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Experience of the Red Sludge Disaster in Hungary, 2010

Lekcja z katastrofy związanej wyciekami czerwonego szlamu na Węgrzech w 2010 roku

Summary

The paper provides an informative fact-based description of how a tragic incident may serve as a lesson to our experts as well as it describes the guidelines and revelations for future improvement. The wall of the sixteen meter high, red sludge reservoir of the alumina plant in Ajka which belonged to the MAL Company was breached early in the afternoon on 4 October 2010. According to aggrieved parties' opinion it was a doomsday for them. People lost their beloved ones, homes, tokens of memory. Although there was no scenario to manage the disaster, the emergency services were able to solve the problem step by step. The government made an unusual decision – which was unprecedented in the world before – introducing a State control above the privately owned MAL. It was done and the other countries were interested in learning about the method. The paper describes the summary of the heroic efforts made by thousands of Hungarians and it reminded us not to forget this disasters ever and help us to avoid similar ones.

Keywords: cassette, reservoir, red sludge, breach the dyke, emergency services, State control, disaster

Streszczenie

W artykule przedstawiono, oparty na faktach, opis katastrofy, która miała miejsce na Węgrzech w 2010 roku. Pokazano jak to tragiczne w skutkach zdarzenie może być lekcją dla ekspertów – podano również szereg wytycznych w celu usprawnienia bezpieczeństwa w przyszłości.

4 października 2010 roku, wczesnym popołudniem pękła jedna ze ścian 16 m zbiornika zawierającego tzw. czerwony szlam. Katastrofa miała miejsce w Ajka, w zakładach aluminium należących do firmy MAL. Dla poszkodowanych był to sądny dzień – utracili najbliższych, swoje domy i dobytek. W chwili wystąpienia katastrofy, nie było żadnego scenariusza dotyczącego zarządzania tego rodzaju

zdarzeniem, a służby ratownicze sukcesywnie rozwiązywały bieżące problemy. Rząd węgierski podjął niespotykaną decyzję, która była bezprecedensowa nawet w skali całego świata. Przejął kontrolę nad prywatną firmą MAL. Po tym fakcie wiele krajów z zaciekawieniem śledziło rozwój wydarzeń i użyte w czasie akcji metody.

W artykule opisano heroiczne zmagania tysięcy Węgrów, jak również przypomniano o tym, aby nigdy nie zapomnieć tej katastrofy i pokazano jak nie dopuścić do wystąpienia podobnych w przyszłości.

Keywords: kaseta, zbiornik, czerwony szlam, pęknięta tama, służby ratownicze, kontrola państwa, katastrofa

1. Description of the event's circumstances

Hungary's most severe industrial ecological disaster so far occurred on 4 October 2010 when western dam of cassette No 10 of the red sludge reservoir of the Hungarian Aluminium Production and Sales Public Limited Private Company (MAL) breached. Consequently, the mixture of approximately one million cubic meters of red sludge and alkaline water inundated, through the Torna Creek, the lower parts of the settlements Kolontár, Devceser and Somlóvásárhely. The strongly alkaline and corrosive industrial red sludge flooded a large area causing inestimable human, economical, ecological disaster and damages. Ten people were killed during and after the flooding, almost 300 persons needed medical treatment, 120 of them were hospitalized. The last injured patient left the hospital on 2 December 2010. According to the later assessments the red sludge flowed through the three townships and damaged more than 300 residential properties. The number of harmed people was over 700, 1017 acres nearby agricultural area was covered with red sludge.



Photo. 1. The broken dam (outside view)

Source: Photo by press of the NDGDM.



Photo. 2. The broken dam (inside view)

Source: Photo taken by the Hungarian official press, by the Hungarian News Agency.

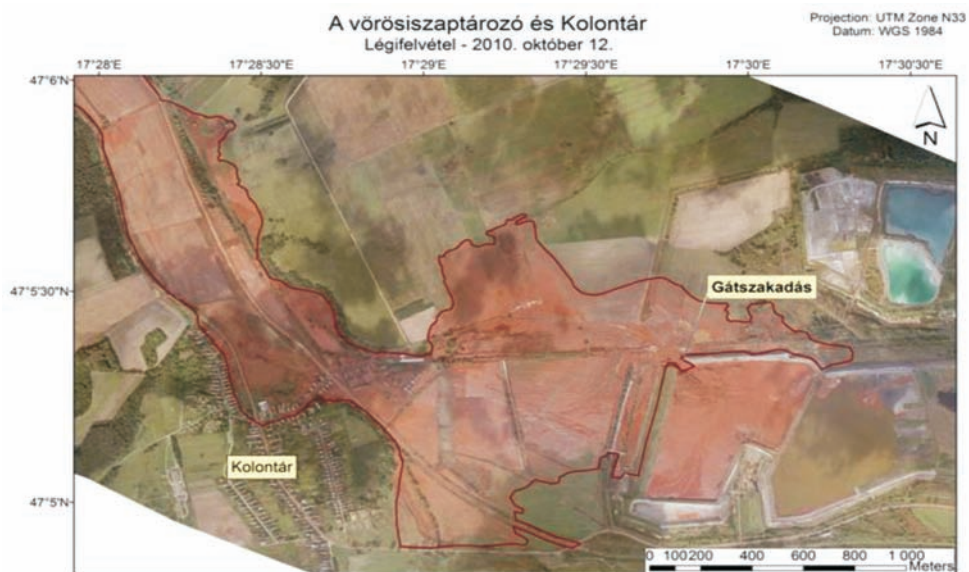


Photo. 3. Air photo of the flooded area on 12 October 2010

Source: Photo taken by the Hungarian official press, by the Hungarian News Agency.

2. Description of security management and rescue operations

2.1. First step of the rescue operations

The Government of Hungary immediately and decisively took measures to respond the situation. The primary and most important task was to ensure safety of the population, to protect human lives and to explore human risks. In the following, the elimination of damages in built-up areas started. The Hungarian Parliament approved the state of the emergency declared by the Government on 6 October from 3 P.M. in Veszprém, Győr-Moson-Sopron and Vas Counties¹.

The competent fire-fighters from Ajka town arrived at the site of the red sludge disaster within 8 minutes after the alert. When the situation became worse and extended, the director general of National Directorate General for Disaster Management (NDGDM) ordered more fire-fighters, disaster management and civil protection personnel from other parts of the country to deploy to the incident site. The main responsibilities on the site were rescuing and its coordination, organizing population protection, controlling the work of the response personnel, distributing earthmoving machines and other vehicles, providing protective equipment and organizing logistics. The collection of information, the clarification and updating of response personnel and intervention equipment by their functions and numbers, their deployment to the incident site, the compilation of reports on the incidents and tasks performed became systematic.

The affected area was closed by the Police, the traffic was regulated through checkpoints, and only the residents were allowed to enter their settlements. A considerable number of the population fled from their damaged properties to their relatives, however, the municipalities and charitable organizations provided lodging for victims, so nobody was left without a shelter even temporarily. The injured were looked after by the Ambulance Service or by other medical institutions at their treatment points, clinics and nearby hospitals.

84 fire fighters with 12 vehicles, 4 Emergency Detection Teams (EDT) with 12 persons, 103 police officers with 22 vehicles, 174 military personnel with 39 vehicles, 29 disaster management and civil protection staff members with 20 vehicles, 149 NGO's persons with 43 machines, the staff of the National Public Health Service (NPHS) with 5 persons and 2 vehicles, plus 50 employees of MAL participated in the elimination of the consequences of the disaster in the region on 6 October 2010. The total number was 606 people with 142 units of equipment. Two weeks later on 20 October 2010 1,125 persons with 292 vehicles and machines participated in the relief efforts. In November a total of 8,535 persons and 4,881 units of equipment were working on the incident sites².

¹ Government Decree 245/2010. (X. 6.) on the promulgation of the emergency situation and the provisions are needed to do.

² Imre HOFFMANN, PhD: Lessons learnt of the elimination of the effect of the red sludge disaster.

2.2. Water quality remediation

The rapid steps of water quality control could result to prevent the contamination reaching the Danube. The temporary protective dykes were constructed within three months and within a year the implementation of facilities ensuring complete protection was finished. The immediate basic strategic goal of the water quality control was to stop the pollution reaching the Danube River, since threatening the water source would have caused long-lasting damages. 8 water management regional directorates participated in the protection. During the first week the average number of persons amounted to 170. Partial detention and neutralization of the spilled 1.5 million cubic meters alkaline (13.5 pH) was carried out in 21 built-up places on the Torna Creek and the Marcal River. The chemical decontamination (neutralization) was realized by dosing gypsum (23,500 tons of re-a-gypsum) and acetic acid (1,800 cubic meters) on 15 scenes, for the mechanical protection 11 bottom lines were established. (In accordance with the EU regulations a material over 11.5 pH is classified as dangerous due to its corrosive effect.)

2.3. Introducing State control

On 11 October 2010 the Hungarian Parliament amended the Act CV of 2004 on National Defence and Army. According to 197/A section of this Act the state supervision could be extended to business entities on behalf of the Hungarian State acts the government Commissioner. This legislative amendment gave the opportunity after the red sludge disaster to carry out state supervision of MAL. The Parliament urgently discussed the proposal and called for urgent publication of the President of the Republic. The amendment of the Act came into force on 12 October 2010. The Government's aim was to relaunch the safe production of the plant as soon as possible after the obligate downtime following the disaster, avert another eventual incident and start the necessary mitigation of the damages. Another objective was to facilitate the following safe operation of the plant as one of the largest employers in the region without loss of assets and observing the authoritative rules.

The Government regulation says that the government Commissioner acts on behalf of the State.

Its competences and tasks are as follows:

1. Review the financial position of the enterprise
2. Approve and countersign the commitments of the enterprise
3. Decide the matters within the competence of the supreme decision making body in the context of the disaster situation. Forthwith about his decisions he informed the senior executives of the enterprise. This law did not affect the main decision making right of the enterprise.
4. Financial and economic injunctions can be initiated against the enterprise.

After creating the necessary legal criteria, the Government issued its Decision on the appointment and tasks of the government Commissioner acting on behalf of the Hungarian State during the State supervision of MAL, appointing LTG Dr. György Bakondi government Commissioner on 12 October 2010. His assignment was valid for up to two years. The activity of the government Commissioner was directed by the Prime Minister, he was responsible for his activities to the latter. His work was assisted by two deputies, the supervisors and experts.

2.4. Change in Technology

At the MAL alumina plant the bauxite is produced by dissolution process. This method was developed by Karl Joseph Bayer in 1887. 90% of the world's alumina production has been manufactured by this technology. The resulting main product is alumina; the by-product is red sludge with high iron (iron III-oxide) content and characteristic colour which contains both fluids and solids. The fluid and solid components are separated by sedimentation and filtration. In March 2011 a new so-called dry process technology was introduced in which the sludge water content was reduced to 30%. This high pressure filtrated material's consistence is earthy, wet solid to the touch. As a result of the technology development the liquid emission has been eliminated, in the reservoir there is no free fluid phase which may leak.

During the more than eight months of State supervision the government Commissioner cooperated with the management and owners of the MAL. He strove to maintain close contacts with the administration and the specialized authorities. Based on this cooperation it became possible to eliminate the uncontrolled risk in human resources and ecology.



Photo. 4. Installation of the technology of the dry refrigerant system
Source: photo taken by the author.



Photo. 5. Dried red sludge after the filtration
Source: Photo taken by the author.

3. Lessons of rescue, decontamination, demolition and reconstruction

3.1. Directing the rescue

To direct the rescue tasks of the Operation Staff, the Supervisor for Population Protection and Reconstruction, Governmental Coordination Centre for Reconstruction (GCCR) (from 4 November 2010), later the Disaster Management Staff for Reconstruction (DMSR) (from 1 July 2011) worked on the scene. From 15 October 2011 the Operational Staff of Veszprém County Disaster Management Directorate controlled the deferred jobs, basically the secondary damages³.

From the very beginning the protection management, the regional and local Protection Committees performed their tasks in order to protect the public of the settlements.

To recover the population compensation, the contracts were concluded. 110 victims who had chosen the residential park could move into newly built houses, 121 victims bought used properties and 121 applied for cash compensation (in 53 cases for financing the reconstruction).

In accordance with the regulation issued by the Ministry of Interior the mitigation of damages in movables organized by local governments extended for period of time. Five hundred ninety-six contracts were signed with 333 victims.

According to the plans by 4 October 2011, on the first anniversary of the red sludge spill, a memorial park was inaugurated in Devecser, set up in memory of the victims of the disaster. Until the end of the year 2011 the National Directorate General for Disaster Management arranged for 376 rightly accepted settlement of claims.

3.2. The activity of the Governmental Coordination Committee

When the disaster occurred the Governmental Coordination Committee (GCCE) was alerted. It started the operation in the National Situation Evaluation Centre in the building of the Ministry of Interior. According to the 1999 Act No LXXIV the representatives of the bodies of national competence participated in continuous change work schedule. Summary of the sectorial information, records of the available capacities, knowledge of the material, expertise and human resources enabled the quick decisions for the leadership of the disaster management, the ministry and the government. The operation of this reporting system facilitated the assessment of the situation, the reports and the authoritative information to the media.

³ Zoltán Benkovics PhD: The Compensation and Reconstruction Team of the Self Government (ÖKUCS), „Protection”, Page 61-62.

The background work was done by the industry bodies, the databases and laboratories were available. Scientific institutions and boards performed essential jobs (e.g. GCC Scientific Council, the University of Pannonia, the Sopron University) in identifying the vulnerability, the protective actions and technologies.

The Operative Staff of GCCE ended its work on 3 November 2010; its duties were taken over by the Governmental Coordination Centre for Reconstruction. In what follows, its reports were attached as enclosures to the National Directorate General for Disaster Management Central Duty, on the base of these reports the director general submitted reports to the Minister of Interior.

3.3. The acts of the Scientific Council of Governmental Coordination Committee

Receiving the request of the director general of NDGDM, to establish the decisions, the specialists of the Scientific Council of GCC and the Hungarian Academy of Sciences assisted the work. Mr. Tamás Németh the president of the Academy led the seats of the scientific council and its sessions, institutes and experts with field experiences were invited to assess the impact of the sludge effect on the buildings, to measure the soil contamination, to devise the possible rehabilitation of the waters. The scientific council systematically worked together with the leadership of the disaster management. With their accurate and authentic information, it was possible to get reasonable picture of the incident, to prevent guessing and rumours.

To ensure effective collaboration in the field of protection against disasters, the leaders of the NDGDM and the Hungarian Academy of Sciences signed a cooperation agreement. On 1 March 2011 a conference was held in the Academy with *Implications and Experiences of Red Sludge Disaster* title.

3.4. Necessity of the One-person Leadership

Controlling and directing the elimination of the consequences of the industrial disaster, the Government established an Onsite Operations Staff from the personnel of disaster management. In the work of the staff relocated in Devecser all the disaster management organs took their share. The activities of emergency services managed to normalize the situation in the affected area.

The government primacy and the one-person leadership of the protection and the support of the staff were guaranteed. The Police and the Hungarian Defence Forces played important role in safeguarding public security.

On the authority of the Ministry of Interior, the director of NDGDM decided about the entities and material assets, mobilization of the state reserves for the protection and directing additional disaster manager officers to the site.

On 4 November 2010, the Operational Staff was replaced by the Governmental Coordination Centre, the leader of which performed executive

tasks as one-person, subordinated to the director general of NDGDM. Assignment to this post corresponded to the impending amendment of the Disaster Management Act.

3.5. The activities of the Operational Staff on the Scene

The primary actions on the scene were saving human and material resources, deployment of intervention equipment and rescue forces (medical service, police and military forces) to the incident site, controlling the work of the response personnel, distributing machines and other vehicles and informing the media. The other responsibilities were as follows: protection of population, roads decontamination, searching for corpses, collection of animal carcasses, pumping cellars, collecting corroded gas cylinders. Another objective was, within a short time to prevent the red sludge contamination reaching the Danube, to prevent harming the aquatic environment.

In the initial period, the Operational Staff in Kolontár settlement was installed in front of the mayor's office in a bus of the disaster management, the logistic base was settled in the local community centre, the Operational Staff in Devceser seated in the Town Hall.

It was imperative to set up a command post in Kolontár because this settlement was the most heavily damaged, people died there, and there was a second possibility of a dyke burst (the northern wall of cassette No 10).

It continued to gather and clarify information in order to have necessary response personnel and equipment on the site. The information administration about the incidents and the performed tasks enabled giving further information and writing reports.

The area was closed, nobody was left without a shelter even temporarily, and the injured were treated by the Ambulance Service or by other medical institutions. Feeding those in need was resolved three times a day at provisionally set up kitchens. Initially there worked mainly volunteers.

Hundreds of persons and equipment participated in the rescue and decontamination operations right from the start. In October on average daily 772 persons and 198 equipment performed the tasks, even in the first period the total number of persons was 1336 and the equipment was 292 a day: the staff of the disaster management, military forces, fire service, water management, medical service, transport and rail workers. In addition the MAL Company sent 50 shovel workers to the scene⁴.

The three Emergency Detection Teams (EDT) from Veszprém, Fejér and Komárom-Esztergom counties, on 6 October 2010 as a first step, started the detailed list of damaged properties (that time 292 buildings), recorded the residential list, compared the data with the local office and registered the staying

⁴ Gyula Fülöp, Attila Horák: Immediate intervention after the red sludge disaster, „Protection”, Page 42-44.

places of the residents. According to the local document office there were 956 inhabitants affected.

In Devecser two decontamination points were set up. The National Ambulance Service operated a medical point in the Palace Garden where they treated the injured. People working in the restricted area were provided with protective clothing and equipment by the disaster management. The population was informed through loudspeakers, leaflets and by the local television channels about the situation, the possible ways of reducing the health risk and the rules of conducting that have to be followed.

The Emergency Detection Teams and fire fighters collected and disposed the industrial and house hold gas cylinders that had been damaged by alkali. The carcasses of dead animals were collected under control of the Central Agriculture Office. A collection point for damaged vehicles was designated nearby the railway station. Animal rescue organizations started the medical treatment and feeding of injured animals then delivered them to animal shelters.

3.6. The actions of Governmental Coordination Centre for Reconstruction (GCCR)

In order to coordinate the regional tasks and the on-site management the GCCR established four working groups in the field of operation management, legal, reconstruction and logistics. Declaring the state of emergency, on 30 June 2011, the director general of disaster management operated a smaller number of Disaster Management Staff for Reconstruction until 14 October 2011.

The Operation Management Working Group was responsible for organizing and controlling decontamination (disaster management and fire officers were designated as street commanders), providing further information for the population, alerting system, transportation, construction official duties, demolition jobs, technical supervisor tasks, evacuation organization, registration of the evacuated population, coordination of population return to the original domicile.

The Legal Working Group prepared and made grant contracts in connection with construction and reconstruction of buildings, used homes buying and financial supports. Based on expert advice they organized the compensations for institutes and ventures, provided legal assistance for those in need.

The tasks of Reconstruction Working Group were the development and management of accurate records of damages about the damaged, demolished, reconstructed, newly built or purchased properties and they registered the claimants. In collaboration with the Legal Working Group they also notified and called up the public to declare and sign contracts.

The actions required from the Logistics Working Group were to maintain the work of the GCCR by supplying technical and protective equipment for the implemented personnel, coordination of the necessary repairs of technique,

participation in the records of charity donations, its storage and distribution. They also supervised the movable properties compensation.

In Devecser a rented guest house, called Pine Tree Pension hosted the GCCR's operation work where the needed IT and management tools were installed. This command post provided facilities for the controlling tasks, keeping briefs, client services and for accepting the legal claims of the inhabitants who suffered damage.

On behalf of the Municipality the Reconstruction Working Group signed contracts in 596 cases for cash and in-kind compensation, treated 333 notified claims, approved 172 in-kind compensations (supporting replacement of furniture). Sixteen citizens' demands were rejected.

3.7. Media

It was an unprecedented scale of interest by the media. The remaining intact parts of Kolontár were almost totally occupied by the domestic and international journalists and by their vehicles mounted with satellite dishes. TV crews and reporters caused potential accident hazards on the damage area. Because of the classified period, for the order of the general director of NDGDM the commander of the Operational Staff regulated the movement of the staff of the media. Attendants took the press representatives to the damage sites in groups. At the gate of the closed area a press point was set up, the broadcast units were sent outside the working area.

Inter alia on the spot there filmed the BBC, the CNN, the Japanese TBS television, the German ARD, the Deutsche Welle, the Austrian ORF Burgenland, the French AFP news agency, the Aljazeera English and the German ZDF public television.

The government Commissioner, the members of the state supervision and the head of GCCE welcomed Ms. Annemie Turtelboom the Foreign Minister from Belgium and Kristalina Georgieva the Commissioner of the EU Humanitarian Aid and Crisis Management. On 6 May 2011 Janez Potocnik, from the European Commission for Environment, on 23 May 2011 the civil protection directors of the European Union member states paid their respects. The delegations arrived also from Vietnam and Taiwan.

The new residential park was allowed to view in every construction phase. Those who were victims, in organized format could visit the parts of some settlements in Bereg where some years ago, after a major flood new houses had been built up.

Having regard the strong interest the government Commissioner underlined for the media that the MAL Company switched to dry technology which is particularly import in terms of population safety.



Photo. 6. Newly built houses for the aggrieved parties

Source: photo taken by the Hungarian official press, by the Hungarian News Agency, 2011.

4. Lessons learnt and experiences

The Red Sludge Disaster has been the most severe industrial catastrophe in Hungary's modern history. Given the number of casualties, injured, human and material damage it surpassed the effects of natural disasters.

Based on the government's cohesive and decisive actions, the rescue was implemented professionally with the national leadership control of the Ministry of Interior and the disaster management.

Drinking water sources and the Danube has not been contaminated. Reliable defence works have been constructed to prevent an eventual dyke breaching, the contamination of outlying and inhabited areas have been returned to the cassettes of the MAL PLC.

The Governmental Coordination Centre of Reconstruction was constantly organizing the properties restoration, reconstruction and mitigation. During the construction of the new residential area they realized the regional architectural style, the rural type of living space.

The cooperation in the management among the ministries, branches and national bodies was outstanding. The governmental coordination in the disaster management tasks worked well. The disaster mobilized significant social forces and intentions to help.

The major numbers of damaged properties have been demolished. For the purpose of replacing them, the government created a new type of resolutions.

The effective management of events required personal control, responsibility and the introduction of a new concept of disaster management law. In this term the need was expressed by the government and the Ministry of Interior.

During the eight months the State supervision of the MAL private company has been successful and achieved its goal.

The financial compensation of mitigation demanded the employment of large number of teams working on legal affairs.

In the emergency situation the local municipalities met the obligations, and fulfilled the requirements. More attention should be taken to the training of their leaders, in order to perform the regulations on higher level. The necessity of safety desk officers' work is supported by the experiences of the disaster management work of Devecser Municipality.

Protection work consumed approximately 33 billion HUF. A new type of cooperation was established between the NGO/charity organizations and social organs. The rehabilitated areas, the memorial park in Devecser and the national memorial site in Kolontár are the scene of national solidarity.

The interest shown by the media from the all parts of the world was continuously intensive therefore it was needed to develop new regulation of the communication.

The following parties participating in the rescue work: fire fighters, disaster management and civil protection officers, policemen, soldiers, paramedics, experts of water management, environmental professionals and civilians demonstrated their courage and devotion.

During the long-lasting remediation and reconstruction work the official staffs were able to cope with the extra load, the GCCE staff has developed specialized competences, also the intervening professionals of the disaster management.

All these experiences should be applied in further trainings, in scientific researches and with any future emergencies or disasters.

Remark: further sources: the text of the paper mainly based on his own on-site experiences of the author