

**Environmental Crisis in Spain:
The Boliden Dam Rupture**

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Chapter 1

Introduction

At 3 o'clock in the morning on April 25, 1998, the small village of Aznalcóllar in southern Spain was sound asleep. The streets were empty and the white lime painted houses seemed to be also sleeping silently like their owners. Only a concert performed by a gang of street dogs, howling to the stars, reminded anyone still awake that this was not a ghost town. Such was the night that embarked the night guards at the Los Frailes mine, outside the village.

At about 3:30 am the lights in the mine suddenly went out and it was pitch black. An alarm indicated that one of the pumps had stopped. The guards quickly ran out of the office and into a jeep parked outside. They headed towards the power station to find out what had caused the power outage. On their way, they heard an enormous noise from one of the dams in the mine. They turned the car and drove towards the noise, driving on the 15-metre wide wall of the dam.

The noise was deafening as they drove closer. Suddenly they had to stop, since they could not see only the wall of the dam or the 'road' they were driving on, because it was no longer ahead of them. Rather there was a 50-metre wide hole in the wall of the tailings pond, from which an enormous stream of water gushed down the slope and disappeared into the darkness. Some of the electric wires had been washed away with the torrent. The guards, shocked and surprised, asked themselves "What happened?"

This accident was the beginning of what was to be perceived as one of the most harmful environmental crises in the history of Spain. The released water turned out to be a giant flood of water and mud containing high levels of lethal metals. An enormous amount of this water and mud flooded large areas on its way down the Guadiamar River until it was finally stopped. The high levels of lethal metals in the water and the sediments deposited in the area put the environment at high-risk for contamination.

The immediate action taken was aimed at containing the flood and preventing larger areas to be flooded, namely hundreds of hectares of cultivated fields, the Doñana National Park and the Doñana Natural Park.¹ The objective of the subsequent measures taken, was to 'clean up the mess;' that is, to remove the mud from the topsoil and to avoid further contamination.

¹ The protected area of Doñana is divided into the National Park (which is administered by the National Government) and the Natural Park (which is administered by the Andalusian Government). This relationship and its importance for the crisis management of this particular case are explained in more detail in this study.

This was a complex crisis in terms of responsibilities and decision-making, due to the extensive area affected and the several actors involved. The national Spanish authorities were involved as well as the regional Andalusian authorities. Due to the environmental character of this crisis, scientific experts played an important role during the management, since decision-makers had to rely on them to a large extent in order to be able to make certain decisions.

Statement of Purpose

The study of environmental issues is becoming increasingly more important in nearly every field of research. Crisis management research, in particular, can provide some interesting perspectives in this regard. As discussed in chapter 2, several environmental catastrophes have occurred in the more recent decades and thus have increased the amount of scrutiny regarding how these have been managed. The fact that a second mining accident occurred shortly after the one in Doñana in 1998 (i.e. the dam rupture in the Aitik mine in northern Sweden in 2000) justifies the importance of studying the crisis management of environmental crises. By doing so, we can help facilitate learning from such experiences, improve civil emergency preparedness for such matters and minimise the negative impact such crises have upon the environment.

The aim of this case study is to analyse the crisis management of the mine dam rupture in the Doñana region making use of the theoretical framework set out by Bengt Sundelius and Eric Stern, what they refer to as cognitive-institutional approach (1997). This report will be organised in the following manner.

After this short introduction I will, in chapter 2, discuss the concept of crisis and raise some issues on environmental crises in particular. This discussion is followed by an account based on the information from different actors and stakeholders involved in this crisis. There were many actors involved and several of the central actors and decision-makers belonged to different institutions within the autonomous administration² of Andalusia and within the national administration of Spain. This account is immediately followed by a list of acronyms of the different institutions involved, which are useful when reading the text. In the last part of the second chapter I verify the applicability of the crisis definition to this particular case by briefly discerning the values at stake, time limitations and uncertain circumstances. In chapter 3, I give a short description on the background information of the region where the accident occurred. Geographical, administrative and political aspects are important features of crisis management, and thus I think it is important to bear this information in mind when striving to understand and analyse the management of this particular situation. Chapter 4

² A description of the Spanish administrative system is presented in chapter 3.

contains an overview of the events that constituted the crisis. The crisis chronology in its entirety, which describes the events day by day, is presented in Appendix I. The part of the crisis considered to be the acute phase of the crisis runs from April 25, when the rupture of the dam occurred, until May 2, which is when the contaminated water flood was completely contained. An account of the events that followed from that day until the end of June, when the Environmental Ministry decided to construct a purification plant in order to deal with the retained water, is also included in Appendix I. This time lapse is considered to be the second phase of the crisis situation. As will be discussed later, the time frame in the study of an environmental catastrophe, in particular, can be somewhat difficult to establish due to the often insidious and hidden effects. The division of the crisis into two phases has been done as a means of facilitating the analysis of the case. It is true that a certain change in the rhythm of the events – and subsequently in the management of the situation – occurred, but the situation was still considered a crisis even after the acute phase. In order to delimit the case, for the purposes of its study, I looked for an important event that marked an end to the most critical period of time. This was rather clear since this point of time also was defined by the central actors in the crisis as an important downscaling period in their crisis management. The chronology contains a section on the aftermath, which ends in April 1999, one year after the accident occurred.

In chapter 5, I list the occasions on which important decisions, that had implications for the evolution of the crisis management, had to be made. Defining these is a central feature of the cognitive institutional approach, in order to conduct the analysis and in order that one case study can be compared with others. Of the ten central aspects in crisis management identified by Sundelius, Stern and Bynander in their research (1997:136-189), I focus on the eight most outstanding aspects of the Doñana crisis management in chapter 6. These are: decision units, experts, problem framing, value conflict, political and institutional competition, symbolic actions, information processing, and multilateralisation. Finally in chapter 7 the report concludes and some reflections are made on the most salient features of this crisis. Following the crisis chronology, photos of the affected area are presented in Appendix II.

Sources and Source Criticism

Empirical material on which this study is based has been collected from multiple sources. There were several reports on this case published during the months following the initial accident, a few which I have in part written. Newspapers and magazines – Swedish as well as Spanish – have also been important sources of information, as well as the different organisations' home pages on the Internet. A small degree of fieldwork in the affected area was carried out and interviews with

individuals involved were conducted over two weeks in August 1998. The number of actors included in this report ensures that the investigation is complex, particularly when it comes to defining the decision-makers. To encounter, define and verify every single decision-maker would require meticulous investigation; something that requires time *in situ*. The minor fieldwork accomplished has, thus, served as one of the primary sources, but this information has been complemented with additional empirical material, in order to be able to interview the 'right person.' Considering the number of actors involved in the Doñana crisis, detailed knowledge on each and every decision-maker has not been possible.³ However, since the theoretical stance in this analysis is cognitive-institutional, the methodological approach focuses on the social dynamics within and between the decision-making institutions, rather than on the profile of each individual. This may be viewed as compensatory for the relative scarcity of individual personal accounts.

I wish to thank all informants in Seville, in Aznalcóllar, in Almonte, in El Acebuche and at the Boliden Apirsa mine that generously gave me their time and answered my questions. Economic support to accomplish this study has kindly been given by the Swedish Agency for Civil Emergency Planning (ÖCB) and institutional support by the Swedish Institute of International Affairs (Utrikespolitiska Institutet), to whom I am very grateful. Finally I also wish to express my gratitude to all of the people involved in this research project for giving me the opportunity to participate, for accepting me as a fellow research associate, for giving me moral and academic support, and for giving me their time and being patient with me as I was writing.

³ Compare the detailed empirics of the decision occasions in the three case studies presented and analysed in Sundelius, Stern with Bynander (1997).

Chapter 2

Studying Crises

This case study forms part of a larger project studying the management of crisis situations. The aim of the project is to build a case bank of crises of different character, which occur in different parts of the world. This case bank can provide information on how different crises are managed, which can provide us with a better understanding for the complex processes that are set in motion during a critical situation. The purpose of this increased knowledge is twofold. On the one hand it can help practitioners in the field of crisis management and decision-makers who often have to confront real decision dilemmas during a crisis. On the other hand, there is a strong scientific interest in developing theory and empirics in this field.

The approach applied in this project when studying crises is labelled cognitive-institutional, meaning that there is a focus placed upon the decisions made during the crisis. This approach illuminates the political, social and administrative context in which the central actors perform and where the decisions are made. The decisions are the outcome of a combination between the individual cognition and the social organisation of the institutions (Sundelius, Stern with Bynander, 1997:47-48).

Defining a Crisis

Among scholars in the area of crisis management various definitions of what constitutes a crisis have been made over the years. One of these holds that there are elements, like the element of 'surprise' and that of 'limited time for taking action', which define such a situation (Herman, 1963, 1972). Other scholars have emphasised the element of insecurity in a crisis situation (Rosenthal, 't Hart and Charles, 1989). This study on the Doñana crisis has originated from an elaboration of the concept by Sundelius, Stern and Bynander (1997). This holds that a national crisis implies that central actors perceive the situation as one where **important values are at stake**, where **time available for taking action is limited** and where the **circumstances are highly uncertain** (Sundelius, Stern with Bynander, 1997).

What is a crisis then? The point of departure in defining this concept is one of social constructivism. Generally speaking this holds that a society (be that a nation-state, an ethnic group, a professional culture or any other kind of social field⁴),

⁴ The concept 'social field' is used within the social sciences, referring to a specific social system of shared ideas, norms and practices.

with its different norms and values, is socially constructed by the actors within it. This social field is simultaneously built and maintained, and also transformed by other actors who do not identify with it, but who are continuously interacting with it. In specific terms, a crisis situation can be described as an alteration in the 'normal' state of things, as there are defined – and constructed – as such by the members within this specific social field. It should be noted that there always exists room for individual perceptions of a crisis situation and that no social field is completely homogeneous. What is remarkable about the cognitive-institutional perspective within crisis management research is that it focuses on group dynamics within and between different social institutions, and thus the individual experience is rather secondary. The social constructivist definition of a crisis implies that there is no objective crisis situation going on 'out there,' but that this is produced in a social context. It is important to note here the distinction between concepts. The crisis is one thing and the situation or event that generally provokes it (an accident for example) is another. An accident is considered a *de facto* situation, happening because of objective circumstances. But this incident, in order to be considered a crisis, must be socially constituted, or given a meaning, between the social actors. That is, a specific situation is given a specific meaning by specific actors – a crisis. If no one reacts to the incident and no sense of danger or emergency is associated with the situation, a crisis has, therefore, not transpired.

Defining an Environmental Crisis

As Eric Stern notes in his cognitive institutional analysis of the Chernobyl crisis in Sweden (1999:9), there has been a relative lack of attention given to environmental crises from a decision-making point of view. Rather, those phenomena labelled 'environmental crises' often refer to deforestation, erosion, air pollution and climate change, just to mention a few. They can be said to constitute a significant threat to basic values but have little to do with the concepts of time pressure and uncertainty, which are dealt with here. Stern distinguishes between first-order and second-order environmental crises. An environmental problem in the first order can be seen as a technocratic issue, but by public opinion, political opposition and/or mass media exposure can be transformed into a second order, that is, a decision-making crisis (Stern, 1999:9). This escalation can also be viewed from the social constructivist perspective, where different social actors interact directly or indirectly, and by which they actually constitute the crisis. Stern exemplifies this process with the Exxon-Valdez oil spill in Alaska in 1989,⁵ and the Chernobyl crisis of 1986 (Stern, 1999:9-10). Also the Doñana case shows, as we will see, a similar parallel.

⁵ For an account of the Exxon-Valdez oil spill, see Davidson (1990).

The study of an environmental crisis is an opportunity to examine the social constructivist stance and in particular how its specific variables put the notion of 'time' in my crisis definition on trial. In studies on crisis situations, the time frame of a crisis is generally, as previously noted, determined by an initial accident or an alarming event, and continues until the situation is 'under control.' There are several examples of these kinds of crises, of which one in particular can be mentioned: the U137-crisis in Sweden in 1981 when a Soviet submarine was discovered and caught in the Swedish southern archipelago (Sundelius, Stern with Bynander, 1997). In this case the starting point for this political and military crisis was the discovery of the submarine, while the drama ended when the hand over of the submarine to the Soviet marines was made. This could be seen as a 'clean cut' crisis with a clear beginning and an explicit end. Another type of crisis is referred to in the literature as a "creeping crisis" (Rosenthal, t' Hart and Charles, 1989:10). The particular feature characterising these crises is that they slowly escalate from a 'normal' state of events to a crisis situation, of which the report "Motorcycle Gang Wars in Sweden and Norden 1994-97" is an excellent account (Svedin, 1998). In a creeping crisis no single event marks the beginning of the crisis. Instead there are several smaller incidents that little by little create the sense of a crisis.

In the case of environmental crises there can sometimes be difficulties in establishing when they begin, but especially when they are considered to be over. This is due to the fact that ecological repercussions can take some time to appear, to be detected and, not least, to disappear. A particular area can be exposed to 'invisible' elements both before and after a so-called environmental catastrophe. This can be exemplified by other environmental disasters, like the Chernobyl case, the Bhopal (India) gas disaster in 1984,⁶ the Basel (Switzerland) chemical catastrophe in 1986,⁷ and that of the Halland tunnel in Sweden in 1997 (Kärde, forthcoming) and the rupture of a dam at the Aitik mine in 2000. In the Halland case, Kärde describes how the construction of a railway tunnel in southern Sweden caused numerous environmental problems since construction began in 1992. The use of chemical products to accomplish this complicated feat of engineering, was, as a matter of fact, affecting the entire ecosystem months before it had been officially announced and defined as an environmental catastrophe by the inhabitants in the region, by the authorities and mass media (Ibid.). However, it was not until a number of social actors claimed the situation to be harmful that a crisis was created and thus considered an environmental catastrophe. In the case of the dam

⁶ In the middle of the night on December 3, 1984, over 40 tons of Methyl Isocyanate (MIC) and other lethal gases leaked from the American Union Carbide pesticide factory. According to the Bhopal People's Health and Documentation Clinic (BPHDC), 8,000 people were killed in the immediate aftermath and over 500,000 people suffered injuries.

⁷ Large parts of the Rhein were in 1986 contaminated with lethal metals after a fire was distinguished at a chemical factory in Basel, Switzerland. High concentrations of pollution were found in the water, air and soil.

rupture at the Aitik mine in northern Sweden in September 2000, there are several parallels linking it with the present Doñana case. Not only were both of the mines property of Boliden Ltd, but both accidents were initiated when the walls of the tailing ponds unexpectedly burst (Aftonbladet, 9 September 2000; Dagens Nyheter, 10 September 2000). Furthermore in both cases, the release of lethal metals into the surrounding waters introduced a factor of uncertainty and unpredictability, since such toxic spills can have complex long-term environmental consequences (see the section “Setting the Stage” later in this chapter).

Determining exactly when the Doñana crisis ended proved to be difficult. It was no problem determining when it began, as this was clearly set by the dam breaking. But how to determine the end of a situation, which continues to be environmentally highly critical, in order to perform an analysis of the case? Was the crisis really over once the acute situation with the flooding water and mud was under control? Should other concerns such as the presumptuous contamination of valuable land, the possible contamination of groundwater and of superficial water; or the possible contamination of marine and wildlife in the ecosystem in the area simply be considered aftermath of the crisis or was it really part of the very crisis? A detailed explanation of how the temporal scheme of this analysis is related to the crisis definition that is used here is provided later in the study.

The time frame for analysis of this crisis has been divided into two parts, of which the first (April 25-May 2) is described in detail day by day. This is considered the acute phase of the crisis since the nature of the situation was one of great concern due to the encroachment of contaminated water and mud. Once this sludge was retained and considered under control, on May 3, the crisis entered the second phase. The decisions made for dealing with the situation at this time were also of a crisis character, although of a less acute nature. But these decisions were also made in order to protect important values, under time pressure and in uncertain circumstances. This second phase concluded at the end of June, when it was decided that a purification plant was to be set up in the affected area in order to take care of the remaining contaminated water.

Perhaps a discussion on the aspect of time frames is somewhat beyond the scope of interest for crisis management practitioners. Their interest may rather be to gather knowledge on how acute crisis situations are resolved and learn from this, as a way of improving preparedness for similar events. However, this might be useful for scholars in this field of investigation in their pursuit of developing further the theoretical framework that sustains this work.

Taking an *emic*⁸ standpoint in my investigation – intimately related with the

⁸ Concept used in anthropological investigation, the *emic* stance – as opposed to the *etic* – holds that the information recollected during a fieldwork and the subsequent analysis of the material is interpreted according to local ideas and concepts, also called “folk models” or “local models” (Harris, 1976; Björklund and Hannerz, 1983).

social constructivist perspective – I let the central decision-makers do the delimiting of this crisis. This methodological strategy is a consequence of the theoretical stance. As actors in this crisis, and thus as constructors of it, they determine the temporal framework as they experienced it. Still, in order to facilitate the analysis and the reading of the case, I have taken the liberty of separating the events into two distinct phases with an aftermath. I wish to emphasise that this has been done purely on my own initiative, although the reconstruction of the crisis, which was put together based on all of the available information and the interviews with the different decision-makers) has indicated that the Doñana crisis occurred in a similar manner.

Defining and determining a crisis situation is, thus, more a question of social dynamics and it must be kept in mind that definitions can considerably vary between the different social actors involved. Enrichment to crisis research would perhaps be gained by further studies on the social relations that are set in motion in the process of a crisis, emphasising the crisis *making* in this process. What social mechanisms are set in motion and how do they interrelate? Why is a crisis situation produced in a particular way? What are the relations between the social structure and the social actors involved? The importance of existing power relations in a social field must not be overlooked in this conclusion; that is, not only who has the power to manage the crisis, but also which social actors have the power to construct it. How do these power relations shape the crisis management process? Without pursuing in greater depth these interesting questions for the moment, one way of continuing the discussion is through defining the central actors, since they were a core part of the entire crisis.

Central Actors

As illustrated in this report, this was a complex crisis, particularly in terms of the various actors involved in the management. Having defined the crisis scenario and the management that will be analysed, the main actors have thus been identified as: the regional Andalusian Government (*Junta de Andalucía*) and its provincial representatives in Seville (*Delegación del Gobierno de la Junta de Andalucía en Sevilla*); the different institutions representing the Spanish National Government; the Environmental Ministry (*Ministerio de Medioambiente*); the Guadalquivir River administration; CHG (*Confederación Hydrográfica del Guadalquivir*); and the National Park authorities in Doñana. These were the entities to which the main decision-makers belonged. On the other hand there were several other actors, such as the independent farmers, the local police, the civil guard, the various municipalities, the authorities of the Natural Park, who during the acute phase of the crisis also made some important decisions and took various measures in relation to the situation.

What about the mining company, Boliden Apirsa? One would perhaps have expected the company to have played an important role in the crisis management. Examining the events and the decisions made during the crisis, it is, however, clear that Boliden did not have a prominent role in the total management. The company must rather be defined as a small actor, like the ones mentioned above. This is not to say that this was not an important crisis for the company – on the contrary! Here an important distinction has to be made. According to the employees at the Boliden Apirsa headquarters (Interview with Åke Nilsson, 17 August 1998) this was certainly defined as a crisis situation within the company. The distinction here concerns the influence the company had in the decision-making process that was developed in order to manage the toxic flood. Their influence was not really important in relation to the other actors like the Andalusian and the national authorities. This limited participation in the decision-making process thus implies that the company was a ‘small actor’.

Boliden has, likely, been greatly harmed by this accident, in terms of its reputation, production and economic situation. The mine in Aznalcóllar had to be closed for approximately one year and Boliden had to pay a great amount for ruined crops and damaged harvests in the area due to the accident. This was a great loss for the company in spite of the fact that it had insurance. The company acquired the mine in 1987 and had already been severely criticised for neglecting leaks in their tailings pond and for not taking seriously security and environmental precautions at the Los Frailes mine, despite several reports from employees and local environmental organisations about these problems (El País, 23, 26 and 29 April 1998). The directors of the Spanish subsidiary, who were from Sweden, were submitted to judicial proceedings in order to establish the cause of the accident and to determine who was responsible for it. The tailings pond that broke had to be repaired and a new one created. The cleanup of the area down the Guadiamar was also to a large degree the responsibility of the company. The growing importance in the business world of having a sound environmental policy is imperative. This was true for this company, especially considering the line of business they are in: mining, which is an exceptionally dirty and environmentally harmful activity. This mine was, in fact, planned to be a model for environmental excellence within the company (Interview with Åke Nilsson, 17 August 1998). The accident and the subsequent accusations of negligence were therefore a particular disgrace to the environmental profile of Boliden, which was completely tainted. A proper study of the company’s internal management of this accident, in my opinion, would reveal many interesting differences in comparison to the management of a public institution. In this case though, when it comes to decision-making of what constituted the total management of the contaminated flood, the company played a marginal role, which is why, from this perspective, Boliden Apirsa can be considered a minor actor and can be analysed as such.

List of Acronyms

AEMA	<i>Agencia Europea de Medio Ambiente</i> (European Environmental Agency)
CC	<i>Comisión de Coordinación del Gobierno Central y la Junta de Andalucía</i> (Coordination Commission between the central government and the Andalusian Government)
CECEM	<i>Centro de Coordinación de Emergencias</i> (Centre for Emergency Coordination)
CHG	<i>Confederación Hydrográfica del Guadalquivir</i> (Hydrographic Confederation of the Guadalquivir River)
CSIC	<i>Consejo Superior de Investigaciones Científicas</i> (Superior Council of Scientific Investigations)
DGJA	<i>Delegación del Gobierno de la Junta de Andalucía</i> (Governmental Delegation of the Government of Andalusia)
GC	<i>Guardia Civil</i> (Civil Guard)
ITGE	<i>Instituto Tecnológico Geominero de España</i> (Technological Geomineral Institute of Spain)
JA	<i>Junta de Andalucía</i> (Andalusian Autonomous Government)
PP	<i>Partido Popular</i> (Popular Party)
PSOE	<i>Partido Socialista Obrero Español</i> (Spanish Socialist Workers Party)
SEPRONA	<i>Servicio de Protección de la Naturaleza de la Guardia Civil</i> (Nature Protection Service of the Civil Guard)

Setting the Stage

Let me now tie together the previous discussions on crisis definition and time frames, by explaining why this case is apt for a cognitive-institutional analysis. I will do this by taking a more specific look at the circumstances within which the central actors defined this crisis.

Important values were at stake. The enormous flood of contaminated water running down the riverbed, its banks and the fields along it was perceived as a threat in terms of the environment, the economy, the political aspects, and the people's living conditions in the area in terms of security and health. The families living nearby the river were physically threatened by the enormous amount of water, which had overpowered the dam. The water and mud covering the area contained high levels of lethal threatened the year's harvest. That would mean a

loss of millions of Spanish pesetas for hundreds of farmers and their families. In the long term, the consequences would be even larger; the contaminated soil and the contaminated irrigation and groundwater would remain unusable for many years to come, which meant the area's entire livelihood was threatened.

Further down the Guadiamar River lies one of Europe's most important National Parks: *Parque Nacional Coto de Doñana*. It has been declared as a World Heritage site of UNESCO and is considered particularly valuable because of its biotope diversity, mainly lagoons, marshlands, dunes, and scrub woodlands. For a huge amount of migratory birds, Doñana is particularly important as a resting place on their way between Europe and Africa. The contaminated water running down the river threatened to invade the National Park and the surrounding Natural Park, which could have meant an ecological catastrophe.

The threat in this case was identified as toxic substances. What could be observed was the dark coloured water and the mud, not the contaminating lethal metals *per se*. Although virtually invisible then, they were not the less frightening. Perhaps the invisible enemy is perceived as more dangerous, since it is quite simply impossible to estimate the amount and strength of the poisons with the naked eye. In this case it was very hard to predict with exactitude the consequences the mine residual spill would have, since many of the substances that were spread with the water and mud continue to act on a long term basis, i.e. for many years to come. The toxic substances in this case were lethal metals in high concentrations. These metals exist naturally in soil and water, filling important functions in the ecosystems. They become hazardous when the quantity of a specific element is altered and displaced from its original location; in this case, large quantities of lead, cadmium, zinc, manganese, arsenic and copper were spread over a large area in abnormally high quantities. Lethal metals are defined as metals with a density higher than 5mg/cm³ (Swedish Environmental Protection Agency, 23 May 1998). In high concentrations they have specific properties which are very toxic to humans and to nature, but cannot be detected by sight or smell, which make them particularly deceptive. They also accumulate in live organisms and do not diminish or disappear over time, but are stored in the organism's organs. They can even bioaccumulate in the transmission, that is, increase in concentration – and toxicity – in the transmission chain that is produced in a tropic chain. This means they are passed on from a plant/animal to animal according to their alimentary patterns and seriously threaten great numbers of plant and animal populations. In short, an overdose of lethal metals for any living species (animal, plant or human) means intoxication in the vital organs and in many cases death. This explains the overwhelming concern for the National Park during this crisis, since an important number of plants and animal species are found there. Unfortunately enough, the accident occurred in the middle of the bird-nesting season, which meant the risk was high that a large number of birds would be drinking the contaminating water.

Local and provincial authorities also realised their responsibility for the social,

economic and political aspects of the accident. With soil and water wells presumably contaminated by lethal metals, the authorities were responsible for the state of health and well-being of their residents. The health risks implied with contamination from lethal metals are substantial even when it comes to human beings. It was known that the toxic river was carrying lead, cadmium, zinc, manganese, arsenic and copper. Arsenic exposure can be cancerous (Harvard University School of Public Health, 23 May 1999) and large quantities can lead to lethal intoxication; excessive cadmium ingestion produces immediate gastroenteritis and then kidney dysfunction and lung impairment (Department of Occupational and Environmental Medicine, Uppsala University Hospital, 23 May 1999); lead intoxication produces colic, affects the nervous system and can generate psychosis and epileptic symptoms (Ibid.); high concentrations of copper produce stomach irritations (Ibid.); manganese intoxication leads to psychotic symptoms and other symptoms similar to Parkinson's disease (Ibid.), while zinc intoxication produces influenza symptoms (Ibid.). An 'epidemic' of poisoned citizens was something of a nightmare pictured by the provincial administration.

On the Atlantic coast, where the Guadalquivir River opens to the ocean, there are two big sources of income: fishing and tourism. These sources of income were also threatened by the contaminated water, which was expected to arrive sooner or later to the coast. Lethal metals in the fishing water and in the swimming water, could diminish and possibly eliminate the selling of fish products from this area and would scare away the summer tourists. It could as well mean additional expenses for the provincial state, since the farmers had to be reimbursed and the land had to be cleaned from the toxic mud. In addition, the fishing community and those people living on tourism would probably also have economic claims. Furthermore, unemployment rates could rise, which would be a serious headache for the Andalusian Junta Government. In reality, almost an entire village – Aznalcóllar – was threatened by unemployment. If the Boliden mine would have to close for a very long time, or maybe even permanently, the majority of the residents would be affected, since they directly or indirectly live off the mine or from the income it generates for the area.

Also in terms of regional and national politics, the management of this crisis situation was very important. Competition between the provincial and national authorities in Spain has a long tradition, originating from the particular cultural context of the country. In Andalusia, in particular, the tense relations between the regional and the national levels are particularly felt nowadays because of the different political affiliations in each respective government. The national government is formed by the PP (*Partido Popular*) while the *Junta de Andalucía* is governed by PSOE (*Partido Socialista Obrero Español*). Thus, it was important for the Andalusian authorities to demonstrate their ability to manage a situation like this.

At the administrative level there were also other distinctive actors who had

responsibilities to assume in this situation. All basins in Spain have a special national board, a hydrographic confederation, belonging to the Secretary of State for Waters and Coasts at the Environmental Ministry. This confederation oversees and administers the water resources. Aspects like urban water supply, energy, environment, and infrastructure are part of the confederations' responsibilities. The affected area belongs to the Guadalquivir basin, named after its main river. These waters are part of the national territory and are administered by the *Confederación Hydrográfica del Guadalquivir (CHG)*. The CHG was therefore implied in the crisis management, since the mine spill ran out into the waters, which were under their jurisdiction and the toxic flooding was a considerable ecological and economic threat to their work.

It is apparent that the dam collapse embodied a complex and not easily manageable situation with many values at stake. The second criteria for determining a crisis situation – **time available for taking action is limited** – was also evident in this case.

The initial rupture of the dam and the subsequent actions taken to save the cultivated land and the National Park occurred during the first week. Limited time was available for preventing the contaminated water from invading the land downstream, and for stopping the flood. The actions taken, of closing the floodgates (many of which were out of order) and building protective walls in an attempt to deviate the flood, involved a race against time.

In the second part of the crisis the time pressure was of a different nature. The enormous amount of contaminated mud, covering more than 2500 m² of riverbed and land, had to be removed from the soil in order to evade further ecological damage. Also the contaminated water (retained in the Entremuros area) had to be purified and taken care of – and all this before the autumn rains. The rains that usually start in October generally produce flooding, which again threatened to transport further the remaining contaminated mud and water to the cultivated land and to the National Park. Furthermore the rains would enable the lethal metals to penetrate the mud and seep into the ground water.

These time restraints kept the Andalusian administration working the whole summer, even during their traditional vacation time.

During this crisis, **circumstances were highly uncertain**. This is the third criterion in the definition of a crisis situation. During the first phase of the crisis, it was not clear how many and how much lethal metals this southward running water really contained and how dangerous it was for the environment and for the human population, although a 'worst case scenario' prevailed in the early stages. Nobody could know with certainty if the protective walls, (which were constructed with soil, gravel and stones), would be finished in time and if they would really be solid enough to stop the flood and contain the waters in order to drain it. Also, it was not clear what the consequences would be and how to handle them.

During the second phase of the crisis, measures had been taken to manage the

situation in terms of the cleanup and dealing with the consequences. Still the removal of the contaminated mud was going slowly and the risk of not getting rid of it all grew bigger every day, despite the fact that every week the labour force grew in personnel as well as vehicles. Environmental organisations criticised the pace of the work and the way it was done. Would the work be finished before the autumn rain and what would the ecological consequences be? Circumstances continued to be highly uncertain, even after the acute phase.

Chapter 3

Contextualising the Crisis⁹

The Boliden Apirsa mine is located just outside the village of Aznalcóllar, some 35 km north-west of the city of Seville in Andalucía in southern Spain and some 30 km from where the Guadalquivir River opens into the Atlantic Ocean. Approximately 45 km south of the mine is the National Park of Doñana, one of the most important parks in Europe.

This part of Andalucía, close to the border of Portugal, is a lowland region without any distinct topographical features. It is rather an exception to the other regions of the country, which are mainly mountainous highlands. Andalucía is a coastal area, facing the Atlantic Ocean. The tidewater cycle is particularly notorious, rising and retiring with an interval of 13 hours. The Guadalquivir River rises several metres with the tide as far up the river as the city of Seville, approximately 150 km from the coast.

The lowlands in this region make it particularly suitable for agricultural activities. Spain in general has a long tradition as an agricultural producing country, thanks mainly to its warm and sunny climate. The southern region in particular is an important producer of vegetables, fruit, rice and olives among many other products, which are exported mainly within the European Union. This can be observed in the Aznalcóllar area where the Boliden mine is situated, surrounded by cultivated fields. The fishing industry is also important to Spain. The country is surrounded by sea: the Atlantic Ocean in the northern part and in the southwest and the Mediterranean Sea from Catalonia in the northeast to Gibraltar in the south.

The recent history of Spain is marked by the regional efforts to establish some form of de-centralised state structure. These efforts were historically oppressed, especially during the dictatorial rule of General Miguel Primo de Rivera (1923-1930) and that of General Franco (1936-1975) (Heywood, 1995:142) whose political aims were the building of a strong central state. These regional features of Spanish political life have historical roots in the distinct cultural traits of the different parts of the country. The Basque Country, Galicia and Catalonia are surely the regions with the strongest cultural identity in Spain. Regional feelings are also strong in the south, and Andalucía has an important history of having been the last bastion of the invading Muslims in the Iberian Peninsula, leaving an

⁹ Specific dates regarding Spanish history and politics have been taken from two publications: Heywood (1995) and the Swedish Institute of International Affairs (1997) if not otherwise stated.

important cultural heritage in terms of art, science and technology. In addition, the presence of the *gitanos*,¹⁰ famous for their flamenco music and dance, has also contributed to the diversity in Spain.

After the death of General Franco in 1975, democracy was installed in Spain. Political parties were permitted and the regional forces were then permitted to make open claims for higher autonomy, something that had been harshly repressed by Franco in accordance with his goals for a strong central state. A new constitution was approved in 1978, which designated the king as the Chief of State and appointor of the Prime Minister, in accordance with the Parliament's approval (Swedish Institute of International Affairs, 1997:20). The constitution devotes special considerations for regional matters, establishing three levels of autonomous communities: privileged, grade one, and grade two. The so-called historic regions – Catalonia, Galicia and the Basque Country – were given privileged status, and would proceed automatically to state autonomy. The grade two category absorbed regions like Navarra, Cantabria and Murcia, since they were considered to lack a distinctive historic identity. These regions had to apply to the national state in order to obtain a certain degree of autonomy. In between these categories were regions like Andalucia, that could also allege a distinct historical identity or other claims. These were placed in grade one and were considered 'exceptional,' which permitted them to achieve a high level of autonomy, after a certain application process. In the 1980s there was an outbreak of so-called 'autonomy fever' among the different regions aspiring to achieve self-determination (Heywood, 1995:143-144).

The seventeen autonomous regions have independent statutes, parliaments, presidents, administrative bodies and functioning judicial systems. The national state sets the basic legislation and outranks the regional laws, but is in general intended to guide the regional laws, not to determine them. Also depending on the community's status their competence in different matters will vary. The framework of the Spanish regional government is deliberately indeterminate, which permits flexibility in terms of decision-making power (Ibid.:147).

The Boliden Apirsa Mine¹¹

The site of the Boliden Apirsa mine is located in an area called the Iberian Pyrite Belt, which runs through southern Spain and Portugal. This area has traditionally been one of the most important mining districts in Europe (Nilsson and Sundvall, 1996:2). Mining in Aznalcóllar has a long tradition; archaeological studies date

¹⁰ Romany (gypsies)

¹¹ Information on the Boliden Apirsa mine was provided during a visit to the mine in August 1998 by interviews with the staff and a guided tour of the mine. Information can also be found in Nilsson and Sundvall (1996) and on Boliden Ltd.'s home page.

this activity back to 3000 BC. Both silver and copper have been extracted in the area. Modern mining began in the 1870s and the current mineral deposit was discovered in 1956. A local company, Andaluza de Piritas S.A., acquired 612 hectares in the deposit area in 1960 and started the production of complex pyrite ore and pyroclast ore with open pit mining in 1979.

Boliden Mineral Ltd. acquired the Boliden Apirsa mine in 1987. At that time the ore reserve in the Aznalcóllar pit was estimated to last until 1992, but further explorations indicated the mill could be supplied with ore until 1996. Once this open pit was in operation, Boliden Mineral Ltd. started to explore the surroundings and discovered the Los Frailes ore reserve. The Los Frailes open pit began production in 1997, after the ore from the adjacent Aznalcóllar mine was depleted, and is designed for a total production of approximately 4.2 million-ton per year (Boliden Ltd.'s home page, 10 October 1998). The Los Frailes mine is a major employer for the surrounding region, providing jobs for 430 residents.

The Boliden Apirsa mine actually exploits pyrite ore and pyroclast ore, which are used to produce zinc, copper and lead concentrates. The mining process starts at the open pit and continues through the crusher, the mill and the concentrator. The final products (zinc, copper and lead concentrates) are then transported by truck to the port of Huelva from where they are shipped. The residuals from the concentrator are pumped to the tailings pond.

The tailings pond is the dam where the remains from the mining process are deposited. Tailings from the concentrator are pumped into the dam, precipitate and are covered by some 20-cm of water. Water enters this dam together with tailings from the concentrator, as sludge from the water treatment plant, as runoff and draining water from the open pit, as waste rock dumps and surroundings, and finally as precipitation. From here the residual water is led through a weir via a small pond and pumped to the treatment plant. After treatment, this water is finally discharged into the Río Agrio (Nilsson and Sundvall, 1996:13). There is also an evaporation process from the open surface of the dam, which produces a loss of water. The tailings pond is divided in two sections with a total capacity of 70 Mton of tailings and the water capacity is equivalent to approximately 5 million m³. It is located at a height just above the course of the Río Agrio, which is the main provider of water to the Guadiamar River.

Chapter 4

Overview of Events

Acute Phase: April 25, 1998 – May 2, 1998

At 3:30 am on April 25 the walls of the tailings pond in the mine burst, provoking a leak of approximately 5 million m³ of residual water. The leak follows the course of the Río Agrio River, which flows below the dam soon uniting with the Guadiamar River. The night guards in the mine discover the accident and alert the Aznalcóllar **Civil Guard (GC)**. The **Centre for Emergency Coordination (CECEM)** in Seville is alerted at 5:15 am and from this moment the Centre functions as the communication centre between different actors involved in the management. The boards of the National Park and the Natural Park are notified, as are those who are politically responsible at the national and local levels.

The residual water from the mine flows at a fast pace down the Guadiamar basin, passing the villages of Sanlúcar La Mayor and Aznalcázar, and floods cultivated land along the river. The local police, the GC, municipal employees, farmers and residents are out early in the field in order to hinder the flooding from entering the cultivated fields. Employees from the National and Natural Parks work with tractors and excavators to close the flood gates and to repair the walls in the irrigation channels crossing the entire area, in order to avoid further flooding.

At 17:30 the reinforcement of a wall crossing the Guadiamar River at Vuelta de la Arena, with the purpose of retaining the water above this wall, begins. This effort is in vain, however, as the flood reaches this point on Sunday morning around 4:00 am and breaks open the wall, continuing its course down the river. While walls protecting the National Park and Natural Park territories are being reinforced, new walls so that they can deviate the flood from the National Park territory are being constructed on Sunday. One wall is being built in the northern end of the Entremuros Channel, at Cangrejo Grande, and another one is being built in the Aguas Mínimas Channel. Water is initially deviated along the course of the river, and is headed out to an outlet into the Atlantic. On Sunday evening, however, the first built wall bursts and water rushes into the National Park territory. Meanwhile at the Boliden mine, the broken dam is being repaired and on Sunday afternoon there is no more water leaking from the tailings pond.

By Tuesday, April 28, the water has finally been contained. Thousands of hectares in the area between the mine in Aznalcóllar and the Entremuros Channel are covered with black mud and dark water. Dead fish and birds are found in the area, indicating toxicity in the water. The media has been reporting on the site since the very first day and the politicians representing the local, regional and national administrations visit the area. Several ENGOS (Environmental Non

Governmental Organisations) are present in the area. Samples of mud and water have been taken repeatedly since the first day.

On Wednesday, April 29, a scientific committee is assembled in Madrid on an initiative from the **Superior Council of Scientific Investigations (CSIC)**. They recommend that the residual water still running towards the Guadalquivir should be stopped and that the water contained in Cangrejo Grande in the Entremuros Channel should be treated immediately.

On Thursday, April 30, a **Coordination Commission (CC)** is constituted between the national government in Madrid and the Andalusian Government (JA) in Seville. The Commission designates a Committee to organise the recovery work. It is decided that all remaining channels containing the residual water should be obstructed. The Andalusian Environmental Council starts publishing daily reports on the Commissions' work on their Internet home page. On Saturday May 2, the 2.5hm³ of residual water is completely contained north of the National Park, marking the end of the acute phase of the crisis.

Second phase: May 1998 - June 1998

On Sunday, May 3, the cleanup of the affected area starts. The Guadiamar Basin is divided into three areas, of which the mining company Boliden is responsible for the removal of mud in the area next to the broken dam. The CC organises the work of the national and local administrations into five groups: one to work with closing up the dam; one to take charge of the mud removal in the river basin; one to control the quality of the affected water and soil; one to work with agricultural concerns; and one to organise security in the affected area.

An order from the Agricultural and Fishing Department of the **Andalusian Junta (JA)** is dictated on May 5 prohibiting all agricultural activities in the affected area. Exports of Andalusian agricultural products decline drastically and tourist agents receive cancellations for the upcoming summer season. The CSIC expert committee publishes their second report, suggesting the installation of a purification plant for the contained water in Cangrejo Grande and emphasising the urgency of cleaning up the affected area before the autumn rains in October.

In a meeting with the JA and several farmers' organisations on May 6, the mining company Boliden Ltd. agrees to provide reimbursement to those farmers whose harvests were ruined in the flooding. Water and mud samples taken in the affected area show high levels of lethal metals.

On Saturday 9 treatment of the contained residual water in Cangrejo Grande with lime is begun in order to elevate the pH level and to provoke the precipitation of sediments in the water. The construction of a purification plant in this area is discussed. Criticism is raised on the slow pace of the removal of the mud, and the JA orders all agricultural products from the affected area to be confiscated and destroyed.

On May 14 the European Parliament adopts a resolution that considers an action plan to restore the Doñana area. The **Technological Geomining Institute**

of Spain (ITGE) declares toxicity in a water source that provides the National Park with subterranean water. This information is, however, denied by the **Hydrographic Confederation of Guadalquivir (CHG)**.

Several public demonstrations are held in Seville in May. Thousands of persons gather and demand political responsibility for the accident and for the restoration of the Doñana area. Meanwhile, farmers in the Guadiamar Basin resist the entrance of machines on their property to remove the residual mud from the land, claiming economic compensation before they accept the removal of contaminated soil. The JA Environmental Counsellor declares that the Spanish Army is prepared to act in those cases where entrance is denied.

By the end of May, in Madrid, the Environmental Minister presents a programme for urgent measures to restore the Doñana region, and also a long term plan called "Doñana 2005." The removal of mud and the treatment of the contained water continue and by the middle of June more than one ton of mud and soil has been removed. The CSIC scientific committee criticises the use of heavy machines in the removal work, arguing that this harms the soil, and recommends using manual removal instead.

On June 9 a JA Decree is promulgated in which the acquisition of affected private land is advocated in order to accomplish the cleanup. This would imply JA buying the land or expropriating it if necessary. On June 22, Boliden Ltd. starts reimbursing the affected farmers.

The water in Cangrejo Grande is being treated chemically and on June 26 the CC agrees on constructing a purification plant using both chemical and mechanical treatments so that it will be possible to later let the treated sludge out into the Guadalquivir.

Aftermath: July 1998 – April 1999

The clean-up work continues. Hundreds of persons are involved in the manual removal of mud, and hundreds of vehicles are engaged in the mechanical removal and transport of the sludge to the open pit at the old mine in Aznalcóllar. The Andalusian representative in the CC issues reassurances that the affected basin will be restored before the autumn rains in October. The purification plant in Cangrejo Grande is built during the summer and is finally inaugurated by the Environmental Minister on August 10. In July the JA approves a modification to the environmental legislation, which regulates the level of sulphates in the water. The modification implies an augment of permitted levels and part of the trapped water is poured into the Guadalquivir.

During the rest of 1998 and the beginning of 1999 the cleanup is finalised. The trapped water is purified and poured back into the river. The soil is restored and reforestation of the basin is planned. After an authorisation of the JA, the Boliden mine in Aznalcóllar is reopened on April 8, 1999.

Chapter 5

Important Decision Occasions

As the chronological account of events show, this was a complex crisis in that there were many authorities, organisations and decision-makers involved. As Sundelius, Stern and Bynander point out (1997:47-48), a crisis – while it is elapsing – is typically not perceived by the decision-maker in holistic terms, but rather as a sequence of decisions to be made under time pressure and in the wake of different problems. A series of ‘what-to-do-now?’ occasions are what the particular decision-makers face and they have to act upon these within certain time constraints, without really being able to perceive the moment as a link in the chain of events. These critical decision occasions (the links) are what afterwards are defined as the crisis; that is, the chain of decision points. It is important to note that a decision occasion can imply a decision to act upon the problem, but it can also mean an abstention from making a decision or making the decision not to act; both are called a non-decision (‘t Hart, Rosenthal and Kouzmin, 1993:25-28). The decisions to be made generally concern a wide range of aspects, which all affect the total crisis situation. These aspects can relate directly to the events in question; like in this case, the flooding. But there are also other aspects for decision-makers to attend to. Problems that at first sight appear to be secondary to the ‘main’ problem, but that in fact are important in shaping the crisis situation. Such aspects can be media pressure, public opinion, logistics, communication, industrial or economic issues. A vital part of cognitive-institutional analysis is, thus, tracing and dissecting different decision occasions within a particular crisis situation.

During the Doñana crisis several important decisions, which shaped the crisis management, were made almost simultaneously by the different actors, both on the individual level and on the small group level. Below I will elaborate upon nine of the occasions that required decisions to be made. These are the decision occasions considered to have been most important for the development of the crisis management. The individual and group decisions have been singled out here into two categories and are presented in chronological order. There is also a distinction made between the operational and the strategic levels of decision-making, referring to which level or by what actor the decision was made. ‘Operational’ refers to the kind of decision made ‘in the field’ by the technicians or by other low-level decision-makers, while ‘strategic’ refers to those decisions made by actors at the top-levels, such as politicians (‘t Hart, Rosenthal and Kouzmin, 1993:25-28).

Decision Occasion	Decision-maker/s	Decision Level
The dam breaks.	Individuals and Small groups	Operational
Toxic water is released.	Small group	Operational
Confining the flood is not enough.	Small groups	Operational
The Vuelta de la Arena wall bursts.	Small groups	Operational
The tide rises.	Small groups	Operational
Expert recommendations.	Small group	Operational and Strategic
Risk of contamination.	Small groups	Operational and Strategic
Entrance to private property denied.	Small group	Strategic
The pool of water in Cangrejo Grande.	Small groups	Strategic

The Dam Breaks

When the broken dam was discovered in the middle of the night between April 24 and 25 by the night guards at the mine, they immediately returned to their office and alarmed their superiors and the Guardia Civil (GC) in Aznalcóllar. A neighbour to the mine had discovered the flooded water by that time and had also called the GC. Around 5:00 am the GC officials on duty decided to evacuate several families living on the farms located in the basin of the Guadiamar in an area called Ranchos de Guadiamar. The Aznalcóllar GC¹² had checked the area around the dam after receiving the telephone calls between 3:30 am and 4:00 am. They worked on the ‘worst case scenario,’ knowing the capacity of the dam, because they did not want to take any chances that the inhabitants would be carried away by a giant flood or drown inside their homes. The flood of water and mud actually never touched a house in the area despite the width of the flood, which was approximately 200 meters.

The GC contacted the Centre for Emergency Coordination (CECEM) in Seville at 5:15 am. The operators of CECEM, in turn, immediately contacted the appropriate organisations and individuals. These communications opened the door for several decision occasions, since the different actors notified found themselves obliged to take some kind of measure. The local police in Aznalcóllar and in Sanlúcar La Mayor sent their forces out to the river, as the different detachments of the GC and the different municipal administrations in the villages down the Guadiamar prepared for the eventual evacuations. Among the individuals contacted

¹² Unfortunately my interview with the Commander of the Guardia Civil (GC) was cancelled, due to a lack of time on the behalf of the Commander. Hence, information on how the GC responded has been based on other reports (CECEM, 25 April 1998a; CECEM, 25 April 1998b; CECEM, 26 April 1998).

were the Head Delegate of the Governmental Delegation of the Junta de Andalucía (DGJA) in Seville and José Antonio Viera, who was later to become one of the decision-makers in the Coordination Commission.

Toxic Water Is Released

In the early morning on April 25 a majority of the public, authorities and organisations had been notified about the accident. This had been accomplished by the CECEM in part, but also within the different organisations between which communication had been established. Everyone was aware of the giant flood coming down river and that this water contained toxic substances from the mining activities. This scenario produced *ad hoc* actions among a lot of people such as the rice cultivators and other farmers in the area, who used their agricultural machines to obstruct the floodgates linking the river up to their fields. These immediate attempts to save their land can be considered a result of individual decisions. They were not prompted by an organisation but rather accomplished separately by each one of the farmers and their employees.

The floodgates and the irrigation channels along the Guadiamar was also closed by the personnel at the Natural Park and the National Park, in order to evade the entrance of toxic water. The personnel at the National Park (guards, guides and technicians working in the park and some of them living within its territory) were out early in the morning in response to an order from the Director of the Natural Park, Alberto Ruíz de Larramendi, and were trying to protect the park (Interview with Director Alberto Ruíz de Larramendi, 24 August 1998). The Director of the Doñana Natural Park, Javier Cobo, also gave orders to his staff to close the links between the park territory and the river (Interview with Manuel Simón Martínez, 25 August 1998). Provincial and municipal employees were also working hard in the field.

These early measures actually saved big parts of the land in the area from being penetrated by the dam water and from being covered by mud. However by closing off the outlets from the river, the amount of water in the riverbed was maintained and enabled it to continue running further down the river. The decisions made to accomplish these measures were simultaneously taken on an operational level by different individuals and in small *ad-hoc* decision-making units, such as those from the National Park and the Natural Park. Considering the threat in terms of an invading toxic river and the lack of available time, the farmers as well as the directors of the park territories decided to endeavour to prevent the flooding of valuable land by taking these measures. The virtual absence of any interference from the authorities in taking control of the situation can bear indication of a non-decision. A lack of preparedness and of organisation for such emergency situations can reasonably lead to the assumption that the authorities were simply surprised

and that they let these actions be taken until they had gathered their forces and more information.

Confining the Flood Is Not Enough

Around 9:00 am an inspection of the area was done by the Environmental Delegate of the Sevillean DGJA together with Javier Cobo from the Natural Park and staff from the JA. On the JA delegation's return to Seville, the functionaries gathered at the DGJA headquarters decided to constitute an Emergency Coordination Committee to manage the situation. At this point there was a clearer picture of the magnitude of the accident and the local authorities had decided to take command. The decision-making locus was now transferred to a large extent to the strategic level, but nevertheless was very much in accordance with what the technicians had to say on the matter. In the DGJA the delegates realised that an *ad hoc* interdelegational coordination group would be more efficient for the management of the situation, rather than using the normal procedures between the delegations. This committee immediately disposed to implement urgent measures such as controlling the riversides and the land affected by the toxic flood, controlling consumable products, and issues regarding potable and irrigation water in the affected area. These decisions were to have social and political importance in what was to become the second phase of crisis management. They were also a sign that the strategic decision-makers were taking control of the situation, for example, by sending in police forces to patrol the river banks in order to protect people from getting harmed and to ensure that no one was negatively interfering with the crisis management.

At this time it was clear to the different actors that closing the floodgates, reinforcing the walls and letting the flood choose its course, would not be enough to control the situation. The different actors started to consider how to best manage the advancing flood in order to protect the valuable land. Considering the flood would seek the 'easiest' course, three possibilities existed:

- 1) that the flood – once it reached the Vuelta de la Arena – would follow the Guadiamar's natural course through the Brazo de la Torre;
- 2) that it would run straight on through the Entremuros Channel or;
- 3) that it would take both ways.

In the National Park area Director Ruíz de Larramendi, in accordance with the General Secretary of Environment (Luís Muriel Gomez) and the Environmental Minister (Isabel Tocino), had given the order that the walls and the floodgates should be reinforced using the park's machines and vehicles. By then it was clear that an important number of floodgates linking the National Park with the Guadiamar River were not in working order, which meant that the contaminated

dam water would penetrate into the park territory. At noon this directorate considered the possibility that the flood would most probably enter the Entremuros Channel, so all machines at their disposal were sent to the area of Cangrejo Chico where the walls of the irrigation dam separate the National Park from the Natural Park. The reinforcement of this wall would become an important protector for the National Park territory, when the water would reach that area a few days later.

Meanwhile the staff of the DGJA and the Natural Park also began considering how to control the flood. While all of the available personnel from the National Park and the JA worked on closing off all channels from the Guadamar, the technicians from the Natural Park suggested at around 10:30 am to the DGJA Emergency Committee, that the water (which was getting closer to the Natural Park territory) should be retained in the Entremuros Channel area. The CHG was requested to consider this proposal, but the suggestion was subsequently rejected. This negative decision was made by the CHG board, which had the DGJA emergency committee's support, since at that time the best solution was regarded as letting the contaminated water reach the Guadalquivir River in which it would be diluted. This measure, which was later reconsidered and modified in the crisis management strategy, delayed the preventive actions. Not until seven hours later, at 5:30 pm, was the construction of the wall at Vuelta de la Arena initiated. By then the flood had already been running in the Entremuros Channel and was heading for the Guadalquivir River. This decision was delayed due to the controversy between the operational decision-making level at which the Natural Park staff was situated, and the DGJA's committee and the CHG at the strategic level.

The construction of the protective wall at Vuelta de la Arena, which was initiated by the JA on Saturday afternoon, was meant to hinder the velocity of the residual water and to deviate its course to the Aguas Mínicas' Channel, as a means of controlling it. The Entremuros Channel was considered to be the fastest way of getting the water out to the Guadalquivir, since it is a kind of shortcut to this river. It was also considered the most appropriate area for controlling the flood, since the walls, which line the Entremuros Channel,¹³ are typically used as roads and are solid. The technicians of the CHG decided that the Vuelta de la Arena wall should have two outlets, one on each end, through which the water could escape to the channel.

The Vuelta de la Arena Wall Bursts

On Sunday morning, when the water arrived, however, the wall was not able to resist the pressure and burst. With or without outlets, the decision to construct the wall was made too late, thus, building a solid resistant wall was not accomplished

¹³ *Entremuros* means "between the walls" in Spanish.

in time. Despite efforts to stop it, the continued flow of the residual water (although with reduced velocity) was received with consternation. Would the flood follow the course of the channel as hoped? Vehicles from the National Park as well as from the JA were still working to obstruct the floodgates and to reinforce the walls, preventing filtration and guiding the flood.

At around 6:00 am it was clear that the operation had succeeded and that the contaminated water was now running through the Aguas Mínimas. In addition, the amount of water and the velocity of the flood was at this time considerably reduced, which would help facilitate its management. During the day, the obstruction and reinforcement activities in the Entremuros area, limiting the Natural Park territory, were continued. The construction of a third wall north of the area called Cangrejo Grande was initiated as a means of protecting the Natural Park territory. The idea of letting the water out to the Guadalquivir through the Aguas Mínimas Channel was advocated by the CHG, the National Park Board and the JA.

The Tide Rises

Around noon the tide from the Atlantic started raising the water level in the Guadalquivir and subsequently in the Brazo de la Torre and in the channels linking these, as well as in parts of the National and Natural Parks, which are essentially wetlands that flood every time the tide comes. There was a rather high risk that the constructed and reinforced walls protecting the park areas would not resist the pressure from the tide – ocean water at that point would have mixed with the residual water. It was decided to keep up the work and to put forth the biggest effort possible in waiting for the retirement of the tide. This decision to persist, on behalf of the people working to save the park territories, resulted in the fact that only small parts of the park were flooded by the tide. It was the highest tide of the year thus far and in parts the water level surpassed the floodgates, although most of the reinforcements were strong enough to resist the pressure.

The tide was expected to recede at around 6:00 pm. The technicians from the Andalucian Junta (JA), from the National Park and the CHG considered that the tides force would serve the purpose of drawing the residual water with it into the Guadalquivir, bringing it into the Atlantic where it would be diluted and less toxic. The velocity of the flood was, by then, considerably reduced and the remnants of the residual water that were still running in the Aguas Mínimas Channel, continued their course into the Guadalquivir. The construction of the wall north of Cangrejo Grande was not finished on time and thus the flood entered this part of the Natural Park territory. Measures were taken to minimise the flooding in this area, by reinforcing yet another wall between the Channel of Aguas Mínimas and Cangrejo Grande. Even though this area had been flooded, it was finally retained behind the protective walls.

Expert Recommendations

On Tuesday morning the majority of the residual water was found trapped in the area of Cangrejo Grande, although some of it was still running through the Aguas Mínimas Channel. The flood was considered to be under control, which permitted the different actors to appreciate a wider panorama of the situation. The affected areas (which extend over more than 4000 hectares) along the Río Agrío and Guadiamar Basins had been transformed into a new landscape. Hundreds of meters of riverside, soil, farmland, plants and trees were covered by black mud, surely a desolate view. Considering the fact that the mud and the water were residuals of mining activities, it was at an early stage defined as environmentally harmful, both to humans and to the rest of the natural environment. One of the early decisions deriving from this problem framing was to take samples of the water and the mud deposited in the Guadiamar basin. These were taken and analysed by the JA and by staff members from the National Park as well as by several environmental NGOs like Greenpeace and WWF/Adena.¹⁴ Samples indicated high levels of lethal metals (lead, cadmium, zinc, manganese, arsenic and copper) in both water and mud, and decreased pH levels in the water.

The environmental character of the accident generated the formation of two expert committees, which included experts from various disciplines in the natural sciences. The first one was formed on April 28 after a petition from the Environmental Counsellor of the JA, while the second one – the CSIC – was formed on behalf of this committee in Madrid on Wednesday 29. The results from the different water samples pointed to one of the immediate recommendations of these committees; the water still running in the Aguas Mínimas Channel should be stopped, since this water contained abnormally high levels of lethal metals and would contaminate also the Guadalquivir and the Atlantic. The CSIC report was published on Wednesday 29 but no measures were taken to respond to these expert opinions. The JA, the National Park Board and the Hydrographic Confederation (CHG) acted non-decisively marked a kind of ‘non-decision’ in the crisis. It was not until Friday May 1, when the inter-administrative Coordination Committee (CC) was formally constituted, that the decision was made by this entity to close the Channel of Aguas Mínimas and to retain the water covering 1,200 hectares in Cangrejo Grande. By then thousands of cubic meters of water had already been permitted to reach the river and the coast.

The initial plan of simply letting the water flow, and in a way letting it drop from the response agenda, had to be reversed in the face of expert recommendations. Otherwise the situation would have become politically unacceptable. This decision and measure, however, forced the national administration and the Andalusian Junta – which were by then working as a team

¹⁴ The NGO Adena in Spain is associated with the World Wide Fund (WWF).

in the inter-administrative Coordination Committee (CC) – to consider the best way of taking care of this water; just as they had to find the way of taking care of the 2,710 hectares of mud covering the basin. The expert committees would have an important influence in these decisions. Here it is apparent that the major pressure on the strategic decision-makers was transferred from the technicians to the environmental experts, since the crisis was in the second phase which had a much stronger environmental dimension than the acute phase. Although the acute phase was also perceived in environmental terms, the technical problem of controlling of the flood was initially bigger. The regional and national authorities were still, however, forced to rely on expert opinions, due to the complexity of the situation.

Risk of Contamination

The subsequent decisions made by the central actors followed this pattern of dependency upon expert opinions. These decisions concerned the clean-up process, which was of high political importance.

The thousands of hectares covered with mud and the 1,200 hectares of retained water in the Cangrejo Grande had to be taken care of and as soon as possible, considering the risk of leakage and subsequent contamination of the groundwater and soil. The time aspect was also kept in mind; the 4,200 hectares that were affected had to be cleaned up before the autumn rains, which usually start in October and often provoke flooding along the rivers. This could mean another threat to the land and park territories; if mud and retained water were still present, it would then mix with the rain and enter the area. Water, as well as oxygen, in contact with these displaced lethal metals, also produces chemical reactions that further contaminate the soil and the ground water. The samples of retained water in Cangrejo Grande showed on May 2 high levels of lethal metals and a low pH level. This contaminated pool of water was also considered by environmental experts in the different commissions as extremely harmful to the bird populations in the area and to the drinking water. Furthermore it was considered dangerous to eat fish from this area.

Following the recommendations of the CSIC expert committee, the CC decided to start removing the mud on Sunday, May 3. Together with Boliden Apirsa, it was agreed that the mining company, using its own personnel and machinery, should be responsible for the clean up from the tailings pond down to the bridge of Sanlúcar La Mayor. The company would then hire the companies EGMASA, TRAGSA and DAP¹⁵ to remove the mud from this point down the Guadiamar to Villafranco

¹⁵ EGMASA [Environmental Management Company], TRAGSA [Agrarian Technology and Services] and DAP [Agricultural and Fishing Development] are Spanish-owned and Andalucian-owned companies dedicated to environmental and agrarian management. Boliden Apirsa hired these organisations for the task of removing the mud.

del Guadalquivir River. The agreement with Boliden Apirsa also included that the mud removed should be deposited in the mine's old open pit.

When the removal activities started, all of the available personnel from Boliden Apirsa were engaged. The removal started out with approximately 50 machines and some 100 individuals. During the first month of work the number of tractors, excavators and trucks and personnel were duplicated, in order to accelerate the rhythm of removal. By June 3 almost 300,000 cubic meters of mud (approximately 15% of the total volume) had been removed and transported to Boliden's old pit. During the summer the number of workers as well as vehicles was constantly increased, reaching an average of 500 persons a day, working manually or with the machines. By the end of July there was likely not a single truck in all of Spain that had not been involved in transporting mud from the Guadiamar Basin to the old Boliden mine. In spite of this, the companies hired to accomplish the task claimed there was a lack of appropriate vehicles (El País, 28 July 1998). This problem was reported to delay the work, since new vehicles and more personnel were continuously incorporated. Vehicles were therefore hired from Portugal and from Eastern Europe (Ibid.).

Entrance to Private Property Denied

The removal of mud was suddenly hindered in the middle of May, when some farmers in the affected area denied the vehicles' entrance to their property. They feared they would not be later compensated for the damages if the 'evidence' (i.e., the mud) was removed (El País, 13 May 1998). This prompted the Subdelegate of the national government in Seville, Andrés Herranz, to claim expropriation of the affected land in order to speed up the work (El País, 12 May 1998). His claim coincided with the presentation of an environmental project, "The Green Corridor" by the JA Environmental Counsellor Blanco with the support of the Environmental Minister Tocino. Counsellor Blanco emphasised the need for abandoning agriculture in the area in order to recover the environment quickly, which could mean expropriation if the involved landowners were opposed to selling (El País, 17 May 1998). These menaces were formalised in a decree promulgated by the Presidential Council of the Andalusian Junta (JA) on June 9, regulating exceptional measures in the acquisition of private land affected by the accident, as a means of cleaning up the area. These exceptional measures implied buying land from the owners or by expropriation if necessary (Presidency of Andalusian Government Decree, 9 June 1998) and offers to sell were received at the JA Agricultural and Fishing Council (Coordination Committee for the Recovery of the Guadiamar Basin, 10 June 1998). In October, 35 selling offers had been presented, including approximately 300 hectares of affected (Coordination Committee for the Recovery of the Guadiamar Basin, 10 June 1998). No expropriations were formally reported.

The Pool of Water in Cangrejo Grande

In the Cangrejo Grande area, the retained pool of water had to be removed. The CSIC expert commission recommended already in their first report that this water had to be treated in order to augment the pH level and so that the water would precipitate and the lethal metal sediment could then be easily removed. The recommendations regarding the allowed level of acidity in the water were, however, not followed by the Andalucian Junta (JA) nor by the national administration (i.e. a decreased pH level). It was not until one month after the accident, on May 25, that the Coordination Committee (CC) decided to act upon the reiterated recommendations from the CSIC, the JA expert commission, the Hydrographic Confederation of the Guadalquivir (CHG) and the Geomining Institute (ITGE); these recommendations included treating the water chemically in order to pour it into the Guadalquivir River. On June 7 the CHG designated the task of purifying and releasing the water to the School of Industrial Engineers in Seville. This was to be accomplished by neutralising the zinc in the water with sodium carbonate and by passing it later into a dam to be let out through the Aguas Míminas Channel. This dam had to be constructed, a project which was decided by the CC on the June 15. The Environmental Ministry decided ten days later, while the water was treated and the dam was being constructed, that a purification plant was also to be constructed, in which the contaminated water was to be treated chemically and biologically before letting it into the river. The first treated water was released on July 24, only after the approval of the JA on July 21. The released water had to conform to the environmental legislation that regulates the allowed levels of sulphates in the Guadalquivir River. Since this was not possible to accomplish, the allowed level was augmented. Four days later the trapped water was released and the purification plant was inaugurated on August 10.

The results from the water and soil samples also generated some administrative decisions. The JA Council of Agriculture and Fishing dictated an order on May 5 that prohibited any agricultural activities in the affected area, so that the consequences of the accident could be properly evaluated. This order was followed by another on May 13, concluding that all fruits and vegetables in the area were to be collected and destroyed. Meanwhile the JA Health Council recommended all of the affected municipalities to see to it that all of the areas being cleaned be carefully watched, in order to prevent any particles from getting in contact with the contaminated mud. This was considered a matter of security, of which several police institutions were in charge; the local police, the Andalucian police, the National police and the civil guard were all dealing with this task. A recommendation letter was also sent to all of the affected municipalities by the Coordination Commission, in which it was strongly recommended to abstain from consuming water from any of the sources in the affected area (El País, 15 May 1998).

Chapter 6

Analytical Patterns

The management of the Doñana crisis has revealed several outstanding aspects of interest to this investigation on how difficult situations are responded to by different actors. The methodology outlined by Sundelius, Stern and Bynander (1997; Sundelius, 1998) suggests the highlighting of several trends that are commonly found in different crisis situations in order to help facilitate comparison with other cases. From this range of analytical points, I have chosen those which appeared most appropriate in the Doñana crisis. These eight analytical points are discussed in the following sections.

Decision Units

The particular character of a crisis situation, as an abnormal state of events for the different actors involved, often requires a particular management of the situation. Decisions are generally to be made under great time pressure, for which normal channels of communication and the normal decision-making structures may be insufficient. In many institutions, whether public or private, emergency plans and routines exist that address the importance of 'who is in charge.' These can work as planned or not; the first question to be posed is, thus, what happens to the decision-making process during a critical moment?

In the Doñana case we find several decision-making units during different phases of the crisis, of which some were 'normal' and others *ad hoc* constellations. The first day after the leak from the dam, anyone that had any interest in avoiding exposure to the invading flood was intervening more or less on-the-spot on their own initiative. That is, there were no formal decisions made by any authority to prevent anyone from acting. There was one common purpose – to save the valuable land – which inspired people from the entire area to work side by side. Those helping were employees at the National Park, farmers, farming employees, employees at the Natural Park, technicians, police forces, fire brigades and residents from the nearby villages in the area. On the other hand, the non-decision to avoid interfering with this spontaneous help may indicate a lack of organisation and a lack of preparedness for emergency situations on the part of the authorities.

A distinction can be made here between the decision units 'in the field of action' (i.e. those working in the Doñana area during the crisis situation) and those acting in their administrative roles in Seville or Madrid. The different levels

of crisis response have been categorised as occurring at an operational level and/or strategic level. The actors belonging to the latter are often defined as top-level decision-makers like politicians, while the actors defined as belonging to the former are typically agencies concerned with implementing policies (‘t Hart et al., 1993:19-20).

The initial decisions made during the acute phase in this crisis management were accomplished at the operational level (meaning on the spot) in trying to control the flood. This situation was reverted quite soon though, when the first Emergency Coordination Committee was created in Seville on Saturday morning. The decision-makers on the strategic level formally took command, but their decisions actually followed recommendations from the people ‘in the field.’ While the actual flood was the main threat, the technicians were the actors at the operational level who had the most influence in the decision-making process. Once the flood was stopped and situation was under control, the locus of influence on this process was passed on to the environmental experts, who became the central actors in determining the direction of the crisis management.

There were territorial administrative factors in this case that were also significant in the decision-making process. The Boliden mine and the affected area are located in the Andalusian territory and more precisely within the province of Seville. While Boliden Apirsa is a holding of a Swedish-Canadian company, its activities are bound and regulated by Spanish and Andalusian legislation. The National Park of Doñana is under the jurisdiction of the Spanish National Administration and belongs to the Ministry of Environment. Also the Guadalquivir River and all water sources in this basin are under the jurisdiction of the National Government and are the responsibility of the Hydrographic Confederation of Guadalquivir (CHG). On the other hand, the outskirts of the National Park and parts reaching the Guadalquivir river are considered to be formally part of the Natural Park of Doñana, which is a low-grade protected area. The Natural Park is under the jurisdiction of the Junta of Andalusia and its Environmental Council. The rest of the affected area is private property located within several different municipalities. These territorial administrative relations meant that a relatively large number of important actors were involved in the decision-making process. It also explains why this process during the first week consisted of two processes, which were not united until five days after the accident, through the establishment of the Coordination Commission (CC).

On the one hand, the National Administration was represented by the National Park Board and the CHG. Within the park administration the Director, Ruíz de Larramendi, continued to dictate the actions within his means. One of his superiors from Madrid was at that time in close proximity to him so that Ruíz de Larramendi had the opportunity to make direct consultations and get immediate approvals. This superior was the Environmental General Secretary, Luíz Muriel Gomez, who had coincidentally been visiting the region and had actually been sleeping at one of the

old royal palaces in the National Park¹⁶ the night the accident occurred. Ruíz de Larramendi could immediately get his orders confirmed by Muriel Gomez and he also had open communication with the Environmental Minister Isabel Tocino via Muriel Gomez. This fortunate coincidence can be contrasted with one of the Swedish submarine-hunting incidents in 1982, when the Minister of Defence, entering the newly-elected Government, was impossible to reach for more than 24 hours due to the fact that telephone lines were under repair (Bynander, 1998:74-75).

The Spanish Environmental Minister was informed early on Saturday morning and travelled to the area in the afternoon. Her participation in the decision-making process was rather modest. In fact, the Environmental Ministry declared during the first day that the whole accident was beyond its jurisdiction, unless the toxic water entered the National Park. This declaration was something Minister Tocino was later harshly criticised for by the Spanish Congress in Madrid and by the Andalucian Junta (El País, 28 April and 8 May 1998). The National Park did face a concrete threat of being contaminated and the central administration was obliged to act through its different institutions. The board and the technicians of the CHG constituted the other decision unit from the central administration that was on site early. As the organisation responsible for the Guadalquivir riverbed, their presence was important since the first idea was to lead the residual flood out into this river. This gave them more weight in the moment of decision-taking as was, for example, evident when guiding the flood into the Entremuros Channel.

An important feature of decision-making processes in crisis situations is where the decisions are made in a hierarchical structure. The thesis of centralisation holds that an upscaling in the decision-making process is produced. This means that the decision-making moves higher up in an organisation as a crisis evolves, be this in an *ad hoc* fashion or by a formal process ('t Hart et al., 1993:12-45). The centralisation feature can develop in different terms, of which one can be territorial administrative, where there is a concentration of the national government's authority vis-à-vis the regional or local administrations. It can also signify a shift upward in authority within a particular organisation or institution. This was, for example, the case in the Halland Tunnel case in Sweden where the decision authority in the construction company Skanska was quickly moved up to a higher level in the organisation (Kärde, forthcoming). This was also the case with the Boliden Company in their management of the dam accident. At first the decisions were made locally at the Los Frailes mine, while after a couple of days the Swedish subsidiary took charge and finally the decision-making was moved to Toronto, Canada, where the main headquarters are located (Interview with Åke Nilsson, 17 August 1998).

¹⁶ The territory that today is declared the National Park was historically a place for the Spanish aristocracy to hunt deer and wild boar. There are buildings in the park which date back to from the 16th century. Nowadays these buildings are used as guesthouses and as a conference hall.

On the other hand, there are studies that give evidence of a contrary process in decision-making, namely the decentralisation of decision-making (‘t Hart et al., 1993:12-45). It is interesting to note that the decision-making process in the Doñana crisis was rather decentralised, due to the territorial administrative features of the crisis and to the specific political culture characterising Spain. This latter feature will be developed within the discussion on political and institutional competition following. The decision units during the first days of the crisis were distributed quite equally between the national and regional administrations. In fact, the constitution of the Inter-administrative Coordination Commission on Thursday, April 30, explicitly stated the distribution of powers in the decision-making during this crisis.

Another indication that a decentralisation process took place within the national administration is suggested by the fact that the decisions were made in Andalucía, not in Madrid. Neither the Spanish Prime Minister Aznar, nor his government, were ever involved publicly in this crisis, which indicates that this was only a national and international crisis in terms of public opinion, not in at least direct political terms. Further the virtual absence of Minister Tocino (except for her symbolic visit to the affected area on the first day where she is seen evaluating the panorama and meeting with responsible figures in the crisis management) strongly indicates that she had delegated responsibility for several decisions to the General Secretary Muriel Gomez and the National Government Delegate in Andalucía (Andrés Herranz). Although the ultimate responsibility was formally that of the Environmental Minister, there was on her part a kind of delegation of authority to the lower level, which can be seen as a kind of downscaling or as a non-decision (Ibid.,1993:25-26). Similar examples of this decentralised crisis response occurred during the Sudavik snow flood in Iceland in 1995, where the Icelandic Prime Minister declared the importance of not intervening with the emergency plan of the National Civil Defence, which was working at a steady pace (Bernhardsdóttir, forthcoming).

The fact that the Spanish Minister Tocino on Sunday afternoon, a day and a half after the accident, declared “Doñana was saved” (El País, 27 April 1998; Svenska Dagbladet, 27 April 1998) illustrates her stance that the crisis was, from that moment on, a problem exclusively for the Andalucian Junta, even though she also promised they would receive the support of the national government. The delegation of powers can have been partly motivated by the Minister’s attendance at the Kyoto Act meeting in New York a few days later. However, if the crisis had been perceived as one of greater magnitude to the Minister, then she would have given it higher priority, which leads me to believe that this decentralisation tactic was used as a crisis management strategy on her part.

On the regional arena, the formal decision-making unit was constituted at the headquarters of the General Delegation of the Andalucian Junta (DGJA) in Seville on the first day of the accident. The Boliden mine and the accident area are located within the territory of the province of Seville, and thus this delegation was assuming

direct responsibility. The Head Delegate of the Junta in Seville, José Antonio Viera, assumed the task of gathering his colleagues in the DGJA and individuals related to this problem (Interview with Juan Martínez Troncoso, 26 August 1998). At the DGJA headquarters in Seville, in the Pabellón de Cuba, a meeting was summoned on Saturday morning including the Head Delegate Viera, the General Director of Community Issues of the JA, and various government and ministry delegates (Environment, Agriculture, Health, Labour and Industry). The mayors of the affected municipalities (Aznalcóllar, Aznalcázar, Sanlúcar La Mayor and Villamanrique de la Condesa) were also asked to join. They decided to create an Emergency Coordination Committee and to proceed immediately with some urgent measures. This committee was constituted in an *ad hoc* fashion, which is quite normal under crisis situations (Stern, 1999). Representatives were gathered from different delegations within the Sevillian administration in order to allow decision-making to occur in a more flexible manner. Decision-making occurred at the provincial administration level during the first days of the crisis, embodied in the DGJA of Seville, although in constant contact with the Andalusian Junta. On Tuesday 28, however, an up-scaling in this process was effected when the Governmental Council of the JA constituted an Emergency Cabinet. In this cabinet various Counsellors of the Andalusian administration were represented. This up-scaling culminated two days later when, on Thursday 30, the national and the autonomous Andalusian administrations agreed to unite forces and work together in the Coordination Commission.

Regarding decision-making at the Andalusian level, the authority was gradually centralised, starting from the Sevillian administration and reaching the Councils of the Andalusian Junta (JA) and the representatives of the national government within less than a week from the accident. This centralisation process culminated with the constitution of the Inter-administrative Coordination Commission on April 29, which was presided over by the Andalusian President Chaves, together with the Environmental Minister.

This commission was created between the national and autonomous administrations, and upon which the Coordination Committee depended. It was co-ordinated by a delegate of the national government in Andalusia (Andrés Herranz) and the Head Delegate of the JA in Seville (Antonio Viera). This commission assumed decision responsibility on Friday 30 and the committee conducted the crisis management in executive terms from then on. By then the flood was retained in the Entremuros Channel and the risk for further flooding was considered to be over. It can be tempting to see the establishment of a commission between different government levels as a rational way of cooperating and of managing a crisis, not least in a Swedish context in which the consensus model is normative. However, studies of crises give evidence and confirm that rationality, consensus and cooperation are seldom features of crisis situations, which gives us reason to consider other aspects of decision-making strategies

(see for example: 't Hart et al., 1993:12-45; Sundelius, Stern with Bynander, 1997; Hermann and Hermann, 1982). One of the reasons for creating this commission could have been to build a common front against the criticism being voiced by mass media and the different ecological organisations on how the crisis had been managed thus far by the different administrations. The Coordination Commission continued their efforts in cleaning up the area and organising the basin.

Experts

Similar to the case of the Halland tunnel, the Doñana crisis turned out to be highly technical and required expert opinions, as was discussed in the previous chapter on decision occasions. It is rather common that decision-makers refer their decisions to expert opinions, which legitimise the decision as one based on what is called "objective knowledge," without pointing out the degree of subjectivity and interpretation implicit in science (Sundelius, Stern with Bynander, 1997:198-199). As providers of necessary information, specialists can sometimes be transformed into *de facto* decision-makers, as was evident in the aforementioned Swedish case (Kärde, forthcoming). In her study on the Halland tunnel, Kärde makes a distinction between "in-house" experts and "outside" expertise (Ibid.) in reference to the specialists' organisational position.

This was also a salient feature in the Doñana crisis, given the wide range of specialist organisations present. The "in-house" experts were represented by the administrations of the National and Natural Parks, which were composed largely of environmental specialists (from board members to guides and park guards) and by the Hydrographic Confederation (CHG) where technicians and engineers in hydrology were most prominent. These were the actual decision-makers at the operational level during the acute phase of the crisis and had the political decision-makers' confidence to accomplish this. They were also agency employees, and thus it appears logical that they kept in line with the interests of their respective institutions, although this is not always necessarily the case. Among the "outside" experts were several national and transnational ENGOs,¹⁷ (among others Greenpeace) which were on the spot from the first day following the events. They voiced severe criticism on how the situation was being managed and emphasised the environmental consequences of the accident. Many of the world's ENGOs together exert significant influence upon the decision-makers, also under "normal" circumstances. This is indeed so, considering the mass media attention they are given and the growing importance of environmental issues in general in the world during the last decade. The ENGOs, like Greenpeace for instance, are thus powerful social actors without exercising any decision-making power themselves.

¹⁷ Environmental Non Governmental Organisations

Finally, among the experts were the different commissions of scientists, who had been brought in to satisfy the decision-makers' need for reliable information. Since there was water and mud containing high levels of lethal metals and chemical substances that would affect the environment and subsequently all organic life (both in the short-term and long-term), the complex character of this environmental crisis gave the experts a prominent position in the crisis management. The commission from the prestigious research institute, CSIC in Madrid, gathered on an initiative by the institute's president, César Nombela, and put itself at the Government's disposition. Prior to this, the Environmental Councillor of the JA had asked for a scientific committee, which was also created in Seville on Tuesday, April 28, and was composed of scientists from different universities and institutes. No doubt the recommendations made by these scientific experts had great influence on the decisions made by the administrations. The Boliden Company had their own environmental staff in Sweden, but also chose to hire external expertise from Spain, Sweden and other countries in order to determine the causes and consequences of the accident (Interview with Åke Nilsson, 17 May 1998; Svenska Dagbladet, 22 November 1998).

Problem Framing

It is common in crisis situations that the initial statement of what is perceived as the problem sets the stage for the subsequent management of the events (Stern, 1999). In the best of cases the statement is based on an insightful understanding of the situation, but there are also cases in which the initial statement was made based on ill-founded information. The characteristics of a crisis – time pressure, uncertainty and threat to important values – are inherently inviting to hasty and non-reflective decisions. Such was the case in the Hårsfjärden submarine incident in the Stockholm archipelago in 1982, when the initial management of the perceived intrusion was mainly guided by the previous submarine chasing experiences in Swedish waters (Bynander, 1998: 52-90). Other examples illustrating the importance of the initial problem framing are found during the European mad cow crisis in 1996 (Grönvall, 1998) and in the Halland tunnel crisis 1997. In the first case the initial determination of BSE¹⁸ as exclusively an animal disease, without recognising the potential threat it had for human health, national economies and the EU principle of free movement for products within the union, had important implications for the evolution of the crisis management (Grönvall, 1998:240-285). In the Halland tunnel crisis, the first measures taken were decided in light of a

¹⁸ Bovine Spongiform Encephalopathy (BSE), or as it is referred to in the media the “Mad Cow Disease,” is a fatal disease which is suspected to be transferred from cows to humans (see Grönvall, 1998; Grönvall, 2000).

perceived workplace environment problem, without also considering the situation as threatening for the residents and the environment (Kärde, forthcoming).

In the Doñana crisis, the different initial framings of the problem were set simultaneously by the different actors. The night guards at the Los Frailes mine perceived the immediate threat as one against the people living downstream from the dam, because of the huge amount of water that was contained in the tailings pond. When they informed the Guardia Civil in Aznalcóllar, the GC proceeded to evacuate these residents as a first measure, indicating their initial problem framing was one of security. It was difficult for them in the middle of the night to estimate the actual situation accurately as it was dark and thus they proceeded to act according to the perceived ‘worst possible scenario.’

The farmers along the Río Agrío and the Guadiamar, without having any accurate information as to what substances were really in the muddy water, deduced it must be toxic since it left black water and mud on the river shores, the rice fields, the fruit trees and the sunflower fields. It was a powerfully desolate image. For the rice, the cotton and the sunflower farmers, their harvests were threatened by the flooding. The fruit producers saw the stems of their fruit trees painted in black mud. Some of the trees were even covered in mud, and they quickly realised that this was bad for their expected production. The farmers’ initial reaction was thus to close off all of the floodgates leading to their farmland further down the river, in order to protect it.

A couple of hours after the actual rupture of the dam, the Guardia Civil communicated with the CECEM in Seville. They had obtained information about the composition of the water released from the dam, which indicated high levels of lethal metals and that the water was extremely acidic due to its low pH level. This set the character of an environmental catastrophe to the actors involved.

The staff of the Natural Park and the National Park were informed of the events from different sources. The National Park Director Ruíz de Larramendi received a call from a national government delegate (Herranz) who is by profession an industrial engineer. Knowing the origin of the muddy flood, Mr. Herranz immediately realised the negative consequences this could have on the environment, and in particular on the protected areas. On the other hand, the people working at the different parks were mainly technicians with some environmental or natural science background. Therefore, they quickly framed the problem as an environmental one and viewed it as a threat to the ecosystems in the area. Their thoughts were short-term in that their immediate actions were aimed at protecting the land and deviating the flood, at first toward the Guadalquivir River. This environmental problem framing during the acute phase was however, interwoven with Herranz’s perspective as an engineer. The flood had to be stopped, in order to avoid further contamination, but this had to be accomplished with the help of technical solutions such as building protective walls and obstructing the floodgates. Implicit in this was a long-term perspective that the lethal metal contamination of

the soil and the water would further contaminate the fish and bird populations in the food chain. This slow process would be very difficult to reverse once the damage was done.

The Emergency Cabinet of the DGJA in Seville had a wider perspective on the accident. This *ad hoc* committee took some early measures, such as ordering the vigilant control of the riverbanks, controlling consumable products and potable water (which could be contaminated), and contacting the agricultural organisations. These early measures indicate that these decision-makers also framed the problem in economic and in social terms, not only as an environmental accident. Perhaps the inter-delegational composition of the cabinet contributed to this insight of the problem's complexity. Their conclusions, however, were still based on assumptions that the water and the mud from the mine dam were highly toxic, without having any confirmed information of this.

The different ENGOs were quick to state that this was the worst environmental catastrophe in the history of Spain (El País, 25 and 29 April 1998; Svenska Dagbladet, 16, 27 and 30 April 1998; Svenska Dagbladet, 8 May 1998), and the European mass media was eager to sell the news of a catastrophe. The enormous area covered with black mud only accentuated this portrayal, together with the huge amount of dead fish and crabs found in the residual water. This image of the accident contributed to its transformation into a national environmental catastrophe. Administratively, the problem was located under the Environmental Ministry in Madrid and the Environmental Council of the JA, which also tells us something about the framing of the problem. The Ministry in Madrid, however, was only present until the moment that the National Park appeared to have been spared from flooding. Minister Tocino declared that the park was saved and from then on it seemed to have been reckoned a regional problem to deal with for the Andalusian administration (JA). This optimistic statement illustrates the different perceptions of a crisis; although the mass media contributed to creating a national catastrophe, the central administration considered this to be a matter to be resolved at the autonomous level.

Water and soil samples were not taken until Saturday afternoon. These were taken from the residual water and mud and also from further down the river where the flood had not yet reached, in order to evaluate the normal metal levels in water and mud to those from the flood. These samples were supposed to confirm the assumptions that this was an environmental catastrophe, which they more or less did. Lethal metals such as lead, cadmium, zinc, manganese, arsenic and copper were found in different, but high, concentrations according to the place and the time of the sample. The findings are common to mining activities and thus they were considered to be from the Los Frailes mine.

The subsequent management of the Doñana crisis was conducted in accordance to the initial problem framing of the situation as an environmental catastrophe. By accepting this problem framing, the crisis managers were able to help minimise the ecological consequences of the crisis.

Value Conflicts

The initial problem framing exemplifies the existence of value conflicts in this crisis. The crisis was defined as an environmental catastrophe and the most important efforts were invested in saving the National Park. The farmers in the affected area voiced their discontent with respect to this focus of attention, as they considered themselves to be the most affected: their harvests were ruined, the soil was contaminated and the groundwater used to irrigate the fields was contaminated (El País, 28 April 1998). This conflict was again apparent when the Green Corridor project was presented and the landowners in the Guadiamar Basin were threatened with expropriation of their land from the Andalucian Junta (JA) if they were unwilling to sell. For the JA this ecological project was undoubtedly a political priority on behalf of the farmers in the area.

During the acute phase of the crisis management there was another value conflict between the administrations of the National and the Natural Park. The National Park disposes of important machinery for maintaining the park territory, due to its status as a National Park. The surrounding Natural Park, though, does not have the same infrastructure to maintain their territory. During the acute phase of the crisis, when the flood was threatening both park territories, the staff from the National Park gave priority to reinforcing floodgates and constructing protective walls around the National Park territory. This meant in some occasions that machines passed Natural Park territory, but without detaining and helping out the staff of the Natural Park and the JA (José Maria Perez de Ayala, 25 August 1998). This “tragic choice” indicates a difference in values, whereby the National Park staff considered this protected area more important to save than the Natural Park; an opinion apparently shared by the Spanish Environmental Ministry. A similar situation of choice was also produced concerning the farmers. What was to be saved in the first hand: the environmentally valuable park territories or the farming land? It stood clear that the authorities (the regional as well as the national administrations) would give priority to saving what was within their jurisdiction – the park territories. The use of the available machinery clearly indicates this. For the rest, farmers had to manage on their own, which they did rather successfully. Afterwards the farmers complained, however, accusing the authorities for neglecting their needs (El País, 28 April 1998). The issue of contradicting values, priorities and subsequent rifts in confidence has parallels with the situation in the Red River floods in Canada in 1997 (Svedin, 1999). In this case the emergency management organisation decided at one point to seal one dike and build another in order to keep the water out of the city of Winnipeg. This measure unfortunately increased the water masses in other parts of rural Manitoba, which provoked strong reactions among the rural residents. They felt that they had been sacrificed for the sake of the city and questioned what they viewed as the authorities prioritisation of urban residents.

Political and Institutional Competition

Implicit in this analysis thus far is the fact that the political and the bureaucratic cultures in Spain are different to that of Sweden. The Swedish Government and state organisations generally aspire to reach consensus in crisis management or at least try to avoid publicly displaying institutional competition and conflict (Sundelius, Stern with Bynander, 1997:150-157). As Eric Stern notes in his analysis of the Swedish management of the Chernobyl crisis, the public administrations that compounded the decision-making units in managing this nuclear accident strove for institutional consensus rather than overt conflict (Stern, 1999:186). However, the Halland Tunnel case was in part an exception to this Swedish tradition. During the Halland crisis, there were two levels of political negotiation: the local and the national levels. On the local level, the municipal leading body pursued a cooperative strategy which implied including the political opposition in the decision-making process and thus reaching a consensus. On the national level, however, the opposition was more or less ignored which resulted in hard criticism from the political opposition regarding the Governments' crisis management (Kärde, forthcoming). The case of the Lima crisis (1996-1997) where hundreds of people were taken hostage by the MRTA guerrilla command at the Japanese Ambassador's residence in Lima, Peru, entailed a complete of political consensus building. Here the Peruvian President, Fujimori, managed the crisis essentially on his own and excluded all opposing opinions from the decision-making process (Ullberg, 1998:163-203).

It is clear that any event in a particular country or region will be managed in accordance with the local culture, which was exemplified above. Likewise the cultural context (the Spanish as well as the Andalucian) shaped the response in the Doñana crisis. The goal for political consensus is not a highly-regarded value in Spanish political culture. The distinctiveness of the administration in Spain generates recurring political conflicts between Madrid and the rest of the country. This has to do with the different categories of autonomous communities in combination with national and autonomous constitutions, which offer a lot of room for interpretation. When the different governmental organisations are of different political affiliations (like in this case) things tend to get even more complicated. In 1998 the Popular Party constituted the national government, while a socialist (PSOE) majority governed the autonomous Junta de Andalucía.

During the Doñana crisis, the political affiliations seem to have influenced some of the crisis management measures taken, at least during the acute phase. The mass media reported on disagreements between the different political parties and between the national and regional governments on issues such as which administration was really responsible for the crisis management (El País, 28 April 1998). Different political representatives were eager to use the accident as a weapon in the political discourses. Further, a large degree of the politically-coloured

criticism was raised in the search for a scapegoat and of finding someone to blame for the actual accident, posing the rhetorical question “How could this happen?” (Newlove, Drukis and Tribis, 2000). In this discussion several political representatives took part, in accordance to their party affiliation, such as the General Secretary of the Popular Party (PP) in Andalucía who defended the heavily-criticised Environmental Minister for her absence on the scene (Ibid.) In the Andalusian Parliament there was a debate on whether or not to create an investigation commission in order to determine the causes of and responsibilities for the accident. The issue was divided between the governing Socialist Party (PSOE) and the Andalusian Party (PA) on the one hand, who defended the measures taken by the Junta, and the opposing Popular Party (PP) and the United Left (IU) on the other, who criticised the governmental actions (El País, 13 May 1998). Various other politicians were also present at a demonstration held in Seville on May 19 (organised by local ENGOS and different syndicates), where the resignations of the Environmental Counsellor of the JA and the Environmental Minister were demanded (El País, 20 May 1998). Darts were thrown in this political blame game but did not obstruct the acute phase of the crisis management at any level; they did not, however, help facilitate the process either.

Where competition did seem to have significant implications for the crisis management was in relation to the national state and the autonomous community. It is often assumed that in critical situations (at the national or regional level) state organisations leave behind whatever rivalries might normally exist with other organisations in order to unite efforts for accomplishing effective crisis management. This notion responds to a theoretical model in political science that presupposes rationality and the common goal of solving the problem for all institutions involved in the decision-making process (Sundelius, Stern with Bynander, 1997:153). This is, however, not the rule in crisis management, but rather, the exception. Recent studies reveal the importance of institutional relations in the crisis management process – relations that generally expose themselves within the small groups that constitute decision-making units (Ibid., 1997:150-157). Such was the case during the crisis management following the assassination of the Swedish Prime Minister, Olof Palme, in 1986. Dan Hansén describes in his study of this case how a competing atmosphere existed between the different police forces comprising the police organisation working on the investigation of the case and how these relations complicated the crisis management (Hansén, 2000).

The complex administrative system of Spain (with the national state governing certain issues and the different regions having autonomy over others) provokes a lot of confusion regarding competence and responsibilities. A similar situation was also found in the Halland tunnel case, where one organisation (the Swedish Railway administration) was responsible for the environmental issues in the area outside the tunnel, while the construction company, Skanska, was in charge of the working environment inside the tunnel (Kärde, forthcoming). In the Doñana case,

the historical aspects of the national-regional relations also raise the issues of competition and prestige.

This competitive relationship between national and regional governments seems to have a kind of trickle-down effect, since tensions are also found at the institutional level between those belonging to the national administration and those to the Andalusian. This was illustrated on several occasions, one of which was between the different park administrations, as discussed in the previous chapter. The Natural Park lacked vehicles, but the National Park, which was well equipped with vehicles, ignored this need.

Another example of organisational competition appeared in the acute phase of the events, when the Natural Park technicians twice (on Saturday morning and in the afternoon) appealed to the Emergency Coordination Committee of the DGJA in Seville to retain the flood in the Entremuros Channel. This proposal was denied on both occasions, though by the Hydrographic Confederation of Guadalquivir (CHG), since their idea at the time was to guide the flood out to the Guadalquivir. The flood was thus permitted to continue its course until it was stopped on Monday in this same area, more precisely in the Aguas Mínimas Channel. The point here is that the flood finally was retained in the area of the Entremuros Channel, as was suggested by the Natural Park staff, although large amounts of this water was left and later reached the Guadalquivir River. The competitive atmosphere in the intra-organisational relations impeded the Natural Park's suggestion from being conceded in the first instance, although their proposal was later implemented.

The highly technical character of this crisis summoned a large degree of expertise. The expert commissions created in Madrid and in Seville were guided by the advice of other scientific institutions. In May, the Technological Geomining Institute of Spain (ITGE) publicly declared a subterranean water source, which provides the National Park with water, as contaminated. This declaration was immediately denied by the CHG, which claimed the samples they had collected detected no alarming levels of lethal metals. As a preventive measure the CC sent a letter to all of the municipalities in the affected area advising them to refrain from consuming the water from the Guadiamar Basin. The CSIC Committee also declared in their fourth report that the retained water in the Entremuros Channel should be treated with calcium hydroxide before being released into the Guadalquivir. The CC, however, decided to act in accordance with the advice of another expert team, from the School of Engineers at Seville University, who recommended the treatment be done with sodium carbonate.

The different ideas on how to manage the situation with the flood and the subsequent decisions made, reflect the relations between the different organisations on the one hand and between the different administrative levels (the national and the autonomous) on the other. They also illustrate how power relations are manifested even in moments of stress and time constraints; situations which perhaps would require more horizontal interrelations between institutions in order to

cooperate and resolve a problem as quickly and smoothly as possible. Had less political-institutional prestige been at stake, things would perhaps have been managed differently. Altogether though, there was a relatively quick union of efforts embodied in the Inter-Administrative Coordination Commission. Considering the competitive relation between the different administrative levels, it is perhaps somewhat surprising that they cooperated in such a prompt manner. Although the first days of the acute phase lacked a precise inter-administrative coordination of measures (a fact which accentuated the competitive relations a great deal), this issue was soon overcome and cooperation established. Through considering a common feature in crisis management where a common political platform is constructed in order to neutralise external criticism towards the crisis management (Sundelius, Stern with Bynander, 1997:153), it is tempting to regard this “union of efforts” as an effective strategy in eliminating opposition to the measures taken.

Symbolic Actions

One important dimension of crisis management is the use of symbol actions. The production of which an aspect recently highlighted within crisis research (‘t Hart, 1993:36; Grönvall, 1998; Kärde, forthcoming). Symbolic actions are highly culturally-influenced traits, central to human interaction and intimately linked to the constructivist perspective which underlines this whole study in emphasising subjectivity in the nature of social reality. All social life is filled with symbolism. In fact, it would be rather difficult to communicate about abstract ideas or about things which are not present ‘here and now’ without using symbols that illustrate the meaning of these ideas.

Interpreting crises as situations in which the ‘normal’ state of things is altered and familiar social and political meanings are disrupted, the management of such a situation is infused with symbolic dimensions. However, some explicitly symbolic actions are often used as part of a crisis management strategy in order to restore the social order which has been presumably lost (‘t Hart, 1993:41-46). In the Doñana crisis there were several examples of symbolic actions created by the different actors.

An important feature of crisis management is, for decision-makers, to regain the control that was lost through the unexpected events, which initiated the crisis. One of the most important means of doing this is controlling the definition of the situation, something that can be done during the initial problem framing, but also during the management process. A vital instrument in this endeavour is directing the information processing. One way is to restrict public access to information, as in the Halland Tunnel case where the information manager distributed an internal letter to the employees recommending them not to inform the press about the events (Kärde, forthcoming). Another way is to use the media in order to define

the situation, which was the case in the Doñana crisis. On Sunday 26, the second day following the actual rupture of the mine tailings pond, the Environmental Minister (Tocino), declared on Spanish radio that the National Park had been saved. This declaration, later strongly criticised, was on the one hand a statement implying that the authorities had gained control of the flood and that the most important region had been spared from contamination. On the other hand, the Environmental Minister herself made this statement, which set the tone of national involvement. This can also be compared with the European Mad Cow crisis in the 1990s. Facing probable restrictions on British meat exports, the British Agricultural Minister had his own daughter eat a hamburger in front of the press in order to show the world that British meat was safe to eat (Grönvall, 1998:280).

Other symbolic actions often recurring in crisis management are those called “rituals of solidarity” (‘t Hart, 1993:43). Rituals are often part of crisis responses and are defined as symbolic pattern of actions, which are socially standardised and repetitive (Kertzer, 1988:9 quoted in ‘t Hart, 1993:42). One ritual, which creates a feeling of solidarity, is the visiting of the disaster site by prominent officials; this was done in the Doñana crisis. The Environmental Minister, Tocino, visited the affected area and the National Park at midday on Saturday, April 25. The presence of the Minister transmitted a feeling of compassion and sympathy and was of great symbolic value. The significance of this ritual is highlighted by the fact that after visiting the disaster site the Minister virtually disappeared from the scene. She had a trip scheduled to New York to sign the Kyoto agreement. The Minister tried to assure the public that she was taking advantage of the meeting to appeal to some of her influential European colleagues for support in resolving the Doñana crisis. In spite of her reassurances, she was harshly criticised for having “abandoned” the crisis management.

Another important symbolic feature of crisis situations is holding certain individuals responsible for what occurred. This usually transforms itself into a blame-game and a hunt after a scapegoat. This search is a commonly applied strategy for reassuring the public and other actors that efforts are being made to get to the root of the problem. Judicial investigations as to the cause of the incident and those held responsible are common responses (‘t Hart, 1993:42-43). In the Doñana case, an investigation into the causes of the dam rupture was initiated on May 7 in the court of Sanlúcar la Mayor. This investigation, which a year after the accident compiled more than 40 volumes of documents and testimonies, accused some 20 persons from Boliden Apirsa and from different Spanish authorities of being responsible (El País, 25 April 1999).

The Boliden Apirsa, on the other hand, assumed in part this responsibility, which had its symbolic value. In spite of emphasising that the judicial authorities would determine the final and formal responsibility, the mining company agreed on reimbursing the affected farmers as a means of showing the company’s goodwill. This was a measure taken by the company in order to restore its good reputation,

both within the country and in the international arena. Boliden was, according to some people at this time, seen as “a foreign company exploiting Andalusian resources without caring for the local social and natural environment.”¹⁹ This action on the part of the mining company was followed by a recommendation from the European Parliament. In their resolution on May 14 they considered the company’s responsibility, and advised Boliden to compensate the victims (i.e. the farmers) and to finance the cleanup of the affected area. Fortunately, because of the pressure of trying to maintain a good public image, Boliden Ltd. had already proceeded with several of these measures.

Another partially symbolic action frequently used in order to demonstrate strong initiative and the will to exercise control on the part of the decision-makers was manifested through the administrative apparatus in the form of formal decisions. Several decrees, orders, resolutions and instructions related to the crisis were sanctioned during the Doñana crisis management. Prohibiting fishing in the affected waters, prohibiting any agricultural or cattle activity in the affected land, and recommending restrictions for potable water consumption (Environmental Council: Government of Andalucia, 28 April 1998; Agriculture and Fishing Council: Government of Andalucia, 13 May 1998; *El País*, 15 May 1998) were implemented soon after the accident and were, at least in part, important measures aimed at regaining the public’s confidence. Yet another example was the decision of the Junta de Andalucia to change the route of the yearly pilgrimage to the Virgin of Rocío, a route which crosses one part of the affected area (*El País*, 15 May 1998). The redirection of thousands of pilgrims was no easy manoeuvre, but this measure conveyed the message that there was a concern for the health of the pilgrims. An even more direct symbolic action was the confiscation and destruction of certain fruit and agricultural products, although they had never been ‘touched’ by the flood (*El País*, 28 April 1998). This transmitted a feeling of severity in the situation. There are several parallels here with the Mad Cow crisis both in Sweden and in Europe (Grönvall, 1998:279-280; Grönvall, 2000). In reaction to the potential health threat for the Swedish population, the Swedish Food Administration decided to prohibit importing and selling meat products from Great Britain and Northern Ireland, in spite of the weak empirics sustaining the correlation between the consumption of British meat and the feared human brain disease (Ibid., 1998:279-280). Another relevant example is found in the Auckland power outage in 1998. The City Administration placed a giant freezer in the affected area so that restaurants could place their food in it in order to prevent it from going rotten without the approval and in contravention of public health principles (Newlove, Stern and Svedin, 2000). Although this measure was unsuccessful, it was a decision within the order of political symbols aimed at regaining public favour.

¹⁹ Opinions transmitted to the author of this study during fieldwork (August 1998).

Symbolic actions are not used by decision-makers and political administrative units exclusively in crisis management. This is rather a tactic found among many actors involved in a crisis, such as various interest groups exercising what has been referred to as counter-symbolism ('t Hart, 1993:46). One example of this is the hostage crisis in Lima, 1996-97. The MRTA's choice to attack the Japanese ambassador's residence during a grand cocktail party was no coincidence, but a highly symbolic target. Japanese firms and bilateral relations between Japan and Peru are very important to the Peruvian economy. One of the MRTA's demands was to change the prevailing neoliberal economic politics in Peru, and to limit the Japanese presence in the country. Prominent businessmen, diplomats and military officials, from Peru, Japan and other countries were also taken hostage. This was an important symbolic message since it affected the national political situation and the situation of Peru in the political and economic world system (Ullberg, 1998:163-203). In the Doñana crisis, several actors employed counter-symbolism. Local, regional, national and international ENGOs were present in the affected area from the very first day, and put significant pressure upon the decision-makers to make environmentally-conscious decisions. They protested in the national and international mass media claiming that the situation was by no means under control in environmental terms, but was rather literally running amuck (El País, 26 and 29 April 1998; 15, 17 and 20 May 1998; 21 and 28 July 1998; 11 August 1998; 25 April 1999) (El Mundo, 26 and 27 April 1998; 1 May 1998; 5 and 6 July 1998; 25 April 1999) (Cambio16, 11 and 25 May 1998; 8 June 1998) (Greenpeace's home page, 10 and 22 June 1998) (Interview/e-mail correspondence with Greenpeace España, 30 June and 2 July 1998). Images were cabled around the world showing the desolate black muddy landscape and environmentalists holding up dead fish. Members of Greenpeace, probably the most famous ENGO, arrived in Doñana on Saturday, April 25 and anchored their ship MV Greenpeace in the outlet of the Guadalquivir on April 28 with the purpose of watchdogging the actions taken and as a demonstration of their solidarity with the local ENGOs (El País, 29 April 1998; Interview/e-mail correspondence with Greenpeace España, 30 June and 2 July 1998). The presence of Greenpeace on the scene caught the media's attention. Street demonstrations were also held in Seville, organised by ENGOs, attracting thousands of people demanding aid for Doñana (El País, 20 May 1998). This kind of insurgency juxtaposed against the official account of the crisis management played, thus, a powerful active symbolic role in this drama.

The power of the images and associations produced by symbolic actions can obviously have both positive and negative effects. In the Doñana case, this can be illustrated by the decrease in the Spanish and European demand of agricultural products from Andalucía, not just those specifically from the affected area. Also the tourist sector (mainly that in the coastal area) experienced a significant economic loss.

Information Processing

The dynamics of information management in crises are of vital importance. These dynamics are manifested in all spheres of crisis management and are central for the evolution of its management. Information must be processed in the initial problem framing so as to determine: the panorama of the problem, the process of decision-making, communication between the authorities and decision-makers, communication within different institutions, how to communicate with the public and with the mass media and the mass media's reconstruction of the events. The Doñana case was no exception to this.

As discussed in the chapter on problem framing in the Doñana crisis, the initial problem framing was determined on basis of the first bits of information received. The telephone calls, from the night guards at the mine and from the neighbour living near the tailings pond, permitted the development of a communication chain. In a 'normal' state of affairs, there are typically pre-established communication channels between the different public agencies through which information is transmitted. These channels can also be used in crisis situations, but they may not always be efficient or sufficient. They might be supplemented by additional formal communication channels activated in an emergency situation, a kind of 'direct line,' but also by communication channels which are of a more informal nature. When the Guardia Civil in Aznalcóllar was informed of the broken dam, they contacted the Centre for Emergency Coordination (CECEM) of the General Delegation of the Andalusian Junta (DGJA) in Seville. The CECEM is a coordination centre, which is only activated in the event of an emergency. The rapid activation of this machinery, in the Doñana case, demonstrates that it fulfilled its purpose. From that moment on, CECEM became the centre from which contacts and communication channels between the different local, regional and national authorities were established with the mass media. Also the relatively quick alarm to the CECEM from the Guardia Civil indicates that the communication between the different institutions functioned well at this stage. This can be contrasted to the MV Estonia Catastrophe in the Baltic Sea in 1994, when the radio operator aboard the ship sent the distress call at a radar frequency that, according to international navigation norms, is not used for emergencies. Not only was this call made on the wrong channel, but it also had a limited range, which is why neither Sweden nor Estonia had received the call. In addition, the operator failed to use the international sea language (English) which made it impossible for those who did not speak Finnish to understand the seriousness of the message. All these mistakes contributed to the delay of the rescue response and seriously hampered effective crisis management of the sinking ship (Hasper, 1998:309).

The notifying procedure on Saturday morning was, thus, mainly performed by the CECEM, but there were also informal channels used; for example, the Director of the National Park was called and informed at his home by the Governmental

Subdelegate Herranz, and the Environmental Minister Tocino was called at home in Madrid by General Secretary Muriel Gomez. The news also spread in a highly informal matter by telephone and in person, between neighbours living along the river. There was hardly any time for the municipalities to call meetings to inform the residents. The initial information (that a residual dam in the mine had broken and that a flood of water was running down the Río Agrio and the Guadiamar) was thus quickly spread among the different actors. There was no time for any careful interpretation of the information. The simple fact that the water came from the mine was enough to set the stage for the environmental catastrophe, as it was soon thereafter defined.

There is one interesting aspect of the risk evaluation of the situation. More than two years before the accident, in January 1996, a former employee of the Aznalcóllar mine registered a complaint to the Andalusian Junta that the tailings pond of the mine should be immediately closed, in order to avoid an environmental disaster. The claim was left unattended though, by the Andalusian authorities as well as by the company (El País, 26 April 1998). Even though it is not known how many people had access to this information it may have influenced the framing of the situation as an environmental catastrophe, despite any immediate concrete information on the supposed toxicity of the flood. During the avalanche in Sudavik, Iceland, in 1995 the knowledge of avalanche risk in the area was not accurately taken into account and thus the avalanche came as more or less of a surprise to the Icelandic Civil Defence on January 20 (Bernhardsdóttir, forthcoming).

A frequent problem for decision-makers in crises is what is called “situational information overload” (Sundelius, Stern with Bynander, 1997:165; Sundelius, 1998:8-9). This means that there is an increase in amount of information which must be processed by decision-makers within a limited time frame. This information pressure, which is generally produced in situations where information and decisions are centralised, often creates an atmosphere of stress, which may inhibit careful analysis of the information acquired. This phenomenon was not produced during the acute phase of the Doñana crisis, since the technicians and the other staff members of the Hydrographic Confederation (CHG), the National and Natural Parks, and the Andalusian Administration (JA) acted as experts and decision-makers *in situ*. The information for making a decision about how to control the flood was, thus, not centralised.

In the second phase there was not only an increase in information, but also the different political and administrative decision-makers had assumed decision-making responsibility. The highly scientific information provided by the different ‘outside’ expert commissions (the analyses of the water and mud samples, air and satellite pictures of the area, evaluations of the environmental impact, and recommendations as to how to proceed) required the interpretation of ‘inside’ specialists. The Inter-Administrative Coordination Commission was composed of five different groups (mud removal, water, mine, health, and security) who processed the information

obtained on each respective area, while decision-making responsibility was assumed by the formally-appointed coordinators: the DGJA Head Delegate (Viera) and Governmental Subdelegate (Herranz).²⁰ This phenomenon was also an information processing strategy within the Emergency Committee of the Andalusian Junta's Delegation in Seville (DGJA) and the Emergency Cabinet in the JA, in which several members represented the Environmental and Agricultural Departments within the different administrations. These 'inside' experts, thus, served as 'gate-keepers' in processing the information (Ibid.). This function can be both positive and negative. In this case their work facilitated a great deal of the decision-making, since the information was rather complex and difficult for those outside the field. On the other hand, the degree of confidence in the experts' recommendations, (both the 'insiders' as the 'outsiders') caused, in some cases, problems. It should not be forgotten that there are differences in opinions between experts as well, and often their professional/academic prestige is at stake. The urgent measure of removing the mud, which contained lethal metals, before contamination could spread, was prompted by the different expert commissions and several ENGOs. This work started a little more than a week after the accident. As the removal proceeded and time passed, criticism was raised that the pace of work was too slow. This prompted the CC to incorporate additional vehicles with greater capacity, as recommended by the technicians. This was suddenly criticised by the scientific commissions and the ENGOs, who claimed the soil was being ruined by the heavy machinery and who demanded that it be removed manually. In spite of the fact that the manual removal entailed a lower capacity and time was limited, the CC did incorporate hundreds of workers for the task of mud removal in the ecologically sensitive areas. Another example of the confusion caused by the contradictory information from the different experts was when the Technological Geomining Institute of Spain (ITGE) declared that a water source that provided the National Park with groundwater was contaminated. Although the ITGE added the environmental impact was minimal, this statement was enough to alarm the public. This information was publicly denied by the CHG, in order to calm the situation.

These examples reflect the vulnerability of decision-makers in crisis management, since they have to rely on the information processed by the gate-keepers, yet at the same time they have to answer to the public. Contrary to the relative heterogeneity of scientific opinions produced in this case, the information processing in the management of the Auckland power outage (also in 1998) reveals the risks implied in relying upon expertise advice (Newlove, Stern and Svedin, 2000). In the New Zealand case the local electric company, which was the central actor in this crisis management, provided all of the expertise, while neither the local nor the central government had their own expert groups at their disposal; thus they had to completely rely upon the company's information management.

²⁰ Andrés Herranz was in June 1998 replaced by another Subdelegate, Félix Pérez Miyares.

This situation created an expert monopoly and unbalanced the distribution of power in the decision-making process (Ibid.:109-113).

Communication with the public and the mass media is another important aspect of information processing in crisis management. Contemporary information technology (each day a bit more sophisticated) and the virtual invasion of news which pervades in western culture are important elements in creating the social 'necessity' of having prompt access to information 24 hours a day. The success of the North American news channel CNN is hardly a coincidence. This need to know how a situation is being managed is accentuated in a crisis where the situation is inherently uncertain.

The public demand for information was contemplated in the emergency plan of the Båstad municipality in the Halland Tunnel crisis and a specific information office and special telephone lines were quickly set up to satisfy public concern (Kärde, forthcoming). Likewise, information channels were established in the Doñana crisis. The Andalucian Junta, which was administratively responsible for the affected population, established daily communication with the press during the acute phase by holding press conferences. In the DGJA headquarters a special telephone line was set up, where information regarding the situation was available 24 hours a day. The different councils had frequent meetings with the affected residents and municipal representatives. On June 18 this communication was formalised through the creation of the Participation and Information Organisation. The purpose of this organisation was to exchange information between the JA, the affected municipalities and the different NGOs involved (such as the environmental organisations, syndicates, and farmers). The JA also set up a special office, the Technical Office for the Recovery of the Guadiamar [Oficina Técnica para la Recuperación del Guadiamar] with its headquarters in Seville, in order to better coordinate actions in the recovery work in the affected area. This office also served to attend to public and media demand for information about the progress of the recovery work and its management. Very soon after its establishment, reports on the accident and the crisis management of it were written and presented. An exhaustive account was published by the Environmental Council of the JA on May 12, and the course of events and the measures taken were presented by the Environmental Councillor in the Andalucian Parliament (Environmental Council: Andalucian Government, 12 May 1998). The Autonomous Organisation of National Parks published another report regarding their intervention in the crisis management (Dominguez Nevado and Ruízde Larramendi, 19 May 1998).

In addition to these rather conventional communication channels, both the Central Administration and the JA applied modern information technology in an attempt to reach the public. The use of Internet as an informative source and e-mail as an instrument of communication is developing in an explosive manner in most parts of the world. Governments and public agencies are taking advantage of these tools and use them under 'normal' circumstances as well as in special situations, like a crisis

for instance. The Environmental Ministry provided information on the Doñana crisis on their home page and the JA home page offered daily reports on the situation, from April 30 until the month of July, and then weekly updates until January 8, 1999. These reports were based on the information provided by the CC and the five groups that constituted the Commission. The Technical Office created a sophisticated CD-ROM providing images – virtual, air and satellite, still- photographs and video segments – of the crisis management (Technical Office for the Recovery of the Guadiamar Basin: Andalucian Government, August 1998). The ENGOs were active in the mass media and also utilised modern technology like cybernetics. These reports and accounts of the crisis served as sources of information for the public and the mass media, but also for the political decision-makers. The development of the Internet has also contributed to the diversification of available information on given matters. The amount of actors using this network – be they agencies, NGOs, newspapers or research institutes – contributes to a more diversified ‘truth’ of any matter of discussion. This can reduce the possibility of any one source becoming a hegemon in the information process. Still, it must not be forgotten that the Internet is not – at least yet – the most powerful channel of information, since access to it is still a social and economic matter. Rather television, radio and printed press must, for now, be considered to have a much bigger audience, especially in the so-called ‘developing’ countries.

It is interesting to note that all these specific information channels furnished by authorities attending to the public need for information also function as a kind of gate-keeper, although in reverse. That is, to say the pressure upon decision-makers to provide information regarding their actions and decisions is minimised by responding to these requirements at a lower level, giving decision-makers time and space to attend to acting rather than informing. On the whole, the information processing on the part of the public administrations seems to have functioned quite smoothly, both in terms of information gathering for the purpose of decision-making, as well as for informing the public and the media. This can be compared to Boliden Apirsa’s information processing in their management of the crisis. The fact that Boliden lacked an emergency plan was already an important obstacle in tackling this situation, but the absence of one person in charge of communications at the mine headquarters was even more disturbing (Interview with Åke Nilsson, 17 August 1998). During the acute phase, public information had to be provided on the spot by the company’s Swedish President (Ola Fägremo) and the company’s President in Toronto (Anders Bülow). This, obviously, was not a reasonable solution for the crisis management of the company. Fägremo had enough to do seeing to the coordination of the closure of the tailings pond, coordinating with the appropriate authorities and attending to the fact that the mining activities had been stopped. Bülow, on the other hand, had not been at the mine when the accident occurred and was not really a good informer. Meanwhile the media pressure on the company was enormous, as was the anxiety brewing among the Aznalcóllar population about

what the economic and social consequences of the accident would be, considering the fact that so many families in the village were dependent upon the mine's activities. This prompted the desperate search within the company in Boliden, Sweden, for an apt person to manage the information. Åke Nilsson, an external consultant in communications, had already worked with Boliden in Sweden and was asked if he could immediately assume the post as information manager. Nilsson accepted the post and arrived in Aznalcóllar within a week (Ibid.). He found virtual chaos in the Boliden Apirsa headquarters and proceeded to organise the information management. Among the immediate measures taken was the establishment of an information office in the village of Aznalcóllar, to be attended by a local hostess. The local population frequently visited this office (Ibid.). The more long-term goal was to reverse the negative image of Boliden Apirsa by carefully planning strategies for public relations (Unpublished notes provided by Åke Nilsson, Boliden Apirsa).

Another important instrument in the information processing during a crisis is the mass media. As mentioned earlier, CNN is a TV news channel that covers world events every day 24 hours a day. But the media also consists of newspapers, magazines, radio channels and other TV media at the local, regional and national levels and they do not always have 'live' coverage of events. The media acts as a transmitter of quick and sometimes unedited information, and is as such an important resource for the people. However, the media has other qualities as well, which can affect the information processing in a crisis management. In the process of informing upon a particular crisis event, the mass media occasionally performs as crisis management actors in its own right. There are examples of how journalists become actively involved in a crisis management in their search for a scoop. Such was the case in the Lima crisis, when journalists found their way into the ambassador's occupied residence in the hopes of interviewing the MRTA leader, Cerpa Cartolini – an incident that had serious consequences for the crisis management (Ullberg, 1998:196). Another way in which the media has the status of an actor in a crisis is the fact that it often influences and manipulates the public image of the crisis management. The power of the mass media in the construction of social reality is not a novelty. As an information provider, the media to a great extent determines the success or failure of the crisis management. Although a crisis situation might be handled well in operational terms, the outcome of it will often be determined by how the media portrays it (Sundelius, 1998:9). In the Doñana crisis there was a great deal of media coverage of the events, especially during the acute phase. The different media sources acted, together with the ENGOS, as the principal source in creating the public notion that the crisis was an environmental crisis by largely focusing on the environmental impact of the broken dam. For the mining company this was primarily a crisis in terms of lost production and a tarnished image. For their employees, it was a crisis as well to their personal economy. For the municipality of Aznalcóllar, the crisis had a hard impact on the communal economy and its identity as a prosperous mining village. For the affected farmers and their associates this

was very much an agricultural crisis. As for those living off the river, it was a crisis which directly affected their livelihood, fishing. These perspectives were also assumed by the Andalusian administrations, which had to take measures to soothe out the effects in the different areas. The hegemonic picture of this crisis mainly produced and reproduced by the media in words and in images, was that of the environmental aspect and particularly the impact it would have on the National Park; hence the designation “Doñana Crisis.” There were several efforts made by some, through the media, to counterbalance the rather apocalyptic image of the situation, such as: the company’s account of the events on their home page,²¹ or the public statement made by Boliden’s President (Bülow) claiming that the released from the tailings pond was acidic, but not toxic as portrayed by the media (Svenska Dagbladet, 28 April 1998). However this statement was counter-productive, so rather than appearing to be open and honest, the Boliden President was seen as arrogant (Interview with Alberto Ruíz de Larramendi, 24 August 1998).

Multilateralisation

The local effects – environmental, socio-economic and political – of this crisis would perhaps have rendered it a regional or a national catastrophe, if it had not been for the growing trend in regional and global integration in large parts of the world today. Local events become international, not just through media exposure but also through different economic and political transnational ties. Several crises studied within the CRiSMART project exemplify this:

- the US plane which crashed on Greenland in the 1950s;
- the Swedish response during World War II;
- the Swedish submarine hunts in the 1980s (Brändström, 2000; Bynander, 1998:52-90);
- the Scandinavian motorcycle wars in the 1990s (Svedin, 1998:204-239);
- the MV Estonia catastrophe in 1994 (Hasper, 1998:286-315);
- the hostage taking incidents in Peru, 1996-97 (Stern and Ullberg, 1997; Ullberg, 1998:163-203) and in Stockholm, 1975 (Hansén, 1998);
- the Swedish citizens’ abductions in Angola in 1987, Colombia in 1994, Kashmir in 1991 (Löfgren, 1998:133-162) and Dagestan in 1998 (Nohrstedt, 2000);
- the terrorist acts in France in the 1990s (Sundberg, 1998:91-133); and
- the Mad Cow crisis in Europe in the 1990s (Grönvall, 1998:240-315; Grönvall, 2000).

²¹ <http://www.boliden.ca>

As all of these studies demonstrate, international relations can work not only as a means in itself for producing a crisis, but – once a crisis situation has been created – such relations can be of significance in managing the situation. In the worst of cases international ties intervene and can further complicate the situation.

In the Doñana crisis there were several multilateral aspects in the crisis response. To begin with, the mining company Boliden Apirsa was not firmly rooted in Spain since the company is not Spanish-owned. Boliden Ltd. is essentially a firm with Swedish origins. It is operated from their headquarters in Boliden in northern Sweden. Since 1997, though, the main headquarters have been located in Toronto, Canada, where the presidency of the company is located. Boliden Apirsa acquired the Aznalcóllar mine in 1987 and, in spite of the Spanish majority in the administrative staff, the board is Swedish (Interview with Åke Nilsson, 17 August 1998). When the accident occurred, the parent company soon took charge of several aspects of the crisis management from Sweden and Canada, including sending in a hired communications manager and an “inside” environmental expert²² to Aznalcóllar. The whole crisis was, on the part of Boliden, managed between these three company branches (Interview with Åke Nilsson, 17 August 1998).

The Swedish connection present in this accident prompted other Swedish actors to get involved. For example, an observer from the Swedish Rescue Agency,²³ Karl-Erik Kulander, was sent to the affected area in the middle of May, in order to study the consequences of the dam accident in order to gather some experience for similar future accidents in Sweden (Interview with Karl-Erik Kulander, 25 November 1998). Another Swede on site after the accident was one of the speakers for the Swedish Green Party,²⁴ Marianne Samuelsson, who participated in a street demonstration in Seville on May 10, organised by a Spanish environmental NGO, local farmers organisations, syndicates and the Spanish Green Party.²⁵ The demonstration was attended by some 10,000 people demanding that the National Park be saved. Samuelsson had been invited to make a speech at the demonstration (Svenska Dagbladet/TT, 11 May 1998) in order to put some political pressure on Boliden to assume more responsibility.

What initially was a local dam failure soon became an international concern due to the fact that the environment (the National Park in particular) was at stake. The marshlands, the moving sand dunes and the Mediterranean pine forests constitute a valuable ecosystem and host an important variety of mammals, fish and reptiles. Many of these are in danger of extinction, like the lynx.²⁶ Also, as mentioned earlier in this report, the Doñana area is a main resting-place for

²² Manfred Lindvall.

²³ Räddningsverket [Swedish Rescue Agency]

²⁴ Miljöpartiet [Swedish Environmentalist Party]

²⁵ Partido Verde [The Spanish Green Party]

²⁶ A kind of wildcat.

migratory birds on their journey between Europe and Africa. These valuable features of the area contributed to the fact that UNESCO declared the National Park a Biosphere Reserve and World Heritage in 1994 (UNESCO's home page, 20 May 1998). This status of the National Park surely played an important role in calling international attention to the accident.

Perhaps this previous acknowledgement of the area's ecological value helped the Environmental Minister Tocino in her multilateral efforts to receive financial support from the EU for the clean-up and recovery which were initiated only a week after the dam failure. It is interesting to note how Minister Tocino retired from the national scene of crisis management – a virtual disappearance that cost her a great deal in public image – but then instead operated at the international level. As already mentioned, Isabel Tocino travelled only a few days after the accident to New York to sign the Kyoto protocol. According to her statements in the media, she took the opportunity to speak to her European colleagues and to several representatives from the European Commission about the accident and to ask them for their support (*El País*, 8 May 1998). The European Parliament approved a resolution on May 14 proposing that the European Commission consider the Andalusian area to be of particular interest and to give it priority when considering structural and cohesion funds (*EU Bulletin 5: 1998 Environment*, 13 April 1999). Minister Tocino also met with the European Commissioner of Regional Politics, Monika Wulff-Mathies, who lobbied for financial aid from the EU for mitigating the ecological effects in the affected area (*El País*, 15 May 1998). These efforts made on the part of the Environmental Minister were rather informal, and thus I would describe her actions as decentralised. Her visit to New York, where important dialogue on the Doñana matter was generated, was already part of her agenda, long before the accident occurred. Her encounters with the European Commissioner of Regional Politics are also part of her regular work routine. Thus, her active participation in the management of this crisis on the international level was a coincidence rather than deliberate.

These international relations indicate how the importance of European regionalism has increased throughout the Union during the last few decades. This political and economic development has also changed interstate relations by making it possible for the regions within the different nation states to directly access a higher administrative level such as the EU. The Junta of Andalusia has, for example, its own representative headquarters in Brussels.²⁷ The Andalusian President, Manuel Chaves, also visited the EU capital on May 19 where he also met with Commissioner Wulff-Mathies. Chaves presented an action plan for recovery of the affected area and a petition for financing this plan to the EU (*El País*, 20 May 1998).

²⁷ The delegation of the JA (Andalusian Government) in Brussels is located at: Avenue des Arts, 4-2e Etage. 1.210 Brussels

Another multilateral aspect in the crisis management of this case was the hiring of external international consultants in order to provide independent expertise on the matter. In the Auckland power outage case (which occurred a few months prior to the Doñana accident) technical expertise was, to a large extent, already available in Auckland, but the electric company was still forced to hire external consultants from Australia and Canada (Newlove, Stern and Svedin, 2000). In the Doñana case, international expertise was consulted with the aim of investigating the possible causes of the dam rupture and the effects of the contaminated flooding. The main purpose was in fact to have a politically independent and ostensibly objective analysis. A Spanish engineering and consulting services company, EPTISA (specialising in dam design, mine engineering and environmental studies) was commissioned by the JA to investigate the causes. According to their report, the probable cause of the rupture of the tailings pond was a slippage in the ground 15-20 meters below the surface. The mining company, on the other hand, assembled a team of independent consultants to investigate the causes and had these final reports reviewed by an international panel of independent engineering experts from Spain, Sweden and Canada (Boliden Ltd.'s home page, August 1998).²⁸ Other international expert opinions were voiced during the International Congress of Mining and Metallurgy in Valencia in June. Finally the expert advisors on environmental matters to the European Commission, the AEMA, visited the affected area in July and commented positively on the management of the environmental effects.

The Coordination Commission embarked on the intensive removal of mud in an attempt to accomplish the clean up before the autumn rains. Facing criticism on the slow pace of the work, the CC employed additional bulldozers and trucks to accelerate the pace of mud removal and transport. The increase in vehicles was successively done during the summer months and by August there was not one truck available to hire in the whole of Spain. This prompted the CC to hire vehicles from Portugal and other European countries in the hope of finishing on time. Here, there is an interesting parallel to the Auckland power outage case, where the electric company Mercury Ltd. imported generators from abroad when the national supply was quickly exhausted (Newlove, Stern and Svedin, 2000). However, this measure was not a complete success, at least not in the view of the various ENGOs (of which many were of international origin, like Greenpeace) present in the area. The work of international environmental networks and ENGOs such as Greenpeace contributed to Doñana crisis becoming a global concern.

²⁸ <http://www.boliden.ca>

Chapter 7

Final Discussion

This study has investigated the crisis management following the dam failure at the Boliden Apirsa mine in southern Spain in 1998, and has analysed it within the cognitive institutional framework. The aim has been to describe the events in as much detail as possible starting from the initial accident on April 25, 1998, until the month of July the same year, when the Andalucian authorities and the national government considered the crisis to be over. This careful description has revealed the decision-making process in this crisis and has addressed this material from several different analytical themes: decision units, problem framing and value conflict, political and institutional competition, symbolic action, information processing, and multilateralisation. In spite of the efforts to dissect the events in as much detail as possible and to cover every aspect of importance, the complexity of this crisis makes this a difficult task. There are reasons to renounce any claim of having accomplished a complete picture of it. Nevertheless, thanks to an important volume of printed material and to a small degree of fieldwork, an analysis on the case has been accomplished, which, in any event, is useful for comparing other crises and will help serve as a reference for the study of learning.

One methodological question serves well as a means of summarising the current case study: Which were the most salient features of this particular crisis management?

One essential characteristic of the entire crisis was its highly scientific and technical core. This complex framing turned the situation into an overall environmental catastrophe very quickly and the response to it could, thus, not be anything other than scientific and technical. It is relevant to bear in mind the importance that environmentalism has gained in the world since the 1970s and arguably especially during the last decade. It is probable that an accident like this would not have gained the same attention or would at least not have been focused on from an ecological point of view in the 1960s. An environmental catastrophe, however, is not just a danger to plants and animals. There are also human aspects associated with such a threat. If the soil one works and lives from is contaminated, if the groundwater which supplies one's wells is contaminated, how can one sustain oneself? Such problems, in fact, pose a threat to one's very existence and continuity of human life (on earth). This scenario of environmental contamination is somewhat exaggerated perhaps, but there were some measures taken in the Spanish case with such visions in mind, as evidenced by the confiscation of agricultural products from the affected area and by the recommendations against drinking the local water.

The point of this is to emphasise the particular character of crisis situations as socially constructed within a stressful context, but also to highlight the scientific feature of this particular crisis. A threat (which is not only invisible but also so complex that experts are required to decipher its danger) can, in fact magnify or minimise a crisis.

This leads us to another important feature of the Doñana crisis, that of information processing. The scientific framework of the crisis (as discussed above), together with the extensive geographic area in which the crisis developed, created the need for specific methods for gathering accurate and concrete information. In the effort to get a wider picture of the situation, photos from the air and via satellite were taken. These provided an overview of the situation, during the acute phase in facilitating certain measures, but also during the second phase and the aftermath. These images – interpreted by expert groups who used specific instruments – provided valuable data about the ground, soil, water, climate and alterations in the landscape. Another method used for evaluating the state of affairs was the frequent and immediate use of water, mud and soil samples. These samples were taken at different sites within the affected area throughout the entire crisis and continued to be taken a year after the accident, as a way of following the evolution of the effects. Various actors (the Andalusian Junta, the National Park administration, and several ENGOS) took the samples which were then sent to different laboratories in Andalusia and Spain for analysis. Dead fish from the Guadiamar were also analysed for indications regarding the level of contamination in the floodwater and sediment.

To process the information acquired, the presence of experts was considered necessary and was prominent in this crisis. The national expert committees, which were formed on an *ad hoc* basis, were recruited from different Spanish universities, research institutes and other scientific institutions. Other specialists were already working within the governing administrations, and their presence was also necessary in processing the data. Their opinions were of great importance to the political decision-makers during the crisis management. This feature, although salient, is not unique for this case. Rather it appears to be part of the development in the trend of increasing specialisation within crisis management. This has been exemplified in several crises analysed within this research project, such as the Chernobyl nuclear accident, the Swedish monetary crisis in 1992, the Mad Cow disease crisis and the Halland tunnel environmental crisis in 1997 (Sundelius, Stern with Bynander, 1997; Grönvall, 1998; Kärde, forthcoming).

When it came to the transmission of information, this crisis revealed some interesting features as well. Internal communication between the different actors involved in the decision-making process was accomplished through pre-existing communication channels (such as through the Emergency Coordination Centre in Seville), formal and informal telephone calls and frequent meetings. What was innovative in this case was the manner in which the public and the media were

informed using modern information technology. There was a significant use of the Internet in different ways by the actors, the decision-makers, and the experts. Internet home pages were updated frequently (in the case of the Andalucian Junta, daily) as a way of keeping the public posted. The home pages contained all kinds of information: images of the affected area, sample results and analyses, and reports on the measures taken and planned. Some of this information was also available on CD-ROM, so as to avoid long downloading time on the Internet. What seems remarkable in this regard today, however, will not likely be the case tomorrow. As earlier noted, the constant development of technology and increasing specialisation are features of our contemporary world. The information technology (IT) which impresses today in crisis management, will quite possibly be an everyday tool in crisis situations in the future. Currently, however, the possibilities information technology bring us are revolutionary (and exciting).

Finally, we arrive at the issue of possibilities. Paul 't Hart has made an important contribution that further emphasises the social constructivist perspective of crises by writing about the "multivalence of crises" ('t Hart, 1993:40). By this he refers to how crises can provide opportunities. What, by decision-makers, may be perceived as a situation of threat and stress, may be seen by other actors or organisations as a possibility or opportunity. A cynical example of this was a farmer in Sanlúcar La Mayor who filed charges in court that five of his horses had died after having grazed in the affected area. The autopsy showed that the cause of death was actually insecticide intoxication, which had nothing to do with the dam rupture. It was finally revealed that the owner of the horses poisoned his own animals, with the intention of gaining an indemnity (Interview with José Maria de Ayala, 25 August 1998).

There are other cases when decision-makers themselves may experience ambivalence in their interpretations of the events. The Doñana crisis provides evidence of such ambiguity. For the Andalucian Junta this was no doubt an opportunity to show the national government, the European Union and the rest of the world that they possessed the capacity for effective management of the crisis and did not need the central government. They gained political credit in terms of the regionalisation process, which is an important issue in the EU as well as in Spanish national politics. Other political revenue would be party-bounded, bearing in mind that the different administrations belong to different parties.

Both the national administration and the Andalucian Junta had plans for the Doñana area well before the accident. The Environmental Ministry (administratively responsible for the National Park) had been pushing for the project "Doñana 2005" (Autonomous Agency for National Parks: Environmental Ministry, May 1998a), which had the objective of regenerating the basins and the water sources which provide the National Park wetlands with water. These sources had been modified over time as a result of the agricultural and navigational infrastructure, which were negatively affecting the ecosystems in the Doñana area.

The dam accident and the threat of contamination gave this project the justification it needed for claiming a total restoration of the whole basin in order to regenerate water provision to the wetlands. The Andalusian Junta had for a long time been claiming their right to administer the National Park – perhaps as a part of the region's strive for autonomy. Spanish NGOs, on the other hand, had for a long time been proposing the creation of a so-called “green corridor” linking the National Park of Doñana with the Sierra Morena mountain range, up north. The accident gave a boost to the “Green Corridor Project”(Andalusian Government, July 1998) by restoring the soil and water in the affected area and stimulating forestry in order to link the ecosystems and to expand the protected territory for different species inhabiting that area.

These projects constituted important political opportunities for both of the administrations, since they not only involved restoration of the affected area, but also transformation of it into a valuable space in ecological, social and economic terms. The value of this opportunity was highlighted when the landowners proved to be somewhat reluctant in handing over their property, both for the clean-up work and for the notion of a permanent ecological reserve. This was handled, however, by letting the owners choose between selling and expropriation, claiming ‘the end justifies the means.’ Boliden Apirsa re-opened the Los Frailes mine approximately one year after the accident. There are no signs indicating that mining activities are slowing down, in spite of the aforementioned projects, although several NGOs would gladly welcome a decrease in, or even better in their view, an end to mining activities. The dam accident at the Boliden mine in Aitik, in northern Sweden, in September 2000 is surely another argument that supports the fight against mining activities in ecologically valuable areas. Environmental crises, like these, paradoxically open new opportunities for environmental organisations to take advantage of world-wide negative press to make a strong political statement against such activities.

Were there any opportunities for Boliden Ltd. in this crisis? First of all, the company has failed to guarantee a certain basic amount of security concerning mining infrastructure, which thus has enabled the accidents in Aznalcóllar and in Aitik to occur. So in that regard it is difficult to say that Boliden Ltd. was able to utilise this crisis as an opportunity in any significant way. However on the other hand, the company was able to manage the crisis, which is of interest here for the purpose crisis management research. Considering that the distance between public agencies, academia and the private sector is diminishing in many respects, perhaps one next step in this crisis management project could be to focus on private sector strategies in handling crises. I am confident that the findings in this study will contribute to a deeper understanding of these complex processes, and that they will help reinforce our preparedness for the “worst-case scenarios.”

Reference List

Literature

Bernhardsdóttir, A. (1998) *A Flood in Sudavik in the Western Fjords of Iceland*. Stockholm: ÖCB (The Swedish Agency for Civil Emergency Planning).

Björklund, Ulf and Hannerz, Ulf (1983) *Nyckelbegrepp i socialantropologin [Key Concepts in Social Anthropology]* Stockholm: Department of Social Anthropology, Stockholm University.

Brändström, A. (2000) *Minkar eller ubåtar i den svenska ubåtsjakten [Minks or Submarines? The Swedish Hunt for Submarines]*. Stockholm: ÖCB (The Swedish Agency for Civil Emergency Planning).

Bynander, F (1998) "A Decision-Making Analysis of the 1982 Hårsfjärden Submarine Incident." In *Crisis and Internationalization: Eight Crises Studied from a Cognitive-Institutional Perspective*, edited by E. Stern and F. Bynander, pp. 52-90. Stockholm: ÖCB (The Swedish Agency for Civil Emergency Planning).

Cambio 16 [Change 16] (11 May 1998) G. Garcia. Doñana, presa del desastre [Doñana, prisoner of the disaster] No 1380.

Cambio 16 [Change 16] (11 May 1998) G. Garcia. Vida en peligro [Life in danger] No 1380.

Cambio 16 [Change 16] (11 May 1998) J. Mellado. Pio, Pio...Que yo no he sido [It wasn't me] No 1380.

Cambio 16 [Change 16] (25 May 1998) M. Casado. Doñana, los frutos del mal [Doñana, the poisonous fruit] No 1382.

Cambio 16 [Change 16] (8 June 1998) G. Garcia. Trabajar por Doñana [Work for Doñana] No 1384.

Cambio 16 [Change 16] (8 June 1998) G. Garcia. La cuna del ecologismo [The cradle of environmentalism] No 1384.

CECEM (Centre of Emergency Coordination) in Seville, Spain (25 April 1998a) An unpublished draft report about the dam rupture at the Aznalcóllar mine in Seville on the night to April 25, 1998.

CECEM (Centre of Emergency Coordination) in Seville, Spain (25 April 1998b) An unpublished draft report outlining the actions taken by CECEM in Seville regarding the rupture of the Aznalcóllar mining dam.

CECEM (Centre of Emergency Coordination) in Seville, Spain (26 April 1998) An

unpublished draft report containing a special section devoted to the rupture of the Aznalcóllar mining dam.

Cobo, Javier – Director of Doñana Natural Park (25 April – 3 May 1998) Unpublished notes on the Doñana accident.

Davidson, Art (1990) *In the Wake of the Exxon Valdez: The Devastating Impact of the Alaska Oil Spill*. San Francisco: Sierra Club Books.

Dominguez Nevado, Luis and Alberto Ruíz Larramendi – members of the Doñana National Park Board (19 May 1998) An unpublished report on the emergency actions adopted in conjunction with the Aznalcóllar dam accident.

Grönvall, J (1998) “Galna ko-krisen, 1996” [The Mad Cow Crisis: 1996]. In *Crisis and Internationalization: Eight Crises Studied from a Cognitive-Institutional Perspective*, edited by E. Stern and F. Bynander, pp. 240-285. Stockholm: ÖCB (The Swedish Agency for Civil Emergency Planning).

Grönvall, J. (2000) *Managing Crisis in the European Union: The Commission and “the Mad Cow Disease.”* Stockholm: ÖCB (The Swedish Agency for Civil Emergency Planning).

Hansén, D. (1998) *The Occupation of the West-German Embassy in Stockholm on April 24, 1975*. Stockholm: The Swedish Institute of International Affairs.

Harris, M. (1976) “History and Significance of the Emic/Etic Distinction.” *Annual Review of Anthropology*, 5. Palo Alto, CA: Annual Reviews.

‘t Hart, P., U. Rosenthal and A. Kouzmin (1993) “Crisis Decision-making: The Centralization Thesis Revisited.” *Administration and Society*. 25: 1 (May), pp.12-45.

‘t Hart, P. (1993) “Symbols, Rituals and Power: The Lost Dimensions of Crisis Management.” *Journal of Contingencies and Crisis Management*. 1:1 (March) pp.36-50.

Hasper, A. (1998) “The MV Estonia Catastrophe.” In *Crisis and Internationalization: Eight Crises Studied from a Cognitive-Institutional Perspective*, edited by E. Stern and F. Bynander, pp.286-315. Stockholm: ÖCB (The Swedish Agency for Civil Emergency Planning).

Hermann, C. (1963) Some Consequences of Crisis Which Limit the Viability of Organizations. *Administrative Science Quarterly* 8:61-82.

Hermann, C., ed. (1972) *International Crises: Insights from Behavioral Research*. New York: The Free Press.

Hermann, C.G. and M.G Hermann (1982) “A Look Inside the ‘Black Box’: Building Upon a Decade of Research.” In *Biopolitics, Political Psychology and International Politics*, edited by G.W. Hoppie, pp.1-36. London: Pinter.

- Heywood, P. (1995) *The Government and Politics of Spain*. London: Macmillan Press Ltd.
- Kertzer, D. (1988) *Rituals, Politics and Power*. Yale University Press: New Haven.
- Kärde, T. (forthcoming) *The Halland Tunnel Crisis*. Stockholm: CRISMART.
- Kulander, Karl-Erik – Swedish Rescue Agency (1998) *The Dam Accident in Los Frailes, Seville*. Unpublished report.
- Lindvall, F. (1998) “Svensk krishantering under operation Weserübung, 1940” [Swedish Crisis Management During the Weserubung Operation in 1940]. In *Crisis and Internationalization: Eight Crises Studied from a Cognitive-Institutional Perspective*, edited by E. Stern and F. Bynander, pp:15-51. Stockholm: ÖCB (The Swedish Agency for Civil Emergency Planning).
- Löfgren, U. (1998) “Svenska offentliga aktörers agerande vid gisslankriser utomlands” [The Reaction of the Swedish Public Actors in Hostage-Taking Situations Abroad]. In *Crisis and Internationalization: Eight Crises Studied from a Cognitive-Institutional Perspective*, edited E. Stern and F. Bynander, pp.133-162 . Stockholm: ÖCB (The Swedish Agency for Civil Emergency Planning).
- Medioambiente [Environment]* (1998) Environmental Council: Andalucian Government. Vertido por la rotura de la balsa en las Minas de Aznalcóllar: El Plan de actuación de la Junta invertirá más de 10.000 millones [Discharge from the broken dam in the Aznalcóllar mines: The Government’s action plan will invest more than 10 billion] No 28.
- Newlove, Lindy, Peteris Drukis and Guntis Tribis (2000) “Collapsed Platform Accident in Talsi: June 28, 1997.” In *Crisis Management in a Transitional Society: The Latvian Experience*, edited by E. Stern and D. Hansén. Stockholm: The Swedish National Defence College.
- Newlove, L., E. Stern and L. Svedin (2000) *Auckland Unplugged*. Stockholm: ÖCB (The Swedish Agency for Civil Emergency Planning).
- Nilsson, Åke – Communication Manager Boliden Apirsa (1998) Unpublished notes.
- Nilsson, G. and T. Sundvall. (1996) *Availability and Handling of Water at the Boliden Apirsa Mine and Concentrator*. Master’s Thesis (1996:193E). Dept. of Environmental Planning and Design – Division of Water Resources Engineering: Luleå University of Technology.
- Nohrstedt, D. (2000) *Managing Crisis Abroad: The Brolin Kidnapping*. Stockholm: ÖCB (The Swedish Agency for Civil Emergency Planning).
- Rosenthal, U., P. ‘t Hart and M. Charles, eds. (1989) *Coping With Crises: The Management of Disasters, Riots and Terrorism*. Springfield, Illinois: Charles C. Thomas.

Stegen, A. (forthcoming) *Thule Crisis*. Stockholm: CRISMART.

Stern, E. (1999) *Crisis Decisionmaking: A Cognitive Institutional Approach*. Ph.D. diss. Dept. of Political Science: University of Stockholm.

Stern, E. and F. Bynander, eds. (1998) *Crisis and Internationalization: Eight Crises Studied from a Cognitive-Institutional Perspective*. Stockholm: ÖCB (The Swedish Agency for Civil Emergency Planning).

Stern, E. and S. Ullberg (1997) "Nationell krishantering ur ett internationellt perspektiv: Gisslandramat i Peru 1996-97" [National Crisis Management in an International Perspective: The Hostage-Taking Drama in Peru in 1996-7]. No.3. (June) pp.12-15. Stockholm: *Nyhetsbrev ÖCB* [The Swedish Agency for Civil Emergency Planning's Newsletter].

Sundelius, B., E. Stern with F. Bynander (1997) *Krishantering på svenska – teori och praktik*. [Swedish Management in Swedish: Theory and Practice]. Stockholm: Nerenius and Santerús förlag.

Sundelius, B. (1998) "Introduction." In *Crisis and Internationalization: Eight Crises Studied from a Cognitive-Institutional Perspective*, edited by Stern, E. and Bynander, F., pp.5-13. Stockholm: ÖCB (The Swedish Agency for Civil Emergency Planning).

Sundberg, A. (1998) "Bombkrisen i Frankrike 1995" [The Bombing Crisis in France 1995]. In *Crisis and Internationalization: Eight Crises Studied from a Cognitive-Institutional Perspective*, edited by E. Stern and F. Bynander, pp.91-132. Stockholm: ÖCB (The Swedish Agency for Civil Emergency Planning).

Svedin, L. (1998) "MC-krig i Sverige och Norden 1994-97" [The Motorcycle War in Sweden and Scandinavia in 1994-1997]. In *Crisis and Internationalization: Eight Crises Studied from a Cognitive-Institutional Perspective*, edited by E. Stern and F. Bynander, pp.204-239. Stockholm: ÖCB (The Swedish Agency for Civil Emergency Planning).

Svedin, L. (forthcoming) *The Flooding of Red River in 1997*. Stockholm: CRISMART.

The Swedish Institute of International Affairs [Utrikespolitiska Institutet] (1997) *Länder i fickformat-Europa: Spanien, Andorra* [Pocket Sized Country Information: Europe – Spain – Andorra]. No.401.

Technical Office for the Recovery of the Guadiamar Basin, Andalusian Government [Oficina Técnica para la Recuperación del Guadiamar, Junta de Andalucía] (August, 1998) *Accidente Minero de Aznalcóllar* [Mining Accident in Aznalcóllar] CD-ROM:

- * Situación Actual de Trabajos de Restauración en Diferentes Zonas [Actual situation regarding restoring the labour force in the various areas affected].
- * Propuesta de Actuaciones para la Recuperación de la Cuenca [Suggestions for the basin's recovery of the basin].

Ullberg, S. (1998) "Limakrisen,1997" [The Lima Crisis of 1997]. In *Crisis and Internationalization: Eight Crises studied from a Cognitive-Institutional Perspective*, edited by E. Stern and F. Bynander, pp. 163-203. Stockholm: ÖCB (The Swedish Agency for Civil Emergency Planning).

Newspapers in Print

Aftonbladet

9 September 2000 (Barck, M.) *Dammburstning i Bolidens gruva* [Dam bursts at Boliden mine].

Dagens Nyheter (DN)

3 May 1998 (AP) *Giftigt slam ska läggas i gruva* [Toxic mud to be put in mine].

20 July 1998 (Flores, J.) *Bönderna vill fortsätta att odla* [Farmers want to continue farming].

20 July 1998 (Flores, J.) *Boliden riskerar dyrt skadestånd* [Boliden risks significant damages].

10 September 2000 (Hellberg, A.) *Gruvdamm rasade utanför Gällivare* [Mining dam bursts outside Gällivare].

Svenska Dagbladet (SvD)

26 April 1998 (TT-Reuters) *Miljöolycka förorenar naturpark* [Environmental accident contaminates Natural Park].

27 April 1998 (TT-Reuters, AP) *Akuta hotet mot naturreservatet över* [The acute threat against the natural reserve is over].

27 April 1998 (Reuters) *Ständigt hotat område* [The permanently threatened area].

28 April 1998 (Forsberg, H.) *Kursfall efter spansk olycka* [Shares fall after Spanish accident].

29 April 1998 (TT) *Kartläggning av katastrof* [The catastrophe is being studied].

29 April 1998 (Forsberg, H.) *Miljörelsens kritik är hård* [Criticism from the environmental movement is hard].

30 April 1998 (Rosin, B.E.) *Giftutsläpp får allt värre konsekvenser* [The consequences of toxic residual discharge are getting worse and worse].

30 April 1998 (TT) *Boliden lovar snabb sanering* [Boliden promises a quick clean-up].

3 May 1998 (Hedberg, C.) *Fond skapas för spanska odlare* [Funds are earmarked for Spanish farmers].

4 May 1998 (TT-Reuters) *Spanjorer började sanera efter utsläppet* [Spaniards begin cleaning up the discharge]

8 May 1998 (Brusewitz, G.) *Nu står träden med svarta strumpor av giftgyttja* [The trees are covered with black soot from the toxic mud].

8 May 1998 (TT) *Höga halter av arsenik* [High levels of arsenic].

11 May 1998 (TT) *Krav på kommission för att reda ut giftolyckan i Spanien* [Demands on the Commission to investigate the toxic accident in Spain].

15 May 1998 (AP) *Döda hästar oroar spanjorer* [Dead horses worry Spaniards].

17 May 1998 (AP) *Spanien expropierar giftområde* [Spain expropriates the toxic area].

22 November 1998 (Forsberg, H.) *Sakta läker såren efter dammolyckan* [The wounds from the accident heal slowly].

Newspapers Internet Editions

El País Digital

26 April 1998 (Casas, J.) *Lo imposible ha vuelto a suceder* [The impossible has happened again].

26 April 1998 (El País, Madrid) *Doñana, un espacio para la humanidad* [Doñana, a space for humanity].

26 April 1998 (El País, Sevilla) *Un ex-directivo de la mina había avisado* [A former board member had adverted].

26 April 1998 (El País, Madrid) *Los precedentes del petróleo* [The precedents of oil].

26 April 1998 (Rodríguez, J.A.) *El lodo tapa más de 4.000 hectáreas de cultivo* [Mud covers more than 4,000 hectares of farming land].

26 April 1998 (Rodríguez, J.A.) *Una ola de agua contaminada asedia Doñana* [A wave of contaminated water is besieging Doñana].

27 April 1998 (Arnaiz, F.) *La riada tóxica arrasa el entorno de Doñana* [The toxic flood is destroying Doñana's surroundings].

27 April 1998 (Arnaiz, F.) *Secuelas para los recursos pesqueros* [The consequences for fishing resources].

27 April 1998 (Sampedro, J.) *Los técnicos tratan de encauzar la riada tóxica por un laberinto de canales, flujos y mareas* [The technicians are attempting to steer the toxic flood through a network of channels, streams and tides].

- 28 April 1998 (A.I., Madrid) *Tocino “Echo de menos la ayuda de los ecologistas en Doñana”* [Tocino, “I’m lacking help from the ecologists in Doñana”].
- 28 April 1998 (Agencias) *Tiros para espantar las aves* [Gunshots used to scare away the birds].
- 28 April 1998 (Araujo, J.) *La callada secuela* [The silent consequences].
- 28 April 1998 (Criado, J.) *Acidez y falta de oxígeno ahora; metales pesados después* [Now acidity and a lack of oxygen...later lethal metals].
- 28 April 1998 (El País, Madrid) *Caída de las acciones en la Bolsa sueca* [Shares fall on the Swedish stock market].
- 28 April 1998 (El País, Madrid) *Un embalse demasiado grande* [The dam was too big].
- 28 April 1998 (Morán, C.) *Pequeños agricultores y ganaderos se quejan de ser los más afectados* [Small farmers and breeders claim they are most affected].
- 28 April 1998 (Morán, C./P.J.V.) *Héroes de madrugada* [The heroes of the dawn].
- 28 April 1998 (Sampedro, J.) *La presa sigue desembalsando 200 metros cúbicos por hora de agua contaminada* [The dam continues to release 200 cubic metres of contaminated water per hour].
- 28 April 1998 (Sampedro, J.) *Un hervidero de vida amenazada* [Threatened lives].
- 28 April 1998 (Valderas, P.J.) *La presa superó una inspección horas antes de romperse, dice la Junta* [The Government says the dam was approved in an examination performed just hours before the accident].
- 29 April 1998 (Arrojo Agudo, P.) *Los oídos sordos de los políticos del medio ambiente* [The deafness of the environmental politicians].
- 29 April 1998 (El País/EFE) *El barco de Greenpeace llega a la zona del Guadalquivir* [The Greenpeace ship arrives in the Guadalquivir area].
- 29 April 1998 (Valderas, P.J.) *Langostinos... ¿de Sanlúcar?* [Lobsters... from Sanlúcar?].
- 8 May 1998 (Rodríguez, J.A.) *La juez decreta la libertad del representante de la mina* [The judge orders the release of the mining representative].
- 8 May 1998 (Mardones, I.G.) *Tocino pide a Hacienda un crédito extraordinario de 4.500 millones para limpiar Doñana* [Tocino asks the Ministry of Finance for an extraordinary loan of 4.5 billion pesetas to clean up Doñana].
- 8 May 1998 (Valderas, P.J.) *Boliden admite la presencia de arsénico en el lodo, pero asegura que es “natural” y fruto de la zona* [Boliden admits the presence of arsenic in the mud, but assures it is “natural” and a product of the area].

11 May 1998 (Rodríguez, J.A.) *Boliden sostiene que la presa de Aznalcóllar se reventó por un movimiento de tierra* [Boliden maintains that the Aznalcóllar dam broke as a result of a subterranean movement].

12 May 1998 (Arnaiz, F.) *Solicitan la expropiación de terrenos para agilizar la limpieza de Doñana* [The expropriation of land is solicited in order to speed up the clean-up of Doñana].

13 May 1998 (Barbero, L.) *PSOE y PA rechazan crear una comisión de investigación* [PSOE and PA refuse creating an investigation commission].

13 May 1998 (Mardones, I.G.) *Agricultores de Doñana impiden la entrada de máquinas hasta recibir sus indemnizaciones* [Farmers in Doñana prevent machines from entering their property until they receive a reimbursement].

13 May 1998 (Pedrote, I.) *Plan de choque de la Junta por 10.244 millones* [A government plan for 10.2 billion].

15 May 1998 (Mardones, I.G.) *El CSIC cree que habría que retirar más de 10.000 toneladas diarias de lodo* [CSIC believes that more than 10,000 tons of mud should be removed per day].

15 May 1998 (Rodríguez, J.A.) *Los expertos admiten que el acuífero 27 ha sido afectado* [The experts admit 27 water sources have been affected].

15 May 1998 (Rodríguez, J.A.) *La Junta obliga a cambiar uno de los trayectos de la romería del Rocío* [The Government is forced to change the route of the Rocío pilgrimage].

15 May 1998 (Vidal-Folch, X.) *El Parlamento Europeo pide que Doñana sea “de especial interés” para fondos comunitarios* [The European Parliament suggests that Doñana be considered for “particular interest” regarding common funding].

17 May 1998 (Barbero, L.) *La alcaldesa de Sevilla llama “pandilla de ignorantes” a la Junta andaluza* [The Mayor of Seville calls the Andalusian Government “a bunch of ignorant people”].

17 May 1998 (Sampedro, J.) *Plan para convertir en corredor verde el suelo tóxico de Doñana* [Plans to convert the toxic soil of Doñana into a green corridor].

17 May 1998 (Bolaños, A.) *Un equipo de peritos calcula el monto de las cosechas que no se podrán comercializar* [An expert team estimates the harvest losses based on that which can not be commercialised].

20 May (Bolaños, A.) *El número de fincas afectadas supera las previsiones de Boliden* [The number of farms surpasses Boliden’s estimates].

20 May 1998 (El País, Sevilla) *2.000 personas gritaron en Sevilla “salvemos Doñana”* [In Seville 2,000 people demonstrate “Let’s save Doñana!”].

- 20 May 1998 (El País, Huelva) *Una visita “ociosa” a Bruselas, según el PP*
- 20 May 1998 (Lucio, L. and X. Vidal Folch) *El Gobierno y la Junta darán cobertura legal a la entrada del Ejército en fincas de Doñana* [The National Government and the Andalusian Government will give the army the legal authorisation needed to enter the farms in Doñana].
- 21 May 1998 (Mardones, I.G. and J. Sampedro) *Baja el ritmo en la extracción de lodos* [The pace of work concerning the removal of mud slows down].
- 21 May 1998 (Bolaños, A.) *Paliar el daño en el acuífero de Doñana precisa medidas que no se están tomando* [Minimising the damage of Doñana's water sources requires measures which have not yet been implemented].
- 21 May 1998 (Mardones, I.G.) *El 72% de las presas carece de garantías de seguridad* [72% of the dams lack security guarantees].
- 26 May 1998 (Bolaños, A.) *El agua tóxica se empieza a verter en el Guadalquivir tras ser tratada* [The toxic water begins to be released into the Guadalquivir River as it's being treated].
- 28 May 1998 (Limón, R.) *La mina de Boliden hizo vertidos durante 12 años con autorizaciones provisionales* [The Boliden mine released residue over 12 years with provisory authorisation].
- 29 May 1998 (Limón, R.) *La Confederación del Guadalquivir estudia cómo permitir a Boliden verter sin permiso definitivo* [The Guadalquivir Confederation studies how to permit Boliden to release residue without a specific permit].
- 2 June 1998 (Mardones, I.G.) *César Nombela, Presidente del CSIC: “En el desastre de Doñana colaboran unos cien científicos”* [César Nombela, CSIC president says, “During the Doñana disaster, some hundred scientists have worked together].
- 3 June 1998 (L.L. , Sevilla) *La recuperación de tierras en Doñana costará 11.000 millones, según la Junta* [The recovery of land in Doñana will cost 11 billion, according to the Government].
- 4 June 1998 (Tejeda, A.G. and A. Bolaños) *El agua y el pescado de Doñana están a salvo, dice la OCU* [The water and the fish are safe, says the OCU].
- 10 June 1998 (Bolaños, A.) *Las máquinas dejan contaminantes al retirar lodos del Guadiamar* [The machines are contaminating the area as they remove the mud from the Guadiamar].
- 21 June 1998 (Mardones, I.G.) *Industria dió 270 millones en 1997 a Boliden para la presa de Doñana* [Ministry of Industry gave Boliden 270 million in 1997 for the Doñana dam].
- 23 June 1998 (Bolaños, A.) *Un ingeniero que revisó la balsa de Boliden dice que*

la empresa no siguió sus consejos [An engineer who checked the Boliden dam says the company did not follow his suggestions].

30 June 1998 (Bolaños, A) *Las pesquisas se centran en quién controlaba la balsa de Boliden* [Inquiries focus on who was checking the Boliden dam].

2 July 1998 (Bolaños, A.) *Doñana estará limpia en octubre de lodos contaminados, según la previsión oficial* [Doñana will be free of contaminated mud in October, according to the official estimates].

4 July 1998 (Fuertes, S.F.) *La rotura de otra balsa minera evidencia de nuevo el descontrol de las administraciones* [Another broken mine dam gives more evidence to the lack of administrative control].

5 July 1998 (F.B.M. and J.B. Cádiz) *Una empresa analizará el estado de las balsas en Andalucía* [A company will analyse the condition of the dams in Andalucía].

8 July 1998 (Bolaños, A.) *La juez requiere a la Junta que aclare si controlaba la balsa de Aznalcóllar* [The judge wants the Government to explain if it was checking the Aznalcóllar dam].

15 July 1998 (Arnaiz, F.) *El proyecto 'Doñana 2000' prevé 15.600 millones de inversión* [The project 'Doñana 2000' is predicted to pull in 15.6 billion].

18 July 1998 (C.M., Sevilla) *El agua del vertido tóxico se desembalsará a partir del martes* [The toxic water will be released on Tuesday].

21 July 1998 (AFP, Argel) *La AEMA cree que el impacto en el Guadiamar se reducirá al mínimo* [AEMA believes the impact upon the Guadiamar will be reduced to the minimum].

22 July 1998 (L.B., Sevilla) *La Junta permite el desembalse del agua tóxica del Guadiamar* [The Government permits the release of the toxic water into the Guadiamar].

24 July 1998 (El País, Sevilla) *Imputados dos funcionarios de la Junta por el vertido tóxico* [Two public employees are involved in the toxic spill].

25 July 1998 (El País, Sevilla) *100.000 metros cúbicos de líquido tóxico depurado van al Guadalquivir* [100,000 cubic metres of purified toxic liquid flows into the Guadalquivir River].

25 July 1998 (Mardones, I.G.) *El Gobierno aprueba el reparto del consumo del agua en las grandes cuencas* [The Government approves the distribution of potable water in the large basins].

28 July 1998 (Mardones, I.G.) *La Junta busca camiones en Portugal y el Este para retirar lodos de Doñana* [The Government is looking for lorries in Portugal and in the East for the removal of mud in Doñana].

11 August 1998 (Bolaños, A.) *Una nueva depuradora abierta ayer en Doñana agilizará la limpieza de lodos* [A new purification plant, opened yesterday in Doñana, will speed up the removal of mud].

11 August 1998 (Bolaños, A.) *Cuarta muerte en la carretera* [Fourth death on the highway].

25 April 1999 (Prades, J.) *La herida de Doñana sigue abierta* [The wounds of Doñana remain open].

El Mundo

26 April 1998 (Catalan, G.) *Desastre ecológico a las puertas de Doñana* [Ecological disaster in the port of Doñana].

27 April 1998 (editorial) *La lección de Doñana* [Lessons from Doñana].

1 May 1998 (Catalan, G.) *Las claves del mayor desastre medioambiental* [The answers to the major environmental disaster].

5 July 1998 (Gonzalez de Vega, B.) *Aznalcóllar intenta lavar su imagen* [Aznalcóllar attempts to clean its image].

6 July 1998 (Gonzalez de Vega, B.) *La fauna del río Guadamar mejora más despacio de lo esperado* [The animals in the Guadamar River recover more slowly than expected].

25 April 1999 (Catalan, G.) *Más de 50.000 aves de Doñana comen en suelos contaminados por el vertido* [More than 50,000 birds in Doñana eat from flood's contaminated soil].

25 April 1999 (editorial) *Doñana no puede caer en el olvido* [Doñana must not be forgotten].

Official Reports in Print

Agriculture and Fishing Council: Andalusian Government (5 May 1998) *Order – A conservation and defence plan for the agricultural soil in the affected areas, and concerning provisory measures in relation to the agricultural and cattle raising activities.*

Agriculture and Fishing Council: Andalusian Government (13 May 1998) *Order – Establishing a system for recollecting and destroying agricultural products in certain indicated areas.*

Agriculture and Fishing Council: Andalusian Government (18 June 1998) *Order -Procedures for the aquisition of land in the affected areas as stipulated in Decree 116/98.*

Andalucian Government [Junta de Andalucía] (July 1998) *Accidente Minero de Aznalcóllar – descripción, medidas adoptadas y propuestas de actuación* [*The Aznalcóllar mining accident: An account of the adopted measures and proposals for action*]

Andalucian Government [Junta de Andalucía] (1998) *Disposiciones de la Junta de Andalucía Relativas a la Rotura de la Balsa de Decantación de la Mina de Aznalcóllar*. [*Bills made by the Andalucian Government regarding the broken tailings pond at the Aznalcóllar mine*]

Autonomous Agency of National Parks [Organismo Autónomo Parques Nacionales] (May 1998a) *Informe sobre la situación del Parque Nacional de Doñana en relación con el accidente de la presa de Aznalcóllar*. [*Report about the situation of the Doñana National Park in relation to the Aznalcóllar dam accident*]

Autonomous Agency of National Parks [Organismo Autónomo Parques Nacionales] (May 1998b) “Proyecto 2005” *Regeneración hídrica de las cuencas y cauces vertientes a las marismas del Parque Nacional de Doñana*. [*“Project 2005” – The hydrological regeneration of the basins and of the water sources connected to the marshlands in Doñana National Park*]

Environmental Council: Andalucian Government [Consejo de Medio Ambiente, Junta de Andalucía] (28 April 1998) *Order – Fishing in the affected area is forbidden*.

Environmental Council: Andalucian Government [Consejo de Medio Ambiente, Junta de Andalucía] (12 May 1998) *Informe al Parlamento de Andalucía sobre las consecuencias de la rotura de la Balsa de Estériles de las Minas de Aznalcóllar* [*The Andalucian Parliamentary Report on the consequences of the broken Aznalcóllar tailings pond*].

Governmental and Justice Council: Andalucian Government [Consejería de Gobierno y Justicia, Junta de Andalucía] (15 July 1998) *Bill – Concession of funds to the municipalities of those villages in the province of Seville that were affected by the accident*.

Health Council: Andalucian Government [Consejería de Salud, Junta de Andalucía] (12 May 1998) *Resolution – Preventive measures in relation to the removal of mud*.

Health Council: Andalucian Government [Consejería de Salud, Junta de Andalucía] (4 June 1998) *Resolution – Control over potable water in the area affected by the Aznalcóllar flood*.

Industry and Labour Council: Andalucian Government Government [Consejería de Trabajo e Industria, Junta de Andalucía] (6 May 1998) *Resolution – Establishing certain directives for mining security*.

Industry and Labour Council, General Board of Labour and Social Security: Andalusian Government [Consejería de Trabajo e Industria, Dirección General de Trabajo y Seguridad social, Junta de Andalucía] (6 May 1998) *Environmental Protection Resolution – Providing minimal services for the maintenance of public service and for the cleanup of the affected area.*

Ministry of Public Administration: Spanish National Government [Ministerio de Administraciones Públicas, Gobierno Central] (29 May 1998) *Royal Decree 1063/1998 – Appointing a General Coordinator to implement necessary actions in the wake of the Aznalcóllar mine accident.*

Presidency of the Andalusian Government [Consejería de la Presidencia, Junta de Andalucía] (12 May 1998) *Decree 99/1998 – Measures to be adopted in the Andalusian territory in order to limit the consequences of the mine dam rupture.*

Presidency of the Andalusian Government [Consejería de la Presidencia, Junta de Andalucía] (26 May 1998) *Decree 110 – An inter-departmental commission is created to conduct and coordinate the measures to be adopted in response to the broken tailings pond at the Boliden mine at Aznalcóllar in Seville.*

Presidency of the Andalusian Government [Consejería de la Presidencia, Junta de Andalucía] (6 June 1998) *Declaration – Urgent completion of mud removal.*

Presidency of the Andalusian Government [Consejería de la Presidencia, Junta de Andalucía] (9 June 1998) *Decree 116 – Exceptional measures for the Andalusian Government's acquisition of private farms due to the accident in Aznalcóllar.*

State Department: Spanish National Government [Jefatura de Estado, Gobierno Central] (22 May 1998) *Royal Decree-Law 4/1998 – A grant of 4.5 billion pesetas given to the Hydrographic Confederation of Guadalquivir in order to help finance the necessary actions in the wake of the Aznalcóllar mine accident.*

Official Reports and Documents from the Internet

Boliden Ltd. (Downloaded 17 July 1998) *Tailings Dam Failure at Boliden's Los Frailes near Seville, Spain.* <http://www.boliden.ca>

Coordination Commission for the Recovery of the Guadiamar Basin: National Government and Andalusian Government [Comisión de Coordinación de recuperación Cuenca Río Guadiamar: Gobierno Central – Junta de Andalucía] *Accidente Minero en Aznalcóllar y Repercusiones Ecológicas en el Entorno de Doñana [Mining Accident in Aznalcóllar and the Ecological Repercussions in the Doñana Surroundings]* <http://www.cma.junta-andalucia.es>

- (Downloaded 6 May 1998 – 8 January 1999) Daily reports.

- (Downloaded 17 August 1998) An evaluation of the land affected by the flooding caused by the rupture of the dam in Aznalcóllar. A descriptive report of the methods used to restrict the affected area from the mud floods caused by rupture of the Aznalcóllar dam, and an analysis of the results.

CSIC – Expert meetings at the CSIC headquarters in relation to the ecological emergency which arose in the Doñana area. <http://www.csic.es>

- (29 April 1998) Report 1.
- (5 May 1998) Report 2. Report presented at the Doñana Biological Reserve.
- (12 May 1998) Report 3.
- (22 May 1998) Report 4.
- (5 June 1998) Report 5.
- (25 June 1998) Report 6.
- (23 September 1998) Report 7.
- (2 October 1998) Report 8.
- (26 November 1998) Report 9.
- (9 March 1999) Report 10.
- (3 May 1999) Report 11.

Department of Occupational and Environmental Medicine Uppsala University Hospital (Downloaded 23 May 1999) “Metals in Occupational and Environmental Medicine.” <http://www.ocemed.uu.se/metal/metall.html>

EU Bulletin 5: 1998 Environment (7/18) (Downloaded 13 April 1999) *Bills: B4-0492, 0508, 0521, 0531 and 0548/98*. European Parliament Resolution on the environmental disaster caused by the break in the tailings dam at the Aznalcóllar mine (in Seville) in the vicinity of the Doñana National Park. <http://www.europarl.eu.int>

Greenpeace home page (Downloaded 10 May 1998) Report concerning the possible impact of the mud and water from the flood upon the aquatic flora and fauna in Doñana. <http://www.greenpeace.es.html>

Harvard University School of Public Health (Downloaded 23 May 1999) “Effects of Arsenic on Human Health.” <http://www.hsph.harvard.edu/>

Price Waterhouse Coopers (Downloaded 25 August 1998) <http://www.cma.caan.es/aznalcollar/informes/waterhouse>

- A report on the accident in Aznalcóllar: an account of and the opinions voiced regarding the adopted actions and measures taken to minimise the effects of the accident. <http://www.cma.caan.es/aznalcollar/informes/waterhouse/descripcion.html>

- A report on the health guarantees (concerning food and water) in the area of the accident in Aznalcóllar. <http://www.cma.caan.es/aznalcollar/informes/waterhouse/garantias.html>
- Various evaluations on the effects of the accident in Aznalcóllar. <http://www.cma.caan.es/aznalcollar/informes/waterhouse/seguimiento.html>

Swedish Environmental Protection Agency (Downloaded 23 May 1998) “Tungmetaller” [“Heavy Metals”] <http://www.environ.se/document/fororen/metaller/tungmet.html>

UNESCO (Downloaded 20 May 1998) World Heritage List. www.unesco.org

Interviews

(17 August 1998) **Nilsson, Åke** – Information Manager at Boliden Apirsa in Aznalcóllar, Spain

(17 August 1998) **Lindgren, Gösta** – Assisting Manager at Boliden Apirsa in Aznalcóllar, Spain

(18 August 1998) **Pérez Miyares, Félix** – Central Government Representative in the Coordination Commission in Seville, Spain

(24 August 1998) **Ruíz de Larramendi, Alberto** – Director of Doñana National Park El Acebuche in Matalascañas, Spain

(25 August 1998) **Pérez de Ayala, José María** – Guide at Doñana National Park Doñana National Park, Spain

(25 August 1998) **Simón Martínez, Manuel** – Technical Assistant Doñana Natural Park in Almonte, Spain

(26 August 1998) **Alvarez, Paco** – Technical Office for the Recovery of Guadiamar River in Seville, Spain

(26 August 1998) **Martínez Troncoso, Juan A.** – Service Manager at the DGJA in Seville, Spain

(25 November 1998) **Kulander, Karl-Erik** – Swedish Rescue Agency in Stockholm, Sweden

(30 June 1998) (2 July 1998) E-mail correspondence with **Greenpeace España**.

Appendix I

Detailed Crisis Chronology¹

Acute Phase: April 25 – May 2

Saturday, April 25

At 3:30 am at the Boliden mine in Aznalcóllar, two walls of the tailings pond (one interior and one exterior) burst. The residual water and mud contained in this dam immediately rush out looking for its natural watercourse. The water from the dam rapidly meets the Río Agrío River, which soon unites with the Guadiamar River. Due to the velocity of the muddy flood, the Guadiamar is quickly flooded and the farming land along the river is submerged by water and mud approximately 200 metres on either side of the river.

A couple of electric wires below the dam are washed away with the flood, which produces a power cut at the mine. The alarm system indicates that the electricity supply at the mine has been broken and that a pump has totally stopped. The night guards at the mine set out to see what caused the power failure and discover that the dam burst causing a major flood. They return to the office to notify the Civil Guard (Guardia Civil) in Aznalcóllar and the company authorities.

A neighbour living along the Guadiamar River, not far from the broken dam, has also informed the local Civil Guard. The Civil Guard proceeds to evacuate those families living near the river, 15 individuals altogether (CECEM, 26 April 1998).

Around 5:15 am the Civil Guard alerts the Centre for Emergency Coordination (CECEM), which is located in Seville, about the broken dam in Aznalcóllar. The Civil Guard informs CECEM that the total dam capacity was 5,000,000 m³. CECEM immediately contacts the local police headquarters in Aznalcóllar, which confirms the information about the broken dam and informs the CECEM that the area below the dam called Ranchos de Guadiamar has been evacuated. CECEM then contacts the local police in the village of Sanlúcar la Mayor, which is located south of Aznalcóllar. The Head Delegate of the Andalusian Government (JA) in Seville, the General Director of Community Issues, several delegates from the JA, technicians and various staff members from the Sevillian Governmental Delegation of the Junta of Andalucía (DGJA) are also contacted by CECEM. The different municipalities in the area, which are directly exposed to the immediate

¹ Reconstruction of the events of this crisis have been based on several official reports, reports from the Spanish and the Swedish mass media, and interviews with people directly involved in the crisis management.

effects of the flood (namely those of Aznalcóllar, Aznalcázar and Sanlúcar La Mayor) are also contacted by CECEM. These municipalities take the appropriate measures needed to evacuate the residents, if that later becomes necessary to do so. The local police in the village of Sanlúcar La Mayor inform CECEM that the level of the river is very high and there is a huge amount of water.

At 6:15 am the Subdelegate of the Central Government in Andalucía (Andrés Herranz) is informed of the accident by the Sevillean DGJA. Herranz then calls the National Park headquarters in El Acebuche. The staff on duty at the park's radio station gives Herranz the Park Director's telephone number. The Director of the Doñana National Park, Alberto Ruíz de Larramendi, is then awoken by a telephone call from Herranz.

By 7:00 am the muddy water has travelled approximately 18 km down river from the mine and is about to reach the bridge in Aznalcázar.

CECEM contacts the Civil Guard again. The officials on site who are supervising the situation estimate the amount of water and solid material released to be approximately 75% of the dam's capacity.² The flood has reportedly submerged large areas along the riverbank. The Civil Guard also informs the CECEM that the discharged water contains solid waste from the mining production (that is, magnesium, copper, zinc, and lead) and that the pH level is around 2 which is extremely acidic.

It is assumed that sooner or later the flood will reach the coastal province of Huelva,³ and thus CECEM in Seville contacts their colleagues in the city of Huelva. CECEM also tries to contact Boliden's headquarters in Aznalcóllar to get more information. This is unsuccessful, however, since the night guard attending the phone says they have no further information to provide (Ibid.).

The Director of the National Park (Alberto Ruíz de Larramendi) calls the Spanish General Secretary of Environment (Luis Muriel Gomez), who is by coincidence staying at one of the guesthouses in the National Park at the time, to inform him of the events. Gomez then immediately calls the Environmental Minister (Isabel Tocino) in Madrid.

At this time the Doñana National Park staff starts closing all of the floodgates which link the park with the Guadiamar River and the irrigation channels. This operation is reportedly finished at around 9:00 am. Director Ruíz de Larramendi then orders the park staff to reinforce the faulty walls and the floodgates using the park's vehicles and machinery. This order is confirmed at 10:00 am by the General Secretary (Muriel Gomez) and by Environmental Minister, Tocino (Interview with Alberto Ruíz de Larramendi, 24 August 1998).

The DGJA Delegate for the Environment in Seville visits the affected area

² Approximately 3,750,000 m³.

³ The Guadiamar River flows into the Guadalquivir River which then flows into the Atlantic Ocean. The provinces of Huelva and Cádiz are located along the Atlantic coast.

together with the Director of the Doñana Natural Park, the JA Environment Council staff, and technicians from the DGJA in Seville.

At 9:30 am, an Emergency Coordination Committee is formed at the DGJA of Seville headquarters. This committee is composed of the Head Delegate of the DGJA in Seville, the General Director of Community Issues from the JA, various delegates from the provinces, and the Mayors of the affected municipalities (Aznalcóllar, Sanlúcar la Mayor, Aznalcázar and Villamanrique). The DGJAs from Huelva and Cádiz also assemble crisis cabinets, in the event that their provinces are affected.

The Emergency Coordination Committee of the DGJA in Seville is informed that the contaminated water is around 5 million m³ and that the flood is predicted to flow through the Guadiamar Basin affecting the surrounding cropland and the ecosystem. The Cabinet takes some urgent measures, such as: implementing a vigilance of those areas which could be possibly affected, and keep an eye on the consumable products and potable water in the area, which could become contaminated. It is decided that the municipalities are to monitor their respective territories. Contacts are also established with various agricultural organisations.

The entry points to the irrigation channels at Dehesa de Abajo and at Brazo de la Torre are obstructed.

At 10:30 am technicians from the Doñana Natural Park propose to the Emergency Coordination Committee that the flood running south should be confined in the Entremuros Channel. This proposal is denied by the Hydrographic Confederation of Guadalquivir (Dominguez Nevado and Ruíz de Larramendi, 19 May 1998).

At 11:00 am the flood reaches Finca de la Tiesa and observations at this point are made claiming that the water level in the Guadiamar River is rising 25-30 cm per hour. The flood is reportedly dark brown and is flowing with great velocity and turbulence taking with it vegetation and debris.

Farmers (in particular, the rice cultivators) with fields along the Guadiamar River have been out in their fields, since the early hours, trying to reinforce the walls and block the floodgates which link their fields with the river and the irrigation channels. They work with whatever tools they have at their disposal, mainly small agricultural machinery. At the mine, the workers begin the task of obstructing the 50-metre hole in the external wall of the tailings pond in order to prevent any further water or mud from escaping.

The Emergency Coordination Committee of the Seville DGJA establishes contact with the Hydrographic Confederation of the Guadalquivir River (CHG).

Around 12:15 pm the tractors and machines, which were mobilised by the National Park staff in the early morning hours, enter the affected area. These machines immediately start working to reinforce the walls of the small irrigation dam in Cangrejo Chico, which divides the National Park and the Natural Park. The dam runs parallel to the Aguas Mínimas Channel, through which the contaminated floodwater will be transferred.

Another tractor is incorporated and starts working in the southern area of the National Park, bordering the salt fields. This tractor starts repairing the existing cracks in the walls which separate the fields from the park's wetlands.

At 12:20 pm the water reaches the Don Simón Bridge, which lies on the border of the Natural Park. The colour of the floodwater is still dark brown, which indicates the continued presence of sediments. The water level is reportedly still rising.

By 1:00 pm an excavator is mobilised by the DGJA to obstruct the irrigation channel which links the Entremuros Channel area with the Brazo del Jerónimo area. In addition, the irrigation pipe leading to the Dehesa de Abajo area is completely obstructed, thus preventing any contaminated water from entering that area.

At 1:11 pm CECEM in Seville makes contact with the Commander of the Civil Guard, who reports that the expanding Guadimar River is being regularly checked. The floodwater has reached the outer limits of the Natural Park and there is a high risk that the contaminated water will also penetrate the National Park.

Around 2:00 pm the water level is reportedly rising at a slower pace. At that time, the contaminated water starts flooding the fields along the riverbanks near the Don Simón Bridge. An excavator is mobilised by the National Park to help the tractors reinforce the walls of the Cangrejo Chico Dam. Another caterpillar starts reinforcing a small wall, which separates an area of the park called the Nuevo Travieso from the Guadimar River.

At 3:37 pm the village of Pilas informs CECEM that the water level of the brooks linked to the Guadimar River is rising. Some people attempting to rescue their animals by wading into the floodwater have apparently reported painful itching. At Patera en Marisma, a raft is called in to save some 20 animals from the flood.

The Minister of Environment (Isabel Tocino) arrives in Seville and flies over the affected area in a helicopter later that afternoon. Around 4:00 pm an excavator is provided by the CHG and starts repairing a big crack in the floodgate in Cangrejo Chico. Due to the size of the crack, another excavator is incorporated into the repair work a couple of hours later.

At 4:04 pm CECEM receives a call from the village of Villafranco del Guadalquivir stating that the situation is under control in that area.

As of 4:40 pm, the flood has not yet reached the Los Vaqueros Bridge.

At 5:00 pm an observation flight of the area is made by a group of representatives from the Junta de Andalucía (JA): the Counsellor of Labour and Industry (Guillermo Gutierrez Crespo), the Government Counsellor⁴ (Carmen Herмосín Bono), and the Counsellor of Environment (José Luis Blanco Romero). In a

⁴ **The Government Counsellor [Consejera de Gobernación]** works within the Council of Government [Consejería de Gobernación], which is the regional administrative body for the Andalusian Government. The Government Counsellor is responsible for advising and assisting the Andalusian Government in implementing and coordinating regional policies. Concretely, the Counsellor's specific areas of responsibility include: the Andalusian police force, civil protection, security and elections, migration politics, consumption politics, and coordinating all of the Andalusian Councils.

meeting held afterwards, together with several Head Delegates and technicians from the different Andalusian provinces, a brief evaluation is made of the measures implemented thus far.

JA begins to take water and mud samples from the affected area.

The proposal of trapping the floodwater in Entremuros Channel is reiterated by the Natural Park board. The request is again denied by the CHG. This decision means that the flood will be permitted to pass through the Entremuros Channel and will eventually reach the Guadalquivir River (Ibid.).

At 5:30 pm, the JA initiates the task of reinforcing a wall which crosses the river at a point called Vuelta de la Arena. It is hoped that the flood will be retained by this wall. The CHG orders that two outlets to be left on either side of the wall. At that point, the flood has reached the Los Vaqueros Bridge, which is located at the northern end of the Entremuros Channel (some 20 km north of the National Park).

At 6:07 pm CECM contacts the administrative centre of the National Park in El Acebuche and establishes contact with the Regional Director for Internal Affairs.⁵

At 7:00 pm the flood reaches the Los Vaqueros Bridge.

At 7:15 pm the Seville Fire Brigade informs CECM that they have executed several actions in the Pilas and Aznalcázar. They also inform them that they are participating in the construction of a wall in Vuelta de la Arena. Several individuals are trapped in the Patera en Marisma area. This information sparks CECM to call the Civil Guard with a request for a helicopter. Five minutes later the Fire Brigade informs CECM that there are two youngsters trapped between two streams of the contaminated flood and they need to be rescued immediately. The Civil Guard verifies for CECM that another rescue operation is to be organised, since there are also three individuals stranded near the Aznalcóllar Dam. Another helicopter is requested. At 7:45 pm the Civil Guard reconfirms that there are two individuals trapped at Patera de Aznalcázar and that a helicopter has been sent to rescue them. This rescue operation reportedly concludes at 8:43 pm (CECM, 26 April 1998).

At approximately 9:10 pm the floodwater rushes over the Los Vaqueros Bridge and surpasses it by 40 cm.

Later that evening the Environmental Minister (Isabel Tocino) calls for a meeting, consisting of the General Secretary of Environment, the JA Counsellor of Environment, the Subdelegate of the National Government in Seville, the

⁵ The Regional Director for Internal Affairs [Director General de Política Interior] serves as a liaison between the Andalusian government and its eight provincial representations [DGJA's]. Its main responsibility is to organise security issues in the Andalusian community by coordinating the different police corps [the local police, the Andalusian police and the national police]. The Regional Director for Internal Affairs is also responsible for the planning and coordination of Andalusian elections and for the surveillance of public buildings.

Subdelegate of National Government in Huelva, the CHG President, the Director of the Doñana National Park, the Director of the Spanish National Park Organisation, the Commander of the Civil Guard in Seville and the Chief of SEPRONA.

At midnight CECM concludes there are no human losses thus far, but that the material damage is extensive. An estimated area of 1500-2000 hectares of arable land is flooded with black mud, presumably contaminated.

All day Saturday CECM attends to calls from journalists from various newspapers, TV stations and radio stations who are eager for additional information regarding the development of the accident. Additionally, hundreds of people working for the Andalusian Administration, the National Park, the Natural Park, the area municipalities and as private individuals in their own interests (for example the farmers) work on hindering the flood throughout the day and into the night.

Sunday, April 26

Around 4:00 am the toxic flood reaches the newly-constructed wall at Vuelta de la Arena. The pressure is too much, and the wall bursts. The water gushes out and enters the one km wide Entremuros Channel which serves as a short cut to the Guadiamar River. The flood begins to lose speed and is flowing at a slower pace (less than 1 km/hour). It no longer contains huge amounts of mud. Instead, huge amounts of mud cover the riverbed and the riverbank in the area above Vuelta de la Arena. Nevertheless, the flood continues to flow.

A bulldozer from the National Park joins the reinforcement work on the Cangrejo Chico wall.

At 4:54 am the local police in Aznalcázar inform CECM that the flood is flowing at a stable velocity.

At 5:22 am the Civil Guard of Aznalcázar informs CECM that the water level in the area around the Los Vaqueros Bridge has descended approximately 40 cm. There are no reports at this point that the flood has penetrated the surrounding area.

At 6:30 am the Civil Guard, the local police and the National Park authorities inform CECM that the toxic flood has been re-routed to the Aguas Mínimas Channel. This channel (some 70 metres wide) runs along the left wall of the Entremuros Channel and is usually used to release water from the minor irrigation channels into the Entremuros Channel.

At 7:00 am the tractors mobilised by the National Park are sent to work in the Caño del Cherry area, where the walls and floodgates have yet to be reinforced. Work on reinforcing the walls had been delayed because the tide the day before had flooded the Caño del Cherry Channel.

At 12:00 pm the Counsellor of Environment and the JA Government Delegate hold a press conference at the DGJA headquarters in Seville.

Water samples are taken at several points along the flood's course. Two boats from JA are used to check the water quality of the Guadalquivir River. Water samples are taken at four different places. Soil samples are also taken at six different places in the affected area. The National Park administration also takes water samples at three different points between the Aguas Mínimas Channel and the Brazo de la Torre Channel.

Observations are made that birds are eating dying/dead fish in the flooded Entremuros Channel area.

The construction of another wall at the Entremuros Channel, near the northern boundary of the Lucío del Cangrejo farmlands, is initiated by the JA.⁶ The idea is to protect the Natural Park from contamination by deviating the flood through the Aguas Mínimas Channel and through the Brazo de la Torre Channel, and leading it to the Guadalquivir River.

The Boliden mine is closed and work there is focused on repairing the broken dam. At 2:29 pm Boliden informs CECM that the broken tailings pond has been partially closed and that no more water is leaking from the dam. Meanwhile the President of Boliden Ltd. (Anders Bülow) declares from the company's headquarters in Toronto that the accident came as a complete surprise and was extremely shocking. In Aznalcóllar a spokesman for the company makes a statement to the media, in which he states that the rupture of the dam wall was apparently caused by some movement in the base of the dam. He also states that the company will assume all legal responsibility and will compensate the affected farmers and landowners.

Around 3:00 pm the Minister of Environment declares on Spanish radio that the National Park has been saved from the flood.

At 4:00 pm two of the tractors mobilised by the National Park are sent to the northern edge of the Cangrejo Chico Dam to reinforce the floodgates. These tractors work in this area for about two hours. At the same time a caterpillar is sent in to make an additional reinforcement of the Cangrejo Chico Dam. The tractors mobilised by the National Park continue working on reinforcing the walls in Caño del Cherry. At that time, it is reported that the contaminated water has reached the edge of Cangrejo Grande, which is about 5-6 km north of the National Park.

By 5:00 pm the tide from the Guadalquivir River is so high that it raises the water level, surpassing the floodgates, and the tide enters Cangrejo Chico. Meanwhile the National Park tractors are sent in to repair the cracks in the wall in Montaña del Río.

Around 7:45 pm the CECM in Seville states that as a result of the measures taken by the JA in the Brazo de la Torre Channel, the contaminated flood is considered

⁶ There is contradicting information regarding the exact time that the construction of this wall was initiated. According to the Doñana Natural Park staff, it was initiated at 1:00 pm on Sunday (April 26), while the report from the National Park Board claims it was initiated late on Friday evening (April 24).

to be under control. In spite of the highest recorded tide of the year downstream, the walls and floodgates of the Brazo de la Torre Channel and Entremuros Channel have resisted the water pressure. The technicians and authorities predict that the tide will take with it a large part of the contaminated water from the Entremuros Channel and the Brazo de la Torre Channel, when it recedes back into the Atlantic Ocean in the late hours of Sunday (CECEM, 26 April 1998).

The National Park machines securely close the floodgate at Cangrejo Chico. Additional efforts are made to close the outlets and to repair the cracks throughout the night in an attempt to avoid the flood from penetrating the park. The construction of the wall at the northern part of Cangrejo Grande is not finished in time and part of the floodwater rushes into the Cangrejo Grande, which is technically part of the Doñana Natural Park territory.

Monday, April 27

In the morning, the JA staff attempts to limit the flooding of the Cangrejo Grande by reinforcing an already existing wall in the Aguas Mínimas Channel, at a point called Chozas del Cangrejo.

Several reinforcements are made by the National Park and the JA at points along the channels where the walls and floodgates are considered weak, even though the majority of the flood has successfully been stopped. The wall at Vuelta de la Arena has been totally reinforced.

The water samples taken by the National Park staff are given to SEPRONA, which seals the samples and ensures they are safely transported to the laboratory.

Some dead animals are found in the Aguas Mínimas Channel. Gunshots are fired as a means of frightening the birds away from the contaminated area in the National Park (El País, 28 April 1998).

In the village of Sanlúcar La Mayor a water hole is deemed contaminated and thus closed by the JA Health Council (Ibid.).

Tuesday, April 28

In the morning it is visible that a large part of the contaminated floodwater was stopped by the protective wall in Cangrejo Grande, although some pools of contaminated water are found on the other side of the protective wall. Cangrejo Grande is almost entirely submerged in contaminated water. Small bits of the contaminated water are allowed to pass through the Aguas Mínimas Channel in a controlled manner, and eventually reach the Guadalquivir River.

All the way from the mine dam in Aznalcóllar to the Entremuros area, residual sediments from the tailings pond (which were transported down the Río Agrío and the Guadiamar Rivers by the flood) cover 200 metres on either side of the riverbed. In the area just below the mine, there is a thick layer of mud – in some parts 3 metres thick.

Reinforcement of the walls and the floodgates bordering the National Park continue. Some floodgates are firmly fortified in order to avoid the flood from penetrating the park. One of these floodgates is connected to the Caño del Cherry Channel, which had to be completely closed off by the National Park staff.

One of the machines working on the construction of the wall between the Cangrejo Grande and Cangrejo Chico gets stuck in the mud and cannot get loose because of the tidewater. Thus, it is decided that the channel linking the Cangrejo Grande with the Aguas Mínimas Channel should be firmly obstructed so that the machine can be safely and quickly removed.

The Government Council in the Junta de Andalucía has a meeting where it is decided to constitute an Emergency Cabinet consisting of the Counsellors from the Presidency, Government, Employment and Industry, Agriculture and Fishing, and Health and Environment. Also the Scientific Committee is created by a group of scientists from several universities, the biological station in Doñana and other scientific institutions.

The JA Council of Environment issues an order which prohibits fishing in the Guadiamar River and in any other water sources affected by the accident (Environmental Council: Andalusian Government, 28 April 1998).

Several dead animals are found in the contaminated area. Meanwhile the newspapers report from the coastal villages, where people nervously are awaiting the “contaminated wave of mud” to arrive (El País, 29 April 1998).

The M/V Greenpeace sails into the Guadalquivir River. The Greenpeace crew makes a report of the situation and expresses its solidarity with the local environmental groups working in the area.

Wednesday, April 29

Small amounts of contaminated water pass into the Aguas Mínimas Channel reaching the Guadalquivir River. The JA initiates the closure of the south channel in Lucío del Cangrejo. This obstruction provokes protests from technicians and guards at the National Park, who claim that the only outlet from the Cangrejo Grande area is being closed and that at the next tide the contaminated water will enter the National Park. After some debate, the parties finally reach an agreement. The channel is obstructed and the machine, which was trapped in the mud the day before, is removed from the area.

In Madrid, the Superior Council of Scientific Investigations (CSIC) assembles another expert committee with 17 Spanish scientists and the council puts itself at the disposition of the authorities. The first meeting is held and some preliminary conclusions are presented the same day (CSIC Report 1, 29 April 1998). Their main suggestion is to prioritise stopping the contaminated water from leaking into the Guadalquivir River and to quickly put together a treatment plan for the water retained in Cangrejo Grande.

Members of the Environmental Commission in the Andalusian Parliament visit the affected area. Meanwhile the Emergency Cabinet (created by the Council of Government the day before) has a meeting in Seville, where it is decided to petition for an investigation on the possible causes of the dam rupture.

At a press conference held in Seville the Boliden President admits the accident is very serious. He also says that once the cause(s) of the accident and those responsible for it have been determined, everyone who has suffered will be properly compensated.

The Environmental Minister Tocino travels to New York, where the environmental ministers from the EU member states meet to sign the protocol to the Kyoto Convention.⁷

Thursday, April 30

The majority of the water in the Aguas Mínimas Channel at Cangrejo Grande and Cangrejo Chico has been properly contained and small amounts are released, in a controlled manner, into the Guadalquivir River.

The Coordination Commission (CC) is established by the Andalusian and the National Government for organising the work in the affected area. The Commission is lead by the Environmental Minister (Isabel Tocino) and the President of the Autonomous Community of Andalusia (Manuel Chaves). At the same time the Committee of Coordination is established. It is lead by the Subdelegate of the Central Government in Seville (Andrés Herranz) and the Delegate of the JA Government in Seville (Antonio Viera) and will be subordinate to the CC (Autonomous Agency of National Parks: Andalusian Government, May 1998a). The work is divided into five groups: the mine group, the mud removal and soil recovery group, the agriculture group, the water group and the health group.

The Commission decides to close off the Aguas Mínimas Channel and to contain the contaminated water there until the sediments have sunk to the bottom and can be removed after draining the dam.

The JA Environmental Council opens a home page on the Internet with daily updates regarding the situation including: the crisis management, geographical information, recommendations for the public, and analytical information on the mud and water quality (Andalusian Government, July 1998).

Friday, May 1

The remaining floodwater is contained in the Aguas Mínimas Channel. The work of obstructing the channel is initiated in an attempt to avoid further contamination of the Guadalquivir River.

The Coordination Commission is officially declared established and becomes

⁷ The so-called Kyoto Convention is one part of the UN Framework Convention on Climate Change, by which a reduction in greenhouse gas emissions was agreed upon by the co-signers.

the liaison between the national administration and the autonomous administration of Andalucia. The CC is administratively located at the DGJA headquarters in Seville.

A meeting is held at the office in Aznalcóllar with representatives from: Boliden Apirsa, the Provincial Delegation of Labour and Industry, the Provincial Delegation of Environment, the Spanish Institute of Geomineral Technology (ITGE); the CHG; and the State Industrial Waste Company. These representatives suggest that the contaminated mud covering the Guadiamar Basin should be recollected and deposited in the mine's old open pit. This is considered to be the safest place for the contaminated soil. The Boliden Apirsa Board agrees to this.

Saturday, May 2

The obstruction and total closure of the Aguas Mínimas Channel is finished around 4:00 pm, which means no more contaminated water is then able to reach the Guadalquivir River. Some 2.5 hm³ of contaminated water is left, trapped between the protective walls. An estimated area of 4,400 hectares has been affected by the accident. This area is covered by mud and water, which both contain high levels of lethal metals.

Second Phase: May 1998 – June 1998

May

On Sunday, May 3, the clean-up process of the 40 km area affected by the accident starts. The Boliden company is directly responsible for the 15 km range from the mine to the road of Sanlúcar La Mayor. Employees from the mine are involved in the clean-up activities. Trucks from the mine are used to transport the contaminated mud from the affected area to the mine's old open pit for disposal. The remaining 30 km (beyond the road of Sanlúcar La Mayor) is cleaned up by the state-owned companies (TRAGSA, DAP and EGMASA) who are employed by Boliden. The Civil Guard, the Andalucian police force and the local police forces supervise the transport.

In the Aguas Mínimas Channel where the contaminated water is trapped, approximately 300 kg of dead fish are removed.

On Monday, May 4, the CC organises the coordination work between the five different working groups. Each group is associated with a different official/governmental organisation. The first group (the mine group) is to work with the mine on closing the dam, with the assistance of the Provincial Delegation of Mining and Industry. The second group (the mud removal and soil recovery group) is to organise the clean-up of the river basin, under the supervision of CHG. The third group (the agriculture group) will monitor the water and soil quality and the surrounding area, together with the Provincial Delegation of Environment in

Seville. The fourth group (the water group) will work on the agricultural aspects of the situation in coordination with the Provincial Delegation of Agriculture and Fishing. Finally the fifth group (the health group), supervised by SEPRONA, will organise security matters and take charge of the working area. The working groups are to adhere to the advice of the CSIC Scientific Committee.

Repair work on the broken dam at the mine continues.

On May 5, the JA Agriculture and Fishing Department dictates a bill to proceed with the plan for the defence and conservation of the agricultural land in the affected area. Agricultural and commercial activities (sowing, irrigation or use of irrigation water, pruning, soil treatments, grazing or any other activity that requires contact with the affected land) are prohibited (Agriculture and Fishing Council: Andalucian Government, 5 May 1998). The JA Health Council also implements a plan for sanitary vigilance with the purpose of monitoring the potable water quality in the area (Health Council: Andalucian Government, 4 June 1998). The export of agricultural products out of Andalucia drastically declines, according to representatives from the local agricultural organisations (Cambio 16, 25 May 1998:34-35). The tourist industry also reports economic losses as a result of the accident; several cancellations have already been made for the upcoming summer season (Ibid.).

The CSIC Scientific Committee makes public their second evaluation of the consequences of the accident. The committee praises the measures taken by the Ministry of Environment and by the Andalucian Environmental Council. CSIC proposes chemically treating the retained water in the Aguas Mínimas Channel, before it is released into the river again. The CSIC Scientific Committee emphasises the need to clean up the area before the autumn rains, which generally begin in October. The installation of a purification plant for the contaminated water is recommended. Also recommendations are made regarding the techniques for removing the contaminated mud and where to deposit the material (CSIC Report 2, 5 May 1998).

On May 6, a meeting is held between Boliden Ltd., the farmers' organisations and the JA Council of Agriculture and Fishing. Boliden promises to provide an evaluation within 30 days of the incurred damages to the farmland. The company also agrees to give a cash advance to those farmers whose 1998 harvest was directly affected by the accident. In this agreement, it is not explicitly stated that Boliden accepts any liability for the damages caused by the dam rupture.

Various Andalucian labour unions have set a general strike for May 14. In response to this, the JA issues a bill stating that those employees who participate in the strike will be jeopardising the work of public service and thus will be sanctioned (Industry and Labour Council, General Board of Labour and Social Security: Andalucian Government, 6 May 1998).

A resolution by the JA Council of Labour and Industry imposes certain restrictions upon Boliden Ltd. such as: stop pumping the remaining water from

the tailings pond into the mine's purification plant, continue reinforcing the broken wall, and present an action plan to the authorities (Industry and Labour Council: Andalusian Government, 6 May 1998).

The pumping of water from the mine's dam to the purification plant is discontinued on May 7. The results of the water and mud samples from the affected area are analysed by the University of Barcelona and published in a report by Greenpeace. The report discusses the possible impact of the contaminated water and mud upon Doñana's aquatic flora and fauna. These samples reveal high concentrations of lethal metals (Greenpeace's home page, 10 May 1998).

In the Spanish Congress, the Minister of Environment reports on the accident. She announces that she has asked the Ministry of Finance for 4.5 million pesetas⁸ to help deal with the after effects (El País, 8 May 1998).

On May 9, work on treating the contaminated water contained in the Entremuros Channel starts, in accordance to the CSIC's recommendations. The acidic water is treated with calcium in an attempt to elevate the pH level and to provoke the precipitation of sediments containing lethal metals. It is proposed that a purification plant be constructed to process the treated water, making it ecologically apt to be released into the Guadalquivir River. The zinc level of the sediment in the Guadimar River has reportedly decreased despite the fact that the river has been stirred during clean up.

On Sunday, May 10, a demonstration is held in Seville attended by about 10,000 people who demand that the National Park be saved (Svenska Dagbladet/TT, 11 May 1998).

The third report from CSIC is published on Tuesday, May 12 (CSIC Report 3, 12 May 1998). The committee has analysed the samples taken from the residual material released after the dam burst, and has found that the material contains zinc, lead, arsenic, copper, cobalt, thallium, bismuth, cadmium and mercury. The committee concludes that these substances are typical to mining exploitation and it recommends extra precaution in the removal work since inhalation of these substances can be harmful to human health.

A decree is proclaimed by the Junta de Andalucía defining the measures to be taken for dealing with the effects of the accident. Decree 99/1998 focuses on certain aspects such as water provisions to the residents in the area and sanitary control measures, among other things (Presidency of Andalusian Government, 12 May 1998). In the Andalusian Parliament an emergency plan is approved with a budget of 10.2 billion pesetas⁹ for dealing with the effects of the accident.

A resolution from the JA General Directory of Public Health and Participation is also mandated, which prohibits individuals from removing or handling the mud left on the riverbanks (Health Council: Andalusian Government, 4 June 1998).

⁸ Approximately US\$ 29,000.

⁹ Approximately US\$ 65,000.

Five horses are found dead on a farm in Sanlúcar La Mayor. Their intestines are sent for an autopsy to a laboratory in Córdoba (Coordination Commission for the Recovery of the Guadiamar Basin: National Government and Andalusian Government, 13 May 1998; Svenska Dagbladet, 15 May 1998).

A congress representative makes an announcement to the press concerning the future construction of a purification plant in the Cangrejo Grande area for cleaning the retained water before it is released into the river. The Subdelegate of the National Government in Seville (Andrés Herranz) declares that the pace of work on removing the toxic mud is too slow and that expropriation of the affected land would be an appropriate measure for speeding up the work (El País, 12 May 1998).

On May 13, it is reported in the press that some of the farmers are denying the clean-up workers, who are to remove the mud covering the farmers' crops, access to their property. The farmers demand economic compensation before they will let anyone remove "the evidence" (El País, 13 May 1998).

A bill from the JA Agriculture and Fishing Council states that all agricultural products from the affected area are to be collected and destroyed (Agriculture and Fishing Council: Andalusian Government, 13 May 1998). Rain halts the removal of the mud and threatens to further spread the contamination throughout the area.

In the Andalusian Parliament a proposal of creating a commission to investigate the accident and the subsequent measures taken is denied in a vote (El País, 13 May 1998).

On May 14, a resolution is adopted in the European Parliament considering an action plan for restoring the stricken area and includes a petition to the European Commission for economic and social assistance for the afflicted population (EU Bulletin: 1998 Environment (7/18), 13 April 1998). The European Commissioner of Regional Politics (Monika Wulff-Mathies) in Madrid declares that she will promote the idea of EU financial help for the clean up of the affected area. She also announces that the subsidies Boliden Apirsa is receiving from the Community Regional Funds will be suspended until further notice (namely, after it is determined who was responsible for the accident) (El País, 15 May 1998).

The Technological Geomining Institute of Spain (ITGE) declares that toxic water has entered water source number 27, which provides the National Park with underground water. The water source will quickly be contaminated, but the impact is considered minimal. The CHG completely denies this information (Ibid.).

One of the scheduled routes for the *Romería de El Rocío* (a pilgrimage procession for venerating the Virgin of Rocío) crosses the Guadiamar River at a place called El Vado de Quema. The JA decides to prohibit this passage considering it a risk to public health (Coordination Commission for the Recovery of the Guadiamar Basin: National Government and Andalusian Government, 14 May 1998). Thousands of people participating in the pilgrimage will have to take another route to get to the village of Rocío.

A calculation of lost earnings (namely, agricultural goods) is initiated by a group of experts. The affected farms are visited and their average annual production calculated in order to determine their estimated losses (El País, 17 May 1998).

A proposal for transforming the affected area into a “Green Corridor” is presented at a press conference by the JA Environmental Counsellor (José Luis Blanco) and the Spanish Environmental Minister (Isabel Tocino) on May 16. Counsellor Blanco states it will be necessary to immediately abandon all agriculture in the affected area as a means of quickly restoring the environment. This could provoke state expropriations in the event that landowners resist selling (Ibid.).

The President of the JA (Manuel Chaves) leaves for the European Parliament in Brussels in order to seek EU support for a management plan for the aftermath.

On May 19, another demonstration is held in Seville gathering some 2,000 people demanding political responsibility for restoring the Doñana area.

The JA Environmental Counsellor announces that the JA has asked the Spanish Army to be ready to act in the event that landowners do not allow access to their property for the clean-up work (El País, 20 May 1998).

The fourth report from CSIC is published on May 22 (CSIC Report 4, 22 May 1998). The expert committee reiterates their recommendations for retaining the water in the Entremuros Channel. They suggest the contaminated water should be treated with calcium hydroxide, which would neutralise the acid in the water and would cause lethal metals to precipitate. Thus the water would be purified before being released into the river, rather than being released in a highly contaminated state. CSIC suggests this as a quick and relatively cheap method for dealing with the contaminated water.

Meanwhile in Madrid the Minister of Environment presents a programme to the Council of Ministers with urgent measures for handling the situation in the affected area. The programme includes measures for organising a plan to clean up the area within five months (by October 30) and a plan for regenerating the afflicted area in ecological, economic and social terms. This plan is called “Doñana 2005.” A royal decree provides CHG with 4.5 million pesetas which was asked for by Minister Tocino (State Department: Spanish National Government, 22 May 1998).

A month after the accident (on May 25) Boliden opens an information office in the town of Sanlúcar la Mayor, where it informs the public on the past events and the progress of the clean-up work. The five horses which were found dead in the affected area and were sent to a laboratory in Córdoba for analysis, are declared to have died from insecticide intoxication and apparently had no traces of toxic substances associated to mining (Coordination Commission for the Recovery of the Guadiamar Basin: National Government and Andalusian Government, 25 May 1998).

The 4.5 hm³ of retained water in the Entremuros Channel will be released into the Guadalquivir River after being treated in accordance with the CSIC recommendations published in their fourth report (El País, 26 May 1998).

On Tuesday, May 26, the JA dictates a decree which constitutes an interdepartmental commission within the Junta de Andalucía for coordinating the measures taken in the affected area by the Andalusian administration (Presidency of Andalusian Government, 26 May 1998).

The General Coordinator for the Coordinating Committee is appointed by the Council of Ministers on May 29 (Ministry of Public Administration: Spanish National Government, 29 May 1998).

June

On June 2, a declaration is made in the JA Council of Government, which declares the urgent need to remove the contaminated mud from the affected area, in light of the threat to public health. The declaration dictates the criteria for proceeding with this (Presidency of Andalusian Government, 6 June 1998).

During the International Congress of Mining and Metallurgy in Valencia, critics say the removal of the contaminated mud is being incorrectly done by using heavy machinery which is ruining the soil by mixing the contaminated mud with the underlying soil. Experts in the international congress also deny the statement that water source number 27, which provides the National Park with ground water, is contaminated as a result of the mining accident. This is declared feasibly impossible since the ground currents are flowing away from water source 27 and not towards it (El País, 3 June 1998). On Wednesday, June 3, the Spanish Prime Minister (José María Aznar) meets with the new representative of the national government in the CC (Félix Pérez Miyares) in Seville to talk about the measures being taken regarding the dam accident.

A national consumer organisation, OCU, states in a report that there are no risks implicated in eating fish from the Guadalquivir area, nor in swimming in the nearby sea or in drinking the potable water (El País, 4 June 1998).

The fifth report from CSIC is published on June 5. The use of heavy machinery in removing the contaminated mud is criticised and the existence of mercury in the mud is denied (CSIC Report 5, 5 June 1998).

It is decided that the retained water in the Entremuros Channel will be treated with sodium carbonate at several of the dams and, once clean, will be released into the Guadalquivir River. This operation will be managed by the Seville Industrial Engineer School (El País, 10 June 1998; Coordination Commission for the Recovery of the Guadiamar Basin: National Government and Andalusian Government, 9 June 1998).

A decree from the JA is issued on June 9 stipulating the acquisition of private land affected by the accident as a means of cleaning up the area. The acquisition is to be accomplished by buying land from the owners, or by expropriation if necessary (Presidency of Andalusian Government, 9 June 1998).

Boliden Ltd. announces that according to a report from an independent

consulting firm, the probable cause of the dam rupture was a shift in the ground 15-20 metres below the surface.

By the middle of June more than one ton of mud and soil has been removed and has been transported from the affected area back to the mine.

The decree from June 9 is, on June 18, followed by a bill from the JA Agriculture and Fishing Council, which stipulates the procedures for the acquisition of the affected land by the Andalusian Government (Agriculture and Fishing Council, 18 June 1998).

By a decree of the JA Environmental Councillor, the Participation and Information Organisation is created on June 18 with the purpose of organising communication between the JA, the affected municipalities and the different NGOs involved (Andalusian Government, July 1998:11).

On June 22, Boliden Ltd. starts reimbursing the farmers whose harvests were ruined.

On June 25 the sixth report from CSIC is published, in which the members of the Scientific Committee reiterate their concern for removing the mud with heavy machinery since it is removing equally as much good soil as contaminated mud. The report also emphasises that there are high levels of atmospheric particles loaded with lethal metals, which is harmful to human health, in the Guadiamar area. These high levels are attributed to the mud removal activities. Furthermore, the use of heavy machinery combined with climatic factors (such as high temperatures and little rain) negatively affect the atmosphere. Also the CSIC committee suggests speeding up the pace of mud removal to assure that the area will be cleaned before the autumn rains (CSIC Report 6, 25 June 1998).

By the end of June, 2000 tons of contaminated mud has reportedly been removed from the affected area and transported to the Boliden pit. Meanwhile the contaminated water retained in the Entremuros Channel is being treated with sodium carbonate. On June 26, the CC commission decides during their weekly meeting to construct a purification plant. This will chemically and biologically treat the water in order to ensure it can be safely released into the Guadalquivir River and in a clean state (Coordination Commission for the Recovery of the Guadiamar Basin: National Government and Andalusian Government, 26 June 1998).

Aftermath: July 1998 – April 1999

July

On July 1, the JA representative of the CC (Antonio Viera) makes a statement to a Spanish newspaper that the contaminated mud (still covering large parts of the Guadiamar Basin) will be removed before the autumn rain begins in October (El País, 2 July 1998).

On July 3, a law is issued in the Junta de Andalucía Parliament that appropriates 8 billion pesetas¹⁰ for the restoration of the affected area.

In a village outside Cádiz in the southern part of Andalucía, a small dam (used in the production of glass) breaks. The exact amount of water released is debated. The Government Delegation claims it was 30,000 m³, while the Mayor of the village and the Andalusian Government claims it was no more than 3,000 m³.

On July 15, the JA grants a total of 170 million pesetas¹¹ to the municipalities affected by the accident in Seville as a means of employing people in the restoration work (Governmental and Justice Council: Andalusian Government, 15 July 1998).

Members from the AEMA (Agencia Europea de Medio Ambiente), who supervise and counsel the European Commission, visit the affected area and approve the measures being taken by the Spanish authorities (El País, 21 July 1998).

On July 21, the JA approves a change in the environmental legislation (which regulates the acceptable level of sulphate in the water) in order to ensure that the retained water in the Entremuros Channel can be released into the Guadalquivir River within the legal framework. The acceptable level is augmented. Four days later, on July 24, the retained water is poured back into the river. The construction of the purification plant continues (El País, 25 July 1998).

An employee of the Boliden mine declares in court that, customary in mining activities, an explosion occurred at the mine the same day the dam broke. Some 12,000 kg of dynamite were used in the explosion (El País, 22 July 1998).

The removal of the contaminated mud requires that additional trucks and machinery are hired from Portugal and other countries, since there is a lack of such vehicles in Spain. In the affected area some 600 vehicles are at work. By the end of the month some 1,800,000 m³ of contaminated mud have been removed from the Guadiamar Basin and additionally some 559,000 m³ from the estimated total of 2,25 hm³ (El País, 28 July 1998).

August 1998 – April 1999

On August 10, Minister Tocino inaugurates the purification plant in the Entremuros Channel. At this point approximately 120 people are employed in the manual removal of the contaminated mud (El País, 11 August 1998).

The removal of mud continues throughout the autumn and the winter, and the purification of the retained water proceeds as scheduled. Luckily, the autumn precipitation is low this year, and thus no major flooding occurs in the Guadiamar area and further contamination is no longer considered a major threat.

On April 8, 1999 (almost a year after the accident) the JA authorises the reopening of the Boliden mine.

¹⁰ Approximately US\$ 50,000,000.

¹¹ Approximately US\$ 1,056,000.

Appendix II

Photos of the Affected Area



Aerial view of the Aznalcóllar area a few days after the mine dam rupture (Photo provided courtesy of the Environmental Council: Andalusian Government)



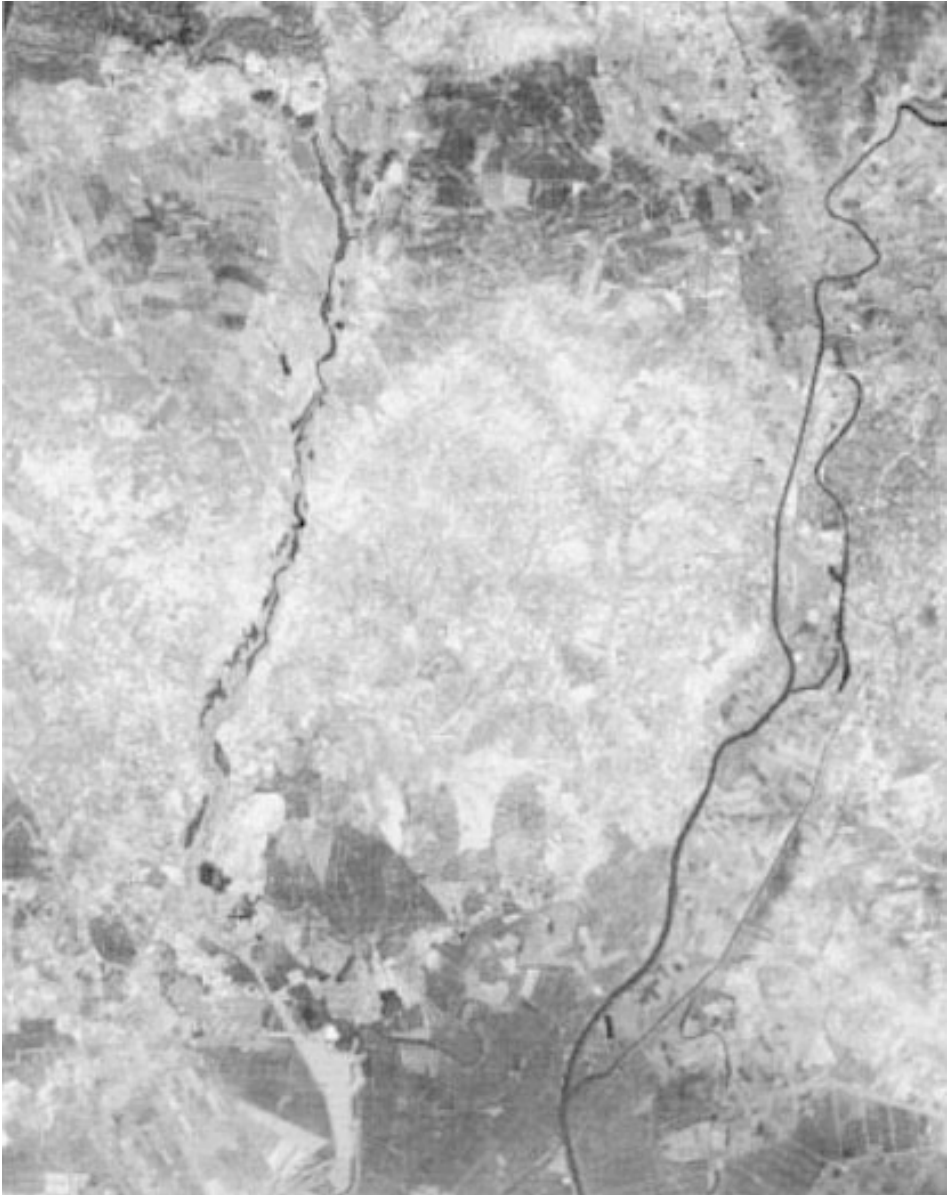
Aerial view of the Guadiamar River (Photo provided courtesy of the Environmental Council: Andalusian Government)



Collecting dead fish and crabs in the Doñana area (Photo provided courtesy of the Environmental Council: Andalucian Government)



Cleaning up (Photo provided courtesy of the Environmental Council: Andalucian Government)



Satellite photo of the affected area (Photo provided courtesy of the Environmental Council: Andalusian Government)