October 2005, and the bodies of animal health, police, national health, disaster management and the secretariat of the Committee were activated. In average the group had one meeting per week, we had a look into the actual situation, we coordinated the tasks of the individual bodies, and we organized and carried out the supply of information to mayors, the population and farmers, both directly and through the media. The police, the border surveillance and the militia made up of volunteers were the most effective in their work. They checked 6200 vehicles during the 50 days of the prevention period, 35 individuals were warned, 58 individuals were fined on the spot, 25 procedures were launched in connection with petty offences, and one person was arrested. We did not have to summon an extraordinary meeting of the Defence Committee, since the professional body and the coordinating working group were able to control the situation in an effective way.

Our experience shows that the effective control of the multi-layered threats and challenges as well as the new challenges can be reached only through tackling the issue in a comprehensive way, involving the coordinated participation of all the actors of defence management. Apart from the participation of state organizations and the citizens dealing with the issue as professionals, the role of volunteers with special skills and training, as well as the role of international cooperation is increasing, and for such cooperation this workshop may provide substantial help.
Pandemic management in Romania
Marcel Lucaciuc
colonel
Vasile Goldiş, Arad Arad County Emergency Situation Inspectorate

1. Általánosságok

A pandemic (from Greek παν all + δήμος demos people) is an epidemic (an outbreak of an infectious disease) that rapidly spreads across a large region (for example a continent), or even worldwide.

The conditions for the emergence of a pandemic:
According to the World Health Organization (WHO), a pandemic can start when three conditions have met:
• the emergence of a disease new to the population,
• the agent infects humans, causing serious illness, and
• the agent spreads easily and sustainably among humans (causing an epidemic).

Also according to WHO, the phases of a pandemic are as follows:

Interpandemic period:
• Phase 1:
  o No new influenza virus subtypes have been detected in humans.
• Phase 2:
  o No new influenza virus subtypes have been detected in humans, but an animal variant threatens human disease.

Pandemic alert period:
• Phase 3:
  o Human infection(s) with a new subtype but no human-to-human spread.
• Phase 4:
  o Small cluster(s) with limited localized human-to-human transmission.
• Phase 5:
  o Larger cluster(s) but human-to-human spread still localized.

Pandemic period:
• Phase 6:
  o Pandemic: increased and sustained transmission in general population.

2. The organizational measures implemented by Romania

In Romania, both the necessary legal background and the conditions for taking the necessary measures have been developed in order to implement procedures for prevention and, once the epidemic or pandemic has become reality, intervention. Hereunder follows a brief description of some pieces of regulation that lay out the procedures to be performed within the above-mentioned fields of activity.

a) Early warning and rapid response system for infectious diseases.

The system is laid out in Decree No 883 of August 16, 2005 of the Minister of Health, establishing the following objectives as regards the emergence and control of infectious diseases:
– early identification of cases of infectious diseases with the ability to spread rapidly in order to prevent/ localize the potential outbreak of epidemics;
– monitoring trends in case of infectious diseases with the ability to spread rapidly;
– evaluating the efficiency of the control measures taken;
– using the available resources efficiently and reasonably.
The above-mentioned decree defines the diseases and gives, for each infectious disease, the alert levels, a
description of the symptoms, instructions on how to report the emergence of cases (“SITREP” sample reports), the
flow of information and decision making, the responsibilities of physicians, institutions, laboratories, the Public
Health Authority, and all other agencies concerned, and the urgent and medium term measures to be taken when
the emergence of such diseases has been detected.

This early alert system is an integral part of the methodology of the public health management of emergency
situations arising because of natural causes or intentional human acts.

b) National intervention plan in case of a flu epidemic

The structure and content of the plan and the organizational levels responsible for its implementation are
laid out in Decree No 1094 of 2005 of the Minister of Health.

The following objectives have been formulated:
- decreasing the number of cases of disease and death;
- preventing the spreading of the diseases;
- containing the social and economic impact of the diseases;
- reducing economic loss (in the context of this decree, the government declared flu pandemics a disaster
situation).

The decree stipulates the following plan system:
- measures and activities to be implemented and performed during each and every phase of the pandemic:
  - during the interpandemic period,
  - during the pandemic alert period,
  - during the pandemic period, and
  - during the post-pandemic period.
- the tasks and responsibilities of the agencies involved in the implementation of the plan.
- the management of the impact of the emergence of the pandemic.
- the possible pandemic scenarios.
- general defence and intervention measures:
  - organizational structures (definition and composition);
  - guidelines for the planning process.
- specific measures (medical measures):
  - observation;
  - managing the cases detected;
  - clinical prevention;
  - treatment (only in the first three periods of the pandemic).
- organizing the channels of information flow and decision making.
- providing for the logistics and financing of the activities.

3. Avian flu

Flu epidemics affecting birds and humans cause major concern in the world of science. Dozens of virus re-
search institutions are searching for solutions that could prevent the constant recombination of viruses demand-
ing new antigens. While the WHO is on the opinion that mankind is not yet prepared for such a threat, poultry
farmers have vested their hopes in local biosecurity programs and are waiting for scientific breakthroughs making
the production of effective vaccines possible. The European Commission is planning to organize an international
donor conference with the aim of supporting Asian countries in the war on diseases, and preventing pandemics.
This initiative reflects the EU’s increasing interest in channelling financial supports towards southeast Asian
countries with the aim of stopping the spread of the disease before it reaches Europe. As European Commis-
sioner for Health Markos Kyprianou said, “We believe that the best defence for Europe is to tackle the prob-
lem at its root – and at the moment that root is in southeast Asia”. Unfortunately, however, avian flu has burst
out of control and has expanded to Canada, the USA, Latin America, and more recently to Europe, and, in all probability, to Romania as well.

The terms avian flu and bird flu include several pathological conditions caused by different subtypes of the influenza virus. Epidemiologically, type A flu viruses fall into subtypes depending on the antigen properties (H and N) of the glycoproteins of the viral membrane. Over 15 subtypes have been classified on the basis of hemagglutinin (H) and another nine on the basis of neuraminidase (N). Each subtype is characterized by a specific antigen formation, which reflects the similarities and differences between the various virus strains. The many combinations of the two separate classifications will be reflected in the nomenclature of the specific virus causing the epidemic or pandemic (the 1957-1958 human flu epidemic was caused by the subtype H2N2, which later evolved into A/H3N2, causing the outbreak of the Hong Kong flu in 1968).

Normally, the virus of the avian flu will only transmit to humans through an intermediary agent, namely pigs, which have receptors both for avian virus types and for human virus types. This explains why human flu predominantly emerges in Asia, where pigs and poultry are typically kept in close proximity to one another on farms, just like in Romania. It is believed that in cases where the virus of avian flu evolves in a human who is already infected by a human type of the flu virus, an antigenic shift may possibly take place between the two types of virus, which leads to the emergence of a new type of antigen capable of causing a pandemic. In other words, pigs and humans serve as the genetic melting pot in which avian viruses combine with human viruses to generate new pandemic virus strains (see the chart).

Avian flu is a virus-induced disease afflicting turkeys, chickens, pheasants, quails, ducks, geese, waterfowl and migrant birds. The disease spreads very rapidly and affects large numbers of birds. Migrant birds, especially waterfowl are generally considered a natural vehicle of the avian flu virus. The disease spreads via migrant birds, via the excrement, secretions, and, eventually, carcasses of the infected birds, but also via any water, feed, equipment, nesting sites and housing facilities, and means of transportation that have come into contact with the virus. The closer the contact between the infected bird transferring the virus and the bird contracting the virus, the easier the infection is transmitted directly.
Between 2003 and 2007, the world has seen a few waves of avian flu causing 218 human infections, out of which 118 have led to death. Just in 2007, 74 cases have been reported, 48 of these eventually leading to death. An overwhelming majority of the infection and mortality cases reported happened in Indonesia and Vietnam. A comparison of these figures indicates an alarming increase in the number of cases reported. This trend is expected to continue in the future.

4. Avian flu in Romania

During the last two years, Romania experienced and successfully defended itself against two consecutive waves of avian flu. The Danube Delta is not only a wildlife sanctuary, it is also an important transitional resting place for migrant birds. Consequently, by far most of the cases observed in Romania were reported from the vicinity of the Danube Delta.

The first wave of avian flu arrived during the autumn of 2005. The intervention measures taken by the competent authorities involved the extermination of 430,000 birds. The compensation paid to commercial poultry farms and to private individuals was in excess of 28 million euros. The second wave arrived in 2006 with over 35 million euros in compensation for poultry stocks exterminated and over 22 million euros in disinfection costs. The Ministry of Transport spent another 40 million euros on preventive and control measures on public roads. Over 183 municipalities were affected in 18 counties, including the national capital, Bucharest. Economic loss amounted to 70 million euros because of a decrease in poultry meat production and an 80 to 85% reduction in poultry consumption, negatively affecting 60% of the total production capacity of the country’s poultry industry. A single “positive” effect of the huge economic loss was that falling poultry meat and egg prices reduced inflation.

5. The methodology of avian flu control used in Romania

a) Organization

In Romania, the methodology of controlling avian flu was based on Decree No 31 of 2006 of the Minister of Health. The decree lays out what should be understood by the terms potential case, possible case, and proven case; what security, defence, and quarantine measures are to be applied immediately; how the tests should be run and the results should be verified; what responsibilities the institutions involved in the response have; what command and control line ensures that the situation is managed; and what the channels of information flow and decision making are.
b) The symptoms of avian flu:
- **In birds:** The infected bird will refuse to eat, squat with wings hanging low, develop a swelling and dark red discoloration in the crest and beard, develop purple discoloration in the skin of the legs, exude secretions through the nostrils and beak. The head and neck develop a swelling and turn to a purple hue. The bird will develop breathing problems and diarrhoea, and may develop head shakes, spasmodic neck distortion, or paralysis.
— **In humans:** Sudden fever of 38 Degrees C or higher, loss of appetite, breathing problems, cough, all in an epidemiological context. It must be noted that depending on the evolution of, or structural modifications in, the A/H5N1 virus concerned, the case description may also change as a function of the epidemiological situation.

**c) Measures taken in Romania during avian flu**

— **Definitions:**
  - **restricted zone:** a minimum of 3 km;
  - **surveillance zone:** a minimum of 10 km.

— **Control of the zones concerned:**
  - limitation of traffic of persons and vehicles until the pandemic period is suspended;
  - setting up and operating health screening crossing points.

— the **total destruction of all poultry** within the area potentially affected.
d) Measures taken by poultry meat owners or producers (commercial or family farmers)
The general measures described in the previous paragraph, with the addition of the following measures:

- permanent clinical supervision of the bird stock using specific tests in and around the zone affected;
- providing continuous support to the action teams;
- controls at the points of entry and exit of the farms; implementing the control and disinfection measures applicable to points of entry and exit;
- immediate notification of veterinaries whenever suspicious cases or bird deaths occur;
- handling infected birds and bird carcasses only when wearing the appropriate protective gear;
- birds must be kept within closed pens or within zones as protected as possible; whenever possible, contact between these and other birds must be avoided;
- it is prohibited to allow ducks and geese to access open waters;
- children must not be allowed to play with domestic birds;
- supporting the efforts of the veterinary authorities involved in the intervention efforts.

e) What should consumers do:

- Poultry meat, eggs, and other products of poultry origin should only be purchased from retailers with a specific license for the sale thereof;
- products of poultry origin should only be consumed after thorough heat treatment;
- whenever handling poultry meat, hands should be washed thoroughly with soap;
- kitchen equipment used to prepare poultry meat should be thoroughly cleaned and washed.

6. Conclusions

During the waves of avian flu that hit Romania, a high number of birds were identified as having been infected with the H5N1 virus, but fortunately, not a single case of human infection was detected.

In each and every case discovered, the rapid response of the authorities, in combination with a confident implementation of the defence and intervention measures, allowed a high degree of efficacy in all intervention activities, keeping the scope of the epidemic within the zones declared affected.

Despite the defence and intervention measures implemented, and despite the rapid and confident response of the authorities concerned, the economic damage sustained reached an unprecedented level, which had a negative impact on the national economy in general, and delivered a severe blow to poultry meat producers. The fact that the general population took a rather long time to regain its trust in consuming poultry meat products made the impact even harder.

Despite the fact that the control measures implemented by the state authorities were very stringent, both the general population and the producers supported these procedures, respecting the application of disinfection, traffic restriction, and biosecurity measures.
7. Lessons learned

1) **The lack of communication strategy:** This was experienced at all levels. An inability to formulate and send out the right message to the general population and the business sector resulted in a state of panic. This is a sad fact especially because during the second wave of avian flu the same mistakes were repeated. Fortunately, the general population was by then better prepared and informed.

2) **The press overreacted** and blew the situation out of proportion. Each and every case was reported as a larger than life event, which was not justified. More emphasis was laid on the mistakes made by the authorities than on the need to support to authorities by sending the right message to the people.

3) Albeit quite late and within a rather limited scope, the authorities and the press eventually developed a **common language,** which had a constructive impact on the activities.

4) In the case of the first wave of avian flu, the **lack of action plans** caused certain delays and disruptions in carrying out intervention activities and in implementing specific defence measures. Defining those plans after the fact helped achieve a significant improvement in the effectiveness of the activities.

5) Another problem related to the **dilemma whether to rely on public or private companies for performing intervention activities;** initially, mobilizing state institutions seemed to be slow and cumbersome because of the lack of preparedness on the part of the personnel and because of the lack of materials used in intervention procedures. The private sector has the ability to adapt to market demands much faster and much more flexibly; it had specialist personnel and it had the necessary materials available to it and therefore it was able to intervene effectively within a short period of time – however, the costs of the private sector were far higher than the budgets of the state agencies could have provided for. In the future, choosing the optimum modality of intervention should be given ample consideration.

6) It has become clear that the **lack of disinfectants, decontaminants, and other necessary intervention materials at warehouse level** caused delays and disruptions in providing for the control of the zones affected. In this context, due consideration should be given to what is more economical: to acquire and store these materials well in advance, which involves storage costs as well as replacement costs on occasion, or to acquire these materials from the market at the time when the virus appears, which may have a bearing on the possible response time.

8. Controlling phenomena in border zones

1) Setting up **points of contact** between major agencies responsible for managing these sorts of situations on both sides of the border in order to facilitate fast information exchange in case of an epidemic, and in order to facilitate concerted intervention and defence activities.

2) Concluding **contracts and agreements** setting out all the obligations and responsibilities of the parties concerned, while also defining the modalities of data transfer and cooperation in actual practice in case of an avian flu epidemic.

3) Elaborating a **joint protocol of procedures** covering the implementation of defence and intervention measures. Such a protocol ensures that situations caused by the emergence of epidemics in cross-border regions can be managed in a uniform manner.

4) Establishing and continuously monitoring the **flow of information** in order to facilitate appropriate and effective data exchange, especially during and around the outbreak of the phenomenon.

5) **Integrating early warning systems** by identifying counterpart agencies, which allows, on the one hand, the uniform interpretation of the phenomenon in the initial phases, and, on the other hand, the concerted and harmonized implementation of the measures to be taken in response to the phenomenon.

6) **Organizing joint preparation events,** exchanges of experience, workshops, meetings, and joint exercises, which allow the participants to become familiar with the organizational structures involved in the prevention of and response to the phenomena concerned, as well as with the partner’s intervention possibilities and capabilities.
7) Ensuring that the response capabilities are complementary to one another, a possibility to decrease the high intervention costs in these situations.
8) Setting up joint laboratories and other measurement, diagnostics, and evaluation facilities on the basis of programs financed by the European Union.
ACCIDENTS TAKING PLACE IN HAZARDOUS INDUSTRIAL UNITS

The plan system of seveso establishments

József Hódi
Fireguard Lieutenant Colonel
Csongrád County Directorate General for Disaster Management

With the emergence of fast-growing industrial corporations, the industrial-scale production, use, and storage of dangerous substances have become an everyday affair (part of our day-to-day life). By now, growth is significantly influenced not only by considerations of economicality but also by the need to ensure that the environment sustains the quality of life. We often experience that the security distances created when the plant was initially constructed tend to shrink over time. This may either be due to an expansion of the establishments towards residential areas or to the tendency of residential areas to claim more space for themselves, in both cases bringing the population closer to the source of danger. The experiences obtained through the clean-up of major industrial accidents all over the world have provided ample proof that we have a lot to do in order to avoid disasters caused by civilization – for their impacts have no respect for national borders. The easiest and most economical way to create an environment that is safer for ourselves and for our children is to elaborate safety requirements well in advance, and then to fully enforce compliance with those safety requirements.

Changes in Hungarian legislation:


The purpose of preparing plans:

Once we understand what dangers we can expect to ensue, we can prepare for the protection of the environment and the population by preparing a variety of plans. This inevitably requires the determination of the type and extent of the potential emergency, modeling, elaborating action plans, and organizing exercises to ensure that all involved personnel become familiar with, and skilled at, the various procedures. Time is a factor of great importance. The time it takes to detect or respond to an incident influences to what extent the emergency may be averted and to what extent its impact may be mitigated. Once the plans have been prepared, command post exercises must be held with the objective of improving familiarity with the premises and with the practical procedures, and to verify the state of preparedness. These help participants become ever more skilled at managing the various points of danger within the establishment, prioritizing and scheduling specific actions in order to avert dangers within the shortest possible time span, while they also help verify that the actions laid out in the plan are feasible in actual practice. Special emphasis is placed on increasing the expedience and accuracy of the flow of information as well as on ensuring the professional and accurate execution of activities concerning the general population. Of course, each and every emergency situation is unique; yet thorough plans prepared well in advance consider the critical bottlenecks of the possible sequences of actions, perform calculations to verify the sustainability of such actions, or decide on the necessity of replanning.
The basis for the plans:
Currently, the determination of whether an industrial establishment represents a danger to the environment is based on Government Decree 18/2006 (I. 26.), which lays out specific reporting obligations. Reporting is followed by carrying out Safety Analysis or by preparing a Safety Report.

Safety Reports:
Establishments exceeding the higher qualifying quantities must prepare a Safety Report with the content and formalities laid out in Annex 2 to Government Decree 18/2006 (I. 26.), in line with the requirements stipulated in Annex 1. Based on the above, they must describe their main objectives relating to the prevention of accidents, the organization they operate, and the control system of the establishment. An important requirement is to describe the environment of the dangerous industrial establishment as well as the establishment itself, and to detail any information that helps identify the dangers. The thorough identification of major accident potentials lays the foundations for determining the degree of danger that each of the potential accidents may cause. The suitability of the system of defense measures and of the safety management system, as well as the speed of response, have a significant bearing on the eventual impact of damage incidents occurring within dangerous establishments. The organizations involved in preparing the Safety Report must be identified in order to allow the authority to judge whether all the opinions of each of the agencies concerned have been taken into consideration; if not, measures may be needed to initiate additional discussions.

Whenever new facilities are constructed, the Safety Report must be submitted at the same time as the construction authorization process is started. The content of such report has been specified, ensuring that the authority, even prior to completing the construction of the establishment, obtains all the substantial data that are necessary to judge the establishment’s level of safety.

Safety Analysis:
Dangerous establishments reaching the lower qualifying quantities must carry out Safety Analyses. Except for the description of the safety command system, which is not required for this category of establishments, the Safety Analysis must cover the same information as a Safety Report.

The report or analysis must be prepared by the establishment itself.

1. Requirements for the form and content of the Internal Emergency Plan:

The Internal Emergency Plan is prepared by the establishment itself.

The requirements for the form and content of the Internal Emergency Plan are laid out in Annex 6 to Government Decree 18/2006. (I. 26.). The Internal Emergency Plan must include a description of the measures designed to reduce the need for the eventual defense activities when major accidents involving dangerous substances emerge, as well as describe the implementation of the management of emergency situations. Identifying the tasks related to the External Emergency Plan ensures that authorized decision-makers are provided – within the shortest possible time span – with appropriate information on events taking place within the establishment, such information containing prespecified data.

◊ A description of the measures designed to reduce the need for eventual defense activities when major accidents involving dangerous substances emerge
  o A description of the emerging situations
  o The defense tasks
  o The defense organization (forces and equipment)
  o The infrastructure of the establishment (equipment and materials)
  o Alerting the employees; the tasks of the employees

◊ Emergency situation management
  o The organization responsible for emergency situation management
  o The organization performing defense operations
The person keeping contact with external agencies
The technical infrastructure available for use

The tasks related to the External Emergency Plan
The tasks of the organization responsible for launching the External Emergency Plan (mode of alert, information to be provided)
The conditions of providing assistance in averting the emergency situation emerging within the environment of the establishment
Preparing those participating in defense operations

Formal requirements

2. Requirements for the form and content of the External Emergency Plan
(Annex 7 to Government Decree 18/2006. (I. 26.))

The definition of the External Emergency Plan:
for rescuing the population living within the environment of the dangerous establishment,
for introducing rules to be implemented in the interest of mitigating the damage caused in material goods and in the environment,
for the executing organization,
for command, and
for data dissemination.

The mayor of the endangered municipality must, in cooperation with the regional agency of the General Directorate for National Disaster Management (these are the county-level directorates for disaster management), prepare the External Emergency Plan within six months from the adoption of the Safety Report ensuring that the competent municipal fire brigade,
the ambulance service,
the police,
the county (or capital city) institute of the State Public Health and Chief Medical Officer’s Service (ÁNTSZ),
the competent environmental protection, nature conservation, and water management authorities, and
the operator of the establishment
are granted an opportunity to express their respective opinions during the preparation of the plan. The finalized External Emergency Plan is approved by the chair of the county’s (capital city’s) defense committee in agreement with the authority.

Only one External Emergency Plan is to be prepared even in cases where the given municipality may be affected by the impact of more than one establishment reaching the higher qualifying quantities.

The structure of the External Emergency Plan
The External Emergency Plan has seven chapters in the following structure:

I. Introduction
The concept of the External Emergency Plan
The purpose of the External Emergency Plan
Definitions and abbreviations
The area and persons falling within the scope of the External Emergency Plan
The persons authorized to issue the orders specified by the External Emergency Plan
II. Threat, alert, defense
   - Reducing the need for eventual defense activities and mitigating damage impact
   - A description of the situation emerging in the wake of the major accident
   - The extent of the zone of danger
   - Potential consequences
   - The consequences of dangerous substance spills
   - Tasks related to defense against damage impact
   - Alerting and briefing the forces and equipment participating in defense activities
   - Alerting, informing, isolating, and evacuating the population
   - Alerting those managing the defense operations
   - Organizing the command staff
   - Carrying out damage clear-up tasks
   - Recovery works
   - The rehabilitation of the environment
   - Organizations, forces, and equipment available for defense purposes
   - Municipal infrastructure, equipment, and materials available for defense purposes
   - Measures adopted in the interest of protecting the population and material goods
   - Control and cooperation tasks
   - Alerting, warning, and information dissemination
   - Evacuation, rescue, and relocation
   - Providing the general population with personal defense and rescue equipment
   - Protecting life-sustaining material goods
   - Protecting cultural goods and important assets
   - Bringing civil defense agencies and organizations to readiness
   - Chemical clearance
   - Temporary reconstruction
   - Firefighting
   - Communication
   - Activities related to casualties
   - Measures adopted in order to assist ongoing defense activities within the dangerous establishment

III. Managing the defense against major accidents involving dangerous substances
   - Command and cooperation in the emergency situation
   - Requesting external help in defense against major accidents
   - The data of persons launching defense activities, managing defense, and enjoying other scopes of competence
   - The infrastructure necessary for command, for assessing the situation, and for preparing decisions

IV. Tasks related to information dissemination
   - The tasks related to informing the general population after a major accident
   - The content of the information disseminated
   - The equipment necessary for informing the general population
   - Informing the press
   - Informing the authorities
   - The content and means of informing the agencies responsible for the administration of defense management
   - The content and means of informing the authority

V. Actions related to cross-border impacts
   - The formalities, content, and means of data dissemination
VI. Cost sharing rules
- The responsibility for:
  - rescue and damage clean-up,
  - implementing the External Emergency Plan,
  - preparing and disseminating publications informing the general population, and
  - organizing supervisions, exercises, further training events, and information dissemination events
- lies with the relevant Municipal Government.

Annex
- The list of persons to be alerted and the rules of alerting those persons
- The list of equipment and forces available for defense operations
- Alerting the communication team
- The document for informing the general population
- Media contact information
- Rules of law
- Map

Informing the general population
- The mayor issues a publication to inform the general population about the dangerous industrial establishment, the potential major industrial accidents, and the possibilities of defense.
- In preparing the publication, an abstract of the Safety Report, as prepared by the operator of the establishment, may be relied upon.
- The abstract forms part of the public Safety Report, which is to use everyday language instead of technical jargon. The abstract must be drafted in a practical manner in line with the requirements for form and content relevant to documents designed to provide information to the general population.

Revision of the External Emergency Plan
The External Emergency Plan must be revised at least once every three years, plus
- it must be revised upon approval of the new or modified Safety Report by the relevant authority.

If the External Emergency Plan requires major modifications, the concept of such modification must be prepared and published.

Exercises to help practice the procedures laid out in the External Emergency Plan
Government Decree No 18/2006. (I. 26.) on defense against major accidents involving dangerous substances stipulates that the mayor must regularly verify whether the procedures laid out in the External Emergency Plan are indeed feasible in actual practice.

Accordingly, the mayor must organize:
- exercises once a year involving részét some of the organizations specified in the plan, and
- exercises once in every three years involving all of the organizations specified in the plan
in order to practice the procedures laid out in the External Emergency Plan

The purpose of the external protection exercise:
- to deepen the knowledge obtained in training,
- to help practice cooperation between the various organizations specified in the External Emergency Plans as well as between these organizations and any other agencies participating in rescue operations,
- to help practice meeting the target times to readiness for deployment, and
- to verify all of the above.
3. Civil defense planning

Government Decree No 114/1995. (IX. 27.) on the rules of classifying municipalities for civil defense purposes and on the requirements of civil defense stipulates that the Civil Defense Plan is approved by the Minister for Municipal Governments and Regional Development based on the proposal of the mayor, following the approval of the County Defense Committee.

Decree No 20/1998. (IV. 10.) of the Minister of the Interior on the system of, and requirements relevant to, civil defense planning stipulates the following requirements:

A General Civil Defense Plan must be prepared:
- by municipalities listed in Decree No 18/1996. (VII. 25.) of the Minister of the Interior;
- by civil defense units operating within the seat of the local defense committee; and
- by the civil agencies specifically designated in the relevant resolutions of the authority.

A Basic Emergency Management Plan must be prepared:
- by municipalities classified in categories I, II, and III for civil defense purposes, and in the districts of the capital city.
- The External Emergency Plan forms part of the Basic Emergency Management Plan in line with Section 20 Para (4) of Government Decree No 18/2006. (I. 26.).

4. Zoning

Municipalities must prepare a Zoning Plan. Such Zoning Plan must be revised once every 10 years. The primary objective of preparing a Zoning Plan is to present alternative settlement structure concepts considered inevitably necessary for achieving the objectives that are important for the development of the municipality, providing support for the municipal representatives as they work towards approving the final concept. In accordance with Section 25 of Government Decree No 18/2006. (I. 26.), this Zoning Plan must also identify the zones of danger of all dangerous industrial establishments. This serves as information for the general population and for the enterprises operating within the municipality.

The tasks of the authority:
- to mark out the perimeters of the zone of danger;
- to inform the mayor about the requirement to identify zones of danger in the Zoning Plan; and
- to inform the president of the County Assembly about the fact that the zones of danger have been identified and marked out.

The requirements of establishing facilities within zones of danger:

Scenario 1:
In the case of establishing retail shops, smaller community facilities, recreational centers, and buildings suitable for the gathering of masses of people:

A committee must be established:
Party to initiate the establishment of the committee: the mayor.
Party to establish the committee: the authority.
Members of the committee: the specialized authority; the State Public Health and Chief Medical Officer Service (ÁNTSZ); the Supervisory Authority for Environmental Protection, Nature Conservation and Water Management; the establishment concerned; and the representatives of the Municipal Government.
Scenario 2:
In the case of establishing residential homes, hotels, resorts, workplaces, parking areas and structures, public spaces, and main traffic routes:
The authority must issue a position statement.

5. Firefighting and Technical Rescue Plan
(Decree No 1/2003 (I. 9.) of the Minister of the Interior)

The Firefighting and Technical Rescue Plan is prepared by the firefighting unit covering the establishment’s primary area of operation or by the full-time fire brigade of the establishment itself, and is approved by the county’s disaster management director.

The main objective of the plan is to lay out the measures that must be taken in order to clean up any damage incident emerging within the establishment.

- Data on the establishment
- Data on the route providing access to the establishment
- Place of reporting for duty; place of deployment; upon arrival of the forces planned to be deployed, specifying the point where they have to report for duty
- Determining and marking out escape and rescue routes
- The classification of the establishment into the relevant fire hazard category
- Features of the establishment tactically important in the context of firefighting
- Determining the greatest source of danger
- The method of averting the hazard of accidents
- Identifying the sources of danger requiring the largest forces and the most equipment and fire extinguishing material
- Identifying the sources of fire extinguishing materials
- The list of fire extinguishing equipment and technical rescue equipment available on site
- The significant special criteria of firefighting and technical rescue
- Planning the cooperation with partner agencies
- Other – so far unlisted – activities and information that may be significant in the course of intervention.

Summary:

- Dangerous establishments have been identified and the system of legal requirements is available.
- The necessary plans have been prepared on the basis of the Safety Reports and Safety Analyses.
- The procedures laid out in the plans have been practiced in the form of exercises and the necessary corrections have been made.
- The various elements of the system of plans build on one another and are maintained continually.
- Experts participate in annual further training events.
The civil defence aspects of nuclear plant safety

Sándor Munkácsy
Civil Defence Lieutenant Colonel
Bács-Kiskun County Directorate General for Disaster Management

It is a widely known fact that the operating licenses for blocks I through IV of the Paks Nuclear Plant will expire between 2012 and 2017. Currently, a procedure is underway seeking approval for plant life extension concerning these blocks. As part of this procedure, public hearings were organized in neighbouring countries such as Austria, Croatia, and Romania. Various green organizations made their appearance at these public hearings, without organizing demonstrations, peaceful or otherwise. This goes to prove that there are no resentments in the public opinion of these foreign countries against the Hungarian power plant on grounds of unreliability.

Hungarian polls have also shown that the initial public mistrust against nuclear plants was not as strong as that experienced in some countries of Western Europe. In 1999, 63% of the Hungarians asked believed that there was a need for the power plant; by August 2005, this increased to 75%. According to polls, 73% of the population continued to accept the presence of the power plant even in June 2003, merely two months after the accident that happened in Block II. I believe this is partly attributable to the power plant’s efforts to inform the general public, even though these are often criticised unjustly.

The power plant decided to take additional steps towards strengthening public trust when it considered immediately publishing information over the Internet on each and every event. This helps provide the general population with comprehensive and reliable information that is definitely more creditworthy than the reporting presented by the tabloid press. The decision is not yet final, as many details are still to be clarified.

The issue may be examined from two different perspectives: the perspective of the general population, and that of the agencies and organizations involved in defence operations. Just for the sake of simplicity, let us first examine the issue from the perspective of the agencies responsible for defence. The tasks and responsibilities of the various agencies and organizations involved in nuclear accident management are laid out in the relevant rules of law.

The system of defence is regulated by Government Degree No 248 of 1997 on the National System for the Management of Nuclear Accidents (“Országos Nukleárisbaleset-elbárátási Rendszer”; ONER). Paragraph (1) Section 3 of this Government Decree stipulates that “the Government Coordination Committee (“Kormányzati Koordinációs Bizottság”; KKB) shall be in charge of the system for accident management”. On the other hand, in Section 12 it stipulates that the defence committees of the counties and of the capital city are in charge regionally. At the same time, it provides that managing and coordinating the implementation of the tasks within the various sectors fall within the responsibility of the competent ministers responsible for the individual sectors. The tasks of all those participating in accident management are laid out in Section 14.

Relying on nuclear energy means that we may have to face a unique and most unfortunate phenomenon: radioactive radiation. Let me just refer to the disaster of the Chernobyl nuclear plant. The government decree stipulates that a radiation monitoring system making measurements continuously must be set up and operated. The backbone of this system is the Nuclear Accident Information and Evaluation Centre (“Nukleáris Baleseti Információs és Értékelő Központ”; NBIÉK) operating on the base of the National Disaster Management Chief Directorate (“Országos Katasztrófavédelmi Főigazgatóstág”; OKF). The centre operates a remote sensing network that monitors the radiation levels to which the general population is exposed. May I just mention that the current daily background radiation values are continuously made available to the general public on the OKF website, broken down by date and by place of measurement. Reviewing these data may lead one to rather interesting observations, might I add, especially if we put together a national background radiation map.
In addition, a centrally controlled early warning sound alarm system has also been installed within a 30 km radius of the Hungarian power plant. Thanks to an application called KISBÍRÓ, the system may also be used to broadcast live public address announcements. The system consists of 227 sirens in total; 70 of these are set up in Bács-Kiskun County, 146 in Tolna County, and 11 in Fejér County. What makes this system special is that it may be operated either all at the same time or sector by sector, and may be controlled either from only one, or from several different command posts at the same time.

The parties in charge of local defence operations are, as in so many cases, the local defence committee and the mayor. Both regionally and locally, the county offices and local branches of the professional disaster management agency—namely, the county directorates and the branch offices—are responsible to provide technical support and expertise to the senior leader of defence operation, who is the president of the county-level or local defence committee or, as the case may be, the mayor.

Those involved in the defence operations must prepare accident management plans, action plans, task plans, or implementation plans for the level of control at which they operate. This must be done during the preparation stage in order to ensure the effective implementation of the tasks that defence operations imply. In addition, they also have to set up and appropriately equip the accident management organization. In the case of most agencies involved in defence, this is done by appointing and equipping those members of their own staff whom they consider suitable for the task; however, in the case of the professional disaster defence agency, the county-level and local defence committee, and the mayor, the procedure is somewhat different. In their case, the regional and local civil defence organizations responsible for performing the nuclear accident management tasks consists of local residents.

The rules of setting up civil defence organizations are laid out in Decree No 55 of 1997 (dated October 21) of the Minister of the Interior, while the legal base for ordering local residents to participate in the defence organization is Act No 105 of 2004 on National Defence, which lays out the civil defence obligations of citizens.

Having outlined the organizational structure of ONER, one especially important detail remains to be mentioned. However perfectly a plan may have been elaborated, and however well-prepared an organization may be, any knowledge that is solely theoretical will ultimately prove to be the best recipe for failure, because in practice any unexpected event, any unforeseen glitch can bring the otherwise well-designed mechanism to a grinding halt. To prevent such a scenario from unfolding, the agencies involved in defence operations regularly organize various types of cooperation, communication, command post, and system wide exercises. These exercises offer participants an excellent opportunity to practise their tasks, to put new ideas to the test, to assess the operability of a part or of the whole of the system, and to identify any detect any potential shortcomings in the planning.

The tasks we have so far outlined may be seen as forming a system of civil defence put in place to ensure that we are prepared for any event that may occur during the operation of a nuclear plant. However, it would be more appropriate to see them as steps taken in preparation for mitigating the consequences of a nuclear disaster with the aim of safeguarding the health, physical safety, and overall security of the general population.

The general population lives in this system as someone with a split personality—someone with two conflicting roles. On the one hand, the population is seen as the target group—the very people we must protect. On the other hand, they are also seen as subordinate team members of one regional or local civil defence organization or another, charged with the responsibility of executing all the tasks necessary for the protection of the target group—be it providing for their needs or carrying out tasks related to local or remote defence. As profane as it may sound in this simplified form, the general population is expected to protect itself and fellow citizens under the command of the experts responsible for managing the defence operations. This requires the general population to be thoroughly prepared well in advance, during what we call the preparation stage. And when it comes to the actual defence stage, they must be as sufficiently informed as possible, as well as provided with the necessary protective and other equipment to the extent deemed appropriate.

Let’s now review the measures that must be taken to ensure that the population is, on the one hand, as safe as possible and, on the other hand, that it feels as safe as possible. The single most important factor is information provided continuously, clearly, and credibly. The average citizen only shows a rather limited interest in what goes on within a power plant as long as he or she does not get the feeling that relevant information is surreptitiously held back from the public. Once such a premonition develops in the public, though, they suddenly lose confidence in the credibility of any information that is disclosed to them for fear of being fooled, while at the same time they develop an immense hunger for relevant information, which is only understandable. At the same time—and this
may be the single most important factor—they also develop a tendency to give credit to rumours and unfounded scaremongering, while their willingness to cooperate diminishes drastically, which may have major repercussions when it comes to implementing defence measures.

Over the past few weeks, Paks Nuclear Plant hosted discussions between the counties of Tolna, Fejér, and Bács-Kiskun, the National Atomic Energy Authority ("Országos Atomenergia Hivatal", OAH), the National Disaster Management Chief Directorate ("Országos Katasztrófavédelmi Főigazgatóság"; OKF), and the environmental authority concerning the details of a command post exercise to take place at the end of May. Informing the general population was one of the central problems. The power plant proposed the idea of widening the base of information disclosure by continuously publishing information over the Internet, in a format accessible to the general public, on all events occurring within the power plant.

The idea was prompted by a piece of sensationalist reporting by the tabloid press on how one of the reactors of the Paks Nuclear Plant has had to be shut down yet again. In fact, a simple washer had to be replaced, a routine intervention that, nevertheless, required shutting off the reactor by standard procedure. This is similar to shutting off the engine of a car when a cylinder head seal is to be replaced. But as the power plant itself failed to communicate this piece of information to the press, it was presented to the general population as sensational news. Unfortunately, irresponsible conduct like this undermines the credibility of the power plant—all the citizen can see is that, once again, information is being held back. Had this piece of information been published on the website of the power plant, it would not have stood a chance of being reported on in that style by any of the newspapers. Then again, journalists are rarely known for their lack of resourcefulness in finding a theme.

Once again, the single most important factor is ensuring that relevant information is disseminated continuously and credibly. And, of course, the information provided must also be clear and understandable; technical jargon must be avoided whenever possible.

In addition to the dissemination of information, an equally important factor is being prepared. Well-prepared citizens are significantly easier to protect under any circumstances than those who are not prepared adequately and therefore only impede the smooth operation of the rescue forces. I believe this hardly needs any detailed explanation.

In order to protect citizens, they must be informed—that is, alerted—in due course of time. This is the purpose that the national alert and information system serves. Consisting of several subsystems, its single most important core element is the sound alert system described earlier in this paper.

This is the fastest alert system because it can be controlled from right where the potential nuclear accident may take place, that is, from the Paks Nuclear Plant. However, the system isn't without its own deficiencies: it doesn't quite cover the entire area it is designed to alert. In addition, it is also only partly suitable for broadcasting live public address announcements as the KISBÍRÓ application making this use possible is not installed everywhere. This deficiency of the system is only partly corrected by radio and television broadcasts, which also form part of the national alert system. Local broadcasting stations are set up in a way that whenever they receive a certain signal from the national broadcasting centre in Budapest, they immediately discontinue the current show and switch to the programming of Kossuth Radio. This method offers a way of simultaneously alerting and informing the general population throughout the entire country.

The next stage in organizing nuclear safety is appropriately equipping the population with the necessary resources. Potassium-iodide tablets are among the most important. While potassium iodide is not the most efficient way to protect residents, it is very cheap and it can be made available well in advance within any area under threat. In addition, we can win time by applying it correctly. And he who wins time wins life. Accordingly, the Defence Committee of Bács-Kiskun County has adopted a resolution to store two days' rations of potassium iodide tablets in all mayors' offices located within a 30 km radius of the power plant.

I personally believe that potassium iodide should be distributed to the general public already during the preparatory stage, and only additional reserves should be stored within various offices. This idea has, however, been discarded. The argumentation of the decision-makers was that Hungarian citizens are not yet mature and responsible enough for such a solution to be viable. In other words, they would misuse the tablets and would not be able to find them quickly when they would need them. I personally believe that this is not the case. Nonetheless, I do agree that some reserves should be stored in public offices as well.

In addition to the stocks of potassium iodide stored in mayors' offices, an additional stock of several tens of thousands of tablets is stored in the Kalocsa warehouses of the Stock Management Institute of the Ministry of
Civil defence organizations are supplied with tablets from these warehouses. However, the human body needs protection not only internally but also externally. The better we prevent radioactive substances from entering the human body the better off we are. This may be achieved by using breathing and skin protection equipment. Providing protective equipment to the general public is regulated in Government Decree No 60 of 1997 (dated April 18). This decree stipulates that the state is responsible for ensuring that those living within a radius of 9 km of a nuclear power plant, as well as those living within a radius of 1 km of a reactor used for research purposes, are equipped with the appropriate breathing apparatus. These are stored in the warehouses of the disaster management directorates in each of the counties concerned. In Bács-Kiskun County, 18,680 escape hoods are stored. Of course, those intervening during a nuclear accident will not only need breathing protection but, depending on the situation emerging, appropriate skin protection as well. They are also provided for by the professional disaster defence agency; in total, 1,290 sets of AUER masks are stored for distribution among intervening personnel.

Once the defence equipment stored locally is not any longer sufficient to protect the citizens, the stage that follows is that of remote defence. This is also the most complicated stage of defence, requiring complex preparations on several levels and in many areas, while involving a great number of agencies and other organizations in implementation. Just think of the amount of work and organization a single family puts into moving house from one town to another. How much more organization work can go into relocating the entire population of a complete city?

Accordingly, this stage of defence should only be called upon as a final resort, and only when doing so is absolutely justified. The activities allocated to the various so-called intervention levels are laid out in Decree 16 of 2000 (dated June 8) of the Minister of Health.

The chart makes reference to Decree No 12 of 1998 (dated December 11) of the Minister of Health, which, however, is not in effect any longer. This regulated the maximum level of radioactive contamination allowed to be present in foodstuffs. While this piece of legislation is not in effect any longer, no other legislation has been adopted to replace it! Therefore we continue to rely on the obsolete legislation for lack of any other support.

Finally, please allow me to summarize what we have covered so far. There is no such a thing as a safe nuclear plant. Nuclear plants are designed and operated by humans, and therefore the factor of human error is inevitable always present. However, we can take measures towards protecting the life and wealth of the population. In my opinion, the most important factor is ensuring that citizens, as well as those involved in the defence operations, are well-prepared and that they have opportunities to carry out exercises both as citizens and as persons required by law to participate in the work of the accident management organization. If those persons are well-prepared, the impact of a potential accident may be minimized. However, if those persons are poorly prepared or inexperienced in terms of exercises, even the best-prepared plan and organization will prove simply worthless.
Petroelum industry of serbia, hazardous material transportation, legislation, inspection monitoring and training of employees in the light of european union conventions and norms

Vladimir Dopuđa
Naftna Industrija Srbije A. D

ABSTRACT
This paper aims to show that the Republic of Serbia and its Petroleum Industry, with their legislation and internal regulations in the field of environmental protection, security and safety and fire, explosion and damage protection, are fully aligned with European Union conventions, norms and standards in all business segments of the company and every hazardous material it handles.

Key words: legislation, inspection monitoring and training

1. Introduction
Petroleum Industry of Serbia (hereinafter referred to as NIS a.d.) imports, processes, produces, stores and sells hazardous materials, thus generating hazardous waste. These materials, involved in NIS a.d. operations, may in case of an accident endanger human health and environment. Thus, NIS a.d. handles hazardous materials in accordance with the European hazardous materials regulations regarding their classification and marking.

In that sense, NIS a.d. hazardous materials are explosive and inflammable materials, as well as cancerogenous, mutagenous and ecotoxic substances causing hypersensitivity.

The Republic of Serbia has declared itself, adopting the Resolution and National Strategy for EU Accession, to respect and apply EU legislation in this area, too.

Acceptance and introduction of international regulations and standards of security and safety at work and fire protection, environmental protection and working environment and road, rail and river transport into national legislation, shows the Republic of Serbia firm commitment to EU standards of environmental protection and working environment and security at work.

The a.m. is of vital importance since NIS a.d. deals with transport, processing, selling and storing of hazardous materials in Vojvodina in three important European lines: the Danube and the Tisza rivers and road and rail Corridor 10. Besides these, NIS a.d partly controls two major European energy lines - ones east part of Adriatic pipeline from Sotin, via Novi Sad to Pancevo and international gas pipeline from the Russian Federation, Ukraine, Hungary to Serbia and Bosnia and Herzegovina.

Local pipelines and gas pipelines in Vojvodina leading to oil and gas wells and processing and storage capacities located in Novi Sad, Pancevo, Elemir and other town in Banat and Backa should also be taken into account.

These production, processing and storage capacities, as well as transport and energy lines directly or indirectly endanger air, soil, watercourses and underground water and watercourses, at local level in Vojvodina and European Corridor 10 at this section, and within Danube-Kiris-Moris-Tisza region.

2. Legislation of the republic of serbia

Enacting the Environmental Protection Law, the Republic of Serbia secured the control of operations of all facilities handling or coming into contact with hazardous materials and being ordered to keep record, define procedure in the event of an accident, monitoring of locations, preventive actions, etc.

The 2004 Law defines hazardous materials management, scheduling/planning, organizing and undertaking prevention and remediation actions, at the same time obliging hazardous materials owners to draw up Accident Protection Plan, Security Report and in the event of an accident immediately notify the accident to the authorized state environmental protection agencies.
In case of new facilities construction, the hazardous materials owner is obliged to notify the authorities and provide them with the information on hazardous materials quantities, security status, preventive and planned remediation actions.

The Accident Protection Plan should be drawn up on local administration, autonomous province and republic level.

The Serbian Rules on methodology for risk assessment of chemical accident, preparatory measures and remediation of the consequences regulate the risk assessment of chemical accidents and give the methodology for risk management, ways of recording classes and quantities of hazardous materials in production, usage, trading, storing and depositing and obligatory reporting the information on hazardous materials quantities to the authorized state environmental protection bodies. Special plans of chemical accident protection are made for settlement, municipalities, etc.

Hazardous Materials Transportation Law enacted in 1990 classified the hazardous materials in nine different classes, specified prescribed packaging, standardized transportation packaging, transportation means marking, compulsory shipping papers, special security measures for some classes of hazardous materials, etc.

The Decree on hazardous materials transportation by road and railway of 2002 classified the hazardous materials based on ADR and RID international regulations which regulates the obligatory accident protection plan, preventive and other actions of risk management depending on quantities, classes and properties of hazardous materials.

A draft of the new law on chemical management is to upgrade the existing regulations on toxins. This law anticipates formulation of hazardous chemicals registrar; prescribes method of classification, packaging and marking of hazardous materials; establishes a system of recording a new chemical substance and elaboration of risk assessment for a new chemical; establishes basic principles of a good laboratory practice, etc.

3. Documentation of accident responses at NIS a.d. as a large technical system

Process of documentation of accident responses at a large technical system is very specific in organization, management and number of employees, having a number of dangerous processes – potential accident spots.

This activity should begin with a definition of a uniformity system in a coordinated accident response process at all levels and in relation to all participants.

In order to define a protection plan or accident response plan on uniformed basis for all parts of a technical system and to provide full cooperation and interaction of all participants, from plant personnel to top management, A DECISION on documents contents and preparation and accident response organization should be made.

Such a document establishes a system of organized and coordinated activities and documents all processes of risk management and accident response and implementation and continuous improvement through trainings and testing.

This decision should define:

- Document types and contents,
- Organization and preparation of accident response documents,
- Bodies and organizations managing accident response,
- Method of training accident response group,
- Implementation and its control,
- Analysis and improvement trainings.

NIS a.d. is determined to respond to accidents, demonstrating it by document types and contents definition. This determination has been documented.

Basically these document are as follows:

- Procedures and working instructions,
- Risk assessment,
- Preventive actions, alertness and accident response.

Procedures and working instructions are efficient and provide personnel ability to perform certain functions, thus they:
Define roles and responsibilities of every employee,
- Contain job and operations description including details on tasks to be performed in given circumstances,
- Identify risks, risk assessment and risk control.

Preparation and active elaboration of these documents ensure competent and aware personnel for each role and responsibility in the risk management system including capability to respond to an accident.

**Risk assessment** is a basic element of an accident response plan. It also identifies dangerous processes, classes and quantities of hazardous materials as well as scope and classes modeling. This is a comprehensive process at NIS a.d. which ends with defining of risk scope and establishing if a risk can be accepted or not. (A case when contents definition is prescribed by law and by-laws will not be elaborated.)

**Preventive actions, alertness and accident response** at NIS a.d. comprise a set of actions and procedures, organization and technical and technological operations aiming at prevention or reduction of accident possibilities and possible consequences, i.e. defining an acceptable level of risk.

Establishment and implementation of emergency measures provide readiness and mobility of the personnel, equipment and resources for on time and efficient accident response, which is accomplished by accident prevention plan and an **Operating plan of accident response** within it.

This Plan defines and regulates operating activities and accident response management.

Pursuant to the existing laws, established management systems and past experience, operating management of accident response is performed by a multidisciplinary team approved by NIS a.d. General Manager. Such a team can also be defined at NIS a.d. subsidiaries, especially with scattered facilities having different processes.

Due to hazardous materials properties handled at NIS a.d., location and scope of accidents, process of documentation of accident response is not formulated only within industrial complex i.e. NIS a.d.

Extremely complex activity with numerous potential accident spots within stationary and mobile facilities, lines of storage, manipulation and transportation within road, rail and inland waterway (river) transport in the Republic of Serbia and with limited engagement of the employees after accident occurrence, forced NIS a.d. to closely cooperate with and actively engage local authorities during the problem resolution process. A **responsibility and cooperation bridge** has been built at the local level i.e. territories NIS a.d. facilities gravitate towards.

### 4. Inspection monitoring

Having in mind that industrial facilities and other owners of hazardous materials are in the course of working process obliged to pay attention to the way of handling hazardous materials and health of employees and people living nearby, the environmental protection inspector ordered mandatory inspection monitorings. Although inspection monitoring is ranked at the level of the republic, province and municipality, depending on the issuing of building permission, it has to include a complex control of:

- location of facilities handling hazardous materials;
- classes and quantities of hazardous materials;
- storage facilities;
- proper functioning of process equipment;
- personnel qualified for operation and procedure in case of accident;
- protective equipment for safe operation and in the event of an accident.

Inspection monitoring also includes review of documentation related to the safety data sheet which accompanies the hazardous matter starting from the manufacturer or in the case of import, then means of marking hazardous materials, recording quantities, signs of warning, etc.

A special part of the inspection monitoring is related to the document of the Assessment of action in case of chemical accident which has to be prepared by industrial facilities possessing quantities of hazardous material equal to or greater than quantities prescribed in the list of the same By-law, or have been prepared subject to the inspector order.

Integral part of the document Assessment of action in case of chemical accident are measures of prevention, assessment of the threat which includes probability of accident, remediation measures, calculation of effects of the damage caused, etc.
In case of an accident a special aspect is organizing response to the accident. Inspector response procedure comprises the communication with information office, fire department, police, employment of experts and institutes for the hazardous material in question, potential assistance with sampling, preparing a memo describing the situation with relevant data on the quantities of split or released hazardous materials, ways in which employees respond at the site of accident, informing of other inspection services and medical service, etc.

After the accident the inspector prepares a report together with a list of all undertaken remediation measures, type of disposal and quantities of waste. Together with professional organizations the level of water, air, soil and plant and animal environment is estimated, as well as the estimated time of remediation. In addition, the cause of accident is to be recorded, possible injuries, condition of the equipment and insurance.

For the purpose of safe risk management Serbia and its Oil industry in compliance with their financial and technological capabilities undertake the following:

1. Heavy investments especially in highly risked units i.e. industries, reduce the number of accidents.
2. Oblige their legal and physical entities generating, transporting, trading, using or storing hazardous materials to:
   o Define Risk Procedure (facilities with large quantities of hazardous materials) i Accident Protection Plan;
   o Define Security Report, accessible to the public
   o Define Accident Protection Plan for settlements, manucipalitites, etc;
3. Provide information connections and mobile intervention teams in the event of an accident at all levels;
4. Perform hazardous materials balancing and establish a system of hazardous materials movement tracking.

5. Training employees for handling of hazardous materials

Training employees for handling of hazardous materials is one of the most important factors in the process of handling of hazardous material. In the course of the training program employees have to be warned against possible risks and threats which are caused by hazardous materials handled.

Training of employees who are handling hazardous materials is conducted in compliance with the Law on safety and occupational health which, in addition to the training for secure and healthy work for all employees, also defines specific training programs for special types of works.

Training of employees who are handling hazardous materials belongs to this group of special works for which a specific training program is planned.

The program and plan for the training of employees who are handling hazardous materials is adopted by an authorized institution dealing with the activities of safety and health of employees.

The Law on safety and occupational health, which is in compliance with the Directives of European Union, emphasises that employees have to be aware of all types of risks related to the jobs for which they have been assigned and about actual measures of safety and occupational health. Also, they have to be aware of dangerous places and harmful effects to the health arising in the course of a technological process, safety measures that have to be applied and areas which are secure for walking.

Employers conduct the training of employees for safe and healthy work both theoretically and practically. Testing of the theoretical and practical qualification of the employee for the safe and healthy work is conducted at the work place.

Theoretical part includes the description of the technological process, process equipment, critical points and physical and chemical properties of the material which is used and handled, stored, distributed and transported.

Practical part includes the training of the employees at the work place, with practical application of the knowledge gained in the course of the theoretical part of the training. The training is conducted by a multidisciplinary team of experts (a chemical engineer, safety engineer, doctors etc.)

Hazardous materials can be handled only by persons of full legal age, who are professionally trained, so that, for example, such material can be transported only by persons who are professionally qualified for the handling and transport of hazardous material and who are more than 21 years old.
Persons who are not professionally qualified for the handling of hazardous material are allowed, if they have previously been introduced to the mode of operation, threats and safety measures, only to carry, load, unload or distribute hazardous material but under supervision of a professionally qualified person for the handling of hazardous material.

Professional qualification of the persons who are handling hazardous materials and transport hazardous material is conducted by companies which fulfill technical conditions and can provide professionals for conducting such activities and which is authorised by a competent governing body at the level of the republic, or at the level of the autonomous province.

In the course of handling hazardous material it is necessary to define a suitable strategy for handling hazardous material which will provide such conditions in which the hazardous material in all phases will present the least possible threat to the health of the employees and working environment.

The program of training employees depends on the way of handling hazardous material (handling, storage, transport). For each of these modes of handling a special program of training is adopted.

Legal regulation includes all valid Laws, by-laws, Serbian standards, Directives of European Union concerning hazardous materials.

In order to achieve safety in handling of hazardous materials, technical and technological measures are being taken (substitution of hazardous and harmful by non-hazardous materials) in order to reduce harmful effects of hazardous material.

Description of the technological process is very important for the training of employees for handling of hazardous materials. In describing the technological process it should be emphasised what are the hazardous areas that might endanger the health of employees working with hazardous materials and the health of other employees who are spending time in the immediate vicinity, as well as to the environment.

In this respect it should be emphasised what are these hazardous materials which are present in the course of the technological process, and also what are the hazardous materials occurring during accidents. Special attention should be paid to the potential chemical reactions that might occur after accidents.

6. Conclusion

Business principle of NIS represents commitment to achieving the highest standards in business operation in the areas of health, safety, security environment protection (HSSE). By introduction of efficient HSSE management systems we would like to achieve maximum protection of health and safety of employees, reliability of the unit and responsibility towards the environment.

General basis for all future activities of HSSE are two major international projects of NIS (Shell and Steinbeis) and several local research projects and studies developed by government organizations in the last decade.

These projects of NIS with companies of Shell and Steinbeis are industrial projects which are intended to improve overall business practice and risk management, and special attention is paid to the field of HSSE. Additionally, it provides to expand its “European dimension” by enabling immediate involvement of NIS a.d. into the project of EU RIMAP (Risk-Based Inspection and Maintenance Procedures for EU industry).

In order to realize the above listed objectives, main practical activities include compliance of the existing security practice in NIS with the EU practice and compliance with the newly established HSSE concept, and involvement of NISa in iNTeg-Risk cooperation activities.

All of this is aimed to identify, assess and manage large threats related to the potential equipment failures during the whole lifecycle operation.

Meeting the requirements related to security is in compliance with NIS business principles and contemporary international practice and supports Voluntary principles for Security and Human Rights.

Main objective of this approach is to provide guidelines for identification and understanding of risks and implementation of adequate risk control measures.

Finally, NIS a.d. as a company involved in a risk-based activity, realizes that the protection and improvement of environment by reducing harmful effects and by meeting legal regulations and expectations of stakeholders is of great importance for the survival and development of the business operation of NIS. Main issues related to
the protection of regional environment related to business operation of NIS, have to be: impact to the climatic changes, quality of air, water and soil in the region. In addition, issues related to the environment at the local level are important, exploitation of resources, air, water and soil quality management and waste management.

LITERATURE:
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4. EPA, CEPO, Guidelines for the programs of risk management and analysis of consequences outside the location (40-CFR-68), EPA 550-B-00-008, 2000
7. Law on explosion material, flammable liquids and gases ("Official Gazzete of SRS", No. 44/77)
8. Decree on hazardous materials transportation by road and railway ("Official Gazzete of RS", No. 53/02)
9. Regulation on the mode of transporting hazardous material in the road traffic ("Official Gazzete of SFRJ", No. 82/90)
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11. Regulation on the professional training of the drivers of the vehicles used for transporting hazardous materials and other persons participating in the transport of hazardous materials ("Official Gazzete of SFRJ", No. 17/91)
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RECOMMENDATIONS

Possibilities for cross-border co-operation in flood emergency, especially during the prevention phase

Tibor Huszár
Fireguard Lieutenant Colonel
Csongrád County Directorate General for Disaster Management

The possibilities for co-operation may be approached from two different perspectives, namely:

1. from the perspective of the water management agencies who are responsible for managing and implementing defence operations:
   - an established system of reporting contacts that runs smoothly
   - a fully functional monitoring system

2. from the perspective of the disaster management agencies:
   - the establishment (expansion) of a monitoring system
   - the establishment of an information system
   - the setting up of joint rescue units

Since the water management agencies already have an information and monitoring system dedicated to the purposes of their professional field, and since over the past several years this system has well proven its worth, I would place the primary emphasis on possible development efforts within the realm of disaster management, while also emphasizing that the experiences gained through the operation of the water management system may also prove important when elaborating any other possibilities that may arise in the future.

The monitoring system:

There is no need to emphasize the importance of forecasting. Clearly, the most important pillars of successful defence operations include time advantage and the best possible knowledge of the situation that is expected to arise.

Along the Csongrád county section of the River Tisza (i.e., the Lower Tisza) we have a calculated time advantage of eight to ten days, which may change somewhat because of the fast flood waves of the River Maros (Mures).

The monitoring system offers us two opportunities:

The further improvement of the water management system already in operation:
- by increasing the number of terminal points;
- by developing means of displaying geographic information; and
- by improving the technical and financial background of operating the system; and

Expanding the scope of forecasting to cover other threat factors
- by surveying the threat factors typical of the territory concerned; and
- by determining the potential impact of such threat factors on the neighbouring country

The information system offers another important possibility. Implementing this system is probably the most cost effective since the system uses the data output of the forecasting systems already operational in the respective countries.
The system’s important components include:
- maintaining continuous contact with the border counties of the neighbouring countries (including at a professional level);
- elaborating effective means of information exchange; and
- ensuring that the above factors provide the time advantage needed for successful preparation and defence.

Our directorate, as well as the counterpart agencies of the neighbouring countries that we are in contact with, have realized the immense importance of the above. As a result, an information system has been operating between Arad and Timis counties (Romania), Voivodina (Serbia), and Csongrád county (Hungary) since 2006.

The essence of the system is as follows: We have elaborated a reporting form for each and every threat factor that may occur in the region representing a potential threat to the neighbouring countries. Once a reporting form has been sent out, actions follow immediately. This procedure offers us the time advantage that is inevitably necessary for managing the events effectively, while facilitating the necessary preparations for requesting cross-border assistance.

The operability of the reporting contacts is tested on the first Monday of each month by sending a “CONTROL SHEET”.

Based on the experiences obtained throughout the past several years, setting up and training a joint rescue unit may be an important part of prevention and preparation.

This, however, involves a cost that is significantly higher than that of the information system, which is why we are planning to rely on European Union funding in the implementation.

**Planned personnel:** Volunteering members of the local NGO’s
**Mission:** performing special rescue tasks, such as
- assisting the forces of immediate intervention;
- ensuring the conditions for setting up a local command post;
- providing information and data to management;
- deploying special technical equipment; and
- ensuring complex logistics support.

**Training:** Based on the UN INSARAG guidelines.
**Tasks related to setting up the unit:**
- involving professionals who have the appropriate experience;
- providing the necessary technical equipment;
- providing the necessary financial resources;
- implementing the organizational structure;
- ensuring full interoperability with the countries’ own rescue organizations;
- determining the number of permanent staff needed and providing such staff;
- organizing preparation; and
- maintaining the level of preparedness and creating opportunities for practice.

Based on the above, and the comments made by the conference participants during the workshop, the possibilities of cross-border cooperation may be summed up as follows:
1. Improving the flow of information either by setting up a dedicated website or by relying on the existing and operational DKMT homepage.
2. Improving the monitoring system by increasing the number of terminal points and by ensuring compatibility.
3. Implementing daily contact between the terminal points of the monitoring system.
4. In a joint effort with all DKMT parties and competent NGO’s operating within regions situated along the borders concerned, setting up a rescue unit that may be deployed in any of the three countries involved.
5. Ensuring the interoperability of the joint rescue unit with the defence systems of the participating countries regarding compliance with the relevant legislation as well as equipment.
Problems related to urban infrastructure, especially unknown public utility structures, within downtown areas, in the context of flood and inundation protection. The possibilities of using state-of-the-art flood protection technologies

Dr. Péter Kozák PhD
Certified Engineer
South Tisa Environmental Protection and Water Management Directorate

1. In order to facilitate the effective execution of flood and inundation protection tasks in urbanized areas, a specialty field within the wider context of flood management, DKMT Euroregion calls for the preparation of a "Best Practice Manual" based on the experiences of the European Union within the area of flood management in downtown areas.

2. Flood awareness must be promoted and increased among those living in areas under the threat of flooding by the planned dissemination of the relevant information.

3. In order to facilitate the effective execution of future tasks, the continuous briefing and preparation of the media operating within the areas under threat must be planned and implemented.

4. The DKMT website must be supplemented with current disaster management information relevant to the Euroregion in four languages (Hungarian, Romanian, Serbian, and English). The information to be published on the website includes the following:

   - Situation report: water damage control, major accidents, water pollution cases if any
   - Alarms, reports on events and situations
Experience regarding the avian influenza outbreak in Csongrád county; cross-border and international cooperation

Mihály Kaszás
executive councilor
Csongrád County Defence Committee

The working group has dealt with the above topic applying several approaches. Although the participants were not experts in animal health, they have a considerable practical experience as well as experience in defense organization.

Observations, suggestions and recommendations formulated during the debate may be summarized as follows:

1./ Avian influenza is a new-type threat, and as such it cannot be stopped at state borders (the main carriers of the infection are wild birds). At the same time, border control is necessary in order to slow down the escalation of the epidemic and to prevent deliberate infection. It is desired that practice followed by states in the region is consolidated complying with the relevant regulations of the European Union.

2./ It is justified to expand and develop cross-border cooperation with food-chain security involving experts in animal health as well. Possibilities for enhancing the promptness of information exchange and its reliability should be explored regarding professional organizations, other organizations participating in defense, as well as the population. In order to reach this the availability of national information should be enhanced through a more open information service system.

3./ A successful fight against epidemics (including avian influenza) is basically a national task and responsibility, which does not exclude the application of regulations (c.f. EU) jointly agreed upon and endorsed. It is primarily national institutions that should develop organizational, legal, material-technological and compensational procedures that guarantee a successful defense. Help received from other nations is mainly supplementary.

4./ A key issue in tackling avian influenza is rapidity and efficiency. National institutions should be capable of identifying the threat, introducing preventive measures and providing a strictly professional defense.

5./ Managing an epidemic situation or an epidemic threat may be carried out most effectively applying a complex method, involving all the available sources and organizations. Staff of organizations dealing with civil protection may be of great help in informing the citizens, apart from their task of actual defense. It is especially useful to contact farmers and related people.

6./ An epidemic may cause severe problems in the animal husbandry and food processing industry of a region or a country. Significant losses may affect entire strata or groups of people. Compensation of losses is the task of the state. The legal regulation and implementation of compensation is not solved everywhere, thus solving this problem should be initiated.