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MEDICAL AND PSYCHOLOGICAL ASPECTS OF CRISIS MANAGEMENT DURING A NUCLEAR ACCIDENT

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MEDICAL AND PSYCHOLOGICAL ASPECTS OF CRISIS MANAGEMENT DURING A NUCLEAR ACCIDENT[1]

Britt-Marie Drottz Sjöberg

Abstract

Crisis handling in most kinds of disasters is affected by e.g. the information situation, prior experience and preparedness, availability of resources, efficiency of leadership and coordination, and type of disaster. A nuclear accident creates a situation which differs from many "normal" disasters and natural catastrophes, for example with respect to the invisible nature of radiation and radioactive contamination and thus the dependence on access to specific technical equipment and expertise, and to information about the radiation situation. The scope of the accident, and the existing levels of radiation, define subsequent actions; information policies and existing channels of communication lay the foundation for public reactions. The present paper explores some examples of public reactions, and crisis handling of some previous radiation accidents on the basis of two dimensions, i.e. degree of information availability and degree of impact or "environmental damage". The examples include the radiation accidents in the Chelyabinsk region in the southern Urals, at Three Mile Island, USA, at Chernobyl in the Ukraine, and in Goiania, Brazil. It is concluded that public reactions differ as a function of existing expectations, and that crisis handling is more affected by the existing organizational and social structures than by needs and reactions of potential victims. Another conclusion is that pre-disaster preparedness regarding public information, and organization of countermeasures, are crucial to the outcome of a successful crisis handling and for enhancing public trust in crisis management.

Keywords: nuclear accident, public reactions, information, trust

Introduction

The word "accident" generally means something unintended and unexpected which has a negative value[2]. The expression "nuclear accident" may refer to a minor and local incident without medical and psychological effects on humans, as well as a major disaster, including widespread release of radioactivity, immediate and delayed human deaths or injury and longtime environmental damage. Quarantelli (1990) distinguished between accidents and disasters by stating that there is a difference of kind, not just degree. And thus, that "an accident cannot be perceived as a little disaster, nor can a disaster be viewed as a big accident" (p. 1). I will nevertheless use this range of meanings and effects, from minor local incidents to major disasters, in exploring the relationship between estimated damage and public reactions. "Medical aspects" in this context refer to a range of outcomes, from actual deaths to physical injury and delayed health damage. "Psychological aspects" refer to states of concern and worry. Both kinds of aspects are used in a dimension of damage caused by an accident, i.e. "environmental damage". Examples of historic nuclear accidents and public, organizational and individual reactions are included.

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[1] This is a revised version of a paper presented at the International Conference on Nuclear Accidents and Crisis Management, March 16-18, 1993, in Stockholm, Sweden.

[2] Accident: "1. an undesirable or unfortunate happening that occurs unintentionally and usually results in injury, damage or loss. 2. an incident that results in injury, in no way the fault of the victim, for which compensation or indemnity is legally sought. 3. any event that happens unexpectedly, without a deliberate plan or cause. 4. chance; fortune; luck; I was there by accident. 5. a nonessential or incidental feature or circumstance". Webster's College

Examples of radiation accidents

G. Medvedev (1991) listed twelve nuclear accidents between 1951 and 1986 in the U.S.A., and eleven nuclear accidents in the Soviet Union, from 1957 and before the Chernobyl accident; accidents which most people have never heard of. He referred to various forms of radioactivity releases in relation to the accidents, e.g. via steam, gas, or waste water. He mentioned three casualties in 1961, due to a steam explosion at an experimental reactor in Idaho, and that three persons were killed due to problems at reactor No. 1 in Leningrad in 1974. The latter types of accidents could be classified as local, affecting especially employees, and possibly indirectly affecting the local population. They are mainly ignored by the media and do not make any lasting impression on the international public.[3]

The accidents which have had a great impact on the public's image of nuclear power, and on official debates and nuclear power politics, are the accidents at Three Mile Island (TMI) and Chernobyl. The TMI accident in March 1979 came to portray the actual manifestation of the improbable, the realization of the ridiculously low probability of a (partial) core melt down. And although there were no casualties, no explosion, and no internationally significant radioactive contamination, the world suddenly came to a standstill. Some groups of the local population were temporarily evacuated[4]. There was no panic, although certainly traffic congestion, and many people became frightened.

Behler (1986) characterized the citizens' reactions during the first two days of the TMI accident as unconcerned. At this time most residents believed that the situation was under control and not really serious. This kind of reaction is sometimes referred to as "the normalcy bias" (Quarantelli, 1990). Events on the third day, when a release of radioactive gases from TMI-2, which gave a radiation reading of 1200 millirems/hour just above the smokestack, was reported, and when evacuation recommendations were issued by the Governor, the situation changed. The citizens' reactions varied from disregard of the information to actual evacuation. Behler (1986) related the estimated figures that 33% to 50% of the Riverside residents "actually took the evacuation step" (p. 155). The evacuees were mostly "female, children and young adults, and the more highly educated members of the population" (p. 155).

The information flow to the public concerning the TMI accident started "by accident"; a traffic reporter scanned the citizen's band radio in his car and heard that there was a mobilization of fire-fighters and police in Riverside. But there was no explanation given to the action. In checking up on this information, the news director of the radio station came to contact the TMI plant and to talk to an operator who said he could not talk due to ongoing problems, and advised the director to instead contact the Metropolitan Edison's Manager of Communication Services. This manager said, in sum, that a general emergency had been declared at Three Mile Island, but that there was no danger outside the plant or to the general public. Before noon, at 11 a.m., March 28, the first official press conference was held about the situation (Behler, 1986).

[3] Similar fates are common for radiation accidents in medical treatment, but they will not be discussed here.

[4] Shortly after noon, Friday March 30, pregnant women and preschool children were recommended by the Governor to leave the area within a five-mile distance of Three Mile Island. The Governor also closed all schools within that area.

Increased levels of stress hormones were measured as late as five years after the TMI accident (Baum, 1987) in the affected population, and the accident is not forgotten even today. Distress under the acute phase of the TMI accident was related to how close people lived to the reactor, and if one had preschool children (Baum, 1987). Baum (1987) concluded that "though the accident may have caused substantial distress and disruption, response to it was not unusual and effects were largely short-lived" (p. 29).

The TMI accident lead to an increased plurality regarding the power structure in the community. Behler (1986) wrote: "Indeed, it is quite clear both from available literature and interview data that the TMI accident not only has permanently affected general social life in the community, but also has led to a basic restructuring of the Borough's political arena by prompting some major changes in community leadership patterns, decisionmaking processes, and problemsolving methods" (p. 69). In an international perspective, the TMI accident will probably be best remembered for its "realization of the improbable" and for the "information crisis" it caused. Official reports of what happened have been described as incorrect, incomplete or contradictory, harming the credibility of the nuclear industry (see e.g. Behler, 1986). In spite of its high level of exposure in the media worldwide, and in spite of it causing acute and long-lasting distress in the surrounding population (e.g. Baum, 1987), the TMI accident never reached the same infamous status as the Chernobyl accident.

The Chernobyl accident in April 1986, in the former Soviet Union, is the accident which has imprinted itself in the minds of the general public worldwide. The accident combined several nightmarish components: there was no warning, there was official silence, there was an explosion, there was a major release of radioactivity, there were tragic deaths of heroes fulfilling their duties to their people without sufficient information and protection, there were uninformed citizens going about their lives as usual, and there came to be massive evacuations of already unfortunate people to totally unfamiliar places[5]; resettlements which are still in progress, delayed in some regions due to economic difficulties. This scenery was not the most influential, however, on the international public in the close "aftermath of Chernobyl"; on the contrary, the immediate concerns were related to possible harm inflicted on the local neighborhood and within the national borders. In due time, however, and in step with releases of new information about the fate of the locally affected populations, and especially the children, details of the massive task of implementing effective countermeasures after a major nuclear accident have slowly begun to be revealed.

The development after the Chernobyl accident has involved a "green movement"[6], and increased availability of information, not the least information about personal radiation doses and degrees of radioactive contamination of land and agricultural products to people in the affected areas. This information is not easily understood by anyone not specialized within the radiation field, however, and information of "doses" and "levels" have in many cases only confirmed that one's person or the home area has actually been affected by the Chernobyl accident. The general uncertainty about long-time and low-dose effects on human health, with respect to both actual relationships and to how such information best should be presented, has

[5] In the first wave, on April 27, 1986, almost 50.000 persons were evacuated from Pripyat. Between May 2 and May 5, more than 38.000 persons were evacuated from the Ukrainian sector, and during May 3-5 more than 11.000 persons were evacuated from affected areas in Belarus (Savkin, 1992).

[6] The Chernobyl accident became the catalyst of a developing "green movement" within the framework of Glasnost; see Wolfson and Butenko (1992), for a review of the current environmental movement in the former Soviet Union and eastern Europe.

created an unhealthy atmosphere of anxiety and vulnerability. Attempts to side-step the problems by putting the blame on the affected people for overreacting, e.g. the "radiophobic" quasi diagnosis of public anxiety, have largely failed (see e.g. Drottz-Sjöberg & Persson, 1993, for a discussion). Public ignorance of radiation effects on health is a world-wide phenomenon, and ignorance and unwillingness to personally test the hypothesis that there are no adverse effects to health simply do not add to a diagnosis of phobia. With respect to the local people affected by the Chernobyl fallout it is even the case that many of them were unaware of a relationship between radiation and nuclear power plants, the localization of nuclear power plants, and the distance they lived from the Chernobyl plant.

Archangelskaya and Ivanov (1992) wrote that "Passive expectation of an outside help, of a "miracle", is becoming very typical of the inhabitants of such {affected} areas" (p. 1). The authors referred to joint seminars and conferences of the different CIS states, where representatives had reported, but not documented, increased morbidity, thyroid diseases and blood diseases. They furthermore presented data from 1991-92 which showed strong beliefs in the public of the respective states that the radiation situation is hazardous for one's health (p. 3). Archangelskaya and Ivanov added that more than 90% of the people in the rural areas were born there and had always lived there. Thus, evacuation and involuntary relocation meant a major life event for the affected people. Relocated people were reported to have two main problems: "social rejection (tearing away) from the local folks and a change in the social status" and "a never-ending belief in inevitability of heavy consequences from the suffered radiation for the migrants themselves and their children" (Archangelskaya & Ivanov, 1992, p. 4).

The *Working Group on Psychological Effects of Nuclear Accidents* within the WHO Regional office summarized, in 1990, the complexity of the situation after the Chernobyl accident by outlining the following interrelated dimensions:

> - "the sociopsychological dimension of the perception of risk involved in radiation, and the part information policy plays;
>
> - the sociocultural dimension of the displacement and consequent social disruption of communities;
>
> - the general pathogenic factor relating to physiological stress reactions and to changes in lifestyle, such as dietary habits and the consumption of alcohol;
>
> - the medical sociological dimension concerning changes in the illness behavior of the population and in the diagnostic behavior of the doctors;
>
> - the socioeconomic dimension relating to the large-scale effects of the Chernobyl accident, such as the closure of the nuclear plants and the reversion to other sources of energy; and
>
> - the radiopathological dimension and its nonstochastic and stochastic effects" (p. 2).

The working group furthermore mentioned dissatisfaction with authorities and medical staff, and anxiety as a major problem in the affected areas, and outlined the difficulties in knowing and informing about the individual health effects due to the radiation situation. They listed several recommendations, including how to come to terms with conflicting health reports

and how to categorize health effects. The voluntary and the organized movements from the affected areas today involve, among other problems, the problem of localizing groups and individuals who should be monitored for health effects. In particular, this is the case with the so called group of "liquidators", i.e. some of the about 500.000 persons who worked in the initial cleanup operations.

In the case of the Chernobyl accident much of today's problems seem to be based on organizational difficulties, not the least in relation to the development of the new Commonwealth of Independent States (CIS), the generally insufficient standard of medical supplies and technology, the underdeveloped infrastructure and the historic hierarchial structures, which influence decisions and availability of information. The Working group concluded:

> "The Working Group is convinced that the population in the affected areas is experiencing very serious worries about the health effects of the Chernobyl accident. People's concerns appear to be increasing with time, and urgent steps are therefore necessary to improve the situation. Appropriate action requires, however, that the psychosocial context of the nuclear accident (as well as the radiation levels and their medical nonstochastic and stochastic sequelae) receive detailed consideration" (1990, p. 1)

In Goiania, Brazil, in September 1987, there was a radiation accident involving a theft of a cylinder, containing a tiny capsule of ^{137}Cs, from a medical device in an abandoned radiation treatment clinic. The subsequent interest in, and handling of, this cylinder and the content of the capsule came to cause radioactive contamination in parts of Goiania city (see Roberts, 1987; IAEA, 1988; Petterson, 1988; Brandao-Mello, 1991; Lipsztein, Cunha & Oliveira, 1991; Rosenthal, de Almeida & Mendonca, 1991; Oliveira et al., 1991). It was estimated that more than 120.000 persons, approximately 10% of the city population, were monitored for radioactive contamination on their own initiative. Of those monitored, about 250 persons were found to be contaminated, and about half of this group revealed body contamination, 21 of whom required hospitalization, including about 10 persons in a serious condition. Four persons died and one had a forearm amputated. The radioactive waste became a problem, and almost 40 tons of contaminated materials were handled in the cleanup process (Petterson, 1988). An IAEA (1988) report on the Goiania accident stated that the actual amount of generated waste was 3500 m^3. Social stigmatization occurred due to the accident and spread far outside the actually contaminated areas, resulting in economic losses to agriculture, manufacturing, industry, home sales, and tourist business. Some illustrative examples are the monitoring of more than 10.200.000 bank notes for contamination (68 bank notes were found to be contaminated, see Rosenthal, 1991), the requirement of more than 8.000 residents for certificates which proved that they were not contaminated, which in turn helped them to book air flights and register at hotels.

Accounts of experts and technical personnel working in Goiania tell of several unexpected experiences. For example, they worked in an "uncontrolled environment" in close contact with the general public, outside their ordinary routines (Lipsztein et al., 1991), and had to violate peoples' privacy when decontaminating homes and bodies. They had to face new tasks because fear of contamination hindered others to help with doing their tasks, e.g. plumbing. Brandao-Mello (1991) described the aversive reactions of hospital personnel with respect to hospitalized victims, resulting initially in the isolation and abandonment of the victims. Even U.S. trained doctors and dentists refused to treat patients who lacked certificates

aminated (Petterson, 1988). They also had to deal with shortage of e.g. fax machines and computer networks, problems with heat in ve clothing, very upset persons and victims unwilling to cooperate or ted treatment. They had to deal with the idea that radioactive y contagious disease (Lipsztein, 1991). They had to face ethical se of the six-year-old girl who was extremely contaminated and her her, as well as letting her receive many toys which would end up as icians and experts were also "tested" by the local population and l drink water which they had judged to be safe (a kind of security by the local populations in the areas around Chernobyl, experienced ersonnel there).

22 victims had to wait more than 24 hours for decontamination baths feared these would contaminate the area (Brandao-Mello, 1991). The ntamination site resulted in spreading the contamination by rain and treatment of victims.

lence was widely publicized in the Brazil papers and the country has ccident involved deaths and extremely dramatic scenes in relation to , and very crudely speaking, there were few victims and the fear was tion, the dramatic media content, and the simultaneous political attention and public support (Petterson, 1988). A very different unveiled from the files of the former Soviet Union.

Oblast in the southern Urals was declared an ecological disaster zone e Russian government (Monroe, 1992). The region is still suffering te pollution of the Techa River beginning in 1947, and the effects of 1957, in addition to pollution from metallurgical and chemical plants waste dumps and storage sites. Z. Medvedev (1979) described the n the Urals, the "Kyshtym accident". This accident, caused by n ound waste facility in 1957, affected more than a thousand square rn Urals, and caused the death of "several hundred persons" (p. 4). of others, and the identification of a danger zone which will remain Monroe (1992) argued that it is believed that the combination of the he resulting radioactive cloud after the Kyshtym explosion, and the 972 which exposed the shorelines of Lake Karachai to the wind rticles, "have exposed over 400,000 to radiation and to be the cause cases of chronic radiation illness in the Chelyabinsk region" (p. 538).

dent, and other major accidents involving radiation, have been officially ner Soviet Union only as late as 1989 (Monroe, 1992). The official and ons to these threats to the populations' life and health have until nce. The silence was partly due to the secrecy surrounding military to the overall political structure which habitually did not volunteer its population or press. Monroe (1992) stated, regarding the Kyshtym ere forced to sign a statement promising not to reveal the reason for tion sickness, cancer and deformities. Patients were informed instead rom 'weakened vegetative syndrome'"(p. 537). It is also interesting to vedev's account of the accident in the Urals, which he first published 1976, that his account was followed by disbelief and denials among vedev, 1979). With respect to the evacuations and demolishing of

villages which took place due to the pollution of the Techa River and the Kyshtym accident, these people certainly understood that something had happened, but Monroe (1992) stated that villagers were not informed about the reason for the actions taken. Medvedev (1979) made the following comment about the population's reactions to the "Kyshtym accident":

> "Millions of people who lived in the Urals knew about the disaster, although most ordinary people thought the story that a nuclear waste storage site had exploded was absolutely false; they were more inclined to believe the inevitable rumors that an atomic bomb had accidentally exploded" (p. 16).

In the former Soviet Union, which must be considered an industrialized country, the aspects of information availability enter the picture in a very different way as compared to the accident at TMI and in Goiania. However, in contrast to the almost total lack of public information regarding the severe accidents in the Chelyabinsk region, the Chernobyl accident happened at the same time as the political reform of *Glasnost* was being introduced, and this gradual change of information policy, in addition to the international reaction to the accident, came to influence significantly all subsequent decisions and actions. The change in information policy was *gradual*, however, and resulted primarily in the actual, although delayed, official announcement that a nuclear accident had occurred[7]. People in some affected regions were not informed of their situation regarding radioactive contamination until 1988 or 1989. Shmelev (1992) reported that the initial media attention in 1986 decreased during 1987, but increased again in 1988, when *Glasnost* had developed further, and new information about contaminated villages appeared. He pointed out that the lack of information had lead to the development of rumors. Young and Launer (1991) described the governmental rhetoric related to the Chernobyl accident as clearly separable into six stages, starting with a period of silence, followed by "a reflexive lashing out at Western news sources" (pp. 104-105).

The health situation in the former Soviet Union is a matter of concern by itself. The decreasing health is often related to the overall environmental situation. For example, Wolfson and Butenko (1992) used official Soviet sources and stated that "in 1988 fifty million people lived in cities where pollution of air, water, or food was a direct threat to their own health or that of their progeny" (p. 43). Estimates of "the cost of the damage from pollution and massive degradation of water, soil, forests, and other natural resources as well as public health was some 6 billion rubles a year, a sum equal to the Soviet GNP in 1986-87" (p. 43). Thus, the medical professionals are facing difficulties in achieving correct diagnoses and in understanding the causes of all reported illnesses, not to mention the practical difficulties in offering adequate medical care. The example from Wolfson and Butenko also casts some light on the problem of finding "clean areas" unaffected by any kind of environmental pollution for comparative research.

The above described accidents all differ from each other in several respects. Accidents within nuclear facilities mostly concern the specific plant or company and the international body of nuclear expertise. They result in changes and developments of rules and safety standards. The accident in Goiania differs from those at TMI and Chernobyl on the basis that is was caused by civilian misconduct. The Chernobyl accident represents the first major nuclear accident to have international consequences. The disastrous situation in the Chelyabinsk region

[7] In Pripyat on April 27 for evacuation reasons, a national four-sentence announcement by TASS at 9 p.m. April 28, continuous short reports until Gorbachev's national TV speech May 14 (see Young & Launer, 1991).

differs mainly from the other mentioned accidents in terms of the more than thirty years of official silence. It can be discussed, however, if the radioactive dumping in the Techa River should be included under the "accident" classification since it was based on deliberate decisions.

Information, fear and trust

When a nuclear accident occurs, time is a scarce resource. The logistic preparations are crucial, including availability of protective materials, appropriate facilities for decontamination, communication networks, and coordination. In industrial countries with well-coordinated rescue teams and appropriate resources, it is possible to meet the requirements of large industrial accidents. Industrial accidents seem to increase, however, in the developing countries (Kapoor, 1992), but that does not mean that the industrial world is safe. Quarantelli (1988) predicted that the United States is going to face more, and worse, disasters in the future: "The future, insofar as disasters are concerned, is certain to produce not only quantitatively more disasters, but qualitatively worse kinds of disasters than we presently have and have had in the past" (p. 1). Kapoor (1992) mentioned that 34 industrial disasters occurred in the world between 1980 and 1987, of which 14 occurred in developing countries. With respect to casualties, the number was considerably higher in developing countries than in the industrial world, a fact due to e.g. population density and uncontrolled settlements close to industrial settings. Land close to hazardous facilities is less attractive to people who have the economic means of choice, with the result that shanty towns and slums grow in industrial danger zones. The accident at the Union Carbide pesticide plant in Bhopal 1984 is one example. The radioactive contamination in the Goiania accident affected especially people from low economic strata for the simple reason that these were the people who worked at junkyards and who collected scrap metals.

Public reactions and subsequent actions mirror the perceived degree of threat, as well as perceptions of violations of expectations and social norms. Thus, public expectations of information vary due to the social system, and the social system seems capable of steering expressions of fear and anger either outward or inward. For example, in relation to the TMI accident the industrial world, and Americans in particular, expected instant and correct information. All deviations from these expectations were subsequently intensively criticized. In contrast, the citation from Medvedev (1979) above indicated that people in the Chelyabinsk region just did not believe "the story that a nuclear waste storage site had exploded...", but not in the sense that they found the scenario unbelievable, rather in the sense that they were more inclined to accept rumors that they had been exposed to the unintentional explosion of an atomic bomb. They could not go public, however, neither with their beliefs nor their fears.

Prince-Embury (1992) gave an example of experienced comfort due to the mere knowledge that studies of possible health effects due to the TMI accident were conducted, from participants of an information course, the Three Mile Island Health and Environmental Information Series, six years after the accident. In her paper, she pointed to one kind of fear by quoting a participant saying: "at the time of the accident some experts said they didn't know but people thought they were lying. It's what they didn't know that you thought they did know that's scary". I would characterize this fear as more "academic" than the fear rising from becoming aware of a direct threat, or the fear caused by action without explanation as in the Chelyabinsk region. Fear deeply rooted in historic events and habitual distrust of authorities leaves little room for expectations of sincere help efforts if you are involved in a disaster.

Remains the reinforced hostile world, the continued dullness of life, the anxiety, the apathy, and the internalization of all kinds of fears - and for some, praying for a miracle[8].

Whereas ongoing follow-up studies in the TMI-area may comfort the Americans, similar studies in the Chernobyl region do not seem to have the same effect. Official statements and reports have down-played the possible health effects caused by the Chernobyl accident at the same time as massive screening and evacuations of the affected populations have taken place. Chazov (1989), at the time USSR Minister of Health, stated firmly in a Kiev conference in 1988: "One must say definitely that we can today be certain that there are no effects of Chernobyl accident on human health, and to the great extent due to the selfless work of medical specialists (399 of them were given the Government awards)" (pp. 9-10). He continued to describe the extent of the undertaken work:

> "During the first few months after the accident the stationary examination was provided for 37,5 thousand people (12,6 thousand of them - children). By the end of 1986, 696 thousand people (215 thousand of them - children) were provided with necessary medical treatment. The All-Union distributed clinical-dosimetric register of irradiated individuals was created. It includes more than 600 thousand people, who are now under the special dispensary observation" (p. 10).

Chazov (1989) concluded that "The complex of measures undertaken in our country allowed to protect the health of Soviet people from the possible negative radiation effects" (p. 10). Blix (1989) reported at the same conference that "The accident was very severe, but the wounds are healing" (p. 13)[9].

The prevailing influence of the historic official information policy in the former Soviet Union complicates the current information situation, and can be described as 'people do not always believe what they hear'. The terms often used for these reactions are "dissatisfaction" and "distrust". However, also the derogatory concept of "radiophobia" has been used (Drottz-Sjöberg & Persson, 1993). The Gomel Sociological Center (ORACUL) has made available some figures of a press poll in Belarus from November 1991 (Kasyanenko, undated), which showed e.g. that about 52% of the respondents believed that the Chernobyl accident may affect the health of the family, and that about 60% did not agree with the conclusions of an "international expert group" that health consequences due to the accident were exaggerated. Archangelskaya and Anischenko (1990) stated that 79% of the respondents, and 85% of the doctors, in a study in the Bryansky region[10], reported that they had noticed "the influence of radiation on their health" (p. 4).

A pilot study, including respondents in the area of Novozybkov, in the southwest of Russia, listed 18 information sources in a questionnaire and asked the respondents to indicate their level of current trust in each of the listed sources on a scale ranging from (1)= "Do not trust at all" to (7)= "Trust completely". The results showed that the four most trusted

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[8]. See Dynes & Yutzy, 1965, for a discussion on religious interpretations of, mainly natural, disasters.

[9] See also the technical report from the International Chernobyl Project (IAEA, 1991), for details on the historic events, levels of environmental contamination, radiation exposure, and health impacts.

[10] The study included respondents from both "controlled" areas, i.e. zones of high radioactive contamination, and "uncontrolled" areas, i.e. zones with no or low level of radioactive contamination.

information sources were all of foreign origin[1], and that the most trusted national source was "health promotion bodies", the least trusted source was "the district soviet". Measured in indices the "external" or foreign information sources gained a mean value of 4.32 compared to "internal" information sources with a mean value of 3.11. (Drottz-Sjöberg, 1992). Note, however, that none of the information sources gained a very high rating, indicating a generally skeptical attitude to available information sources. See Fig. 1.

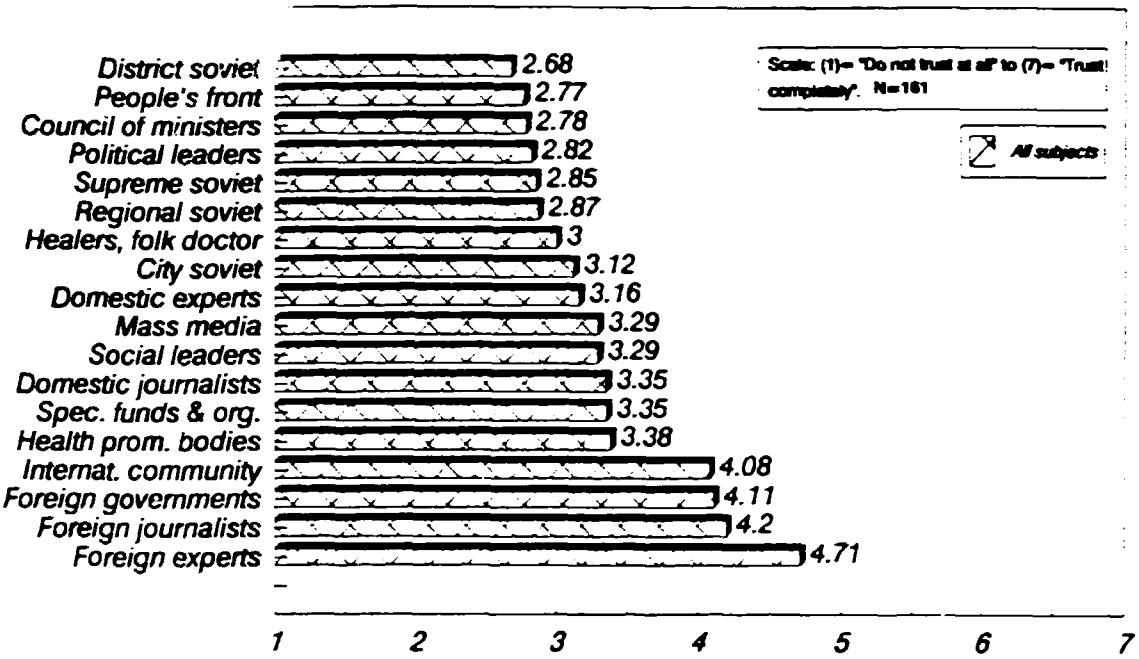

Figure 1. Mean values of current trust in 18 information sources regarding information about the Chernobyl accident, respondents in Novozybkov, Russia, 1992.

Since the time of the Chernobyl accident local populations have been approached by many technical and medical teams for investigations (see e.g. Havenaar & van den Bout, 1992; the IAEA reports 1989; 1991). Rumyantseva and Martushov (1991) described their examinations of stress reactions among people living in areas contaminated by the Chernobyl accident. They divided the reactions into three periods: *an acute phase*, lasting approximately 10 days, from the accident to the end of the evacuation of the disaster zone, *a subacute phase*, lasting approximately 6 months and ending when the reactor was sealed by the sarcophagus and the migrants from the 30 km zone were settled (i.e. in November-December 1986), and *a chronic phase* which still continues. The first phase was characterized by increased anxiety and decreased physical well-being. In the second phase the effects of social factors such as loss of home and property were added and asthenic and subdepressive reactions detected. In the current phase, and since 1991, asthenia and apathy have become the main symptoms.

In response to the request of marking the five most worrisome aspects of the Chernobyl accident the most often indicated alternatives in the ORACUL study (Kasyanenko, undated) were: 1. "Risk of another accident at Chernobyl" (74.8%), 2. "Lack of control over health

[1] "...ign experts" (mean=4.71), "foreign journalists" (mean=4.20), "foreign governments" (mean=4.11), and "the international community" (mean=4.08).

condition" (74.0%), 3. "Uncontrolled expenditures of the Chernobyl means" (64.7%)[12], 4. "Lack of protection of those who directly suffered from the accident" (57.4%), and 5. "Absence of independent ecological expertise" (44.3%). Asked about who did the most valuable contribution in eliminating the consequences of the Chernobyl accident in Belarus, the respondents most often indicated the following five alternatives: 1. "International community" (55.7%), 2. "Foreign governments" (40.5%), 3. "The Belarus People's Front" (35.8%), 4. "Special funds and bodies of the Republic of Belarus" (33.4%), and 5. "The Supreme Council of the Republic" (32.3%).

Discussion

A small interview study was conducted in Sweden in October 1979 among persons who could expect to be assigned tasks in relation to a radiation accident (Jansson & Sjöberg, 1979). The respondents were active in the fields of transport, health care and agriculture. The study showed generally low knowledge of a current emergency plan, and the issued guide-lines for radiation doses. Information on these matters, especially related to the own profession, was asked for. Farmers, for example, stressed the importance of knowledge of how to use a dosimeter, and how issues of compensation would be solved in an accident situation. Regarding willingness to help out in a crisis situation, transport workers had a positive attitude, and health care workers tended to respond that they would do so themselves, but that they were not so sure about the willingness of their colleagues. Health care workers stressed the importance of children's safety, and that pregnant women should not do work where they could be exposed to radiation. The respondents furthermore emphasized the need for unbiased information, which should include recommendations of necessary protective actions. Most respondents thought that the population in an affected area would panic and try to leave the area irrespective of official advice. Although this small study was conducted after the TMI accident, but before the Chernobyl accident, it contained some indications of what were to become major issues in Sweden after the Chernobyl accident, i.e. the stressed need for unbiased information, the need to understand measurements of radiation, issues of compensation, and the anxiety and egocentric attitude the accident would create. (See also Quarantelli, 1984, on reactions to sudden warnings).

A radiological accident potentially or actually threatening civilians presents a severe test on everyone involved. Examples from Goiania in Brazil show that experts had to deal with a variety of tasks, many of them outside their daily routines and expectations, from plumbing, dealing with noncooperative victims and as testers of food and water. Help from labor and specialists of other fields than those related to radiology could initially not be guaranteed. The reactions to the TMI accident foremost reflected the increased uncertainty which follows a nuclear accident, with the attached request for quick and correct public information, and it amply showed the problems of coordination of both internal and external information. The lack, or delay, of information, which has been common in the former Soviet Union, results in severe distrust in official announcements and in authorities, and is accompanied by persistent rumors.

During a known, major and ongoing radiation crisis, it may be difficult to maintain and relay on a "normal" functioning of the society. One concern is that some people may refuse to

[12] It is unclear what the "uncontrolled expenditures of the Chernobyl means" actually refers to, but it may be related to the various forms of economic compensation currently in effect in areas affected by the radioactive fallout and their vicinity. (A follow-up study within the EC Joint Study Project 2.2 will e.g. investigate the local populations' perceptions of economic compensation issues in 1994).

or carry out, orders, or simply act on their own initiative, perhaps on the basis of false ıcomplete information. For example, a State Health Secretary, responsible for the toring and distribution of potassium iodin under the TMI crisis, did not follow instructions ɜtribute the iodine to suppliers, but kept the arrival and location of the drug secret and r armed guard. Among his reasons for these contra order actions were his belief that the bution of the drug may have caused panic (Behler, 1986; see also Quarantelli, 1977). 'antelli (1985) related research which showed that people, including health professionals, believe that disasters evoke extreme emo nal reactions in the victims, but that such fs usually are invalid. He stressed (Quarantelli, 1990) that people in most disasters act nally, are active and prosocial, and at times that "victim rise to the occasion and behave ı better than is believed" (p. 4). This is not to deny, however, that disasters may involve mely traumatic experiences on an individual level.

Behler (1986) mentioned the citizens' tendency towards introversion during the initial e of the TMI crisis, and it may be justified to predict that in a dangerous radiation tion some people first of all try to localize family members and to take care of personal family needs rather than remain on their jobs or attend to their usual functions. In the case e TMI accident, two major Riverside nursing homes had to be evacuated due to lack of ng (Behler, 1986). In the pilot study of respondents in the Novozybkov area, Russia, 80% small group of local firemen chose the response alternative "to immediately leave the area" ıe best way to protect oneself if a radiation accident had happened in the vicinity[13] - to ompared with the 53% of other respondents who also chose this response alternative ɔttz-Sjöberg, 1992).

The examples of nuclear accidents given above do not permit an inference of a ionship between degree of damage, in terms of deaths or injury and ecological damage, public reactions. The broadcast hysteric scenes at the funerals in Goiania certainly reflected ıendous personal grief and public fear, but the mute fear in the Urals concealed a much ɜe and more widespread disaster. See Fig. 2.

Figure 2 gives a rough description of how some nuclear accidents can be categorized in the dimensions of "environmental damage" and "information availability". The ironmental damage" dimension has been divided into the areas of minor accidents within ear facilities, accidents outside nuclear facilities with a potential to affect the public, ıdents which have had a documented impact on the environment and the public in terms ıgh concentrations of radioactive substances resulting in deaths and injury, and accidents h have had an excessive impact on the environment and local populations. The ɔrmation availability" dimension has been divided into the areas of no information, expert vledge, mainly national information, and international information. Given these dimensions, the approximate localizations of the nuclear accidents within it, the figure suggests that ɜ is no relationship between the actual impact of an accident and the extensiveness of 'mation related to it. If however, the Kysthym accident and the events in the Chelyabinsk ɔn, still had been unknown, the figure would have shown a weak, but positive relationship ɣeen accident severity and information availability - a relationship which should be expected democratic society. The information of the Kysthym accident and the Chelyabinsk region ɜter is available today, however, due to the ongoing democratic process in the former Soviet ɔn, and must be acknowledged in an overview of public reactions to nuclear accidents.

The results does not indicate that this would be their actual *behavior* in the referred to situation, but it is oteworthy.

Considering that the general public cannot react openly or directly if there is no information about an accident, the "information availability" dimension becomes the basic dimension from the public point of view. Information availability and correctness also tend to be the main issues of controversy during a crisis and in the following debates of actual crisis handling.

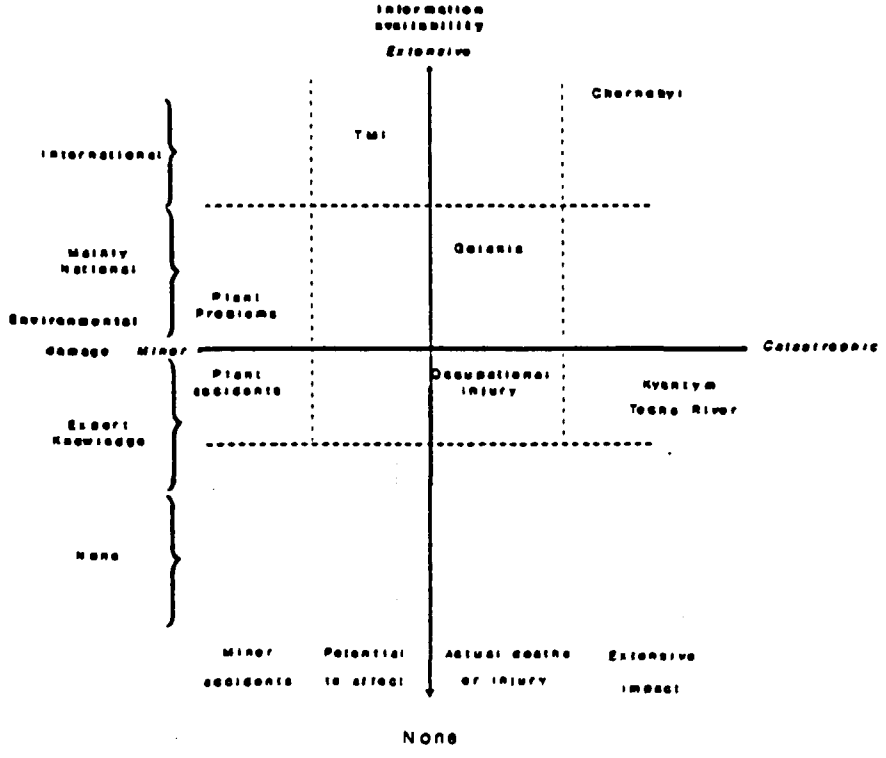

Figure 2. Schematic description of nuclear accidents related to the dimensions of environmental damage and information availability.

In sum, public reactions are fueled by availability and correctness of information. This conclusion points to two basic approaches to the handling of a crisis situation: to totally block all kinds of awareness of the situation, or to inform immediately in full. All alternative routes in between will have some kinds of negative effects. It may be that the strategy of total silence is possible only in totalitarian regimes and that the public responses to the following necessary actions taken are profoundly interwoven with already established structures of social life, but this choice of strategy nevertheless exemplifies the development of reactions of persistent rumors, amplified distrust of authorities and experts, and the populations' withdrawal into apathy. To delay information, for some hours or some days, also creates distrust, especially if the delayed information finally is revealed by outsiders, for example by a radio station as was the case in the TMI accident, or by foreign radio stations as in the Chernobyl case. To provide full, as well as correct, information is certainly difficult during a crisis. Given that there are early warnings and immediate information, however, most people would in due time understand the complexity of the task. Implicit in the total information strategy are the communicated attitudes that authorities care for citizens' well-being, recognition that people want to make decisions about their health and life themselves, and trust that civilians can act rationally in the situation. If these basic attitudes are communicated, instructions of how to act will be trusted. There will certainly be disagreements and debates in the aftermath of the crisis all the same, but there will also be more understanding of mistakes if these are perceived as honest attempts to handle the crisis situation. And generally, an angry population is much healthier than an apathetic one.

It is unfortunate that in describing nuclear accidents worldwide there does not seem to be any general guarantee that the local public is properly informed about risks. This state of affairs calls for the inclusion of a dimension such as "degree of democracy" into the analysis of public reactions to nuclear accidents. Sjöberg (1992) suggested the introduction of "a nuclear ombudsman", elected by the local communities, to tackle the problems of fear of nuclear power, public distrust, and information reliability. Increased international inspections and cooperation may also help regulate inadequate conditions regarding hazardous technical systems, information availability and care for victims worldwide.

An intriguing question is certainly if a country more affluent than the former Soviet Union could have handled an accident, in the scale of the Chernobyl accident, much better. Without trying to diminish the enormous and intensive work done after the Chernobyl accident, consider what the public reactions might be if it happened in a country with quick and free media information. Disregarding for a moment the different types of nuclear reactors and other technical arguments making this very comparison impossible, the question remains if a rich and democratic country is ready to handle a major nuclear disaster, and swiftly evacuate a large number of people, for example 200.000 persons from a rural area. Does the population of a democratic country already have enough adequate information to act rationally and to protect itself from radiation harm during the first weeks? Do official authorities and specific technical experts have enough fantasy and authority to, first, imagine the kind of tasks they would face, and, second, be able to implement efficient behavior in a major crisis situation? It is important to point out the necessity that all key persons related to nuclear crisis management take part of the available experiences from former accidents, discuss the events with ordinary, local people who were actually involved, and try to use this personal knowledge in relation to their specialist tasks. The importance of e.g. emergency planning, effective communication networks, and availability of all necessary resources are obvious and well known to those working with crisis management. The long-term judgements of how they actually handle a crisis will most certainly be based on the concern communicated to the affected people and the success in actually protecting their safety.

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References

Archangelskaya, G. V., & Anischenko, E. V. (1990). Sanitative propaganda in the work of sanitation and epidemiological service under the condition of radiation accident. In Proceedings of *The Work of Sanitary Epidemiological Service under the Condition of Radiation Accident.* Leningrad: Leningrad Scientific Research Institute of Radiation Hygiene.

Archangelskaya, G. V., & Ivanov, E. V. (1992). Public opinion in Russia, Ukraine and Byelorussia after the Chernobyl accident. Manuscript. S:t Petersburg: The Institute of Radiation Hygiene.

Baum, A. (1987). Toxins, technology, and natural disasters. In G. R. VandenBos and B.K. Bryant (Eds.), *Cataclysms, crises, and catastrophes: Psychology in action.* Washington, D. C.: American Psychological Association.

Behler, G. T. Jr. (1986). The nuclear accident at Three Mile Island: Its effect on a local community. *Historical and Comparative Disaster Series, No. 7.* Delaware: University of Delaware, Disaster Research Center.

Blix, H. (1989). Address to the participants of the conference. *Medical aspects of the Chernobyl accident.* IAEA-TECDOC-516. ISSN 1011-4289. Vienna: IAEA.

Brandao-Mello, C. E. (1991). Personal insights into the Goiania radiation accident. *Health Physics, 60,* 3-4.

Chazov, E. I. (1989). Opening speech. *Medical aspects of the Chernobyl accident.* IAEA-TECDOC-516. ISSN 1011-4289. Vienna: IAEA.

Drottz-Sjöberg, B.-M. (1992). Risk perception six years after the Chernobyl accident. Results from a pilot study in Novozybkov, Russia, 1992. Preliminary version of fortcoming report. Stockholm: Stockholm School of Economics, Center for Risk Research.

Drottz-Sjöberg, B.-M., & Persson, L. (1993). Public reaction to radiation: Fear, anxiety, or phobia? *Health Physics, 64,* 223-231.

Dynes, R. R., & Yutzy, D. (1965). The religious interpretation of disaster. Delaware: University of Delaware, Disaster research Center.

Havenaar, J. M., & van den Bout, J. (1992). *Mental health problems in the Gomel Oblast (Byelorussia) raised after the Chernobyl-disaster: assessment and suggestions for intervention activities.* Opdrachtbrief 145/92 BIS. Utrecht: Rijksinstituut voor Volksgezondheid en Milieuhygiene Bilthoven.

IAEA report (1988). *The radiological accident in Goiania.* ISBN 92-0-129088-8. Vienna: International Atomic Energy Agency.

IAEA report (1989). *Medical aspects of the Chernobyl accident.* IAEA-TECDOC-516. ISSN 1011-4289. Vienna: International Atomic Energy Agency.

IAEA report (1991). *The International Chernobyl Project. Technical report.* ISBN 92-0-129191-4. Vienna: International Atomic Energy Agency.

Jansson, B., & Sjöberg, L. (1979). Attityder till arbetsuppgifter i samband med evakuering vid kärnkraftsolycka {Attitudes to work tasks in relation to a nuclear accident}. Appendix 2 till Bilaga B. In Statens strålskyddsinstitut, *Effektivare beredskap* Volym 2. Stockholm: The Swedish Radiation Institute.

Kapoor, R. (1992). The psychosocial consequences of an environmental disaster: Selected case studies of the Bhopal gas tragedy. *Population and Environment, 13*, 209-215.

Kasyanenko, A. (undated). ORACUL. The Gomel center of sociological studies. (Abstract). Gomel, Byelorussia: ORACUL.

Lipsztein, J. L., Cunha, P. G., Oliveira, C. A. N. (1991). The Goiania accident: Behind the scenes. *Health Physics, 60*, 5-6.

Medvedev, G. (1991). The truth about Chernobyl. London: I.B. Tauris.

Medvedev, Z. A. (1979). *Nuclear disaster in the Urals.* London: Angus & Robertson.

Monroe, S. D. (1992). Chelyabinsk: The evolution of disaster. *Post-Soviet Geography, 33*, 533-545.

Oliveira, A. R., Hunt, J. G., Valverde, N. J. L., Brandao-Mello, C. E., & Farina, R. (1991). Medical and related aspects of the Goiania accident: An overview. *Health Physics, 60*, 17-24.

Petterson, J. S. (1988). Perception vs. reality of radiological impact : The Goiania model. *Nuclear News, 31*, 84-90.

Prince-Embury, S. (1992). Information attributes as related to psychological symptoms and perceived control among information seekers in the aftermath of technological disaster. *Journal of Applied Social Psychology, 22*, 1148-1159.

Quarantelli, E. L. (1977). Panic behavior: Some empirical observations. Delaware: University of Delaware: Disaster Research Center.

Quarantelli, E. L. (1984). Perceptions and reactions to emergency warnings of sudden hazards. *Ekistics, 309*, 511-515.

Quarantelli, E. L. (1985). An assessment of conflicting views on mental health: The consequences of traumatic events. In C. R. Figley (Ed.), *Trauma and its wake: The treatment of post-traumatic stress disorder* (pp. 173-215). New York: Brunner/Mazel.

Quarantelli, E. L. (1988). Future disasters in the United States: More and worse. Preliminary paper No. 125. Delaware: University of Delaware, Disaster Research Center.

Quarantelli, E. L. (1990). Radiation disasters: Similarities to and differences from other disasters. Preliminary paper No. 153. Delaware: University of Delaware, Disaster Research Center.

Roberts, L. (1987). Radiation accident grips Goiania. *Science, 238*, 1028-1031.

Rosenthal, J. J., de Almeida, C. E., Mendonca, A. H. (1991). The radiological accident in Goiania: The initial remedial actions. *Health Physics, 60*, 7-15.

Rumyantseva, G. M., & Martyushov, A. N. (1991). Risk of psychic disadaptation in nuclear accidents (Chernobyl accident as a model). Paper presented at the 3d meeting of the Society for Risk Analysis, European Branch, Paris, in December 1991.

Savkin, M. (1992). History of dose assessment methodology and zoning processes. Paper presented at the Joint Study Project 2 (JSP2) meeting in Paris, October 12-16, 1992.

Shmelev, V. (1992). Political, sociological and economic events having influenced the postaccident management. Paper presented at the Joint Study Project 2 (JSP2) meeting in Paris, October 12-16, 1992.

Sjöberg, L. (1992). Risk perception and credibility of risk communication. *Rhizikon No. 9.* Stockholm: Stockholm School of Economics, Center for Risk Research.

Webster's College Dictionary (1991). New York: Random House.

Wolfson, Z., & Butenko, V. (1992). The green movement in the USSR and eastern Europe. *Research in Social Movements, Conflicts and Change, Supplement 2*, 41-82.

Working Group on Psychological Effects of Nuclear Accidents (1990). Kiev, USSR, 28 May-1 June, 1990. EUR/HFA target 11. EUR/ICP/CEH 093(S). Copenhagen: WHO.

Young, M. J., & Launer, M. K. (1991). Redefining Glasnost in the Soviet media: The recontextualization of Chernobyl. *Journal of Communication, 42*, 102-124.