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Sensible fear

Finnish reactions to the threat of a nuclear accident
in Sosnovyi Bor, Russia



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Introduction

Fear is part of life. The objects of fear may have changed during centuries. Some contemporary researchers think that we have entered a new era concerning dangers (e.g Beck et al., 1994; Erikson, 1991). Nuclear power is certainly one of the dangers our forefathers did not fear. Not everybody is afraid of it nowadays either. Nuclear power is a controversial issue in the society. At the moment there is a public debate going on about the suggested construction of a fifth nuclear power plant in Finland. The main issue of disagreement is: is nuclear power safe? Can we as a society accept the risks it includes? Is it naive to be afraid of risks, that are so small? The subject of this research is nuclear power as a threat, especially as an object of human fear in case something goes wrong.

As a research subject threat of a nuclear accident is very social psychological: it deals with the interaction of a person and his physical and social environment and with the meaning of social interaction in case of a nuclear threat. Theoretically the subject is studied from several viewpoints before presenting the empirical results of a survey study. This study is part of the research tradition of disaster studies started by Morton Prince in 1921 and followed by Fritz and Quarantelli in 1950's and later on by several social psychologists. However, it also connects to the trauma psychological research area started by Freud and Janet in the end of 19th century and later developed further by many important researchers since the 1960's. This dissertation is structured in eight chapters.

In the first chapter threat is studied as a stressor and from the framework of stress theory (Lazarus, 1966; Selye, 1956). The basis of feeling of security and basic assumptions about life are presented from a schema theoretical framework. (Janoff-Bulman, 1985; Epstein, 1991.) Then studies on risk perception and the several heuristics connected to it are reviewed specially in relation to nuclear power (Tversky and Kahneman, 1982; Slovic, 1991). Risk has been studied also as a social construction, as something that is created and modulated culturally in social interaction. The possibility for different social constructions creates opportunity for disagreements and social problems. These have been studied by Nigg and Cuthbertson (1987) who have shown the importance and the consequential lack of social support that is so different from the altruistic community, typical of the aftermath of natural disasters. Finally the concept of risk society is briefly presented.

The second chapter compares psychological effects of nuclear accidents with those of other man-made or natural disasters. Nuclear power as a threat differs from more traditional and more familiar accidents and the importance of these differences is discussed here. (Quarantelli, 1991.) The history of reactions and attitudes to radiation and nuclear power is presented to see how the roots of attitudes to nuclear power are to be found in history. These attitudes may represent a more general tendency in the development of human beliefs (Weart, 1988).

Warning situation or an impending danger have been studied as situations demanding decision making from the subject. Different decision making theories are presented in chapter three. The concepts of rationality and irrationality are central in connection with decision making theories, where the central question is if man is a rational being or not. The applicability of decision making theories to nuclear threat is assessed beginning from subjective expected utility theory (Simon, 1955) to later developments of naturalistic decision making and situation awareness (Klein, 1995; Endsley, 1997). Perception is studied as information processing where new information is interpreted according to existing schemas (Wyer and Srull, 1989). The importance of af-

fective factors in information processing is discussed, to avoid a purely cognitive perspective (Etzioni, 1992).

Chapter four combines the current topic with more general trauma psychology as the psychological consequences of a nuclear threat are studied from the viewpoint of being a potential traumatic event. The development and the most important theoretical models of traumatic stress are presented. The main interest here is in the information processing model (Horowitz, 1986, 1997) and in the psychosocial model (Green, Lindy and Wilson, 1985; Herman, 1992). The psychological consequences of nuclear accidents are reviewed mainly on the basis of studies of three cases: accidents that took place in Three Mile Island in 1979 (Baum et al. 1983; Prince-Embury and Rooney, 1988), in Chernobyl in 1986 (van den Bout, 1995; Torubarov, 1991) and in Goiania in 1987 (Brandao-Mello et al. 1991).

In chapter five the basic facts of the incident, that took place at the nuclear power plant in Sosnovyi Bor, Russia in 1992, are presented. Chapter six defines the research questions and describes the design and main hypotheses of the current study followed by a description of the data sample.

In chapter seven results of the statistical analyses conducted on the data sample are presented and structured around the main areas of interest: interpretation of the situation, protective activities and perceptions of information delivery. Results concerning psychological consequences of the incident at the Sosnovyi Bor nuclear power plant are presented, followed by results of comparisons between groups named "healthy" and "sick" based on the amount of symptoms on different scales used in the study.

In chapter eight the results of the study are discussed in light of earlier research results and interpreted within the different frameworks presented in the theoretical part of the dissertation. The main results are also discussed from the viewpoint of emergency preparedness.

1 Reactions to threat

On a very general level threat can be defined to be a harm of some kind that is anticipated on the basis of present cues. The most general concept used in research on reactions to threatening situations is stress. Three basic types of stress are usually delineated: physiological, psychological and social. Physiological or systemic stress is primarily concerned with the disturbance of the tissue systems. Psychological stress relates to the cognitive factors leading to the evaluation of threat and social stress follows from disruption of a social unit or system. However, it is not totally clear if with the concept of stress is meant a stimulus, a response or an interaction of them, as the concept has been used in all of these meanings. Because of this inconsistency in the use of the basic concept, Lazarus (1966) wanted to define the concept rather as a collective term for an area of study. Stress refers to any event in which environmental demands, internal demands, or both, exceed the adaptive resources of an individual, social system or tissue system. (Selye, 1976, Monat & Lazarus, 1991; Barton, 1969.) In comparison to other factors that may cause stress, namely frustration and conflict, threat is different in that it refers to something that has not yet happened and thus is possible to be prevented. A threat provides a warning that invites the person to take preventive steps to mitigate the impending harm (Selye, 1991). Stress can be seen as a product of the interaction between an individual's psychological make-up and the appraisal of a threat.

The appraisal process has gained a lot of research interest. It is usually understood to consist of two phases: primary appraisal involves the assessment of threat cues to estimate the amount of danger present in a given situation. Secondary appraisal involves assessment of the resources available for dealing with the stressor. The level of an individual's arousal state is dependent on the degree of threat believed to be present, and on the coping resources believed to be available (Paterson & Neufeld, 1987; Janis & Mann, 1977.) Appraisal is an evaluation of what one's relationship to the environment implies for personal well-being. Cognitive evaluations of noxious stimuli determine the nature of emotional and physiological responses. A positive emotion is produced by an appraised benefit and a negative emotion by an appraised harm. (Smith & Lazarus, 1993; Tomaka et al., 1997.) Recent research has also shown that threat response relates to aspects of personality, such as belief in a just world (Tomaka et al., 1997). In recent studies, Smith and Lazarus (1993) have delineated appraisal components, two of primary appraisal, four of secondary appraisal. The components of primary appraisal are motivational relevance and motivational congruence. Motivational relevance is an evaluation of the extent to which the encounter touches upon personal commitments that the person cares about. Motivational congruence refers to the extent to which the encounter is consistent with the person's goals. The components of secondary appraisal are accountability, problem-focused coping potential, emotion-focused coping potential and future expectancy. Accountability determines who is to receive the credit or the blame for the outcome of the encounter and therefore who should be the target of coping efforts. The components of coping potential refer to the main means of reducing discrepancies between one's circumstances and one's desires and motivations. Problem-focused coping potential reflects evaluations of the person's ability to act upon the situation and emotion-focused coping potential refers to the perceived prospects of adjusting psychologically to the encounter by altering one's interpretations and beliefs. Future expectancy refers to the possibility of there being changes in the situation which could make the encounter seem

more motivationally congruent. Smith and Lazarus also delineate the core relational themes for different emotions. The emotion relevant here is fear/anxiety, the core relational theme for which is danger or threat: the perception that one will not be able to psychologically adjust to a harm in case it should occur. (Smith and Lazarus, 1993.)

Stress and its damaging effects have gained a lot of research interest, but recently interest has been directed also to the ways in which humans respond to stress positively through coping and adaptation. Coping refers to an individual's efforts to master demands caused by the threat (or harm or challenge) that is appraised exceeding his or her resources. (Monat and Lazarus, 1991.) Two major categories of coping strategies are usually agreed upon: problem-focused coping that refers to efforts to improve the troubled person-environment relationship by changing things, for example, by seeking information about what to do or confronting the person responsible for the harm. Emotion-focused coping refers to thoughts or actions whose goal is to relieve the emotional impact of stress. These strategies are mainly palliative in that they do not actually change the threatening situation but make the person feel better, through for example denying that anything is wrong, avoiding thinking of the threat, distancing oneself by joking about the threat, or attempting to relax. (Monat and Lazarus, 1991.)

The comparative effectiveness of different coping strategies has been under discussion. Traditionally, emotion-focused modes of coping, particularly defense mechanisms such as denial, have been viewed as pathological or at least maladaptive. This view is often supported by research studies where defensive behavior (like denying a suspicious lump in breast) have actually endangered an individual's life. But denial may be effective for parents of terminally ill child prior to the child's death. Behaviour that might be effective from physiological perspective might have devastating consequences for the psychological or sociological domains. Within any domain, an optimal response in one situation at a particular point in time may be damaging in some other situation or at a different point in time. Also, what is considered

to be optimal response is highly dependent upon one's perspective and judgements. Emotion-focused modes of coping may be harmful if they prevent direct actions, but may be helpful in maintaining a person's sense of well-being or hope under conditions otherwise likely to encourage disintegration. (Monat and Lazarus, 1991.)

1.1 Basic assumptions and feeling of invulnerability

While the effectiveness and harmfulness of denial and other emotion-focused modes of coping are under discussion in professional journals, the role of illusions and self-deception for mental health has lately been agreed upon (Monat and Lazarus, 1991; Lazarus, 1983; Taylor, 1989). Seymour Epstein (1991) like many others expect that a person develops over time a conceptual system that provides him/her with expectations about the world and himself. This conceptual system is represented by a set of assumptions or internal representations that reflect and guide our interactions in the world and enable us to function effectively. Different terms have been used to refer to a single underlying phenomenon, called assumptive world (Parkes, 1975), working model (Bowlby, 1973), implicit theory (Kelly, 1955) etc. This implicit theory is hierarchically organized with the most fundamental assumptions being most abstract and general. They are also those we are least aware of and least likely to challenge. At a general level, the core assumptions are beliefs about ourselves, about the external world and the relationship between these two. According to Janoff-Bulman (1985; 1992) the three most fundamental assumptions are: the world is benevolent, the world is meaningful and the self is worthy. What Antonovsky (1979) calls sense of coherence comes close to this, too. A sense of coherence is, according to him, a long-lasting way of seeing the world and one's life in it as meaningful, controllable and having a high probability that things will work out well.

Coping with reality entails attempting to fulfill the basic functions of a personal theory of reality, which are to maintain a bal-

ance between pleasure and pain, to assimilate data of reality into a cohesive conceptual system and to maintain a favorable level of self-esteem. A personal theory of reality develops through the interaction of conceptualization and exposure to experience. This happens through the processes of accommodation and assimilation that Piaget (1972) described. The conceptual system becomes increasingly differentiated and integrated and is able to fulfill its functions with increasing efficiency. However, things may not go well and the theory may be unable to fulfill any of its functions because of an incompatibility between the environment and the individual. The structure of the conceptual system will be placed under stress, which subjectively is experienced as anxiety. If cognitive coping cannot reduce stress enough, disorganization will occur. Disorganization provides an opportunity for a new organization that can better fulfill the basic functions of a theory of reality. (Epstein, 1991.) In the realm of everyday life one's basic assumptions change when they can no longer account for the data of one's life experiences. This is what happens to a victim of a disaster or other life-endangering threat. The basic assumption that seems to be most dramatically challenged by an experience of victimization is the assumption of invulnerability (Wolfenstein, 1957; Horowitz, 1997; Janoff-Bulman, 1991.)

The assumption of invulnerability probably is one of the most basic assumptions we hold, as it is the first to develop. The importance of early experiences have been discussed, especially the early development of trust and feelings of basic security in a child. Erikson (1950) nominated a sense of basic trust to the first component of a healthy personality. According to him, basic trust is an attitude toward oneself and the world derived from the experiences of the first year of life. Because of this basic trust we believe at an emotional level that "it cannot happen to me", even though we intellectually know that crimes and accidents are common. We usually act on the basis of an illusion of invulnerability. Both male and female subjects underestimated the probability of negative things happening to them compared to the likelihood of these things happening to other persons of their age in a study by Janoff-Bulman et al. (1980). A sense of invulnerability devel-

ops early in childhood through responsible, predictable interactions with caregivers. By receiving appropriate, dependable care we learn to trust our environment and simultaneously we learn to feel good about ourselves by believing that we are worthy of such care. Janoff-Bulman believes that there is a strong preverbal assumption of security that derives from the earliest experiences. Over time cognitive assumptions develop from the interaction of the child's experiences and his preverbal expectations: a rich cognitive network of beliefs make up an adult assumption of invulnerability. There are three primary categories of assumptions: benevolence/ malvolence of the world, which consists of two sub-categories, the benevolence of the impersonal world and the benevolence of people. To what extent do good and bad events happen in the world? Do good events outnumber bad events? Are people basically good, kind and helpful? The more a person believes in the benevolence of the world, the more he believes that the world is a good place and misfortune is relatively uncommon. Good fortune is perceived as more likely than misfortune. (Janoff-Bulman, 1991.)

The second category of assumptions involves the distribution of outcomes. When an individual has an understanding of the extent of good and bad events occurring in the world, the question of how these are distributed among people then arises. At least in western world there seems to be three possible distributional principles. People may believe that outcomes are distributed in accordance with the principle of justice. Then personal deservingness determines which events affect which people. According to Lerner (1980), people have a need to believe in a just world where people get what they deserve. This belief may lead to victim blaming, for example, as a negative consequence.

The assumption of controllability maintains that people can control very much the events in their surrounding. Own vulnerability can be minimized by taking proper protective behavior. There is evidence showing that people usually overestimate the amount of control they have over outcomes. Even in games known to be uncontrollable, people take certain behaviour believing that they can in that way control the outcome. (Langer,

1975.) Together the two beliefs, justice and controllability, comprise a sense of meaning. An event is meaningful when it is consistent with social laws, and the most important social laws in western world are justice and controllability. (Janoff-Bulman, 1991.)

The self-relevant dimensions of the assumptions are needed, to know a person's level of feeling of vulnerability. Some people may believe that the world is very malevolent and the primary principle of distribution is justice. In that case we still need to know if that person considers himself to be a moral, decent person deserving good outcomes. Even if the world is seen benevolent, someone may feel vulnerable if he has low self-worth causing him to believe in deserving bad outcomes. (Janoff-Bulman, 1991.)

An increased feeling of vulnerability is a common response of victims of accident, crime or disease. The victim feels unsafe and unprotected and the victim's psychological state is often characterized by anxiety, fear and depression. (Wolfenstein, 1957; Lifton & Olson, 1976; Janoff-Bulman, 1991.) Several writers have claimed that an important part of the post-traumatic stress reaction lies in the shattering of the fundamental beliefs (Janoff-Bulman, 1985; Epstein, 1991; Horowitz, 1997.)

1.2 Risk perception

In addition to the more or less emotional component consisting of the feeling of invulnerability and self-worth, there is the mainly cognitive component of risk perception that has an effect on responses in face of an impending danger. People respond to risks and threats that they perceive. Their perception of riskyness of some activity is based on several factors: on some hazards there is statistical data on which to base the judgement, but after all human judgement is always needed to interpret the statistics and findings.

Many decisions are based on beliefs concerning the likelihood of uncertain events. Fear of nuclear accidents is partly based on

a belief about the likelihood of a serious nuclear accident. These beliefs are based on subjective assessments of probability: but how do people assess the probability of an uncertain event? According to Tversky and Kahneman (1982) people rely on a limited number of heuristic principles which reduce the complex tasks of assessing probabilities and predicting values to simpler judgemental operations. These heuristics are often quite useful, but sometimes they lead to severe and systematic errors. Some of these heuristics are briefly presented below.

When thinking of nuclear accidents, one of the typical heuristics belongs to the following type: What is the probability that process B will originate event A? In answering this kind of questions people usually rely on representativeness heuristic, in which probability is estimated by the degree to which A resembles B. For example if A is similar to B, the probability that A originates from B is high. On the other hand, if A is not representative of B, the probability of A originating from B is low.

A misconception of chance leads people to expect that a sequence of events generated by random process will represent the essential characteristics of that process even when the sequence is short. People expect that the essential characteristics of the process will be represented, not only globally, but also locally in each of its parts. A locally representative sequence, however, deviates systematically from chance expectations, it contains too many alternations and too few runs. Chance is commonly viewed as a self-correcting process in which a deviation in one direction induces a deviation in the opposite direction to restore the equilibrium. Deviations are not in fact corrected as a chance process unfolds, they are merely diluted. The gambler's fallacy is well-known: after observing a long run of red on the roulette wheel people expect that black is now due because a black would result in a more representative sequence. But deviations are not corrected as a chance process unfolds, they are only diluted. (Tversky and Kahneman, 1982, 5-7.)

Sometimes people are asked to make predictions of some future events. Often the predictions are based on **representativeness**. This mode of judgement violates the statistical theory in

which extremeness of the range of predictions are controlled by considerations of predictability. This means that if predictability is nil, the same prediction should be made in all cases. If predictability is perfect, the predicted values should match the actual values. In some situations people assess the frequency of a class or the probability of an event by the ease with which they can bring this kind of instances into their mind. One may assess the risk of heart attack among middle-aged people by recalling their occurrences among their acquaintances. This is called **availability**. It is a useful clue for assessing frequency or probability, because instances of large classes are usually better recalled than instances of small classes. However, availability is affected by other factors than frequency and probability, and thus leads to biases. (Tversky and Kahneman, 1982.)

Third common heuristic is called **anchoring**. People often make estimates by starting from an initial value that is adjusted to fit the final answer. The initial value may be a value given in the problem or it may be a result of a partial calculation. In both cases the adjustment made is usually insufficient. In a demonstration of anchoring individuals were asked to estimate various percentages. For each percentage a number between 0 and 100 was given by spinning a wheel of fortune in the presence of the individual. The individual was then asked to evaluate if the actual number was higher or lower than the number given by the wheel. Then he/she was expected to estimate the percentage by moving upward or downward of the given number. Different groups were given different numbers, but in all groups these arbitrary numbers had a strong effect on the estimate the individuals gave. (Tversky and Kahneman, 1982.)

The heuristics of representativeness, availability and anchoring are not attributable to motivational effects like wishful thinking. The errors of judgement may occur even in cases where people are encouraged to be accurate. Although everyone is exposed to examples from which rules could be induced, very few people discover the principles of sampling and regression on their own. Statistical principles are not learned from everyday life. (Ibid.)

According to Slovic (1991) the most important generalisation from studies in risk perception concerning nuclear accidents is that there is no uniform perception of radiation risks. Public perception and acceptance is determined by the context in which radiation is used. Results from psychometric studies show that perceived risk is quantifiable and predictable. They have also shown that the concept of risk means different things to different people. When experts judge risk, their responses correlate highly with technical estimates of annual fatalities. Lay people's estimates, however, incorporate other factors as well and because of that differ from experts' estimates.

Many of the risk characteristics are highly correlated with each other across a wide range of hazards: hazards rated as voluntary are usually also rated as controllable and well-known. Hazards that appear to have catastrophic potential also tend to be seen as having fatal consequences. For lay people's risk estimates one factor seems to be especially important: dread risk. The higher a hazard's score on this factor, the higher its perceived risk and the more people want to see its risks reduced.

In several research studies it has been found that nuclear-reaction accidents, radioactive waste and fallout from nuclear-weapons testing are seen by people uncontrollable, dread, catastrophic, lethal and inequitable in their distribution of risks and benefits. Diagnostic x-rays are seen much more favorably. In some areas known to be characterised by high radon levels, residents have been found to be indifferent to the risk. Most believed that radon might be a problem for their neighbors, but not for themselves, thus showing a strong feeling of invulnerability. The perceived risk of radiation from different sources seems to be very different. The acceptance of x-rays suggests that acceptance of risk is conditioned by perceived benefits and by trust in the managers of the technology, in this case the medical profession. The managers of nuclear power and other chemical technologies are less trusted and the benefits of these technologies are not so highly appreciated. The apathetic response to radon appears to result from the fact that it is of natural origin, occurring in familiar set-

ting, with no one to blame. And it can never be totally eliminated. (Slovic, 1991.)

Kasperson et. al. (1988, ref. Slovic, 1991) describe how psychological, social and cultural factors interact to amplify risk and produce ripple effects. An important element of this theory is the assumption that the perceived seriousness of an accident or other unfortunate event, the media coverage it gets and the long-range costs are in part determined by what the event signals. Signal value reflects the perception that the event provides new information about the likelihood of similar or more destructive future mishaps.

1.3 Social construction of risk

In the cultural tradition of risk theories risk is seen as a social construction mediated by cultural and social beliefs and definitions. Fitchen et al. conclude that "risk perception is a complex and dynamic process that is influenced by the local context in which the risk is embedded and by the manner in which the risk is addressed" (Fitchen, Heath and Fessenden-Raden, 1987, 31).

There is considerable evidence that the media are selective and biased in their reporting emphasizing drama, wrongdoing and conflict. Some studies suggest that the amount and content of media coverage affects public risk perception and level of concern. Other studies have failed to confirm this and an explanation for this discrepancy is that public knowledge, attitudes and behavior are significantly influenced by media coverage only when the media are the exclusive source of information on the risk. (Johnson & Covello, 1987, 179.) This is usually the case with unfamiliar and invisible threats like nuclear power or environmental pollution. A difficult question is, however, why in some communities very little concern is expressed about health risks from contaminated ground water e.g. when in others the concern expressed is strong. On the basis of several case studies conducted in small communities Fitchen et al. (1987, 41-43) suggest

that when the cause or agent of the contamination or the risk is inside of the community, less fear is felt than when the cause or agent is perceived as coming from outside of the community. This finding is consistent with observations by anthropologists from an American cultural tendency to perceive harm as coming from outside. A similar finding is reported by Lahti from Finland in a community where ground water was contaminated. Very little concern was expressed by inhabitants and no strong activism emerged in the village (Lahti, 1996). Level of trust felt in officials and companies investigating the situation is affected by their familiarity, too. It seems that the local people feel outside agencies distant and their trust seems to diminish with geographic distance. As a consequence of this distrust public attention has turned away from health risk and focused instead on the investigation process itself. (Fitchen et al. 1987, 44-45.) A similar reaction took place after the Chernobyl accident in Nordic countries where the information delivery and authorities' activities received most of the public attention (Sjöberg et al. 1998).

The tendency to feel distrust to outside agencies is comparable to the phenomenon of "disaster identity" (Eränen & Liebkind, 1993; Paton, 1996) or trauma membrane (Lindy et al. 1985) as it is also called. In an emergency the internal solidarity and common identity are strengthened by the common fate and at the same time distrust towards those that are seen as outsiders, not sharing the emotional experience of the disaster. As compared to natural disasters where victimization is clear and common fate serves as reason to return to "mechanic solidarity" (Turner, 1967), Fowlkes & Miller (1987) report a lack of common identity in Love Canal neighbourhood where toxic contamination from a landfill was found.

A major difference between natural and man-made disasters is the perceived difference of government officials. Victims of natural disasters often perceive government officials negatively because of their inability to act quickly and efficiently in resolving the disaster. Victims of man-made disasters, however, perceive government as being at least partly responsible for the disaster by allowing it to happen. The perceived responsibility may

result in polarization and distrust. The development of so called therapeutic community in natural disasters has been confirmed by several researchers. However, it seems that in man-made disasters the social processes taking place are different. In disasters involving toxic substances or radioactivity a first disagreement emerging may be the question whether a disaster has occurred or not and is there a danger for health or not. Often these questions are difficult to answer. In cases where it is known that a certain substance is bad for the health, it may be difficult to define exact limits for the health risks. Also, it is often very difficult to prove that certain health consequences are caused by exposure to a substance, especially as the health consequences may take years to develop (e.g. cancer). Even the experts may disagree on these issues. (Berren et al., 1989, 49-51; Cuthbertson and Nigg, 1987.)

As risk is socially constructed it implies that any risk can be perceived and constructed in different ways and there is always a possibility for conflicts. Especially when we are discussing invisible risks like nuclear power, the old social psychological principle is applicable: "when a situation is defined as real, it is real insofar as consequences are concerned" (Thomas, 1923.) The risk does not have to be real, the crucial issue is the perception of the risk as real. This kind of relativism, however, opens door for endless list of imagined harms. It is clear that some culturally created concepts may refer to phenomena that exist independently of those concepts. Much knowledge is acquired through empirical experience. (Rayner, 1987, 6-7; Quarantelli, 1985, 47-48.)

Douglas and Wildavsky hypothesize that people in individualist, bureaucratic and small-group organisations focus on different kinds of risk: technical, environmental or social depending on what they perceive as most threatening to their institutional order. Each form of social life has its own typical risks: common values lead to common fears. (Douglas and Wildavsky, 1982.)

Cuthbertson and Nigg have described the emergence of conflicts in a community after a technological or environmental disaster. In a natural disaster the damage is highly visible and the victims' needs clear-cut which support the emergency of con-

sensus and so called altruistic community¹ (Cuthbertson & Nigg, 1987; Wolfenstein 1957; Barton, 1969.) Concerning risks of technological and environmental nature it is difficult to establish "safe" levels of exposure. There is no definitive scientific evidence available. In the climate of controversy within the scientific community experts frequently disagree about the nature of the exposure and the amount of risk to public health. Ordinary citizens rely on experts in formulating their own definitions of risk in situations involving technological or toxic agents. Ambiguous messages from experts leave open the realm of decision concerning the riskiness, thus allowing disagreement to emerge. Individual decisions concerning the riskiness of the situation are then made after discussions within own social network. (Cuthbertson & Nigg, 1987.)

Basically, two different perspectives emerge: on the one hand, belief that a technological hazard exists and it could be harmful to the health of those exposed to it and on the other, the belief that a substance is not harmful to those exposed to it. A similar result was found by Fowlkes and Miller (1987) at Love Canal community where they named these groups as minimalists and maximalists. At Love Canal demographic factors like age and household composition were strongly associated with the formation of the groups: young families with small children tended to be maximalists and retired couples with no children at home tended to be minimalists. Own experience and information did not automatically lead to a certain definition, but the life situation and perspective from which people evaluated information affected their definition of risk. An important remark by them is that as compared to sudden impact events, the problem at Love Canal and comparable situations is not the problem of response

¹ It has to be remembered that nowadays it is often difficult to separate between natural and man-made disasters. A natural disaster may be caused by human activities like construction of dams that interfere the natural processes. A natural disaster may cause as a consequence technological accidents, like explosions.

to what happened but the problem of constructing and responding to the meaning of what happened. (Fowlkes and Miller, 1987, 73.)

Natural disasters are indiscriminate and becoming a victim is a matter of fate. However, exposure to toxic substances or other environmental hazards may be situated in a special location. As a consequence many residents may feel singled out as victims. Also, they can attribute their victimization to human intention or neglect and focus blame onto certain institutions. If the occurrence of the hazardous substance resulted from arrangements or uses that provided benefits to certain interest groups, e.g. agricultural community, officials that allowed the condition to occur when it could have been prevented, may become defined as having been unjust and arouse anger among victims. (Cuthbertson & Nigg, 1987.)

The consequences of hazardous chemical may be invisible or have a long latency period. If the harmful effects are seen as insignificant, emotional distress will be inauthentic or consequence of tactics of the media.

In the context of ambiguity over the level of risk or necessity of remedial action the existence of victims and the question of true victimization become crucial. If there is no threat, can there be a victim? And who are the "true victims"? Are they entitled to some remedial action? There seem to emerge four groups with different definitions of the situation.

Hazard-endangered victims believe that they have been exposed to harmful health effects from a hazard and they may suffer from explicit health problems. They are often not only victims of the agent but also victims of uncaring community: they believe that officials and industry have been in advance aware of the harmful consequences but have tried to cover them.

Hazard-disclaimer victims were exposed to the substance but believed that it is safe and did not suffer from any health effects. These victims often feel that their lives have been disrupted as a result of publicity. Two conflicts emerged from this disagreement: was the agent hazardous enough to warrant community concern and whether resources should be given to remedial activities.

These two victim groups found themselves in a situation where their different perspectives disrupted neighbourly cohesiveness.

Perpetrator victims were those individuals that were labeled as unethical by the hazard-endangered victims. They are usually big business representatives, those who had "committed the crime". They reported emotional distress over being defined as villains. They could not believe that a beneficial chemical could be as hazardous as it was claimed. Perpetrator victims saw themselves as victims of overzealous officials, misinformed citizens and certain media. They saw hazard-endangered victims as victims of fear and panic created by media.

Bystander victims were those community members who lived outside the exposed area. Their victimization arose from connection to the issue: they saw themselves and their community's economic welfare endangered by publicity of the hazardous situation. They personally suffered from outsiders' remarks or fears about the danger in the community.

In this kind of controversial situation the emotional climate that emerges is one of anger, frustration, resentment and anxiety. Feelings of helplessness and lack of control over the environment develop within victims and create a reluctance to support the members of other victim groups. (Cuthbertson & Nigg, 1987.)

Although Cuthbertson and Nigg found this kind of community conflict in communities exposed to toxic hazards, many of the features found here can be found in a nuclear accident situation as well thus creating a situation possibly giving rise to community conflict.

1.4 Risk society

History describes development from traditional society to industrial society to modern or post-industrial society. Information society also refers to modern society. This historical narrative is a story of positive development: industrialization has meant more freedom for people. Only in late 1980's and in 90's some opponents for this idea emerged. One of the first of them is Ulrich

Beck. When theories of modern see environmental risks as side effects of modernisation and impossible to totally avoid, Beck asked if modernisation really is development towards a better society. Beck, Giddens and Lash (1994) have suggested that we have moved from modern society to reflexive society. For Giddens reflexivity involves a move in trust relations, so that trust is no longer a question of face-to-face involvement, but is a matter of trust in expert-systems. For Beck, reflexivity in modernity means a growing freedom from and critique of expert-systems. Reflexivity is not based in trust but in distrust. For both of them, reflexivity aims to minimize insecurity. For Beck reflexivity is to bring social change through the minimization of environmental hazards when for Giddens the question is not how to cope with environmental but with psychic and social hazards and maintain reasonable levels of order and stability both in our personalities and in society. But both see modern society as including large risks and being actually risk society (Beck, Giddens and Lash, 1994.)

According to Beck, during modernity dangers of man-made technology have increased and still increase which changes classical industrial society into risk society: distribution of risks and controlling them have replaced the logic of distributing property. A conflict of distributive responsibility emerges. The most important question nowadays is how to prevent, mitigate and control the risks and threats caused by the modernity itself. The problem with risks is that they are characterised by uncertainty: they have no unambiguous solutions: risks can tell us what should not be done but not what should be done. Avoidance is the dominating imperative. However, the optimistic tone in Beck emerges from the possibility that admitting the inherent uncertainty of risk society also gives rise to self-criticism. (Beck, 1994, 1-8.)

In many ways, this discussion seems to culminate in nuclear power and nuclear power accidents that are very representative of the threats of risk society.

2 Nuclear power as a threat

All disasters have much in common. Radiation disasters are more similar than they are different from disasters produced by other agents. Instead, some disasters have characteristics that they do not share with others. Some dimensions are of special interest in connection of nuclear accidents, even though they are not unique to nuclear disasters. (Quarantelli, 1991.)

Unfamiliarity with a threat is psychologically disturbing. People have different images of various kinds of threats, but they are clearly most afraid of those that are most unfamiliar to them. Such are threats associated with nuclear power plants or hazardous chemicals. Their threat is quite unknown to people as compared to other threats with which most people have knowledge or experience. Of course this depends on the sociocultural setting: what is familiar to one population could be very unfamiliar to another. Familiarity is a matter of learning and experiences. (Quarantelli, 1991.)

In some cases exposure to a threat can be predicted, in other cases the disasters are totally unexpected. The evidence indicates that the unexpected is much more psychologically disturbing than the expected, because then people are not able to quickly use the coping mechanisms they have for dealing with unexpected threats. Also, if predictability is high, people are more sensitive to danger cues and have more willingness to act upon the cues. Radiation accidents in general lack predictability to time, place and magnitude. (Quarantelli, 1991.)

According to Quarantelli, studies suggest an almost sure relationship between length of threat and psychological effect. The relationship is not, however, linear. The longer people are subjected to a threat, the more they will adjust to it. This adjustment can also include a desensitization process. But on the other hand, the longer the threat lasts the more negative effects can cumulate. (Quarantelli, 1991) Nuclear accidents are not confined to a certain time and space like more traditional disasters, there is no "low point". Their effects on health may continue long into the future. (Berren & al., 1989.)

In some disasters victims become slowly involved in the situation and in these cases they adjust better and a crisis might not even develop. With very rapid involvement in a disaster, adjustment seems to be much more difficult. Rapidity of involvement refers to what happens in the response pattern as viewed from the perspective of those involved. It may correspond to what others deem as the actual time available for action, but psychological effects do not stem from how long people have to react, but rather from whether they perceive themselves as having to hurry to save threatened things and themselves. It seems that most people don't see radiation threats as requiring rapid response. (Quarantelli, 1991.)

Nuclear accidents also have greater catastrophic potential than other dangers, i.e. fires, that are thought to be more controllable. Nuclear accidents differ from others in that their danger is impossible to perceive. (Perry, 1985; Slovic, 1982.) Loss of control in itself is a cause of stress. (Baum & al. 1983a,b.) It can be concluded that technological disasters may have more serious psychological consequences than do natural disasters as a technological disaster always involves an unexpected loss of control.

In nuclear power plant accidents two quite independent processes are going on at the same time. On the one hand there is the accident, which causes the threat of radiation. That is, however, only possible to perceive with the aid of special equipment. Socially and psychologically the accident becomes real only through information delivery. In nuclear accidents people are much more dependent on information delivery than in other accidents,

because of the lack of possibility of their own perceptions and experiences. (Tessarini, 1986; Lombardi, 1986.) The only real image of the accident is that created by the mass media. The mass media can not be only outside observers who report on the situation. They are central in creating the psychological reality to which people react. They can not give up this involvement even though they would like to do so.

Because of this dependence on information delivery trust on authorities and trustworthiness of the information given becomes a major issue in nuclear accidents. There easily happens a division into in- and outgroups where "ordinary citizens" see authorities as unreliable and as trying to hide information from them. It is very difficult - if not impossible- to confirm that the authorities have told the truth about the level of radiation and the size of the threat caused by it. It is well known that information delivered seldom is received in exactly the planned mode. The channel through which the information is delivered may cause disturbances and the message may not be understood. Especially when discussing the threat caused by radiation the problems caused by technical and difficult language are not minor. The terminology used to express level of radiation varies and is unfamiliar to most people who are not experts in this field.

Quarantelli (1991) emphasizes that the major sources of problems in radiation disasters are social not technical. After Three Mile Island disaster the President's Commission concluded that the major factors involved in the accident were "people problems". These were not only what the crew did in the control room, but originated from how the personnel were trained, how construction decision was made and how emergency planning was developed. These problems were the source of a potential catastrophe. The same seems to apply to the Chernobyl nuclear plant disaster, too. The technology functioned reasonably well and safety devices operations were acceptable. But human errors, bad judgements, knowledge gaps, inadequate training procedures and confusion over responsibilities turned an initially minor mishap into a major disaster.

2.1 Images of nuclear power and their history

Radioactivity was first discovered at the end of the 19th century, and it only aroused little interest. Marie Curie presented a new metal, radium, in 1900 at a physicists' meeting in Paris. Radium was so active that even very small pieces of it gave a bright light and newspapers became interested in radioactivity. Soon after that two physicists suggested radioactivity might have the property of transmutation, the ability to change one type of matter to another. This aroused strong public feelings even though the meaning was not fully understood. Several more years passed before it was discovered that uranium could release great amounts of energy. The enthusiasm aroused by this invention was further increased due to the typical optimism of the time: the scientists especially believed in development and that it would lead to wisdom. The utopia of a "white city" seemed possible. Scientists were willing to tell the audience about their discovery partly because they were proud of it, partly because research would get funding only if the usefulness of it was believed. Journalists were immediately eager to report the possibilities of nuclear energy. (Weart, 1988.)

Already in the beginning of the last century doomsday prophecies were expressed in connection of nuclear energy, but the dream of the "white city" clean of coal dust and its side effects was much more powerful. An important reason for journalists' readiness to write about radioactivity and nuclear energy were the great opportunities it offered to make sensations, stories that fascinated readers. In the 1930's the saying "alchemists' famous problem has been solved" became a cliché, although this was not the case, as the transmutation invented with radioactivity was totally different. For centuries people had tried to manufacture gold by mixing chemicals, which was thought to be quite important. In the late middle ages wise men understood that they were working more with their minds than with matter. Manufacturing of gold was believed to be more of a spiritual symbol than important as an actual fact. Reaching transmutation meant

perfecting soul. According to alchemists, transmutation also included death. This was a metaphor of a process where people have to descend to darkness and chaos to be purified in Godly fire, before reaching spiritual rebirth. Also in Christian religion preachers have expounded on the belief that before humanity can enjoy golden age, there must come the Armageddon. Consciously these thoughts came together briefly in 17th century before the beginning of scientific revolution. Shortly these thoughts divorced and continued their separate paths. In the 19th century the idea of a “white city” ceased to remind people of the alchemists. The transformation of the soul and doomsday predictions also moved into separate directions.

Thoughts of doomsday departed from their original religious and mythical connection and instead became connected to science. The few facts known about atomic energy at the beginning of the 20th century were only a white sheet on to which scientists and their admirers projected ideas. By the end of 20th century the idea of doomsday has become inseparable from nuclear energy. (ibid.) According to Weart the idea of massive destruction and human suffering was thus connected to nuclear energy decades before the invention of nuclear weapons. Later, in the 1960's and 1970's death has been associated with radiation exposure (Perry, 1985).

It seems that people do not see a difference between consequences of high dose radiation from nuclear weapons and the low dose exposure during nuclear accidents. This was also found in a Finnish sample (N=247) collected in 1986 seven months after the Chernobyl nuclear power plant accident. In this sample the threat felt from nuclear power was highly correlated with the threat of nuclear war, conventional warfare and competitive armament. Radiation, however, was correlated with threat from increased violence, demoralization, dangerous wastes and food additives. (Eränen, 1988.) After the Chernobyl accident in Belorussia most illnesses have been attributed to the radiation by both lay people and medical professionals, even in cases were radiation clearly cannot have anything to do with the illness. (van den

Bout et al. 1995.) It seems probable that some of the fear felt in regards to nuclear accidents comes from these potent images and historical associations with death and destruction.

3 Reactions to danger and to warnings

3.1 Decision making in danger

The classical decision theory is designed to describe the choices of an ideal hypothetical decision maker: omniscient, computationally omnipotent economic man. In its normative role the theory is an internally logical system that reflects its origins as an attempt to rationalize observed decision behavior. Since the publication of the theory of games by von Neumann and Morgenstern (1947), followed by Edwards' (1954) introduction of classical decision theory to psychology, it has become common to attribute a prescriptive role to classical decision theory. By prescriptive it is meant that the way the economic man would make decisions is assumed to be the only rational way. The optimality of humans' decisions usually is judged by whether the decisions conform to the prescriptions of the theory. There is also an implicit assumption that if decision makers behaved as they "should" the theory would also be descriptive of human decision behavior. (Beach & Lipshitz, 1995, 21-22.)

There has been several attempts to deal with the lack of conformity of human behavior to the classical theory. One response is merely to reject the behavior as irrational and save the theory. There are people who prize the theory and are also interested in the behavior. They strive to reduce the gap between theory and behavior by changing the behavior. The third response has been to retain the general logic and structure of the classical theory

but make some modifications of some of the theory's components and operations in light of the research findings. The fourth response is represented by the attempts to describe more accurately the process involved in real-life decision making. Research in the area of the fourth response was started by Herbert Simon (1955.) (Beach & Lipshitz, 1995, 21-23.)

The theory of subjective expected utility (SEU) has been central in much of the existing knowledge about decision making and problem solving. The theory of choice has its roots mainly in economics, statistics and operations research and only later received attention from psychologists. The theory of problem solving, however, has a different history and has been initially studied principally by psychologists. (Simon, 1992.)

Subjective expected utility theory defines the conditions of perfect utility-maximizing rationality in a world of certainty. However, subjective expected utility theory only deals with decision making, but says nothing about how to frame problems or set goals. SEU expects that decision maker possesses a utility function, an ordering of preference among all possible outcomes of choice, that all alternative choices are known to him and that the consequences of each alternative can be ascertained. The assumptions of the subjective expected utility theory are strong. The assumptions cannot be satisfied for most complex situations in real world, but they may be satisfied approximately in some problem situations that can be isolated from the world's complexity and dealt with independently. Linear programming and related operations research techniques are used to make decisions in situations that can be carved out of its complex surround. What is common to all these techniques is that they assume that what is desired is to maximize the achievement of some goal, assuming that all alternatives and consequences are known. (Simon, 1992, 33-35.) Some of the problems of SEU theory are computational complexity and the enormous demands on information. The range of available alternatives and the consequences following from each of the alternatives must all be known. Increasingly, research is nowadays directed at decision making that takes realistic account of the compromises and approximations

that must be made in order to fit real-world problems. Incompleteness and asymmetry of information have been shown to be essential for explaining how individuals and business firms decide when to face uncertainty by insuring, when by hedging, and when by assuming the risk. (Simon, 1992, 35-37.) Empirical findings also show that decision makers often overreact to new information. When people are given information about the probabilities of certain events, and then are given some additional information as to which of the events has occurred, they tend to ignore the prior probabilities in favor of incomplete or even quite irrelevant information about the individual event.

Human problem solving is usually studied in laboratory settings. The laboratory study of problem solving has been supplemented by field studies of professionals solving real-world problems, like physicians making diagnoses. Problem solving usually proceeds by selective search through large sets of possibilities, using rules of thumbs, heuristics, to guide the search. Because the possibilities are numerous, trial-and-error search would not work and the search must be highly selective. A common procedure used is means-ends-analysis where the problem solver compares the present situation with the goal, detects a difference between them and then searches memory for actions that are likely to reduce the difference. (Simon, 1992, 42-43.)

Rational choice models use an economic metaphor, they are theoretically generalized to explain not only economic behavior but also the behavior studied by nearly all social sciences. Evidence that the rationality of decisions is blocked by emotions, as found in several studies (e.g Holsti, 1979) showing that one's capacity for rational decision making may seriously decline in situations of high stress, is negated by rational choice theorists. Students of social organizations and complex organizations have begun to challenge the neoclassical model. Rational choice models in their pure form hold that individuals have one stable ranking of preferences, full information about alternatives, and behave independently of each other, and behave independently of other alternatives in maximizing outcomes. Zey (1992, 10) clearly differentiates rational choice theory from decision making as

a process of reasoned choice. Reasoned choice models assume that decision-making theories deal exclusively with the process of decision making and not with goals (Zey, 1992, 10; Janis and Mann, 1977, 11). Janis and Mann list seven steps that are descriptive of how decision makers arrive at reasoned choices out of alternative options. Janis and Mann have applied their model in warning situations, like others after them (e.g. Perry, 1985).

Social scientists agree that humans have reasons for what they do: rationality is not in question, but what constitutes rationality is in question. The neoclassical model defines choice as rational if the outcome is rational. All behavior that does not produce rational outcome is irrational. In other social sciences, the conceptualization of decision making is rational because of the process it employs. The rational choice models rest on substantive rationality, while the other social sciences concentrate on procedural rationality. (Zey, 1992, 15).

3.1.1 Naturalistic decision making

In the 1980's and 1990's researchers realised that decision making in real-life contexts did not follow the stages of rational decision making. Much of the research on decision making concentrated on showing the limitations of decision makers. Emerging from the discrepancy between real-life decision making and laboratory studies, a new branch of decision making research started in 1990's, the study of naturalistic decision making. The aim of naturalistic decision making research is to study decision making in real-life situations that may differ from laboratory settings in several respects. One difference they found is that in the laboratory settings decision makers are usually novices when in reality decision makers are often experts with experience and knowledge from their field. Some researchers even found out that training principles derived from formal models produced counterproductive behaviors in some contexts. (Klein, 1998,1-3; Zsombok, 1997, 4-5.)

The key contextual factors that affect decision making in real world in contrast to laboratory settings are:

1. Ill-structured problems instead of artificial, well-structured problems.
2. Uncertain, dynamic environments instead of static, simulated situations.
3. Shifting, ill-defined or competing goals instead of clear and stable goals.
4. Action/feedback loops instead of one time decision.
5. Time stress as opposed to ample time for tasks.
6. High stakes as opposed to situations devoid of true consequences for the decision maker.
7. Multiple players as opposed to individual decision maker.
8. Organizational goals and norms as opposed to decision making without any stated values.
(Zsombok, 1997; Klein, 1998.)

Orasanu and Connolly (1995, 5) conclude that the basic cause of the mismatch is that the traditional decision making research has invested most of its energy in only one part of decision making, the decision event. In this view the crucial part of decision making occurs when the actor surveys a known and fixed set of alternatives. Several empirical studies on the contrary show that often most of the efforts focus on defining the situation. Much effort is devoted to situation assessment or figuring out the nature of the problem. Single options are evaluated sequentially through mental simulation of outcomes and options are accepted if they are satisfactory. The decision event approach emphasizes concurrent evaluation of multiple options and relies on analytical methods for integrating values and probabilities associated with each option and finally seeks an optimal solution. The fundamental difference between these models is that in everyday situations decisions are embedded in larger tasks. In the laboratory decision making tends to happen apart from any meaningful context. (Orasanu & Connolly, 1995, 5-6.)

In naturalistic decision making research a need for clarification soon emerged: a comprehensive definition of naturalistic

decision making emphasizes complex, uncertain and unstable situations where routine action or thinking is not enough. But in real life a great deal of decision making happens in activities which are quite routine. A model of Recognition-Primed Decision developed by Klein (1998) describes simple, routine naturalistic decision making as different from complex or nonroutine naturalistic decision making. Before the development of this model Klein et al. believed that novices would impulsively jump at the first option they could think of, whereas experts would carefully deliberate about the merits of different courses of action. However, they found out that it was the experts who generated a single course of action while novices needed to compare different actions. There are times when deliberating about options is needed: it is usually when experience is inadequate and logical thinking is needed as a substitute for recognizing a situation as typical. (Klein, 1998, 19-23.)

What Klein et al. discovered in their studies of expert decision makers like fire commanders was that they made not decisions in the classical meaning of the concept. Instead of comparing different options the decision maker evaluated the options one at a time, rejected it and turned to the next. They used a singular evaluation approach instead of a comparative approach. (Klein, 1998, 19-20.) Simon identified a decision strategy he calls satisficing, selecting the first option that works. Satisficing is more efficient than optimizing that takes a long time. (Simon, 1957, ref. Klein, 1998.)

Cue learning refers to the need to perceive patterns and make distinctions. An experienced decision maker is able to judge the situation to see if it is prototypical and to know what to do. If his first choice does not work out, he might consider others. The suitability of the first option will be tested through mental simulation (Klein, 1998, 5, 20, 57.) Part of the decisions people make based on what they call intuition seem to be based on pattern recognition. Intuition has a strange reputation as skilled decision makers know that they can depend on their intuition, but at the same time feel uncomfortable trusting a source of power that seems so accidental. Intuition seems to be activated before a per-

son is consciously aware that he has made a decision. Intuition seems to depend on the use of experience to recognize key patterns that indicate the dynamics of the situation. Because patterns can be subtle a person may not be able to describe what he has noticed or how he has judged a situation as typical. One basis for intuition is recognizing things without knowing how we do the recognizing. Klein claims that intuition grows out of experience. One reason for not knowing how we use our experience is in cases where we are reacting to things that were not happening. A simple version of the Recognition Primed Decision model is a model of intuition. A basic aspect of recognition-al decision making is that people with experience can size up the situation and judge it as familiar or typical. (Klein, 1998, 31, 89.) Some research has shown that people may do worse at some decision tasks if they are asked to perform analyses of the reasons of their preferences or to evaluate all the attributes of their choices. (Wilson & Schooler, 1991.) If skilled decision makers are able to generate reasonable courses of action as the first ones to consider then the advice to generate large option sets (cf. Janis & Mann, 1977) is less valuable. Time pressure does not need to decrease the quality of performance of decision makers who have experience, because they are able to use pattern matching. In analytical processes time pressure would interfere with decision making. (Klein, 1997, 290-291.) A growing body of research shows that under realistic conditions experts make decisions using a holistic process involving situation recognition and pattern matching to memory structures to make rapid decisions (Endsley, 1997, 267.) In a study Klein et al. contrasted experienced and new commanders and tested the toughest decision points in the nonroutine incidents. They found that 60 % of decisions were made on Recognition Primed Decision model, but the number was lower for the novices than for the expert commanders. As a conclusion, Klein states that the rigorous, analytical approach cannot be used in most natural settings, but they may be useful for people who lack experience. Also it was found that experts placed a greater emphasis on situation assessment while the novices emphasized deciding on the course of action. (Klein, 1998,

101.) However, research studies testing the generality of the heuristics and biases described in decision making research (e.g. Tversky and Kahneman, 1982) have obtained findings in the real world that parallel those found in original laboratory research. Based on these findings Wickens et al. (1998, 197) conclude that the traditional work on decision making and the naturalistic approach should be considered to be complementary models rather than mutually exclusive. Some researchers have suggested that decision making processes occur somewhere along a cognitive continuum ranging from intuition to analysis. They also expect that processing could rapidly oscillate between intuition and analysis. Intuitive processes are characterized by low control and low conscious awareness, rapid processing and high confidence in the answer. Analytical processes are characterized by higher levels of cognitive control, slow processing and lower confidence in the answer. The use of intuitive versus analytical processing is determined by two factors 1) certain tasks induce either intuitive or analytical processing and 2) failure in the use of one type of processing causes switching to the other type of processing. Tasks that induce intuitive processing have large number of cues, provide simultaneous and brief display of cues, large relationships between cues and short period for decision making. Analytical processing will occur with fewer cues, high confidence in the task and long sequential availability of cues. (Wickens et al., 1998, 197-200.)

Rasmussen (1995, ref. Wickens et al., 1998) has described three different levels of cognitive control that might potentially be used by a person during task performance. People operate at one of the levels depending on the nature of the task and on their degree of experience with the task or situation. If a person is extremely experienced with the task, he will process the information at the skill-based level of performance, reacting to the perceptual elements at an automatic, subconscious level. Performance is governed by pure stimulus-response associations developed at a neurological level. Because the behavior is automatic only a minimum of attention is needed. When people are familiar with the task but do not have extensive experience, they will

process the information at the rule-based level. The cues are recognized as meaning certain things and these signs then trigger rules accumulated from past experience. The rules are if-then associations between cue sets and the appropriate actions. (Wickens et al., 1998, 198-199.)

When the situation is novel, decision makers will have no rules stored from previous experience. They will therefore have to operate at the knowledge-based level, which is analytical processing using conceptual information. The person assigns meaning to the cues and integrates them into an identification of what is happening and then begins to process the information with respect to goals in working memory. Mental models are often used to run cognitive simulations in evaluating an action plan. Some authors describe knowledge-based behavior as problem solving rather than decision making. According to this model, a person might operate at different levels and switch between them depending on task familiarity. The levels can also be used to characterize people with differing amounts of experience. When a novice can only work at knowledge-based level, at an intermediate level a person also has some rules in their repertoire from training or experience. The expert has a different knowledge base, a greatly expanded rule base and a skill base as well. The expert moves between the different levels depending on the task. When a novel situation rises, lack of experience with the situation moves the expert back to the analytical knowledge-based level. (Wickens et al., 1998, 198-199.)

3.1.2 Situation awareness

Naturalistic decision making research provides a descriptive view of how people make decisions in actual settings that often feature unstructured problems in complex systems. Within this framework a person's situation awareness, an internal conceptualization of the current situation, becomes an important factor in the decision making process. (Endsley, 1997, 267.) Several studies have found that accidents attributed to human errors often

involved situation awareness as a major causal factor. Many human errors in decision making actually involve problems in the situation awareness portion of the decision making process as opposed to the choice of action portion of the process. Situation awareness is formally defined as “the perception of the elements in the environment within a volume of space and time, the comprehension of their meaning and the projection of their status in the near future” (Endsley, 1988, 97, ref. Endsley, 1997.) Situation awareness involves perceiving critical factors in the environment, understanding what those factors mean and an understanding of what will happen in the near future. (Endsley, 1997, 270.) Situation awareness can be formed rapidly, through intuitive matching of features or deliberately through mental simulation. (Klein, 1997.)

Level 1 Situation Awareness. The first step in achieving Situation Awareness is to perceive the status and dynamics of relevant elements in the environment. A pilot needs to perceive important elements such as other aircraft, mountains or warning lights. An automobile driver needs to know where other vehicles and obstacles are and the status and dynamics of own vehicle. (Endsley, 1997, 270-271.)

Level 2 Situation Awareness. Comprehension of the situation is based on a synthesis of level 1 elements. Level 2 goes beyond being aware of the elements that are present. It includes an understanding of the significance of those elements in light of one’s goals. For example, a military pilot needs to understand that the appearance of enemy aircraft in a particular location indicates certain things about their objectives. A novice decision maker may achieve the same level 1 Situation Awareness as more experienced decision makers, but may fall short of being able to integrate various elements along with important goals in order to comprehend the situation as well. (Endsley, 1997, 270-271.)

Level 3 Situation Awareness. The third and highest level of situation awareness consists of the ability to project the future actions of the elements in the environment. This is achieved through knowledge of the status and dynamics of the elements and a comprehension of the situation. For example, an air traffic

controller needs to put together various traffic patterns to determine which runways will be free. (Endsley, 1997, 270-272.)

Situation awareness therefore involves more than simply perceiving information in the environment. It includes comprehending the meaning of that information in an integrated form compared to one's goals. These higher levels of Situation Awareness are particularly critical for effective decision making.

In dynamic systems the development of situation awareness and the decision process are restricted by the limited attention and working memory capacity for novices and for novel situations. Direct attention is needed for perceiving and processing the environment to form situation awareness, for selecting actions and executing responses. In complex and dynamic environments, information overload, task complexity and multiple tasks can quickly exceed a person's limited attention capacity. (Endsley, 1997, 270-272.)

3.2 The importance of personal scripts

Social cognition is the study of how individuals form mental representations of persons and social events. Social cognition draws on a general information-processing framework borrowed from cognitive psychology where information processing is the sequence of cognitive activities whereby information from the social world is combined with the person's knowledge to produce an interpretation or mental representation. Different theorists describe information processing sequence in somewhat different ways, the basic stages include the following:

- Attention and encoding: initial selection and identification of information units to be processed.
- Elaboration: interpretation of the new information in terms of existing knowledge and concepts.
- Organization: formation of a coherent mental representation of the information as interpreted.
- Storage of the representation in memory.
- Retrieval from memory when relevant to a decision.

The central feature of social cognition perspective is the idea that perception of new persons or events is largely a product of the mental representations we have developed during our past experience. As individuals gain experience with different social situations they develop rules for how to behave in social situations. The set of rules developed become structured knowledge for use in processing new information. These knowledge structures are called schemas. Schemas are set of rules that represent what we know about certain categories. (Wickens, 1998, 163-164; Wyer & Srull, 1989.)

The information we have in long-term memory tends to be organised around central topics. The entire knowledge structure about a particular topic is often termed a schema. People have schemas about all aspects of their world. Examples of common schemas are semantic networks associated with “college courses” or “vacations”. Schemas that describe a typical sequence of activities, like going on a date, getting up in the morning or dealing with a crisis at work, are called scripts. (Wickens, 1998, 163-164.) People also have schemas about equipment or systems. The fact that systems are dynamic in nature make them unique and schemas of them are called mental models. Mental models typically include our understanding of system components, how the system works and how to use it. Mental models create a set of expectancies about how the system will behave.

Declarative knowledge includes what we know about concepts, facts, principles, rules, procedures, steps for doing various tasks, schemas, mental models etc. Procedural knowledge on the contrary is implicit and skill based. It is knowledge that results in our ability to do tasks, but it is difficult to verbalise directly. One example is our ability to speak languages. We can do it, but cannot articulate how we do it or the rules we use to combine words. There is body of research showing that we learn in both declarative and procedural modes simultaneously. Declarative knowledge is gained quickly and used by a relative novice at a task, while procedural knowledge is acquired much more slowly and is characteristic of experts. We acquire declarative knowledge more quickly, but it also decays more quickly. Procedural

knowledge takes time to acquire but appears to have a slower decay function. (ibid., 170.) An example of the different memory functions, a man recounted his training for what to do if an earthquake hits in the middle of the night. He learned that he should keep his shoes by the bed and put them on to leave the room if an earthquake occurs. He experienced an earthquake one night, and while his shoes were by the bed, he walked out barefoot. He knew the information in declarative form but not in procedural form, as he had never practiced it. (171.)

Both procedural and declarative knowledge is embodied in schemas, scripts or skills and acquired from multiple experiences. Personal knowledge or memory of a specific event or episode is acquired from a single experience. This may be the first encounter with an employer, a particular accident or incident at home, or eyewitness view of a crime. Such memories are based on visual imagery, but the memories themselves are not always faithful video replays of the events, having a number of biases as Elisabeth Loftus has shown in her empirical studies. (Belli and Loftus, 1994, 420; Wickens, 1998, 171.)

In the same way as perception may be affected by expectancies of how perceptual world is usually constructed, so episodic memories may be biased by plausible scenarios (or scripts) of how the episode in question might have been expected to unfold. For example, an eyewitness to a plane crash may report seeing a ball of flame or smoke or hearing an explosion even if there was none because these are plausible associations with a plane crash. Usually people tend not to be aware of these biases and the confidence with which they assert the accuracy of their episodic recall appears to be only poorly related to the actual accuracy of the recall. (Wickens, 1998, 171.) In the empirical part of this study the subjects were asked to tell what they did when they first heard of the incident at a nuclear power plant. It is possible that their answers reflect not only what they did in reality, but also what they thought would have been the right thing to do.

Failures of episodic memory refer to inaccurate recollection of things that happened in the past, failures of prospective mem-

ory represent forgetting to do something in the future.

The schema for actions and events associated with particular social situations is called a script. Scripts are generalised representations of common events that tell us what to expect in a situation and how to expect people to behave in a situation. Scripts include role schemas, rules for the parts various persons are expected to play in a particular setting. The role of a customer is quite different from the role of a shop assistant. Customers are expected to stay in certain areas of the shop whereas shop assistants can move around and go to areas forbidden from customers. We have many expectations on how a shop assistant and a customer should behave in a shopping situation. If the shop assistant were unpolite and insulted the customer, she would violate the "shopping script" most people have. Scripts help us to organize behaviour in new situations and they also influence our memory for these situations. In a new situation a person uses the cues available to identify which scripts and role schemas to apply. But the choice of schemas is partly determined by schema accessibility, which is determined by both environmental factors and internal factors. When situations are uncertain or ambiguous the person's own expectations, needs and values determine which schemas are most accessible. Recent experience has been shown to affect the selection of schemas for interpreting new information. Priming effects haven been demonstrated for identifying symbols like letters or numbers but for social schema as well. Priming affects the accessibility of stored schemas. Srull and Wyer (1980, ref. Wyer and Srull, 1989, 150-151) found that primed concepts could influence impressions formed within 24 hours of the priming task but not after a week had passed between the priming and impression. Some schemas are more accessible to particular individuals than others: those concepts that are most central and important to individuals' perceptions of themselves are called self-schemas. Self-schemas are used for organising and interpreting information about others as well. (Higgins et al., 1982.)

Perception is a process of connecting new information with existing categories. Schema accessibility is a critical part of this

process as the schema activated then affects all steps in the information processing: what a person attends to, how he interprets and organizes the information and what he will remember about it. Persons systematically attend to certain aspects of information and ignore the rest. Only information that is attended to are encoded and available for later recall. What a person attends to depends on what he expects to find and his expectancies are determined by schemas activated at the time. The activated schemas also determine what is unexpected. Information that does not fit with our active schemas can be unexpected or irrelevant. An event may not fit in with a schema, but as long as it does not violate against it, it can be ignored. Under certain circumstances schema-inconsistent information is remembered better than schema-consistent information. Schema-inconsistent information attracts attention but it also generates extended processing of information. As a consequence an associative network is established that makes the information easy to remember. As schema-based processing is usually biased in the direction of confirming prior expectations, the activation of existing schemas to process new information helps to reinforce the original schema.

Kantowitz (1989) suggests three stages : 1. Perceptual stage in which we bring information in through the senses and compare it with knowledge from memory to give it meaning 2. Cognitive stage which is a central processing or thought stage where we compare the new information with current goals and memories, transform the information, make inferences, solve problems, and consider responses, 3. Action stage in which the brain selects a response and then sends motor signals for action. (Wickens & al. 1998, 146.) The information processing approach assumes that we receive information from the environment, cognitively act on it on various ways and then emit some response back to the environment. There are many theories and models that fall under this category, but all portray human information processing as a flow of information between various information stores and transformational processes. Perception adds meaning to visual information by comparing it with relatively permanent information brought from long-term memory. When meaning is added to

sensory information a person either reacts to the perceptions with a response or sends the information on to working memory for further processing. Only a limited amount of information can be brought from sensory register to working memory. Under certain circumstances information is encoded into long-term memory for later use. Most cognitive processes require some allocation of attentional resources to proceed efficiently. The two exceptions are the sensory register and the maintenance of material in long-term memory. (Wickens & al. 1998, 146-148.)

3.3 Affective factors in decision making

Habits, values and emotions are bases for selection of ends but also means in economic, political and social decision making. Decisions that are made out of passion, fervor or rage are not rational, means-ends related decisions in the classical economic sense. Parents work to feed children out of love and affection, responsibility and commitment, not out of maximization of profit. Parents work even for salaries that are less than what is rational in order to provide for their children. If carried to its extreme, the rational choice models define competition as the core human value, meaning that competition is the essential pleasure of life. (Zey, 1992, 16, 23-27.) In real life most choices are made on the basis of emotional involvement and value commitment. Commitment, solidarity, altruism and trust are relational concepts and do not exist in nonrelationships. Rational choice models do not consider the meaning of this kind of values and relationships. (Zey, 1992, 16-17.) According to Etzioni most choices people make are largely or completely based on normative or affective considerations, not only with regard of goals but also of means. What is even more important in connection of crises, is that normative affective factors determine to a considerable extent on which sources of information people draw, how they interpret what they see and what they believe they ought to infer from what they believe. According to Etzioni, in many areas choice is made only on normative-affective basis, in some areas logical-empirical considerations play a minor or secondary role.

The bases of choices can be divided in normative-affective exclusion, infusion and indifference zones of decision making, describing the relative importance of these factors. However, these segments are not of equal size, but for most individuals in most societies the indifference zones are much smaller than the other two, as hardly any knowledge lacks affective connotations. (Etzioni, 1992, 89-93)

One major way exclusion of logical-empirical considerations take place, is by fusion of particular means to particular ends. All other means that logically might be considered are treated as morally or emotionally unthinkable. In many cases the excluded options are not even considered; they are blocked out of consciousness because even the consideration of them is tabooed. Durkheim referred to this as sacred realm (1954, ref. Etzioni, 1992.) Normative affective factors exclude logical empirical considerations because it is the right way to do it, because it feels right. When a house is in fire and children inside, their mother runs into the house without considering alternatives. The moral values and emotional investments in the children rule out other alternatives. College, career and job choice may also be made on normative affective basis.

Normative affective infusion usually takes two main forms, loading and intrusions. Normative affective factors may load or color various facts and the way they are interpreted. Unlike exclusion, loading only provides differential normative affective weights that rank options in different ways from logical empirical factors. Intrusion occurs when normative affective factors prevent the completion of a specific logical empirical consideration. Normative affective factors may cut short logical empirical considerations by skipping some steps or completing them inadequately. Abelson (1976, ref. Etzioni, 1992, 95) distinguishes between two kinds of intrusions: one in which the picture of reality is distorted and the other where the reasoning used to deal with current picture is distorted. Both are distorted by normative affective factors and often both intrusions are present simultaneously. According to some studies (Etzioni, 1992) high stress has been shown to increase error rate, random behavior and gen-

erate regression to lower responses. Stress is also said to reduce attention and tolerance for ambiguity and diminish the ability to separate dangerous events from trivial ones. These factors are especially salient in connection of critical incidents. It is also claimed that stress may cut the ability to think abstractly which would directly affect the ability to understand complicated, technical information that is often delivered in connection of nuclear incidents. Once a decision has been made, people tend to stick to their decisions. The more a person is emotionally involved in his beliefs, the harder it is to challenge his decision by argument or propaganda.

Some personality theories see raw emotions as forces that disrupt reason. Also implicit in the arguments of logical empirical considerations is the prescription that they are the correct ones: it is already mentioned that neoclassical theories are much more prescriptive than descriptive. Janis and Mann (1977) make an exception from main stream research in that they deal with the role of affect in the whole decision making process. According to them, it is very difficult to judge the efficiency of a decision maker by outcomes as the outcomes may be numerous and difficult to measure. They call their model of decision making as vigilant, but claim that most decision making is not vigilant, because all significant decision making evokes anxiety. In the tradition of humanistic psychology (for example, Abraham Maslow) people are seen as motivated by the desire to satisfy basic human needs such as affection, self-esteem or security. Etzioni concludes that raw emotions do limit and interrupt reason, but emotions often play significant positive roles, too. Emotions can help ensure that considerations of other than instrumental rationality will be taken into account, including primacy of ends over means, selection of ethical means over others etc. However, it is shown that great emotional intensity makes one's focus narrower. In an extreme state of fear an individual may only notice the feared object. This narrowing can be beneficial or detrimental depending on the task involved. Pieters and van Raaij (1987, ref. Etzioni, 1992, 101) distinguish four major functions of affect. 1) Interpretation and organization of information about oneself and the

environment is affected e.g. by pain and fatigue or fear and anxiety. 2) Mobilization and allocation of resources is influenced by affects. In strong emotional states somatic energy resources are mobilized (fight or flight) or inhibited (freeze). 3) Sensation seeking and avoiding may occur in order to reach an optimal level of arousal. When stimulation level is too low, it causes low level of arousal that is experienced as boredom. When stimulation level is too high, it causes high level of arousal that is usually experienced as stress. 4) Affect is also a way to communicate with other people. Etzioni concludes that affect can have both positive and negative influences on decision making. (Etzioni, 1992, 101) In dangerous situations reflective fear is necessary as a motivating force (Janis & Mann, 1977.)

4 Psychological consequences of disasters

Disasters and trauma have been known to us through centuries. They create suffering, losses, death, insecurity etc. Science and technology has helped us to fight some of the perils of nature, but at the same time created new ones. There has emerged what Erikson calls "a new species of trouble". (Erikson, 1991.)

Social and psychological consequences of disasters have been studied since the beginning of 20th century. Before World War II there were some individual research studies and historical accounts, but a growing body of research started to accumulate only after the WW II. The social and psychological effects of disasters have, naturally, been reported from ancient times. Community reactions have been reported to be mostly negative, social disorganization, chaos and suffering. Some positive reactions have also been found: the altruistic community and unanimity on most important values and tasks being the most central of these. There can be found two more or less distinct research branches: the psychologically and clinically oriented branch studies individual trauma. The sociologically and social psychologically oriented research studies human behavior and community reactions in collective stress or crises situations. (Quarantelli, 1985,175-179; Wolfenstein, 1957; Trimble, 1985, 10; Herman, 1992.) These differentially oriented research branches have also used different methods and had different results concerning the amount and severity of psychological problems after disasters. However, these research results should not be considered to be

contradictory, but rather describing different aspects and levels of the same phenomena.

The psychological responses of individuals to trauma vary greatly. The meaning of a traumatic event is a complex interaction of the characteristics of the event itself and the individual's past, present and expected future as well as the social context (Ursano et al. 1994, 4-5). Traumatic events include natural disasters (floods, volcanoes, earthquakes), technological disasters (car accidents, plane crashes, large fires) and deliberately caused events (bombings, torture, violent crimes). Breslau et al. estimated the lifetime prevalence of exposure to traumatic events as 40 % in a random sample of 1007 young adults in a US sample. (Breslau et al., 1991.) In another study Norris (1992) found in a community sample of residents in Southeastern cities of United States a life time rate of exposure to at least one traumatic event of 69 %. In a community sample of women in US 75 % reported having at least one crime victimization and a majority of them having several (Kilpatrick and Resnick, 1993). Several population studies of trauma and post-traumatic stress disorder indicate that on the average, about 15 - 25 % of individuals exposed to a traumatic event will develop post-traumatic stress syndrome. In disaster studies PTSD rates have varied a great deal, but may be up to 50 % in severely exposed populations and much lower in less visible disasters (like toxic or nuclear accidents) (Green, 1994, 346-347).

4.1 Trauma, stress and post-traumatic stress

Symptoms resembling those that nowadays form the criteria of the diagnosis of post-traumatic stress disorder (PTSD)² were first

² Post-traumatic stress reactions are considered to be a normal reaction to an abnormal situation. The criteria of the diagnosis of Post-traumatic Stress Disorder as described in the DSM IV expect that the reactions continue more than a period of 4-6 weeks and there are a certain number of the symptoms for them to be considered a "disorder".

recognized in medicine in the end of 19th century. In the first scientific articles they were discussed as an organic syndrome: railroad spine caused by the trembling of a train, shell shock caused by the pressure of the explosion of a shell etc. After some time doctors started to wonder and think if the symptoms might be caused by psychological factors. In America William James and Morton Prince were interested in the psychology of trauma, in Europe it was studied at the hospital of Salpêtrière where Charcot was conducting research on hysteria. Both Janet and Freud were among his students and were among the first to study psychoneurosis as it then was called. (Herman, 1992, 10-12; Trimble, 1985, 5-14; Peterson et al., 1991, 3-8.)

For two decades hysteria became a major focus of scientific inquiry. Until that time hysteria had been considered a strange disease with incomprehensible symptoms. It was a suitable disease for women, and some believe that it was a metaphor for everything that men found mysterious in women. (Herman, 1992, 10.) Both Freud and Janet concluded based on their case studies that hysteria was in most cases caused by psychological trauma. They also realized that by listening to the patient it was possible to reconstruct her past and uncover the traumas. Freud finally concluded that a sexual neurosis was the basis of hysteria. In his report he made a dramatic claim saying that at the bottom of hysteria there are one or more occurrences of premature sexual experience that belong to the early years of childhood. However, "The Aetiology of Hysteria" marked the end of this line of inquiry. Hysteria was then so common among women that if his theory was true, he would be forced to conclude that "perverted acts against children" were very common, not only among proletariat of Paris, but also among the respectable bourgeois of Vienna. This idea was unacceptable, beyond credibility. Because of the social atmosphere of the society, Freud had to reject this, known as his first trauma theory or seduction theory. Instead he developed his second trauma theory where he expected that instead of being facts, the stories of his patients' experiences of sexual abuse were fantasies. Psychoanalysis was founded on the basis of his theory of Oedipal conflict. After some time the dis-

ease of hysteria was said to have disappeared. (Herman, 1992, 12-15.)

The shell shock and combat neurosis gained scientific interest again during the WW I, where number of psychiatric casualties was great. There were still two very different views on the causes and proper treatment of this state. The traditional view believed that psychiatric casualties were best to be treated badly, so that it would be easier for them to go back to combat than to stay at the hospital. Progressive medical authorities, on the contrary, believed that they should be treated in a humane way, encouraged to talk about their experiences. The use of "talk cures" was in the end found to be the successful treatment. Just before the beginning of WW II Kardiner published his book on The traumatic neuroses of war where he found the war neuroses to be very similar to hysteria. (Herman, 1992, 20-22.)

Theoretically, in the early 1900's trauma-related disorders were seen to be psychoneuroses of individuals and their drives. Inner conflicts were seen to activate the trauma. Later the emphasis was moved to the ego that was seen to be unable to master the trauma. The problem was failed adaptation to environmental changes. The etiology of traumatic neurosis was clearly within the individual. Even in the DSM I and DSM II that recognised that stress could contribute to psychiatric symptoms, the model primarily viewed enduring symptoms as being caused by pre-morbid vulnerability (Yehuda & McFarlane, 1999, 42).

It was only after the Vietnam war in the 1970's when war trauma gained attention again. During the same time feminist movement made the society to pay attention to rape trauma and battered woman's syndromes. Meanwhile new theories in psychology had developed and the emphasis now was on the stressors instead of the individuals psyche. The new orientation is visible in the new diagnosis of Post-traumatic Stress Disorder that was established in 1980. The issue that was raised by the proponents of PTSD was not whether extreme stress could cause psychological damage. Rather the question was how should people suffering from trauma be viewed and treated in the mental health field. The formulation of PTSD as a normative or adaptive response to

trauma was a social and political issue as well and made the statement of traumatic stress as "normal reaction to abnormal situation" a well-known slogan. (Yehuda & McFarlane, 1999, 43.) In addition to the emphasis on the stressor, also the importance of the environment increased when lack of social support was identified as a risk for exacerbating symptom development. Even basically analytic writers like Horowitz (1986) gave increased importance to the role of the stressor. Learning theory, classical conditioning and stimulus generalisation explained the learned fear responses to traumas. Avoidance response typical for PTSD was explained by instrumental learning. Attribution theory is used in explaining the dynamics of PTSD where the meaning given by the individual to his experience has a strong influence on his adaptation. Constructivism and the persons internal structure of reality has explained many of the adaptational processes to be seen in PTSD. (Peterson et al. 1991, 4-6; Herman, 1992, 20-22.)

There is some confusion related to the label of PTSD concerning the specificity of traumatic stress as opposed to nontraumatic stress. Traumatic stress has been associated with events such as war, captivity, torture, disasters. However, no one has successfully distinguished traumatic from stressful events. Interestingly, the field of traumatic stress has evolved independently from the preexisting domain of stress and coping. Despite some attempts to form theoretical links between stress and traumatic stress there has been very little interaction between the two fields. (Shalev, 1996, 92.)

Stress theory is one of the central paradigms of 20th century psychology (see chapter 1). Stress researchers have shown that excessive demands on the organism produce a typical sequence of physiological responses involving sympathetic activation. These responses buffer the effects of external demands defending vital functions (e.g. central temperature, supply of oxygen to the brain) at the expense of secondary functions (like digestion, peripheral temperature). Stress responses follow a triphasic pattern: an acute response, a phase of resistance and either recovery or exhaustion. In psychological stress, the effects of controllabil-

ity and predictability of the stressor and the modulating effects of coping and appraisal are important as regulatory mechanisms to keep the mental responses within manageable boundaries. (Selye, 1956; Shalev, 1996, 92.)

The core of stress theory consists of homeostatic model of self-conservation and resource allocation in response to excessive demands. These responses usually occur under stress or in the immediate proximity of the stressor. However, the intermediate and long-term consequences are beyond the scope of the model. Selye's model focuses on immediate coping responses: in an example of massive bleeding the body adaptively attempts to reduce the effects of bleeding on vital functions of the organism. It does not address the healing of the wound that has caused the bleeding. Stress, however, becomes traumatic at the point when psychological damage analogous to this type of physical damage occurs and the hypothetical stimulus barrier is broken. (Selye, 1956; Shalev, 1996, 92-93.) This makes understandable that Lazarus and Folkman do not mention PTSD as a possible consequence in their monograph *Stress, Appraisal and Coping* which was published four years after the DSM III definition of PTSD. They suggest impaired social functioning or somatic complaints as typical examples of negative outcome from stress. They are studying the effects of mild stressors, not traumatic stressors. (Shalev, 1996, 92.)

Horowitz's (1986) stress response syndrome has been cited as an extension of classical stress theory. His theory, however, includes a prolonged recovery phase which consists of a struggle with the results of exposure to the trauma. (Shalev, 1996.) Baum (1990 ref. Shalev, 1996) has defined stress as a negative emotional experience accompanied by biochemical, physiological and behavioral changes. Chronic stress is not limited to situations in which the stressor persists for long periods of time. Responses may habituate before a stressor disappears and on the contrary may persist beyond the physical presence of the stressor. Theoretically, the use of the term stress for both acute and chronic responses may be problematic. Recent studies show reduced cortisol levels in PTSD as opposed to elevated cortisol

during acute stress. This supports the distinction between acute stress and prolonged states of posttraumatic morbidity. Some authors (e.g. Hobfoll, ref. Shalev) have suggested that massive stressors may lead to a qualitatively different type of stress reaction. At the moment, it is not quite clear theoretically, how stress and traumatic stress relate to each other. (Shalev, 1996, 93.)

Post-traumatic stress reaction is usually described as a process consisting of different phases with their typical reactions. The stressor is defined in the DSM III (1980) and later in the DSM IV (1994) together with other criteria for the diagnosis. Although there has been concern about stigmatizing people with psychiatric labels in general, trauma victims have usually received the diagnosis as a validation of their psychic distress. (van der Kolk & McFarlane, 1996, 4-5.)

The most crucial aspect of the PTSD diagnosis is establishing the nature of the stressor. The diagnosis has been criticized for lack of refinement, but there are general accepted guidelines for the stressor. First, the stressor must be psychologically distressing and such that it would be distressing to almost anyone. Secondly, the stressor is something that is "outside the range of usual human experience". A traumatic event includes: a serious threat to one's life; a serious threat or possible harm to one's spouse, children, close relatives or friends; a sudden destruction of one's home or community; seeing another person who has been seriously injured or killed; physical violence; and learning about serious threat or harm to a relative or to one's family. Sometimes the traumatic event includes a physical element, e.g. direct damage to the central nervous system like head injuries and malnutrition. The stressor is usually experienced with intense fear, terror and helplessness (Peterson et al., 1991, 15; March, 1993, 38.) Trauma differs from other psychiatric disorders in that in trauma the core issue is reality, not e.g. displacement of meaning (van der Kolk, 1996, 6). The other criteria for post-traumatic stress disorder are classified in three categories: symptoms of intrusion, avoidance and arousal.

During the early days and weeks following the impact phase of trauma, symptoms resembling those of PTSD are frequently

observed. Intrusive symptoms seem to appear within 48 hours after the event in the majority of survivors. Survivors differ, however, in the amount of discomfort, arousal and dissociation that accompany early intrusive recall. For some survivors these repeated memories are intolerable. Many survivors are judging themselves and reevaluating their actions with particular intensity during that time period. (Shalev, 1996, 90.) Persons suffering from PTSD have an impairment in the capacity to integrate traumatic experiences with other life events. The traumatic memories often consist of intense emotions or somatosensory impressions which occur when the victims are aroused or exposed to reminders of the trauma. The experience of persistent intrusions of memories related to trauma interfere with attending to other incoming information. These intrusions can take many different forms: flashbacks, intense emotions, such as panic or rage, somatic sensations, nightmares, interpersonal reenactments. Years after the original trauma victims claim that their reliving experiences are as vivid as when the trauma first occurred. Because of this timeless and unintegrated nature of traumatic memories, victims remain embedded in the trauma as a contemporary experience. (Van der Kolk & McFarlane, 1996, 8.)

Traumatized individuals become haunted by intrusive reexperiences of their trauma and because of that they start organizing their lives around avoiding having these emotions that the intrusions evoke. Avoidance may take different forms, such as keeping away from reminders, ingesting drugs or alcohol in order to numb awareness of distressing emotional states. The avoidance of specific triggers is aggravated by a generalised numbing of responsiveness to emotional aspects of life. In DSM IV numbing and avoidance are lumped together, but van der Kolk and McFarlane (*ibid.*) suppose that they probably have different underlying pathophysiology. Several authors studying different victim populations describe a gradual withdrawal and detachment from everyday activities. Some call this reaction "dead to the world". To feel nothing seems to be better than feeling irritable and upset. (*ibid.* 8-12.)

People with PTSD try to deal with their environment through emotional constriction, but their bodies continue to react to certain physical and emotional stimuli as if there were a continuing threat of annihilation. They suffer from hypervigilance, exaggerated startle reaction and restlessness. It has been shown that they suffer from conditioned autonomic arousal to trauma-related stimuli. Often they seem to move immediately from stimulus to response without realizing what makes them so upset. They seem to experience intense negative emotions in response to even minor stimuli. As a result, they either overreact and threaten others or shut down and freeze. The hyperarousal phenomena seem to represent complex psychological and biological processes in which the continued anticipation of overwhelming threat seems to cause difficulties with attention and concentration. These difficulties in turn give rise to distortions in information processing. People suffering from arousal symptoms tend to experience sleep problems as well because they are unable to quiet themselves sufficiently to go to sleep and because they wake themselves up in order to avoid having nightmares. The most distressing aspect of hyperarousal is the generalisation of threat. The world has become an unsafe place. (ibid.)

The most influential theoretical model for PTSD is the information processing model proposed by Horowitz (1986, 1997). This model was also the cornerstone for the diagnostic criteria for PTSD. Horowitz's model of PTSD builds upon classical and contemporary theories of trauma, but places a major emphasis on information processing and cognitive theories of emotion. (Peterson et al. 1991, 70.)

Horowitz contends that traumatic events involve massive amounts of internal and external information. Most of the information does not match with a person's cognitive schemas due to the fact that it lies outside the realm of normal experience. The result is information overload, where the person experiences ideas, affects and images that cannot be integrated with the self. Because the person cannot process the information, it is shunted out of awareness and it remains in an unprocessed, active form.

Denial and numbing are used as defenses to keep traumatic information unconscious. Due to the completion tendency the traumatic information keeps coming conscious at times as part of the process of information processing. Such intrusive material continues entering consciousness until the traumatic information is fully processed. Prior to full integration of traumatic material there is oscillation between intrusion and denial-numbing. Horowitz sees intrusions as potentially facilitating information processing and defensive operations as promoting gradual assimilation of traumatic experience. (Horowitz, 1986, 1997; Peterson & al. 1991,69-71.)

The psychosocial model of traumatic stress developed by Green, Lindy and Wilson (Figure 1) (1985) describes the different factors that affect the process of an individuals information processing and the end result of it. It includes the idea of completion tendency and information processing presented by Horowitz, but emphasises the importance of individual experience and recovery environment. When a traumatic event occurs

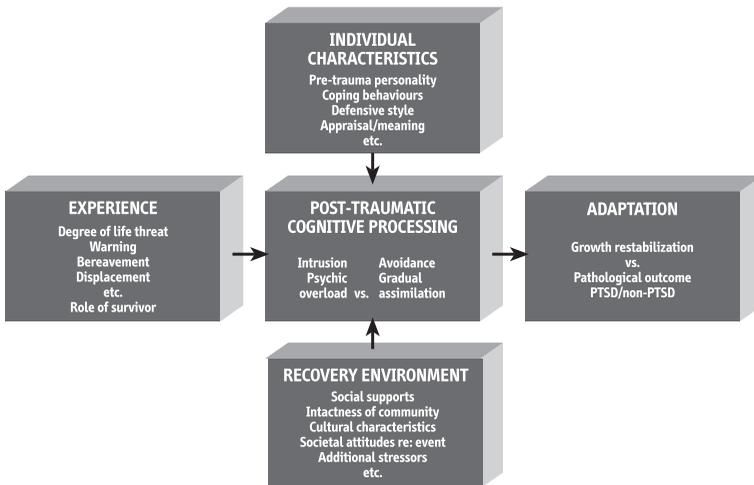


Figure 1. The psychosocial model of cognitive processing of a traumatic event.

an individual has his own experience of it with certain details that he appraises in his own way, depending on his personality traits, earlier experiences etc. Several characteristics of the traumatic event have been found to influence the adaptation and recovery. The degree of warning an individual has is important, because that defines if he can prepare for the event both materially and psychologically. Traumatic events usually cause losses that vary in their amount and importance to the victim. The degree of bereavement is an important characteristic of the experience. The amount of life threat an individual experiences during an event, varies from zero to a total certainty of annihilation. Depending on the nature of the traumatic event victims may be exposed to grotesque and traumatic details. The role of an individual in the event may be that of a passive victim or of an active participant in the event. These roles create very different experiences. Afterwards, if the society or a person's home has been destroyed, relocation may be necessary. (Green, Wilson & Lindy, 1985.)

Individual characteristics of victims have been found to affect the cognitive processing of the trauma and the level of adaptation. Individuals have different personality traits, they use different coping strategies, they have different defensive styles etc. Some research results suggest that biological vulnerability may explain some amount of arousal symptoms whereas the quality of the experience of trauma was a major determinant of reexperiencing phenomena. (McFarlane & Yehuda, 1996, 161; Krystal et al. 1999, 275-277.) There are characteristics called vulnerability factors that may make a person more prone to psychiatric disorders in general, e.g. earlier psychological disorder. Temperament differences have also been suggested to affect the consequences of stress (Strelau, 1995, 66-67.) Other factors can be called resiliency factors that help to buffer and to recover from the diseases. Rape trauma victims with high self-esteem were found to be less distressed after three months of the event than those with low self-esteem. (Kilpatrick et al., 1985, 137-138.)

Green, Wilson and Lindy (1985) note that the quality of the environment where the individual tries to recover from his trau-

matic experience will affect his recovery. Social support has been found in several studies to be important for recovery. Lindy et al. found that often family and friends of survivors form a sort of membrane around the survivors to protect them from people and circumstances that might be further traumatic. They compared this phenomenon to the cell membrane in biology and called it "trauma membrane" (Lindy et al. 1981, Green et al. 1985, 60-61). The psychological process behind it can be explained by the saliency of the common fate and the increased importance of social identity as a trauma victim (Eränen & Liebkind, 1993). Attitudes of the society concerning the event vary as well as intactness of community and cultural characteristics. For example, with Vietnam veterans or rape trauma victims, the environment has often been less supportive than it is for disaster or accident victims.

The outcome of a traumatic experience can vary greatly. The worst possibility is chronic PTSD or character change, the best one being personal growth and positive change in life values. Positive outcome presupposes that the working through of the trauma has been successfully completed and the experience integrated, even though some symptoms may occasionally be manifest. (Green et al. 1985; Peterson et al. 1991, 75.)

The current tendency to study only post-traumatic stress disorder may prevent the adequate assessment of other psychiatric disorders after trauma. Such comorbid disorders are e.g. depression and substance abuse, but also general anxiety. In community sample studies a majority of PTSD cases are accompanied by another disorder. Some victims do not develop PTSD but develop other disorders, such as depression. Some authors have suggested that the comorbid disorders in relation to PTSD, particularly panic disorder, major depression and phobias are autonomous in their pattern. (McFarlane & Yehuda, 1996, 163.)

The concepts of cognitive appraisal, schemas and basic assumptions were already discussed in chapter 1. Post-traumatic stress can be explained by a threatening event invalidating, at a deep experiential level, the three most basic beliefs in the personal theory of reality: the assumption of invulnerability, the world as meaningful and the self as worthy. People who have

been victimized can no longer think that "it cannot happen to me". Instead, there is a marked sense of vulnerability and a fear that if it could happen once, it can happen another time, too. The victimization also shatters the assumption of the world as meaningful and forces the individual to search for new meanings and assumptions about the world and himself. The central question for a victim is not "why do these terrible things happen?", but "why did this happen to me?". Usually, there is no good, logical answer to this question. The result is that until a new equilibrium is reestablished the world for the victim is not meaningful, controllable or predictable. (Janoff-Bulman 1985; Peterson et al. 1991, 79-80.)

The sense of coherence, as defined by Antonovsky (see ch. 1), includes elements very similar to the basic assumptions described by Janoff-Bulman and Epstein. The sense of coherence is defined to be a "generalized, long-lasting way of seeing the world and one's life in it". The sense of coherence is dynamic, it is shaped and modified in childhood but also throughout the life. A central element of it is a person's perception of his inner and outer environment as predictable and comprehensible. If one understands what is going on and if the world is seen as predictable, the outcomes may still not fulfill his needs. The third element of the sense of coherence is the faith that things will work out as well as can reasonably be expected. (Antonovsky, 1979, 123-125.) For a person with a strong sense of coherence a disaster is against his basic beliefs and may cause more pressure towards changing his beliefs than for a person with weaker sense of coherence. However, a strong sense of coherence is seen as a general resistance resource buffering stress. A strong stressor like war or disaster inevitably results in a weakening of one's sense of coherence, but the weakening may not be permanent. By contrast to sudden disruption caused by a disaster or trauma to the sense of coherence, a slow modification may take place within the context of one's previous level of sense of coherence and depend on the experiences a person will later have or choose to have. Movement towards the strong end of the continuum requires hard work. Usually, people tend to seek out environments and experi-

ences that reinforce their level of sense of coherence. (Antonovsky, 1979, 187-189.)

4.2 Psychological consequences of nuclear accidents

Nuclear accidents belong to human-induced acts of omission that will be described below. Psychological consequences of disasters have been seen to differ depending on whether they are natural or human-induced. Frederick (1980) compared the consequences to victims and concluded that they differ in terms of 1) the emotional stages the victims pass through, 2) the psychological symptoms the victims suffer and 3) the social processes they encounter. One reason for the differences is the perceived involvement of the victims. Victims of natural disasters are perceived as innocent victims of events beyond their control. Victims of man-made disasters can be perceived partially responsible for their fate. Man-made disasters can be further subdivided into acts of omission and acts of commission. (Berren et al. 1989, 47-49.)

Acts of commission include terrorism, mass kidnappings and other purposeful violence. Acts of omission are more seldom reported in the literature, but are likely to occur more often in the future. They do not usually result from malevolent intent, but because of poor planning or attempts to save money, resources or time. Negligence is a concept often associated with acts of omission. With many acts of omission the initial impact follows a public report of the precipitating events as opposed to the events themselves. Victims of acts of omission often do not know they are victims until they have been so informed. Often there is also conflicting evidence as to whether a disaster has occurred or not. Two phases have been reported in the reactions of victims: 1) learning to live with the risk and 2) coping with the anger for allowing the situation to develop. As technological disasters are, in principle, avoidable they tend to produce aggression rather than acceptance (Weisaeth, 1994, 76). Victims of acts of omission tend to develop generalized mistrust compared to the specific

mistrust to the perpetrator seen in acts of commission. (Berren et al., 1989, 49-51.) Manmade disasters frequently cause withdrawal and social isolation which is more detrimental to mental health than the limited phobias typical of natural disasters (Weisaeth, 1994, 76).

Both natural and technological disasters are relatively uncontrollable, but perceptions of their controllability differ. Natural forces are perceived as uncontrollable "acts of God" suggesting that they cannot be foreseen or prevented. Technology is supposed to be regulated and managed: as man created technology, man should also be able to control it. Failures in technology represent a loss of control over systems we have created when natural disasters only highlight the lack of control. Research shows that stressfulness of an event is affected by the perceived controllability. (Baum et al., 1991, 33-35.) Technological crises comprise four categories: those derived from large system failures (e.g. nuclear power plant accident), structural failures (e.g. bridge collapse), low level delayed effect crises (e.g. pollution) and chemical hazards (e.g. oil spills, leaking toxic waste). System and structural failures are sudden and affect large number of people. (Baum, 1987, 31-33.) The sudden loss of control might cause a decrease in sense of coherence of the victims.

An important difference between natural and technological disasters is their different time sequence. In a natural disaster a community moves from order to chaos to the reconstitution of order. With the reconstitution of order the disaster enters the collective memory. In a technological hazard there may be no low point when the danger could be cleared to be over. Rather, there is an unending period of threat. The chronic uncertainty is more likely to be experienced as a greater stressor than the certainty of even bad news. (Kroll-Smith and Couch, 1991, 299-301; Berren et al. 1989, 47-49.)

Research on the psychological consequences of nuclear accidents consist mainly of studies done on Three Miles Island (TMI) nuclear power plant accident that took place in March 1979. Chernobyl accident in April 1986 has been studied, but not in the amount and scientific rigour than the Three Miles Island acci-

dent. A clearly different kind of accident that has gained some research interest was the radiation accident in Goiânia, Brasil in September 1987. It was smaller in scope than the other two, but had serious health consequences to the persons affected by radiation.

4.2.1 Three Mile Island accident

The accident at the TMI nuclear power plant caused a two week emergency period that had both acute and long-term consequences to the residents. The neighbors of the power plant had generally a positive attitude toward the power plant and the few who believed it to be a threat to the community felt that a serious accident was a very unlikely possibility. The accident at the plant surprised the local people and first they believed it to be an incident similar to earlier ones. (Goldstein et al. 1989.) The information released was in the beginning contradictory, but after a couple of days an evacuation was recommended to pre-school children and pregnant women inside an area of 30 kilometers from the plant. Ten days later the evacuation was canceled and people returned to their homes. In 1985 the TMI power plant was restarted after being closed down for six years. Two thirds of the residents opposed the restart of the power plant on an election three years earlier. (Trunk and Trunk, 1981; Goldstein et al. 1989; Prince-Embury and Rooney, 1988.)

No instructions on the beginning, ways or the goal of evacuation were given. The governor's advice to evacuate only applied to pregnant women and pre-school children. Evacuation was left on the residents own decision making. It is evaluated that 90 % of pregnant women evacuated. The total amount of evacuated persons vary from 80 000 persons (Paakkola, 1988) to 144 000 persons (Bromet, 1989). Dohrenwend et al. estimated that at least one family member evacuated from every second family inside the 30 kilometers radius and over 60 % of families living inside the 10 kilometers radius. Only one quarter of families with pre-school children did not evacuate. Of those who did not evac-

uate one third prepared for that and two thirds considered evacuation. (Flynn, 1981, ref. Haukkala and Eränen, 1994.)

The most common reason for evacuation was the threat felt when the most common reasons for not evacuating were 1) waiting for exact instructions for evacuation 2) a belief that the situation was in God's hands 3) not feeling the situation was threatening or 4) being afraid of looting (Barlett et al., 1983). Every tenth of the subjects reported having had serious arguments about evacuation in the family (Flynn, 1979, ref. Haukkala and Eränen, 1994). More educated subjects were more willing for evacuation than others. Most of the subjects that evacuated went to their friends or relatives in the same state. Average distance to the goal of evacuation was 150 kilometers from home. In an official evacuation shelter there were at largest only 180 persons and the situation was calm. Most of the evacuated persons returned home on the 4th of April even though the governor's advice to evacuate was canceled only on the 9th of April. (Flynn, 1981, ref. Haukkala and Eränen, 1994.)

The psychological consequences of the accident were studied by several research groups. First interviews were started two weeks after the accident and follow-up time of some of the studies has been several years. (Dohrenwend et al. 1981; Houts and Goldhaber, 1981; Baum et al. 1983; Bromet, 1980; Bromet, 1990.)

In the first telephone interviews of persons living inside a 10 kilometers radius nearly all subjects reported to be worried because of the accident. Women were more anxious than men, especially women with pre-school children. Mothers living near the power plant (10 kilometers) reported more worry than mothers living farther away (70-90 kilometers) from the power plant. A quarter of the subjects reported a decrease in trust of authorities. After two months the amount of symptoms, like depression, were decreased. (Dohrenwend et al. 1981.)

Clients of local mental health centers showed increased depression compared to clients in other mental health centers in the country. The level of their depression decreased during the following months, but was still higher compared to clients in other parts of the country. Clients living near the power plant were

more depressed than those living farther away. (Dohrenwend et al. 1981.)

Cleary and Houts (1984) reported a study on persons living at ten kilometers distance from the power plant and those living at 80 kilometers distance from it. Persons living close to the power plant felt more threat, were more upset and showed more psychological symptoms. Women had more symptoms than men, but single persons and older persons had lower levels of symptoms than other subjects. In October 1980 the differences had disappeared.

Baum et al. studied a smaller sample where they found the residents living near the power plant to be worried and uncertain of the consequences of the accident. They had more unspecific symptoms and somatic complaints than residents in other areas. They felt more alienation and anxiety, too. The group living near TMI had poorer results in problem solving tasks than the other group and their level of adrenalin was higher than in the other group. No statistically significant differences were found. Conclusions of the results were that some residents were suffering long-term stress caused by the accident. They were not on clinical levels, but higher than in the average population. (Baum, Fleming and Singer, 1983.)

Bromet et al. (1980) found the greatest psychological consequences in mothers of pre-school children that were more depressed and more anxious than others one year after the accident. More symptoms were found in mothers, who lived in the area evacuated, who had little social support and who had prior psychiatric history.

All research groups found acute negative psychological consequences increasing anxiety or anger but the long-term results found by research groups differ from each other.

Goldstein and Schorr (1982) found that subjects living closer than 15 kilometers from the power plant were still one year after the accident more worried than before the accident. Mothers of small children and persons with prior psychiatric history showed more symptoms of depression, anxiety and anger than subjects

in the control areas 42 months after the accident and especially after the restart of the second reactor. (Bromet et al. 1990.)

There were great individual differences in the perceived threat of the accident. Cleary and Houts (1984) studied the coping strategies used by the residents and their effect on psychological consequences. It has been suggested that problem-focused coping would be more successful than emotion-focused coping. Here the subjects using active problem-focused coping were 9 months after the accident still more anxious than those subjects who denied the problem or the threat.

Collins et al. (1983) studied coping strategies and stress two years after the accident. Here emotional management was shown to be more successful in reducing stress than denial or problem-focused coping. Here the Ways of Coping Inventory was used to compare different coping strategies instead of questions asking about behavioral responses used by Cleary and Houts (1984). The difference in their results originates from different concepts. In chronic stress emotion-focused coping strategies used to manage negative feelings, but that have no effect on the threat, seem to be successful. Denial of the problem may be difficult in a situation where the person may be faced with the problem daily. Problem-focused coping strategies used to affect the problem have here no success as the accident already happened cannot be affected. Bromet (1988) found that subjects living near the power plant had more symptoms than subjects living farther away. However, subjects living farther report more worry because of the closeness of the power plant than those living closer to it. This may be explained by denial of the threat in subjects living near the plant.

Davidson et al. (1982) found weaker sense of control in subjects living close to the plant than in control subjects. Subjects in TMI showing less sense of control had also more symptoms and poorer ability in problem solving. Subjects using emotion-focused coping had greater sense of control. (Baum et al. 1983.)

Fleming et al. (1983) studied the mediating effects of social support on stress caused by the accident. Social support is de-

fined as emotional support received from significant others like talking about the problem and instrumental support like financial aid. Lack of social support affects negatively the welfare even when the person is not in a stressful situation. On the other hand, social support has a buffering role so that the consequences of the accident are smaller in persons who have social support. In TMI accident the role of social support was seen in less symptoms, less depression and less alienation in residents having more social support. Subjects having less social support also showed poorer performance in problem solving tasks. In Bromet et al. (1989) mothers and children having more social support had fewer symptoms. In Cleary and Houts (1984) social support was not related to the level of anxiety caused by the accident, but the fewer friends a subject had, the more anxiety he reported.

Goldsteen et al. (1989) found that mistrust of authorities and closeness to the power plant increased perceived danger from the accident. Perceived danger and mistrust of authorities increased perceived harm to health, which was not affected by close-

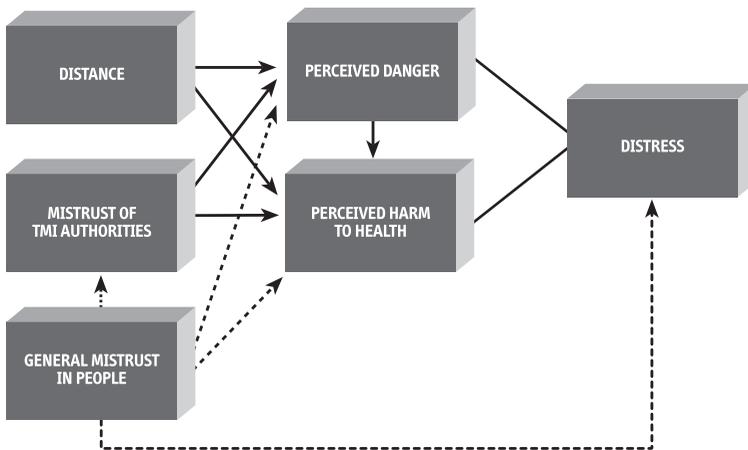


Figure 2. Proposed path model representing the relationship between mistrust of authorities, distance from TMI, perceived harm to health and distress. (Goldsteen et al 1989)

ness of the power plant. General mistrust of people was not connected to mistrust of authorities. Three years later level of anxiety was affected by threat to health at the first measuring time, that was affected by perceived danger from the accident. Anxiety was mainly affected by the appraisal of the situation.

Bromet et al. (1990) showed that mothers of pre-school children who perceived the accident as dangerous had more symptoms of depression, anxiety and anger than mothers not perceiving the accident as dangerous still 42 months after the accident and especially after the restart of the second reactor. In the first follow-up 9 months after the accident the perceived risk and danger were not connected to the level of stress caused by the accident. (Bromet and Dunn, 1981.) The perception of threat of the accident has long-term effects especially in groups feeling to be involved in the accident, like mothers living in the area that was evacuated. On the other hand, symptoms caused by the accident in power plant employees decreased soon after the accident. (Bromet et al. 1990.)

Prince-Embury and Rooney (1988) studied consequences of the restart of the second reactor at TMI. The sample consisted of 108 subjects from their 1987 study sample. No significant differences from results found a year before the restart of the power plant were found, except anxiety that decreased from 1984. Compared to 1981 study more symptoms of depression and anger were found after the restart. However, the subjects studied were different at different measuring times, so caution is needed when evaluating the results.

Dew et al. (1987) studied the effects of restart of the reactor on mothers of pre-school children. After the restart the mothers had more symptoms than on any other time since the accident. For the first time attitudes towards nuclear power, as measured before the restart, predicted symptoms after the restart. Symptom levels increased especially in those mothers who had symptoms of depression and anxiety after the accident and perceived their personal risk to be high.

Davidson et al. (1991) found more symptoms of chronic stress in TMI area residents than in control subjects. They reported more

somatic complaints and poorer performance on problem solving tasks. Stress-related arousal measured by catecholamine and blood pressure levels was higher in TMI residents than in control subjects. TMI residents reported the restart to be bothersome, but no evidence of restart-related lasting effects were found. There was a tendency for the levels of stress to decrease among TMI area residents. This result was found consistent with the anticipatory stress reduction interpretation of the venting procedures (Gatchel et al. 1985). If the venting procedures were associated with anticipatory stress and the successful completion of it alleviated these fears and stress levels the pattern would look as if there were no changes at all from pre- to post-venting. Chronic stress persisted in TMI residents six years after the accident as measured by arousal but not in reported emotional distress. (Davidson et al. 1991.)

Prince-Embury and Rooney (1995) studied cognitive adaptation in subjects who stayed in vicinity of TMI between 1983 and 1985 compared to those who left the area. According to them, those who remained in TMI area appeared more likely to disconnect perceived threat of TMI from their sense of personal control. They suggest that early adaptation response may involve disconnection of perceived threat from other cognitions and relevant affect. Lazarus (1989) defines disconnection as a cognitive coping process comparable to defensive processes described by others such as dissociation (Janet, 1965; van der Kolk, 1985). Cross-sectional comparisons of initial responses between those who stayed in TMI and those who moved from TMI between 1985 and 1989 yielded findings that were consistent with their proposed disconnection hypothesis. TMI related worry tended to be more related to psychological symptoms among those who moved than among those who stayed. However, symptoms were also significantly related to loss of faith in experts among those who remained in the area. This aroused suggestion that those who stayed possibly displaced symptoms to concern about experts. This is consistent with the suggestion that TMI residents have been sensitized to the responsibility that experts have for their continued safety. The loss of faith in experts was a salient

cognition for TMI residents in 1985. Prince-Embury and Rooney find the persistence of this finding as consistent with the "shattered assumption" formulation by Janoff-Bulman (1985, 1992) and "loss of innocence" reported by Titchener and Kapp (1976).

Longitudinal analysis of the data indicated a decrease in symptom levels from the pre-restart elevation of symptoms that had persisted in the community since the accident. This finding is significant as the pre-restart symptom level had been significantly elevated compared to normative samples. The symptom level measured in 1989 represented a return to a normal level. This decrease in symptoms occurred in spite of increase in perceived lack of control, loss of faith in experts and greater fears of developing cancer. Working through an experience could mean that related cognitions would reflect more realistically the experience of the individual and the negative cognitions would be more appropriately associated with psychological symptoms. Healing, working through or functional coping of the event has been defined as the introduction or reassessment of additional potentially modulating elements into the preexisting internal model of the individual. (Horowitz, 1997.) In this study Prince-Embury and Rooney believe that "awareness of what to do in the event of an emergency", a cognition of emergency preparedness, was such an element.

4.2.2 Chernobyl accident

In April 1986 one of the four blocks of Ukrainian (then part of former Soviet Union) nuclear power plant at Chernobyl exploded as a result of human error. The fatal accident sequence was initiated by the decision of the plant's management to shut down all safety mechanisms in the reactor in an overnight experiment to test the generator under extreme conditions. The management did not understand the danger of the situation before it was too late. The explosion left a gaping hole in the roof, exposing the reactor core to the outside air. The fire continued for ten days and hundreds of tons of radioactive dust was released and dis-

persed over Europe. The release of radioactive dust was over only after the fire in reactor core was extinguished by covering it. (van den Bout et al. 1995, 213-215; Hänninen et al. 1988.) The extinguishing of the fire and rescue operation after that involved even 400 000 civil workers and an unknown number of men enlisted in the army (Romanenko, 1990 ref. Ginzburg et Reis, 1991). Of the workers involved in the rescue operation 30 died from injuries caused by the radiation and 200 got seriously ill. The number of casualties might have been smaller if proper protective equipment had been used. (Paakkola, 1988.) Present estimates of deaths vary from 250 persons (Romanenko, 1990 ref. Ginzburg et Reis, 1991) to 321 persons (Collins, 1992). The Chernobyl accident was the most serious radiation accident in the world (class 7).

Approximately 135 000 people were evacuated and dislocated from the distance of 30 kilometers from the power plant in Ukraina, Belarussia and Russia. (Paakkola, 1988.) Evacuation was started only 36 hours after the accident. Close to the power plant located town Pripayat with 45 000 inhabitants was evacuated only after the wind had turned towards it. The residents were allowed to take with them only things they were able to carry themselves. (Ginzburg et Reis, 1991.)

Torubarov (1991) and Chinkina (1991) have reported psychological consequences of the accident and psychological characteristics of those suffering from radiation disease. According to them 145 persons developed symptoms of radiation disease. 115 persons of them were sent to Moscow for special treatment.

Patients were grouped according to the seriousness of the disease into four classes where the amount of symptoms and levels of radiation dose varied from low to high. Patients in the fourth group had so large doses that only one from twenty patients survived. Because of that only patients from the three groups are included in the study. Different phases of the patients suffering from radiation disease were described as consisting of four phases lasting together several years. It was not possible to differentiate between the different phases in patients most seriously ill. (Torubarov, 1991.)

Psychological consequences of the accident were studied according to the phase of the disease and treatment. Seriously ill patients belonging to class three were physically so ill in the beginning with large burns that no psychological symptoms could be identified when the focus was in survival. In the recovery phase and after that started psychological symptoms to emerge when there was certainty of survival. This caused confusion and uncertainty about the future with all social problems. This was visible especially as a symptom that was called "weak nerves". Patients belonging to the second class on the other hand were suffering from serious psychological symptoms from the beginning as they were aware of their own state and of the dying of those more seriously ill. Concern over own survival was great. Also patients suffering from milder radiation disease had psychological symptoms like depression, suspiciousness and weak nerves that got worse during the follow-up time. (Torubarov, 1991.)

The central and most important stressor for the inhabitants of the contaminated areas is the threat of having been exposed to dangerous levels of radiation. Evacuation of the contaminated areas caused severe psychosocial stress as government policy was to evacuate families and individuals rather than whole communities. The result was a severe loss of structure and social ties. People also lost contact with relatives and the source of social support. Psychological reactions varied, but there was found symptoms of psychological tension, anxiety and depression that later might develop to somatic symptoms. (Aleksandrovskij, 1989; van den Bout et al., 1995, 216-222.)

In the acute phase the authorities reacted by keeping silent. During the first three years the authorities withheld a great deal of information. As a consequence of that all official information was distrusted even when it was in accordance with Western reports. In the former USSR people actually trusted rumors more than official reports. Van den Bout et al. (1995, 222) write: "It looks as though people are constantly seeking for reliable information but, at the same time, disqualify every piece of information that

is presented. Reassuring information only triggers the search for more reassuring information." Loss of trust is a general characteristic of the inhabitants. In the first years anxiety was the core negative emotion of the residents, but in later years Russian investigators have reported a gradual shift toward depression. (van den Bout et al., 1995, 222-223.)

Experts disagree to some extent about the health consequences of exposure to the doses of radioactivity that took place in Chernobyl. However, there is an absolute consensus that radiation causes a limited number of discrete medical problems and is not related to any kind of medical problems. Cancer is clearly related to high doses of radioactivity. Thyroid cases in Gomel region has risen from 1 or 2 cases in 1986-1989 to 39 cases in 1992. The results of an international study on the medical effects of Chernobyl accident are in agreement that the accident had not resulted in any measurable radiological effects on the health of local population. (van den Bout et al., 1995, 227.) According to the research results of the International Atomic Energy Association the largest health consequences caused by the accident were psychological. (IAEA, 1991.)

In comparison to "classical" or natural disasters a nuclear accident is invisible, there is no high point and no low point. During the Chernobyl accident only a few outward signs were visible. The absence of a high impact phase probably explains also the absence of intrusive reactions related to the accident that are typical to other kinds of traumatic experiences. The accident left hardly any psychological impression on the majority of the population as nothing concrete seemed to have happened. Psychologically nuclear accidents are more comparable to other accidents consisting of leaking of toxic substances than to natural disasters. (van den Bout et al., 1995, 224.)

The most typical characteristic of the inhabitants in the contaminated area is the preoccupation with their health. They experience many kinds of health problems (like headaches, gastrointestinal complaints, common infections) which seem to be of psychosomatic nature. The complaints are to a large extent attributed to radiation. The preoccupation with health problems

and attribution to radiation is understandable and similar to that observed in Hiroshima and Nagasaki. However, the physical arousal state caused by chronic stress may be interpreted as symptoms. The symptom constellations may be interpreted as radiation-related. This interpretation leads further to anxiety and depressive reactions. This view is, however, so contrary to the beliefs of inhabitants, including medical doctors, in the contaminated areas that it can be hardly expressed in public. The people themselves appraised the situation as real death threat. (van den Bout et al., 1995, 230-231.) There are clear differences between inhabitants in the contaminated areas and in control areas: in contaminated areas 40 % of people e.g. don't believe that the radioactivity is decreasing in their environment, when only 25 % of persons in control areas believe so. (Ginzburg, 1993.)

4.2.3 Goiania accident

In September 1987 a serious radiation accident occurred in Goiania, Brazil. Approximately 20 grams of ^{137}Cs , a radioactive Cesium isotope was stolen from an old radiotherapy machine in an abandoned medical clinic. The protective container that covered the ^{137}Cs was opened in the backyard of a local junk dealer. The curious sandy grains of the isotope, which glowed in the dark, were distributed to friends and family in the immediate vicinity. Many people living near the epicenter were contaminated by either ingesting the ^{137}Cs or by being directly exposed to it. Four people died from acute radiation syndrome and 22 got seriously ill. (Collins et al., 1993.)

Protective measures were started only two weeks later when the local medical doctor realised that several people were exposed to radiation. He invited radiation authorities and wide rescue operation was started. 112 000 people were examined, of whom 249 were exposed to radiation and of them ingesting 129 persons. Externally exposed persons were immediately decontaminated. From the persons exposed internally 50 needed treatment and 20 of them hospitalization. About 50 houses were decontaminated during two months. 700 employees from radiation relat-

ed offices and companies were involved in the rescue operation. The radioactive waste was stored in an area near the town of Abadia, a suburb of Goiania about 30 kilometers from the epicenter in Goiania. (Collins et al., 1993; Rosenthal et al., 1991.)

As a consequence of the accident 11 seriously ill persons were transported to the local hospital in a separate room where the ordinary personnel of the hospital was too afraid to go. The persons who were ill had been given no information of their symptoms. Treatment was made even more difficult by a strike taking place at the same time. The situation was extremely difficult when radiation specialists arrived a few days later. The patients had serious symptoms and they did not know what caused them. More seriously ill patients were sent to Rio de Janeiro to a hospital with better treatment facilities. During the following six months 20 victims of the accident – ages varying from 6 years to 60 – were treated in these two hospitals. The patients were poor inhabitants of the local slum, most of them living on collecting junk paper.

The personnel was in the beginning wearing radiation protection which made contact with patients more difficult. Often the patients refused to follow their instructions. Two of the patients escaped the hospital, but returned back themselves. 14 of the 20 patients became depressive and started to recover only in December. The transfer to Rio de Janeiro caused anxiety and led to serious depression in 6 patients. One of the patients said after hearing of the transfer, that he knew he would die and wanted to die in Goiania. After arrival in Rio de Janeiro he was extremely depressed and died from an infection after a few weeks. Two patients with prior psychiatric history were aggressive in the amount that they had to be isolated. (Brandao-Mello et al., 1991.)

During the acute phase of the disease the patients were very anxious and frightened of the developing disease. The second phase lasted till the end of November when the survived patients returned from Rio de Janeiro. At that time the patients were depressed and anxious about continuing their life, their ability to work or their lost homes. In the third phase that lasted till January the patients wanted to leave the hospital. This caused

sometimes aggressive behavior. Especially patients having children were worried and wanted to leave the hospital. Psychological reactions and symptoms were treated with medication, psychotherapy and discussing their feelings. (Brandao-Mello et al., 1991.)

The rescue operation was very demanding to the personnel involved in it. The victims of the accident were people who had no knowledge of the consequences of radiation. Workers wearing protective suits aroused fear and suspiciousness in local people. A worker was hit when he was measuring radiation in the street and another one was threatened with a gun. All the persons working in the rescue operation had technical education and no experience of rescue in an environment like that. They had no idea of the scope of the accident before arriving on the spot. The workers could not understand the hostility showed towards them when they were helping the local people. Conferences organised for information delivery were especially frustrating. The inhabitants were upset and it was almost impossible to convince them about their false beliefs. They insisted that everything had to be "totally clean from radiation". They demanded the workers to drink or eat food before using it themselves. Most of the time was spent in explaining the situation to the local people. The hospital personnel had conflicts with the rest of the hospital personnel. It was found to be especially important to provide psychological support to the rescue personnel, too. Mental health workers working with population need to have basic knowledge of radiation. (Carvalho et al. 1991.)

Ten percent of the inhabitants came to the stadium during the two weeks to have their radiation dose measured. 5000 from the first 60 000 showed symptoms of stress and allergic reactions. Some people came there daily. Over 8000 people demanded to get an official certificate of the examination to avoid discrimination outside the town. The amount of products from Goiania that were sold outside the town decreased 50 %. Prices of agricultural products dropped by 90 %. 70 % of people reported having been discriminated outside Goiania after the accident. (Curado et al. 1991.)

The residents felt strong mistrust of authorities after the accident. Other people discriminated against those living in contaminated area, but on the other hand associations were founded to assist the victims. The whole community was first uncertain about their future. The 10 000 persons who experienced closely the accident, were frightened and wanted to separate from other people but at the same time discriminated against the primary victims. Only after three years of the accident the psychologists noticed some decrease in symptoms of depression, aggression and fantasies. (Curado et al. 1991.)

Collins et al. (1993) studied long-term psychological consequences after three years with a design similar to that used by Baum et al. (1982) after TMI. Here three groups were compared: one group of persons (n=23) exposed to radiation (0,5 – 1 Sv), another group (n=23) living one and a half kilometers from radioactive waste storage in Abadia. They were not exposed to radiation which was also confirmed by examination. The control group consisted of 21 persons from an area not exposed to radiation who did not believe themselves to have been exposed. Psychological consequences were measured with questionnaires, tests of levels of adrenalin, noradrenalin and blood pressure. The main result was that persons exposed to radiation and persons who were only afraid of exposure to radiation had similar stress symptoms three years after the accident. Both groups had difficulties in decision-making, had psychosomatic symptoms and increased levels of adrenalin and blood pressure compared to the control group. Persons exposed to radiation experienced their health to be poor and were worried of possible future health effects. Persons living near the waste site felt more helpless than those exposed as they were still living near the radioactive waste and perceived it as a risk to their health which they could not affect. (Collins and Carvalho, 1993.)

5 The incident at Sosnovyi Bor nuclear power plant

On March 24, 1992, there was an incident at a nuclear power plant in Sosnovyi Bor near St. Petersburg. The malfunctioning of the block and control valves of a fuel element flow channel resulted in damage to the fuel element of unit 3 in the power plant. This power plant is situated about 100 km from the Finnish border. Damage at the power plant was quite small: according to the Finnish authorities on radiation and nuclear safety, this incident did not cause any dangerous radiation in Finland. However, this incident aroused much interest in the Finnish mass media and there was much discussion of the consequences for Finland in the case of a serious accident at the Sosnovyi Bor power plant. The Chernobyl accident was still in people's minds and there were speculations and scenarios about the consequences if an accident, like the one in Chernobyl, had happened at the Sosnovyi Bor plant. Concern about the poor conditions at Russian nuclear power plants in general was aroused, as this increases the risk of a serious accident happening at some of these plants in future. It seems that in this case people reacted more to the failure of the control system than to the threat of radiation, and to some extent there was overlap of these two concerns. Certain representatives of the mass media accused Finnish authorities of delaying the information and underestimating the incident. Some representatives of the general public also accused the media to have been too late in informing about the incident. These accu-

sations were similar to those that took place in Finland after the Chernobyl accident, which was also characterised as an information crisis (Sjöberg et al. 1998). Considering the actual situation, the reactions in Finland were quite strong. At some schools and kindergartens, children were not allowed to go out during the day and some places were sold out of iodine tablets. The threat was taken seriously at least by some people.

Among the Finnish public, the Swedish-speaking minority were probably the first to learn of the incident, as they often watch Swedish television. Rumors spread that the Swedish morning news reported a serious accident had occurred and 'had caused contamination' of the southern Finnish coast.

The nine o'clock news on Finnish radio, however, reported a minor incident with no serious consequences. Radio talk shows ruminated about the incident and the consequences of a possible serious accident. So, from the earliest news reports information was inconsistent. The public discussion suggested that reactions were strong and it was decided by the Department of Social Psychology to take a closer look at the concern the Sosnovyi Bor incident evoked in the Finnish people.

6 Sample and methods

6.1 Research questions and hypotheses

The purpose of the study was to find out which factors affect the interpretation of a situation as dangerous or non-dangerous. Another aim was to study if the activity a person is involved in when hearing a warning, has an effect on his/her willingness to interrupt that activity to take necessary protective measures.

The first hypothesis was that subjects living closer to the power plant would interpret the incident as more serious and threatening than those living further away. It was expected that subjects living closer to the nuclear power plant would express more concern and fear about an accident.

The second hypothesis was that perceived quality of information delivery was related to the interpretation of the situation. It was expected that those who perceived information as unclear would interpret the incident as more serious and also express more fear. Third, it was expected that subjects interpreting the situation as more serious would have more stress symptoms than those interpreting the situation less serious. Fourth, commitment to an activity was expected to be related to less willingness to take protective measures.

6.2 Description of the sample

The populations to be studied were chosen from communities in southern Finland at varying distances from the Sosnovyi Bor plant. Kotka is situated on the southern coast of Finland, 134 km from Sosnovyi Bor. Hämeenlinna (274 km) and Varkaus (280 km) in the interior of the country are clearly farther away from the power plant. The three communities chosen for the sample are middle size Finnish towns and, by their social structure, comparable to each other. The fourth, Helsinki (229 km) was included in the study because it is the capital of the country and located on the southern coast of Finland like Kotka, although in terms of population size Helsinki is not comparable with the other communities. For this study twelve hundred and eighty (1280) people were randomly chosen from the population registry. The sample includes an equal number of males and females whose ages vary between fifteen and seventy. There were no significant differences between the sample towns in response rate or in sex, age, marital status or other demographic variables of the respondents. The number and distribution of participants from sample towns is presented in Table 1.

A questionnaire was sent by mail to the subjects about one and a half months after the incident. The return rate of the questionnaires was 55 %, which is comparable to that in other similar studies in Finland. The size of the sample is large enough for statistical analyses. The low return rate is understandable due to the long intervening time, and the length of the questionnaire. One reason possibly affecting the willingness to participate in the study, is that for financial reasons envelopes stamped with the name of the Ministry of Interior were used in the mailing. This may have had a negative effect on some participants as this is the same authority responsible for information delivery in disasters and nuclear accidents. In an earlier study some participants gave negative comments on this connection.

Table 1. Number of participants from different sample towns.

Towns	%	N
Kotka	25,5	170
Helsinki	24,8	165
Hämeenlinna	24,9	166
Varkaus	24,8	165
Total	100	666

54,8 % of the respondents are female and 45,2 % male. The number of subjects in different age-groups is presented in Table 2.

Table 2. Number of subjects in different age-groups.

Age	%	N
15 - 25	21,9	146
26 – 40	24,2	161
41 – 55	24,8	165
56 - 70	29,1	194
Total	100	666

One third of the respondents were single, 46 % were married and the rest (24 %) were either in common law marriages, widowed or divorced (see Table 3).

Table 3. Number of subjects according to their marital status.

	%	N
Single	30,3	202
Married	45,8	305
Common law marriage	12,2	81
Divorced	6,8	45
Widow	5,0	33
Total	100	666

As there was available information about the age and marital status for the initial sample, the differences between those who returned their questionnaires and those who did not, were analysed. There are slightly more married persons among respondents than among non-respondents, and consequently more single and divorced persons among non-respondents ($\chi^2 = 22.11$; $df = 3, 1191$; $p < .001$). This comparison was made excluding those living in common law marriages as the population register that was used here as source of information does not include that information. Respondents and non-respondents do not differ according to sample town or according to their age group.

The percentage of respondents having children under 7 years was 10, 5 %, 14,9 % had children between 7 - 15 years and 38,6 % had children over 15 years.

The distribution of respondents according to their social-economic status are presented in Table 4. The distribution of respondents compares to that of the general population in Finland.

Table 4. Distribution of respondents according to their social-economic status.

	%	N
Entrepreneur	2,0	13
Upper middle class	18,2	121
Lower middle class	31,7	211
Worker	27,2	181
Student	11,0	73
Retired	7,8	52
Other	2,3	15
Total	100	666

6.3. Measures used in the study

The survey consisted of questions designed for this survey concerning different aspects of the incident, The nuclear accident appraisal questionnaire:

- what information the subject received on the Sosnovyi Bor incident
- what the subject did after learning about the incident
- subject's opinion of the official information delivery of Finnish authorities concerning the incident
- subject's opinion of information delivery after the Chernobyl accident
- on what kind of issues the subject expects the authorities to inform the general public
- subject's own evacuation plans
- subject's own perceived risk caused to him by Russian nuclear power plants (see appendix 1)

The questionnaire also included several standardized measures.

There are many scales that have been developed to measure the stress caused by different life events. One of the best known of them is the Holmes & Rahe (1967) Schedule of Recent Experiences. This has previously been used in Finland. Sarason & al. (1978) wanted to differentiate in their Life Event Scale between the effects of positive and negative life events, as the level of stress may be heavily based on negative or positive event experience. In the questionnaire used in this study mainly negative life events experienced by the subject during the past year are assessed as well as his/her evaluation of the effect these events have had on his life. Life events assessed in the questionnaire include own and significant others illnesses, death of a significant other, economic difficulties, change of job or place of living. The items creating the composite variable have a reliability of Cronbach alpha .65. The reliability of the composite variable is rather low, but it is still used in some analyses.

The Sense of Coherence scale developed by Antonovsky (1979) was also utilised within the survey. Sense of coherence is defined as "a global orientation that expresses the extent to which one

has a pervasive, enduring though dynamic feeling of confidence that one's internal and external environments are predictable and that there is a high probability that things will work out as well as can reasonably be expected" (Antonovsky, 1979).

Sense of coherence has a central position in an individual's personality structure. An experience or a certain situation may produce a temporary, small change in the sense of coherence, but these changes, however, take place along a the continuum. A strong sense of coherence includes seeing the internal and external environment as predictable and understandable. (Antonovsky, 1979.) The scale produced in this sample a reliability coefficient of .82.

The self-esteem measure used in this study is the one developed by Rosenberg. It measures the extent to which a person has an experience of him/herself as a valuable person and respects him/herself. (Robinson and Shaver, 1980.) This measure produced a Cronbach's alpha .75.

The General Health Questionnaire by Goldberg was developed to be a general mental health screening inventory measuring non-specific stress reaction. The questions are activity oriented, assessing different aspects of everyday life. The scale that originally consisted of 60 items was later revised. A shorter version of 36 items was used in the Mini-Suomi project in Finland (Lehtinen et al., 1985.) Shorter versions have also been widely used in disaster studies, e.g. in Norway and Australia (Raphael et al., 1989.) The 28 item version was used here. The items of the scale represent different areas of psychological symptomatology and activity, such as concentration, energy level, affective state, sleeping habits and anxiety. Problems in these areas during the last couple of weeks were assessed. A reliability coefficient of .93 was found for this sample.

The Symptom Check List (SCL-90R) is one of the most widely used scales to assess psychological and psychosomatic symptoms (Derogatis et al. 1976.) This scale has been used in Finland, but later versions of it are also known in connection with trauma and disaster studies. The questionnaire used in this survey included the somatization and anxiety sub-scales. The reliability

of the anxiety scale was .89; the reliability of the somatization sub-scale was .85 and the reliability of the composite scale was .92.

The symptoms of radiation disease are ambiguous and this disease only develops as a consequence of very strong radioactivity. Some people have a tendency to worry of their health which naturally could be enhanced and cause stress symptoms in a situation where there is a fear of health consequences caused by radioactivity. Therefore the Whiteley-index, designed to assess hypocondria, was included in the survey (Pilowsky, 1967.) It has been used in the Mini-Suomi project although the scale has been validated on a relatively small sample (Lehtinen et al., 1985.) The Cronbach alpha for this scale in this study was .86.

Social support has repeatedly proved to have a buffering effect in stressful situations. The Social Provision Scale developed by Cutrona (1986) was used in this survey. It measures different dimensions of social support, like attachment, social integration and alliance. The reliability of this scale was .93.

A tendency to answer questions according to social norms may affect research results. On the other hand socially desirable behavior has been shown to be related with unwillingness to start protective actions in an alarm situation (Breznitz, 1984). To measure these effects, the questionnaire included Balanced Inventory of Desirable Responding by Paulhus (1990). It consists of two sub-scales, one measuring an inclination to self-deception, the other inclination to impression management. The reliability of the self-deception scale was .69 and the reliability of the impression management sub-scale was .80.

According to Folkman (1984) coping strategies are cognitive and behavioral attempts to control, diminish or tolerate outer and/or inner demands caused by stressful situations. The attempts may take very different forms. Usually a distinction is made between problem-focused and emotion-focused coping strategies. Here, subjects' coping strategies were measured by a scale developed by Dewe and Guest (1990) on the basis of the inventory developed by Folkman and Lazarus. As the scale is work oriented, a shortened version was used in this study, and

the least appropriate items were left out. A principal component analysis did not yield five factors as in the study of Dewe and Guest, but followed the pattern found by Folkman and Lazarus of problem-focused and emotion-focused coping strategies. The reliability of all items was .71, the reliability of the items creating emotion-focused strategies was .73 and the reliability of items creating problem-focused coping was .62. (appendix 2).

7 Results

7.1 Interpretation of the situation

Most of the respondents learned about the incident through mass media (71,6 %), whereas 28,4 % heard about it from their social network. There was a significant difference between the sample towns: the proportion of those who heard about the incident from their social network increases the closer the power plant is (Table 5). This may show that this information is more important to those living closer to the power plant, which increases the willingness to talk about it with significant others.

Table 5. The first source of information in sample towns (%).

First source of information	Sample towns			
	Kotka	Helsinki	Hämeenlinna	Varkaus
Social network	39,1	32,7	28,7	12,8
Mass media	60,9	67,3	71,3	87,2
Total %	100	100	100	100
N	169	165	164	164

$\chi^2=30.57$; $df=3,662$; $p <.001$

One fifth of the respondents received the information on the incident the morning it occurred, almost half of them had heard it by the afternoon. One third only heard of it on the next day (Table 6). There is a significant difference in the time of first information between the sample towns; in towns closer to the power plant respondents heard of the incident in the morning significantly more often than in towns farther away from the power plant.

Table 6. The time of first information in sample towns.

Time	Kotka	Helsinki	Hämeenlinna	Varkaus	Total
Morning	34,9	29,3	14,9	8,9	22,2
Afternoon	41,0	43,9	46,6	43,0	43,6
Next day	21,7	25,0	34,2	39,9	30,0
Later	2,4	1,8	4,3	8,2	4,2
Total	100	100	100	100	100
N	170	165	166	165	666

$\chi^2=53.87$; DF= 9, 666; p <.001

One third of the respondents indicated that they had heard about an incident, one third had heard about an accident. Almost ten per cent reported they had heard a serious accident had taken place. Consequently, almost half of the sample interpreted the situation to be quite serious.

Table 7. Interpretation of the situation, % of respondents.

An incident	31,6
Serious incident	14,6
Accident	33,0
Threatening accident	11,7
Serious accident	9,1
Total	100,0 (N=658)

When a situation is insecure or information delivery is unclear, there is more room for own interpretations of the situation. In most insecure situations people have been found to interpret the situation as undangerous. The result found here, however, confirms the conclusion made by Nigg (1987) that in the face of a nuclear power plant accident the insecurity of the situation leads people to interpret the situation as more dangerous than it objectively is.

A comparison of the sample towns shows (Table 8) that in Helsinki and Kotka, located psychologically closer to the Sosnovyi Bor power plant, the proportion of those who reported hearing of an accident was significantly higher than in the towns located farther away from the power plant. It is not probable that these towns really had delivered different information, but the result can be explained by the different interpretations made by respondents. In Helsinki and Kotka the respondents reported greater fear of Russian nuclear power plants. The level of fear provided the basis for respondents interpretation of the situation. Half of the sample is afraid of the risk caused to them by the Russian nuclear power plants, but in Helsinki and Kotka one third of the respondents is very afraid of it. This result confirms the earlier results showing that the same message can be interpreted in different ways by different groups (Nigg, 1987; Perry, 1985). Even though the risk of radioactivity in a certain place is dependent on the weather conditions, people seem to experience the risk related to geographic distance.

Table 8. Interpretation of the situation in sample towns, %.

Interpretation	Kotka	Helsinki	Hämeenlinna	Varkaus
Incident	26,5	27,8	37,4	35,0
Serious incident	12,4	13,6	14,7	17,8
Accident	37,6	32,1	31,9	30,1
Threatening accident	11,8	9,9	12,3	12,9
Serious accident	11,8	16,7	3,7	4,3
Total	100	100	100	100
N	170	162	163	163

$\chi^2=29.55$; $df=12,658$; $p <.01$

The respondents interpretation of the situation, as an incident or an accident, was related to the first source of information: those who had heard of it from a friend or co-worker found the situation more serious than those who first heard of it from the mass media. (Table 9.) Social interaction, interaction with significant others, has been found to be an important process in the confirmation of a warning. According to Nigg (ibid.) mass media deliver facts, but only social interaction transforms the facts to an evaluation of the seriousness of the situation and of the necessity of protective measures. It seems that when there is no real danger of radioactivity, social interaction enhances believing in danger.

Table 9. Interpretation of the situation according to the source and time of information, %.

Interpretation	When heard of the incident			
	Morning		Afternoon	
	Source of information			
	Social network	Mass media	Social network	Mass media
Incident	7,5	39,0	15,9	36,4
Serious incident	4,5	19,5	9,8	21,2
Accident	58,2	24,7	47,6	26,3
Threatening accident	13,4	9,1	14,6	11,1
Serious accident	16,4	7,8	12,2	5,1
Total %	100	100	100	100
N (424)	67	77	82	198
	$\chi^2=33,94; df=4,424; p <.001$		$\chi^2=25,12; df=4,424; p <.001$	

Respondents in Helsinki and Kotka had significantly more often heard of the incident from their social network and also earlier than respondents in other towns. They were more often at their workplace when hearing of the incident, which also was related to interpreting the incident as more serious than it objectively was. (Table 10.)

More respondents of those who heard of the incident in the morning than of those who heard of it later had interpreted the situation to be an incident. However, the difference is not significant. Those who heard of the incident in the morning learned more often than others about it from their social network ($\chi^2=27,58$; $df=1,648$; $p <.001$).

Table 10. Interpretation of the situation/where subject was when heard of the incident, %.

Interpretation	At home	At workplace	On the way	At school	Other
Incident	38,4	22,6	25,9	20,5	25,9
Serious incident	16,1	12,3	40,7	2,6	3,7
Accident	27,0	40,0	14,8	64,1	37,0
Threatening accident	10,1	13,8	18,5	2,6	25,9
Serious accident	8,4	11,3	-	10,2	7,4
Total %	100	100	100	100	100
N	367	195	27	39	27

$\chi^2=67,49$; $df= 16,655$, $p <.001$

After controlling for other variables the significant difference in interpretation of the situation between sample towns remained only in the group who heard of the incident in the morning. This means that only those who heard of the incident in the morning interpreted the situation to be more serious the closer to the power

plant they were ($\chi^2=25.66$; $df=12, 144$; $p <.01$; see Table 11). On subjects who heard of the incident later, the distance from the power plant did not have an effect. Mack and Baker (1961) found that people took more seriously an alarm sent out late at night than an alarm sent out in morning or afternoon. They expected the reason to be, at least partly, that alarms are usually tested in daytime and the exceptional timing of alarm scared people. In this study those subjects who heard of the incident in the morning were the ones who evaluated the situation as most serious. An explanation for this may be that the incident happened at night time and so the situation in the morning was much more insecure and unclear than it was in the afternoon. In the afternoon it was already known that the situation caused no harm to environment.

It seems that in this data two factors are significantly related to the interpretation of the situation: the source of information and subject's home town. Among those who heard of the incident in the morning interpretation of the situation varied according to the hypothesis: subjects in Kotka, living closest to Sosnovyi Bor, interpreted the situation to be most serious, next were subjects living in Helsinki and Hämeenlinna; of subjects living in Varkaus over 50 % interpreted the situation to be a nondangerous incident.

Table 11. Interpretation of situation among those who heard of it in the morning in sample towns, %.

Interpretation	Kotka	Helsinki	Hämeenlinna	Varkaus
Incident or serious incident	25,9	37,5	33,3	85,7
Accident	44,8	35,4	54,2	14,3
Serious accident	29,3	27,1	12,5	-
Total	100	100	100	100
N (144)	58	48	24	14

$\chi^2=20.89$; $df=6, 144$; $p <.01$

Regression models examined the predictive influence of variables on the interpretation of the situation. Different models based on theoretical considerations and hypotheses were tested. In a stepwise multiple regression analysis including all sample towns the largest significances were found for variables measuring the distance from the power plant and the fear and perception of risk from Russian nuclear power plants ($\beta_{\text{Distance from power plant}}$.153; $p < .001$; $\beta_{\text{Fear and risk perception}}$.117; $p < .01$; $R^2 = .04$). However, the variability explained by this model was quite small. New regression models were run with data selected from one town at a time. These analyses showed that in the sample towns, slightly different variables predicted the variance of the interpretation of the situation. In Kotka, located closest to the power plant, 19 % of variance was explained by two variables: the source of information and the fear and perception of risk from Russian nuclear power plants ($\beta_{\text{Source of information}}$.264; $p < .001$; $\beta_{\text{Fear and risk perception}}$ -.377; $p < .001$; $R^2 = .19$). In Helsinki, also located close to the power plant, 19 % of variance was explained by source of information, fear and risk perception, perceived timing of information and having children ($\beta_{\text{Source of information}}$ -.285; $p < .001$; $\beta_{\text{Fear and risk perception}}$.175; $p < .05$; $\beta_{\text{Timing of information}}$ -.257; $p < .01$; β_{Children} .166; $p < .05$; $R^2 = .19$). In Hämeenlinna and Varkaus smaller percentages of variance were explained and by different variables: in Hämeenlinna negative life events, source of information and perceived risk from Russian nuclear power plants explained 9 % of variance ($\beta_{\text{Negative life events}}$ -.171; $p < .05$; $\beta_{\text{Source of information}}$ -.175; $p < .05$; $\beta_{\text{Risk perception}}$.200; $p < .01$; $R^2 = .09$). In Varkaus, 10 % of variance was explained by source of information, but negative life events and fear and risk perception did not reach statistical significance ($\beta_{\text{Source of information}}$ -.328; $p < .001$; $R^2 = .10$). Source of information seems to be a general factor predicting interpretation of the situation, but fear of nuclear accidents seems to decrease in importance when getting further away from the power plant, where the importance of other negative life events increase their effect on the interpretation instead. Further away from the power plant other factors not explained by this data, have stronger effect than in towns closer to the power plant.

The relationships of psychological factors to interpretation of situation were also analysed, but no significant relations were found. Interpretation of situation seems clearly to be connected to the perceived risk based on geographical distance and the source of information. Although there may be an irrational element in the fear felt for nuclear power, it seems not to have an effect on the interpretation of the situation.

7.2. First activities after hearing about the incident

Interpreting the situation to be an accident did, however, in most cases not lead to any activities: 72,5 % of the respondents continued whatever activity they were involved at the time, 25,2 % sought more information and 2,4 % took protective measures. This confirms the conclusion made by Canter (1980) that people are usually reluctant to interrupt their activities to start protection, if they are not totally convinced that the danger is real. When they are insecure about the seriousness of the situation, they try to confirm the warning they have heard (Perry, 1985; Janis & Mann, 1977; McLuckie, 1970). The perceived seriousness, however, was related to what a subject did after hearing about the incident: subjects that interpreted the incident more serious, also more often tried to find more information about it (Table 12). The relationship is not linear, however, so some other, unknown factors also affect the chosen activities.

Table 12. What subject did after hearing about the incident/interpretation of situation, %.

Interpretation of situation	What subject did after hearing about incident		
	Continued activity	Sought information	Protective measures
Incident	35,9	20,4	33,3
Serious incident	15,6	10,8	26,7
Accident	30,3	39,5	40,0
Threatening accident	11,1	13,4	-
Serious accident	7,1	15,9	-
Total	100	100	100
N (621)	449	157	15

$\chi^2=28.78$; $df=7$, 621; $p <.001$

Taking protective measures was not related to what a subject was doing when he/she heard about the incident. This means that the second hypothesis was not supported: commitment to an activity did not decrease willingness to start protective measures.

To the question where they looked for more information about the incident, 35 % answered that they sought it from their own social network, 5 % sought it from authorities and 63 % (N=419) did not answer the question. It is possible that discussions with significant others are not considered as information seeking, but as part of normal social interaction. On the other hand, 49,6 % of subjects had themselves informed other people about the incident. Only 2 % of the subjects (5 % of those who answered the question) had sought more information from authorities. People seem to trust more their significant others and want to confirm their knowledge from them rather than from authorities.

An equal proportion of men and women learned about the incident at home and at their workplace, there was no difference between genders. Neither were there differences in interpretations of the situation between men and women. This is somewhat against expectations as in most studies the result has been that women evaluate a threat as more serious than men. It can be concluded that contrary to common beliefs, women do not exaggerate threats more than men. In the contrary, it seems that men in other types of threats belittle the danger. A threat caused by radioactivity is impossible to control and it is possible that in the face of other dangers men more than women think that they can control the danger. Even though there was no gender difference in interpretation, there was a significant difference in what was done after hearing of the incident. More men than women continued what they were doing, women instead tried to get more information (Table 13).

Table 13. What men and women did after hearing about the incident, %.

Activity chosen	Women	Men
Continued what was doing	68,4	77,2
Sought information	28,9	20,8
Protective measures	2,7	2,1
Total	100	100
N	339	289

$\chi^2=5.97$; $df=2,628$; $p <.05$

Age was related to the evaluated seriousness of the situation: young persons evaluated the situation to be more serious than did older persons (Table 14). There was a nonsignificant tendency of younger subjects to take protective measures more often than older subjects. (Table 15).

Table 14. Interpretation of situation by age groups.

Interpretation of situation	15 - 25	26 - 40	41 - 55	56 - 70
Incident or serious incident	31,0	39,4	49,1	61,2
Accident	50,3	39,4	25,5	20,7
Serious accident	18,6	21,3	25,5	18,1
Total	100	100	100	100
N	145	160	165	188

$\chi^2=47,59$; $df=6$, 658; $p <.001$

Table 15. First activity/interpretation of situation by age-group, %.

Interpretation of situation	Age groups											
	15 - 25			26 - 40			41 - 55			56 - 70		
	activity taken			activity taken			activity taken			activity taken		
	cont inue	info rm.	prot ect.	cont inue	info rm.	prot ect.	cont inue	info rm.	prot ect.	cont inue	info rm.	prot ect
Incident	27,6	11,8	33,3	31,4	24,4	16,7	34,0	22,9	33,3	46,4	20,6	66,7
Serious incident	7,1	5,9	-	12,4	9,8	16,7	19,8	10,4	66,7	20,7	17,6	33,3
Accident	46,9	61,8	66,7	37,1	36,6	66,7	24,5	33,3	-	17,9	29,4	-
Threatening accident	9,2	2,9	-	12,4	14,6	-	17,0	14,6	-	7,1	20,6	-
Serious accident	9,2	17,6	-	6,7	14,6	-	4,7	18,8	-	7,9	11,8	-
Total	100	100	100	100	100	100	100	100	100	100	100	100
N	98	34	3	105	41	6	106	48	3	140	34	3

$\chi^2=7,79$; $df=7,666$; ns. $\chi^2=6,08$; $df=7,666$; ns. $\chi^2=17,00$; $df=7,666$; $p <.05$ $\chi^2=13,84$; $df=7,666$; $p <.08$

Subjects living in Kotka and Helsinki were more often at their workplace than other subjects when they heard of the incident. Those who were at the workplace, tried more often to find more information than those who were at home ($\chi^2=19.56$; $df=2,537$; $p<.001$). The result is different from earlier ones that usually have shown that when alone, people get more easily upset and also start protective measures or information seeking more easily.(Mack & Baker, 1961). Here the company of other people clearly increased the seriousness of the interpretation of the situation and also need for more information of it. Half of those who tried to get more information were in the company of co-workers or friends; 81 % of those who were alone continued their ongoing activity ($\chi^2=29.76$; $df=4,616$; $p<.001$).

There was a significant difference between the sample towns in what subjects did after hearing of the incident ($\chi^2=28.39$; $df=6,628$; $p<.001$): subjects in Kotka most often tried to get more information or took protective measures when subjects in Varkaus did it least. This difference between sample towns remains significant even after controlling the place where subject was when she/he heard of the incident. First activities after hearing a warning or information of a nuclear incident is clearly connected to the geographical distance to the power plant and to the risk experienced to be connected to it. Considering the very small real danger caused by this incident at Sosnovyi Bor, quite large a proportion of those living on the coast started some activities because of it (Table 16). The percentage of those that took protective activities is quite high in Hämeenlinna, too, but the reason for this is not possible to be explained by the data.

Table 16. First activities after hearing of the incident in sample towns, %.

Activity taken by subject	Kotka	Helsinki	Hämeenlinna	Varkaus
Continued ongoing activity	61,8	67,7	73,9	86,5
Sought more Information	35,0	30,3	22,4	12,9
Protective activities	3,2	1,9	3,7	0,6
Total	100	100	100	100
N (628)	157	155	161	155

$\chi^2=28.39$; $df=6,628$; $p <.001$

Almost half of the subjects informed someone else about the incident. 20 % told about it to a family member, 3 % to a close relative, 20 % to a friend or co-worker. 5 % of subjects told about the incident to more than one person.

Some kind of protective activities were taken by less than half of the subjects: when asked in detail about actions taken, it came out that listening to radio was the most common action, taken by 38 % of subjects. 6 % of them stayed inside or kept children inside because of the feared radioactivity, almost 2 % bought or ate iodine tablets.

The most important reason for not taking any protective measures was an assessment of the situation as undangerous or uncertainty about that. 12 % of subjects waited for more information and a few % evaluated that protection was too late. However, it is important to remember that e.g. in studies done after the Three Miles Island nuclear accident showed that uncertainty of the dangerousness of the situation was given as a reason for taking protective measures as often as it was for not taking protective measures (Cutter & Barnes, 1982; Lindell & Perry, 1983.) Uncertainty as such can lead to opposite interpretations and decisions.

A new composite variable was created based on interpretation of situation and activity taken after hearing of the incident. The variable describes the consistency of interpretation and action, the categories being: interpretation as an incident - no information sought; interpretation as an accident - no information sought; and interpretation as an accident - information sought. Those taking protective actions were separated to a group to be analysed separately.

An ANOVA test showed that there was a significant difference in consistency depending on what an individual was doing when hearing of the incident ($F=15,81$ $df=2, 550$; $p < .001$), but not in the direction expected on the basis of the second hypothesis: of the inconsistent group those who were not committed in doing anything special were the largest group. Their lack of information seeking was not based on the involvement but on some other factor. In a regression model 26 % of the variance of the consistency was explained by fear and risk perception from Russian nuclear power plants, the source of information, having no evacuation plan and by informing someone else of the incident ($\beta_{\text{Fear and risk perception}} .234$; $p < .001$; $\beta_{\text{Source of information}} -.352$; $p < .001$; $\beta_{\text{No evacuation plan}} -.143$; $p < .01$; $\beta_{\text{Informed someone else}} .196$; $p < .01$; $R^2 = .26$). Belief that evacuation would be necessary and reliability and clarity of information lost their significance when not having own evacuation plan was added to the model.

The small group ($N=15$) that took some protective measures was analysed separately, but very few significant differences were found. As a group, they did not differ from other subjects: they had high self-esteem, they were symptomless on psychological symptomatology scales; on scales measuring perceptions of information delivery, they varied evenly. In a regression model, 48 % of variance of protective measures in this group was explained by the interpretation of the situation ($\beta_{\text{Interpretation of situation}} -.692$; $p < .01$; $R^2 = .47$), of which in turn 49 % was explained by negative life events ($\beta_{\text{Negative life events}} -.706$; $p < .01$; $R^2 = .49$).

7.3 Perceptions of information delivery

One criterion in evaluating information delivery in emergencies is the correspondence of information to the actual situation; that is, how good a mirror-image of reality does the information represent. When trying to reflect a mirror-image of reality one tries to answer the question "what happened". In danger, the question "what should be done", is, however, more important. When an event is reproduced in the mass media, how it is reproduced becomes most important. Action is possible only when the event has been symbolically transferred from an uncontrollable situation to one that is under control. (De Marchi & Ungaro, 1987.) When mass media want to appear comprehensive or objective, they will seek controversial information. Then people get contradictory messages that all can come from a reliable source. The image of the situation may be incoherent and disordered, and thus confirm an interpretation of the situation as uncontrollable. At such times people can not appraise what has happened and know what should be done. (Eränen, 1992.)

The subjects followed many news broadcastings and information about the situation. Over 50 % of subjects received information from radio, television and newspapers. Over one third followed all news broadcasts. (Tables 17 and 18).

In the oldest age-group 53 % of subjects followed all news broadcasts, in the other age-groups that amount was lower. The youngest age-group included the most of those who didn't follow news broadcasts at all. Other age-groups usually followed 1 - 3 broadcastings a day. ($\chi^2=99.71$; $df=9,656$; $p < .001$.)

Fifty percent of those who have only completed primary school followed all news broadcastings, in other education levels usually 1 - 3 a day were followed ($\chi^2=39.52$; $df=9,647$; $p < .001$). There were also differences between professional groups. Housewives and retired persons followed the most of news broadcastings, next those working in health care and social services. Students were the group to follow the least news broadcastings ($\chi^2=64.61$; $df=24, 656$; $p < .001$).

Life event changes were related to news watching: those who had experienced unemployment, lay-off or worsening of their economic situation followed news broadcastings more than others (lay-off $F=3.42$; $df=3,656$; $p < .05$; unemployment $F=3.50$; $df=3,656$; $p < .01$ and economic difficulties $F=3.84$; $df=3,656$; $p < .01$).

In a regression analysis 16 % of the variance in news following was explained by source of first information, perception of timing of information delivery and age ($\beta_{\text{Perception of timing of information}} .113$; $p < .001$; $\beta_{\text{Source of information}} -.120$; $p < .001$; $\beta_{\text{Age}} -.298$; $p < p.001$; $R^2=.16$).

Of course, some of these differences may only reflect differences in amount of leisure time: groups of people who spend more time at home, also spend more time on watching tv or listening to radio.

Table 17. From which mass media did you receive information about the incident?

Mass media	%
Radio	3,9
Radio + television	17,5
Radio + television + newspapers	52,3
Radio + television + newspapers+ eveningpapers	26,3
Total	100 (N=662)

Table 18. How often did you watch the mass media?

Number of broadcasts	%
All broadcastings	31,1
At least three broadcastings a day	19,5
1 - 3 broadcastings a day	44,5
I did not follow news broadcastings	4,9
Total	100 (N=656)

Subjects who perceived Russian nuclear power plants to be a serious risk and who were very afraid of consequences of potential accident, followed more news broadcastings than did those who found the risk smaller and were less afraid. However, also those who answered “I don’t know” followed many news broadcastings. (Tables 19 and 20.)

Table 19. Relationship between perceiving high risk from Russian nuclear power plants and following news broadcastings.

Number of daily News broadcastings	Perceived high risk	Perceived moderate risk	Perceived small or very small risk	I don't know
All news	34,9	28,1	22,2	44,0
At least 3 news broadcastings	21,7	20,9	13,1	14,0
1 - 3 news	38,8	47,0	59,6	32,0
Not at all	4,7	4,0	5,1	10,0
Total	100	100	100	100
N	258	249	99	50

$\chi^2=23.00$; $df=9,656$; $p < .01$

Table 20. Relationship between being afraid of consequences of an accident at Russian nuclear power plants and following news broadcastings.

Number of daily news broadcastings	Very afraid	Somewhat afraid	Little afraid	Not at all afraid	I don't know
All news daily	39,4	27,7	24,2	25,0	41,2
At least 3 news	22,9	20,6	16,2	12,5	5,9
1 – 3 broadcastings	33,5	48,2	52,5	54,2	41,2
No at all	4,3	3,5	7,1	8,3	11,8
Total	100	100	100	100	100
N	188	311	99	24	34

$\chi^2=28.15$; $df=12,656$; $p < .01$

There was a significant difference in perceptions of official information delivery between sample towns: subjects in Kotka were more critical of authorities than other subjects; they were most likely to view the officials as too late in releasing adequate information. The other sample towns had levels of criticism similar to each other ($\chi^2=28.15$; $df=12,656$; $p < .001$) (Fig.3). The same view was expressed about the mass media ($\chi^2=11.51$; $df=3,646$; $p < .01$) (Fig. 4). This presumably reflects the short distance between Kotka and Sosnovyi Bor, and also earlier information to these citizens regarding correct behavior in case of radiation exposure that probably pre-conditioned the residents for greater awareness of the threat. Also, the fire chief in Kotka publicly criticized the state officials of information delivery.

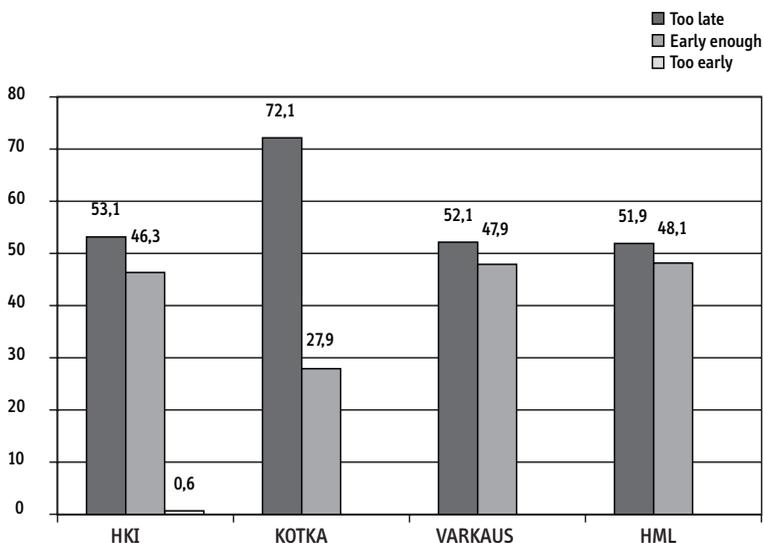


Figure 3. Opinion on timing of official information in sample towns.

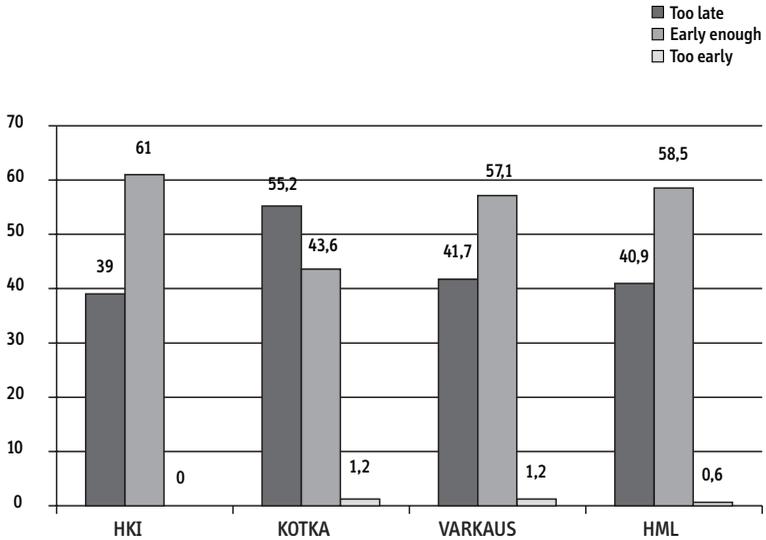


Figure 4. Opinion on timing of mass media information in sample towns.

Table 21. What was the timing of information like?

Timing was	Official information	Media information
Too late	57,4	44,2
Early enough	42,5	55,0
Too early	0,2	0,8
Total	100 (N=650)	100 (N=651)

Perception of information delivery was critical: over 50 % of subjects believed information delivered by officials to have been too late. The doubt, that officials would belittle the seriousness of accidents seems to be quite general.

Table 22. How was the incident described?

Level of description	Official information	Media information
Exaggerating	4,7	12,9
Objective	54,5	61,0
Belittling	38,7	22,4
Total	100 (N=652)	199 (N=641)

The amount of information given was not perceived to be enough. Dissatisfaction was partly directed toward mass media, but clearly more towards the authorities. Examining subjects' perceptions of information clarity, we see that a majority of them considered the information delivery to be contradictory. It is possible that dissatisfaction in the amount of information partly reflects dissatisfaction in its clarity: it is difficult to create a clear image of a situation based on unclear information. More information is asked to relieve this problem. In reality, the amount of information does not guarantee its clarity, on the contrary too much information may make decision making even more difficult. (Eränen, 1992.)

Table 23. Were you satisfied with the amount of information?

The amount of information	Official information	Media information
Too much	0,8	6,0
Right amount	53,5	67,2
Too little	45,7	26,7
Total	100 (N=654)	100 (N=647)

Table 24. Was the information clear and understandable?

Level of clarity	Official information	Media information
Very clear	2,2	1,5
Clear	24,9	29,6
Quite clear	32,2	35,9
Contradictory	40,8	32,9
Total	100 (N=650)	100 (N=659)

Differences between sample towns in level of reliance on authorities were small ($\chi^2=23.77$; $df=12,655$; $p <.05$). The majority of subjects partly relies on officials and mass media; only a small minority does not rely on them at all or only very little. Although social interaction has important role in interpreting a situation and confirming a warning, however, as a source of facts and information about the incident mass media and authorities are more reliable. (Tables 25 and 26.)

Table 25. Did you rely on information about the incident?

Level of reliance	Official information, %	Media information, %
Totally	11,3	8,5
Almost totally	34,4	6,4
Partly	43,4	47,3
Little	7,5	6,5
Not at all	3,5	1,2
Total	100 (N=655)	100 (N=659)

Table 26. Which sources of information were trusted most, %.

Information source	%
Social network	3,4
Mass media	58,2
Officials	21,0
Several sources	17,4
Total	100 (N=649)

Most satisfied with the amount of instructions given by authorities were subjects in Kotka and Varkaus. The most significant difference emerged, however, in the amount of insecure answers: subjects in Kotka had a clear opinion on this issue, more subjects in the other towns were unsure if there were too few instructions or enough of them. The increased information delivery in Kotka is clearly visible in the results, they had instructions for radioactivity delivered to their homes. Satisfaction with instructions by subjects in Varkaus is partly explained by the fact that a larger proportion of subjects in Varkaus interpreted the situation as undangerous and did not expect to get any instructions. The large amount of insecure answers, however, shows that subjects in Varkaus do not really know what kind of instructions to expect.

Table 27. Satisfaction with official instructions in sample towns, %.

Amount of instructions	Kotka	Helsinki	Hämeenlinna	Varkaus	Total
Enough	29,8	18,2	20,6	28,8	24,3
Too little	47,8	47,9	40,6	40,5	44,2
I don't know	22,4	33,9	38,8	30,7	31,4
Total	100	100	100	100	100
N	161	165	160	163	649

$\chi^2=16.07$; $df=6,649$; $p < .05$

Question “on what kind of nuclear incidents should population be informed” received clear answer. About half of the subjects perceive that also officials should deliver information on even small incidents. For authorities the situation is problematic: if information on small incidents is not delivered, it may increase distrust on authorities. On the other hand, it may be difficult to make a clear distinction between small incidents and real accidents that demand protection. This distinction is very important to make in information delivery, though it does not guarantee a correct interpretation of the situation.

Women said significantly more often than men that information on even small incidents should be delivered. Men expect information delivery only on serious incident or on an accident ($\chi^2=20.69$; $df=3,660$; $p <.001$).

Table 28. On what kind of situations should population be informed on?

Level of threat	Authorities should inform	Mass media should inform
Small incident	48,8	52,9
Serious incident	29,5	29,8
Threat of accident	20,3	16,3
Serious accident	1,4	1,1
Total	100	100
N	660	662

It may be a relief to Finnish authorities that most subjects considered the reason to unsatisfactory information to be circumstances in Russia or activities of Russian authorities. Even though Finnish authorities are not totally trusted, the real reason for lack of information is in Russia.

Table 29. Who was responsible for the lack of information?

Responsible	%
Finnish authorities	4,9
Mass media	1,6
Russian authorities/circumstances	55,9
Several reasons	37,6
Total	100 (N=615)

Variables concerning information delivery were factor analysed. In Varimax rotation four factors were found (see appendix 2). New composite variables were constructed of these factors. The first composite variable consists of variables on reliability and clarity of information from authorities and mass media. Reliability coefficient for this variable was .78. Another composite variable was made of variables describing the amount and level of truthfulness of the information from authorities and mass media. Cronbach alpha for this variable was .74. The third factor consists of variables describing on what kind of incidents should population be informed. The reliability coefficient for this variable was .84. The fourth composite variable describes opinions of timing of information from authorities and mass media. Cronbach alpha for this variable was .76. The factor analysis showed that subjects did not make a distinction between information delivery from officials and mass media. Official information is usually delivered through mass media, so making a distinction between them may be difficult.

Relations between these composite variables, as well as their relations to other variables, were analysed by ANOVA.

How often a subject was watching news was related to his/her evaluation of information delivery. Subjects who followed all news broadcastings found more often than others both official and mass media information too late ($F=4.09$; $df=3, 636$; $p < .01$) and belittling ($F=4.60$; $df=3, 626$; $p < .01$).

Table 30. Relation between following news and being afraid of Russian nuclear power plants.

How afraid of nuclear plants	How often followed news broadcasts? %			
	All	Three daily	One to three daily	Did not follow
Not at all	2,9	2,3	4,5	6,3
A little	11,8	12,5	17,8	21,9
Somewhat	42,2	50,0	51,4	34,4
Very much	36,3	33,6	21,6	25,0
Does not know	6,9	1,6	4,8	12,5
Total N=656	100 (N=204)	100 (N=128)	100 (N=292)	100 (N=32)

$\chi^2=28.15$; $df=12$, 656; $p <.01$

Those following news more than others perceived Russian nuclear power plants to be larger risk (Table 31) and were more afraid of the consequences of a potential nuclear power plant accident (Table 30). 44 % of subjects following news more than three times / a day, found Russian nuclear power plants a serious risk and 36 % of them was very afraid of consequences of a potential accident. Of subjects following news less often, 34 % found Russian plants to be a serious risk and 21 % was very afraid of the consequences. It seems that watching news often increased evaluation of accident risk and fear for consequences of an accident. Slovic et al. (1982) have found that topics having a lot of publicity are evaluated as having greater risk than those having less media coverage. On the other hand, people who are very afraid of consequences of an accident may expect more of information delivery than others.

Table 31. Relation between following news and perception of risk from Russian nuclear power plants.

Risk perceived	How often followed news broadcasts? %			
	All	Three daily	One to three daily	Did not follow
Very small	2,5	1,6	2,7	6,3
Small	8,3	9,6	17,5	9,4
Serious	34,3	40,6	40,1	31,3
Very serious	44,1	43,8	34,2	37,5
Does not know	10,8	5,5	5,5	15,6
Total	100 (N=204)	100 (N=128)	100 (N=292)	100 (N=32)

$\chi^2=25.97$; $df=12$, 656; $p <.01$

Finding the Russian nuclear power plants a high risk and being very afraid of the consequences of an accident at the Russian nuclear power plants were related to dissatisfaction with information delivered. Subjects who were dissatisfied with the information considered the risk of Russian nuclear power plants higher and were more afraid of consequences of a nuclear accident than those who were contented with the information (Tables 47, 48, 49 in appendices).

Those subjects who considered Russian nuclear power plants a high risk and were very afraid of the consequences of a nuclear accident, were more uncontented with the information. Subjects, who are less afraid, trust the authorities more ($\chi^2=47.91$; $df=12$, 654; $p <.001$). The same is true with the mass media ($\chi^2=28.39$; $df=12$, 658; $p <.01$). Subjects, who after the incident believed that evacuation might take place, were more uncontented with the timing of information delivery ($t=-2.99$; $df=641$; $p <.01$).

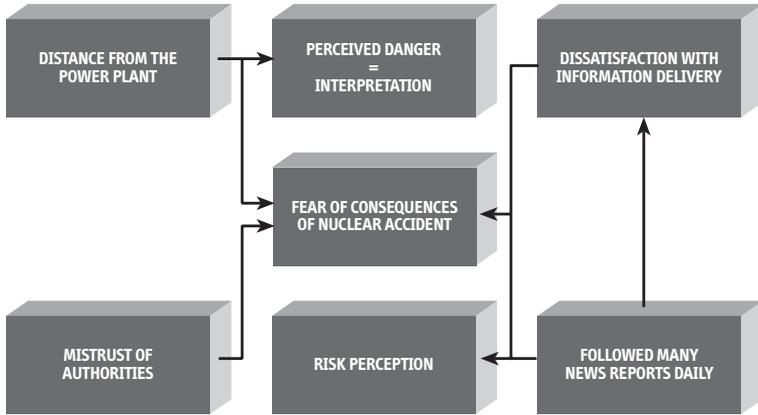


Figure 5. Nuclear accident risk perception and fear of an accidents consequences.

In Figure 5 are shown the relations between different factors, leading to an interpretation of the situation and to fear of nuclear accident. A short distance from the nuclear power plant increased the level of seriousness interpreted to the situation and also fear of the consequences of an accident. Being uncontented with information delivery was related both to being afraid of the consequences and to the perception of risk of an accident. Distrust on authorities was related to fear of the consequences of an accident, but not to risk perception. Amount of information was related to uncontentedness with information delivery and risk perception.

However, amount of information received was related to a positive evaluation of the amount of instructions given by authorities ($\chi^2=20.13$; $df=6, 641$; $p < .01$). Those, whose answer was 'I don't know' when asked for evaluation of instructions, received less information. It seems, that only with a large amount of information a subject was able to really perceive the instructions given. Maybe the amount of instructions in information delivery

should be increased. De Marchi's and Ungaro's (1987) conclusion, that answer to the question 'what should be done' is equally important in information delivery than answer to the question 'what has happened', is supported by this result.

Finding the information delivered contradictory, was not related to the amount of information. The amount of information was not related to the level of trust felt on authorities or mass media. Thus it seems that an evaluation of the clarity and reliability of information is made already on the basis of smaller amount of information.

Of the demographic variables age, gender and having children were related to the perception of information: however, each variable to different aspects of information delivery.

The oldest age-group was more often satisfied with the timing of information, when the middle-aged group was more often dissatisfied with it ($\chi^2=13.70$; $df=6, 644$; $p < .05$). The satisfaction with timing of information was not related to the time when the subject first heard of the incident.

Women more often than men found the information to be belittling and to have too little of it. Men were more happy than women and also more often found the information to be exaggerating or to have too much of it ($\chi^2=10.65$; $df=2, 633$; $p < .01$).

Those subjects who have children were more dissatisfied with the clarity of information than subjects not having children ($\chi^2=9.64$; $df=2, 579$; $p < .01$).

Psychological variables were related to the perception of information delivery. Being satisfied with the clarity and reliability of information was related to the lack of anxiety and to a strong sense of coherence (Table 47, see appendix). The subjects who were satisfied with the amount, quality and timing of information, used less psychological coping strategies (Tables 48 and 49, appendix). Even though subjects who were dissatisfied with the information used more psychological coping strategies, the strategies seemed to be unsatisfactory, as they found the Russian nuclear power plants to be a greater risk and were more afraid of the consequences of an accident than those who were satisfied with the information.

Looking closer at the dissatisfaction with different aspects of information, it can be seen that the dissatisfaction is a continuum, where dissatisfaction with timing and amount of information is related to factors of the situation, but dissatisfaction with reliability is related to psychological factors (figure 6). It can be concluded, that psychologically the reliability of information is more important than the amount or timing of information, and it is also the area that is more difficult to affect.

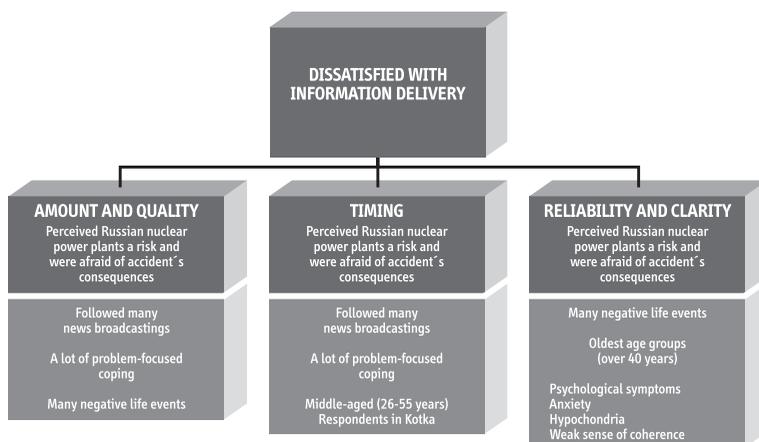


Figure 6. Factors related to dissatisfaction with information delivery.

7.4 Evacuation in connection of the incident

Twelve percent of all respondents thought at some point during the Sosnovyi Bor incident that it might be necessary for them to evacuate. This shows that, even though the majority did not think this way, a relatively large subgroup found the situation really worrying. 11,8 % of respondents had an own evacuation plan in case evacuation would take place. In addition, 8,2 % of those who did not have an evacuation plan, made one after the incident. At

the time of the survey, 20 % of the respondents had an own evacuation plan.

The respondents were asked where they would have gone in case of evacuation. Answers to open-ended question were later categorised. 3 % of the respondents answered that they would have stayed at home even in case of a general evacuation order. The amount of uncertain subjects was high, as well as the amount of those whose goal was just to leave the area of danger without any definite goal. To an agreed meeting center or following authorities' instructions would go only 16,5 % of the respondents, which in a real danger is such a small amount of the population, that the situation would be out of control if the group uncertain would not decide to follow instructions. Those subjects who had an own evacuation plan, knew better where to go in case of evacuation ($\chi^2=18.10$; $df=1$, 605; $p < .001$).

Table 32. The goal of evacuation in sample towns, %.

Goal	Kotka	Helsinki	Hämeenlinna	Varkaus	Total %
Don't know	14,2	21,7	17,9	27,5	20,3
Gathering	34,2	7,2	11,3	12,8	16,5
Cent./follow instruct.					
Shelter/own Shelter	15,5	22,4	35,1	18,1	22,7
Relatives/ Summer cottage	16,1	28,3	15,9	10,1	17,6
Out of danger/north	18,1	16,4	16,6	24,8	18,9
Stay at home	0,6	3,3	2,6	5,4	3,0
Emergency	1,3	0,7	0,7	1,3	1,0
Professional					
Total	100	100	100	100	100
N	155	152	151	149	607

$\chi^2=88.89$; $df=18$, 607; $p < .001$

There were significant differences in choices of goal in case of evacuation: most respondents in Helsinki would go to their summer cottage, to relatives or some other definite place. Most respondents in Hämeenlinna would go to a shelter or to own cellar. Respondents in Kotka, however, would follow authorities' instructions, which in this case reflects the clear instructions given to them by local authorities. In Varkaus, the amount of those who didn't know or who would just try to escape, was largest. Partly these differences are understandable on the basis of the concrete situation: respondents in Helsinki have relatives or summer cottages in north, as the inhabitants from inner land already live in the area where most summer cottages are located. For them, going to summer cottage, would not mean more safety, as it would for respondents in Helsinki. Delivery of detailed, concrete instructions in Kotka is easy to perceive in the data: respondents in Kotka have much clearer image of what they should do in case of threat of radioactivity.

There were differences between sample towns in perception of evacuation: in Kotka, located closest to the nuclear power plant, respondents believed more often that evacuation might have been necessary for them. In Helsinki the amount of those believing so was smaller, but still larger than in the other two towns (Table 33).

Table 33. Belief in the possibility of evacuation in sample towns, %.

	Kotka	Helsinki	Hämeenlinna	Varkaus	Total %
Evacuation possible	23,1	12,2	7,2	6,1	12,2
Evacuation not possible	76,9	87,8	92,8	93,9	87,8
Total	100	100	100	100	100
N	169	164	166	165	664

$\chi^2=28.30$; $df=3$, 664; $p < .001$

Those who believed in the possibility of evacuation and those who did not believe, were compared to each other (Table 34). Those who believed in the possibility of evacuation sought more information, followed more news broadcasts, found the information delivery too late, and believed that there were too few instructions for radiation protection. However, there was no difference between these two groups on whether they found the information true or belittling.

Those who believed in the possibility of evacuation had an own evacuation plan more often, and if they did not have one, they made it in connection of the Sosnovyi Bor incident. Those, who now have made an evacuation plan, know where they would have gone in case of evacuation ($\chi^2=14.20$; $df=1$, 553; $p < .001$).

90 % of those who believed in the evacuation were still worried about the consequences of the Chernobyl nuclear accident, of the other respondents 77 % were still worried. They more often found the Russian nuclear power plants to be a serious risk and were more afraid of the danger these plants caused to themselves. Of those who believed in the possibility of evacuation, one fourth did not know what to do in a real situation, but half of those who did not believe in the evacuation, did not know that. More respondents of those who believed in the evacuation had a first-aid training.

As a total, those who believed evacuation might have been possible during the Sosnovyi Bor incident, found the risk of nuclear power plant accident more serious, tried to get more information about it and were more prepared for it than other respondents.

Table 34. A comparison between those who believed in the evacuation and those who did not.

	Evacuation possible, %	Evac.not possible, %	χ^2	df	p <
Continued on-going activity	46,6	75,9	28.18	2, 626	.001
Followed all news broadcasts	45,7	29,1	16.59	3, 655	.001
Had own plan	34,6	8,6	46.10	1, 663	.001
Made now a plan	23,7	6,5	20.88	1, 609	.001
Found information late	58,2	38,8	10.79	2, 643	.01
Too little instructions	61,7	41,8	12.68	2, 648	.01
Worried about Chernobyl	90,1	77,5	6.80	1, 660	.01
Found nuclear power a serious risk	59,3	36,6	15.88	4, 663	.01
Afraid of power plants	53,1	25,4	26.94	4, 663	.001
Doesn't know what to do	27,0	46,8	10.31	1, 619	.01
First-aid trained	63,3	41,3	13.68	1, 658	.001

The choice of means of traveling seemed to be clear for most: they would go by own car, only those living in Helsinki would also use public transportation in greater amount. There were many missing answers to this question (17 %), but it is self-evident that most people would choose to go by their own car. Only those who would go to a gathering center or a nearby shelter would walk.

Table 35. By what means would you have evacuated?

Vehicle chosen	%
Does not know	8,1
Follow instructions	1,3
Public transportation	14,8
Own car/bicycle	63,5
Walking	12,3
Total	100 (N=553)

The company chosen for evacuation reflects the demographics of the sample towns: most respondents would evacuate with their family (75,2 %). There are more of those who would evacuate alone or with friends in Helsinki ($\chi^2=20.80$; $df=9$, 552; $p < .05$). Single persons would evacuate with friends, divorced persons alone. In 1992, 44,7 % of families in Helsinki were persons living alone, when the average in whole Finland was 32,5 % (Helsinki statistical yearbook 1992).

Slightly more than a third of respondents (40,4 %) would have taken with them only personal necessities, but 31 % would also have taken food and drinks and an extra 15 % also a radio, iodine tablets and valuables.

If an evacuation order would have been issued during the working hours and there would have been only one hour to prepare, over half (54,2 %) of the respondents would have gone home and tried to gather the whole family before leaving. Only 7,8 % would have left immediately: however, this was not related to marital status. In thinking of practical instructions this is very important: the authorities should remember to give time for families to gather before evacuation. Pets are considered to be family members and that should be taken into account also in plans. Especially nowadays, when animal rights and animal protection are hot issues, it sounds impossible to expect families to leave their pets behind without care.

Differences between sample towns in case of own evacuation plan, form a pattern similar to the case of belief in the possibility

of own evacuation. In Kotka, 24,6 % had an own evacuation plan; some respondents in Helsinki (12,9 %) and Hämeenlinna (16,4 %) had a plan, too, when in Varkaus 90 % of respondents had no plan ($\chi^2=13.35$; $df=3$, 598; $p < .01$).

There was no difference between men and women in the amount of own evacuation plans, however, there was a difference between age groups. Older people more often than younger ($\chi^2=9.18$; $df=3$, 598; $p < .05$) had an evacuation plan, of those over 56 years, 20,3 % had an own plan. There was no difference between those having and not having children.

Those having and not having an evacuation plan were compared to each other. After controlling for age, the only psychological variable remaining significant, was problem-focused coping. Those respondents who had an evacuation plan used more problem-focused coping than did those not having a plan ($\chi^2=4.93$; $df=1$, 493; $p < .05$). This relation was significant only in Kotka and Helsinki, in the other towns the difference was in a non-significant level.

Having an evacuation plan was not related to perception of information delivery, risk or fear of nuclear power plant accidents or social status. Those who had an evacuation plan found emergency preparedness important and less seldom replied 'I don't know' than those who did not have a plan ($\chi^2=18.56$; $df=3$, 579; $p < .001$). They believed more than others that protection would decrease harmful consequences of an accident ($\chi^2=9.78$; $df=4$, 597; $p < .05$) and they felt they had received enough information on disasters ($\chi^2=11.50$; $df=1$, 558; $p < .001$). Those having a plan knew what they would do in case of a disaster (78 % vs. 47 %, $\chi^2=27.76$; $df=1$, 564; $p < .001$) and they knew where the closest shelter is (90 % vs. 57 %, $\chi^2=37.10$; $df=1$, 595; $p < .001$).

Problem-focused coping seemed to be the only psychological variable to explain having an evacuation plan. Those individuals who usually pursue problem solving, have made an evacuation plan. They have a positive attitude towards emergency planning and they trust that protection decreases negative consequences of an accident. Those having a plan have received in-

formation on disasters and they know the location of nearest shelter. It can be concluded that delivery of information and instructions based on local situation that was done in Kotka clearly increased reasonable preparedness for disasters. This information delivery does not show in increased anxiety or fear, but it serves rational preparedness, which is best to be seen in individuals who usually have problem-focused coping strategies.

7.5 The Chernobyl accident, perceived risk and fear of Russian nuclear power plants

16 % of respondents could not remember what the information delivery was like after the Chernobyl accident. One quarter of respondents thought that information delivery was as it should be and 65 % found it too little. 76,3 % of subjects found the information delivery too late, only 6,6 % thought it happened in time, 15 % cannot remember. Most critical in this respect were again subjects living in Kotka, 66 % of them said the information was too late.

Information delivered after the Chernobyl accident was found contradictory or confusing by 77 %, it was found clear by 9 % of respondents. 17 % said that they trusted totally or almost totally the information delivered then, it was partly trusted by 50 % and only little or not at all trusted by 27 %. 24 % thought there was enough of instructions for protection, it was too little said 55 % and the rest cannot remember. 58 % thought the instructions were given too late, 10 % thought the timing was good, the rest cannot remember. Guilty for poor information delivery was found the Soviet Union authorities (37 %) or both Soviet Union and Finnish authorities (40 %). 42 % of respondents took some protective measures after the Chernobyl accident, 53 % did not protect at all. 79 % of respondents were still worried because of the Chernobyl accident.

Those respondents who are still worried about the Chernobyl accident, find the risk of Russian nuclear power plants higher than those who are not worried ($\chi^2=26.30$; $df=4$, 660; $p < .001$).

Among those who are not worried because of the Chernobyl accident, are more respondents who are only little afraid of Russian nuclear power plants ($\chi^2=48.75$; $df=4$, 660; $p < .001$). The respondents who protected after the Chernobyl accident, are still more worried than those who did not ($\chi^2=8.05$; $df=2$, 651; $p < .05$).

Almost half of the respondents were somewhat afraid of the danger caused to themselves by the Russian nuclear power plant accidents. However, one third of respondents living in Kotka and Helsinki were very much afraid of it. (Tables 36 and 37.)

Table 36. Perception of risk from Russian nuclear power plants in sample towns, %.

Perceived risk	Kotka	Helsinki	Hämeenlinna	Varkaus	Total
Serious	50,9	41,5	37,3	27,3	39,3
Quite serious	38,5	38,4	34,3	41,2	38,1
Small	7,1	12,8	16,9	13,3	12,5
Very small	-	3,0	3,0	4,2	2,6
I don't know	3,6	4,3	8,4	13,9	7,5
Total	100	100	100	100	100
N	169	164	166	165	664

$\chi^2=41.31$; $df=12$, 664; $p < .001$

Risk perception and fear were related to age: subjects in age group 26 - 55 found nuclear power plants more often to be a risk than did younger or older subjects. The amount of those finding them risky was greatest in the age group 41 - 55 years and smallest in the age group 15 - 26 years ($\chi^2=35.42$; $df=12$, 664; $p < .001$). The evaluations that young persons would be more worried because of nuclear power than older people is not supported by this result. The oldest age group was more afraid of the consequences of an accident than younger subjects; the trend was increasing from youngest to oldest age group ($\chi^2=31.79$; $df=12$, 664; $p < .01$). The result is interesting compared to the interpretation

of the situation: young subjects interpreted the situation to be an accident more often than older subjects. It seems that older people make a clearer distinction between a small incident and a serious accident than young persons.

Table 37. Are you afraid of the danger caused to yourself by accidents possibly happening in Russian nuclear power plants?

Level of fear	Kotka	Helsinki	Hämeenlinna	Varkaus	Total
Not at all	1,8	2,0	6,0	4,8	3,8
A little	11,8	15,2	15,7	18,2	15,2
Somewhat	47,9	46,3	48,8	45,5	47,1
Much	36,7	32,3	22,9	23,0	28,8
I don't know	1,8	3,7	6,6	8,5	5,1
Total %	100	100	100	100	100
N	169	164	166	165	664

$\chi^2=24.84$; $df=12$, 664; $p < .05$

Although 70 % of all respondents think that they have received too little information on disasters and 23 % think that they have had it enough, the difference between Kotka and other towns is again significant. In Kotka, information delivery on disasters has been enhanced and 40 % of respondents in Kotka think that they have received enough information (Table 38). Contentedness with information on disasters increased with age, the oldest age group found most often that they had received enough of information ($\chi^2=21.70$; $df=6$, 660; $p < .01$).

Table 38. Have you received enough of information to be prepared for disasters?

Amount of information	Kotka	Helsinki	Hämeenlinna	Varkaus	Total
Too little	57,4	79,3	72,3	72,6	70,3
Enough	38,5	15,2	21,1	17,7	23,2
Too much	-	-	0,6	1,2	0,5
I don't know	4,1	5,5	6,0	8,5	6,0
Total %	100	100	100	100	100
N	169	164	166	164	663

$\chi^2=36.49$; $df=9$, 663; $p < .001$

Almost one quarter of respondents in Kotka believed, that preparedness for disasters in their community has been satisfactory. In other towns almost 80 % of respondents thought that it should be increased. In Helsinki and Hämeenlinna almost half of the respondents did not know where to find more information on disasters when needed, in Varkaus and in Kotka the amount of those not knowing is much smaller. In Kotka 70 % of respondents trusted the local authorities, more than in other towns, where information was sought also from other sources. Young subjects were less sure of the importance of emergency planning in their town than were older subjects ($\chi^2=34.74$; $df=9$, 664; $p < .001$).

In Kotka the amount of those who do not know what to do in case of a disaster is much smaller (35 %) than in other towns. In Helsinki and Hämeenlinna the proportion of ignorant subjects is 45 %, in Varkaus it is 53 % ($\chi^2=19.82$; $df=9$, 620; $p < .05$). Although 29 % of the respondents would follow instructions given by authorities, that is, stay inside and listen to the radio for instructions, a remarkable proportion, 16 % of respondents, would immediately go to a shelter and a few percent of them would even take iodine tablets. In Hämeenlinna and Kotka three quarters of

respondents know the location of nearest shelter, in Helsinki and Varkaus only half of respondents know it.

There is a significant difference also in what kind of risks are found dangerous in the sample towns. In Helsinki and Hämeenlinna one fifth of the respondents did not know any local threats. In Helsinki and Kotka nuclear power was found threatening in greater respect than in other towns, where subjects were more afraid of local risks ($\chi^2=20.84$; $df=18$, 549; $p < .001$).

7.6 Stress symptoms

General Health Questionnaire 28 measuring general psychological well-being and anxiety and somatization sub-scales of the SCL-90R all have cutpoints that were used here, too. The level of stress symptoms in the total data was quite low. On all used scales 70 - 80 % of respondents had values in the range of normal levels. The stress symptoms found were not related to the interpretation of the situation or perception of information delivery. Some of the respondents had interpreted the situation to be an accident, but it seems that still the situation was not experienced so threatening that it would have caused stress symptoms.

The Whiteley-index measuring hypochondriasis has not been given any cutpoints and in this study the variable has been divided into three categories on the basis of the variation of the data. Being worried about one's health seems to be related to the worry felt for the consequences of a nuclear accident. The highest levels of hypochondriasis in this data were found from the respondents who are very afraid of the Russian nuclear power plants ($\chi^2=3.49$; $df=4$, 653; $p < .01$). The subjects who are still worried because of the Chernobyl accident have higher levels of hypochondriasis than those who are not worried of it ($t=2.46$; $df=647$; $p < .05$).

The respondents who do not have a first-aid training are more anxious ($t=-2.17$; $df=646$; $p < .05$) and have more hypochondriasis ($t=-1.91$; $df=646$; $p < .05$) than those who have first-aid train-

ing. It is possible that first-aid training enhances a person's sense of control over own health and thus decreases the amount of worry felt for it. Those having first-aid training have more problem-focused and less emotion-focused coping than those who have not first aid training ($t=-3.35$; $df=564$; $p < .01$ and $t=2.80$; $df=634$; $p < .01$).

Personal experiences of an accident were quite rare in this data. 66,3 % had no experience of an accident, 18,8 % had experienced a minor accident, 10,4 % had experienced quite serious accident and 4,5 % had experienced a serious accident. Personal experience was not related to any of the factors studied here.

However, stress symptom levels were related to other negative life events so that the respondents who have had many negative life events during the last year had higher levels of symptoms on all scales used here, than those who had only had a few negative life events (Table 39).

Table 39. The mean levels of stress symptoms in groups having different amounts of negative life events.

Symptoms measured	Few neg. Life events	Some neg. Life events	Many neg. Life events	F	df	p <
GHQ	2.58	3.56	5.62	15.17	2, 567	.001
Somatization	4.77	6.14	8.71	21.12	2, 567	.001
Anxiety	3.90	4.72	7.28	16.47	2, 567	.001
Hypochondria	8.46	9.37	11.42	10.84	2, 567	.001

In this data the stress symptoms seem to be related to other negative events in the subjects life than the Sosnovyi Bor nuclear incident, the effect of which is low in this level of study.

Table 40. Correlation Coefficients of the life event scale and stress symptom measures.

	LIFESC	GHQ	HSCLAHD	HSCLSOM	HYP0
LIFESC	1.0000	.1428***	.2129***	.2178***	.1882***
GHQ	.1428***	1.0000	.5289***	.4107***	.3756***
HSCLAHD	.2129***	.5289***	1.0000***	.5839***	.5251***
HSCLSOM	.2178***	.4107***	.5839**	1.0000	.5701***
HYP0	.1882***	.3756***	.5251***	.5701***	1.0000

*** p < .001

Stress symptoms are related to low self-esteem, weak sense of coherence, low self-deception and impression management and low level of social support (Tables 41 - 46). High self-esteem, good sense of coherence and social support seem to prevent or buffer stress symptoms.

The relation of self-deception and impression management to lack of stress symptoms refer to a tendency to give a good impression and to belittle own symptoms. Also the significant relation between self-esteem and self-deception ($\chi^2=28.32$; $df=2$, 650; $p < .001$) refers to the possibility that the subjects' self-esteem may not be as high as they want to believe themselves. Shelley Taylor e.g. (1989) has concluded that a positively skewed self-image is typical for "normal" people. Actually only depressed persons have a totally realistic self-image. Positive illusions protect a person from uncomfortable realities. Self-deception seems also to protect from stress symptoms.

Table 41. Stress symptoms and self-esteem, group means.

Symptoms	Low self-esteem	Moderate self-esteem	High self-esteem	F	df	p
General psych.health	8.59	5.39	2.72	40.86	2,639	.001
Somatization	9.95	8.97	5.50	24.69	2,639	.001
Anxiety	10.29	7.23	3.99	41.87	2, 639	.001
Hypochondr.	14.14	11.42	8.78	22.39	2, 639	.001

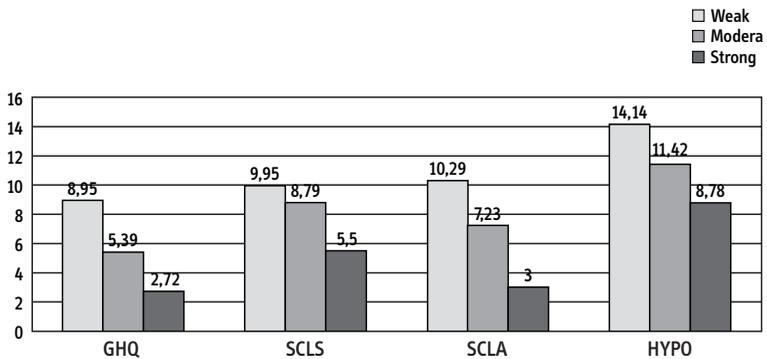


Figure 7. Stress symptoms and self-esteem, group means.

Table 42. Stress symptoms and sense of coherence, group means.

Symptoms	Weak sense of coherence	Moderate sense of coherence	Strong sense of coherence	F	df	p
General psych.health	6.92	2.94	1.94	53.64	2, 634	.001
Somatization	9.64	6.06	4.64	41.64	2, 634	.001
Anxiety	8.92	4.21	3.04	62.99	2, 634	.001
Hypochondr.	12.89	8.79	8.20	39.93	2, 634	.001

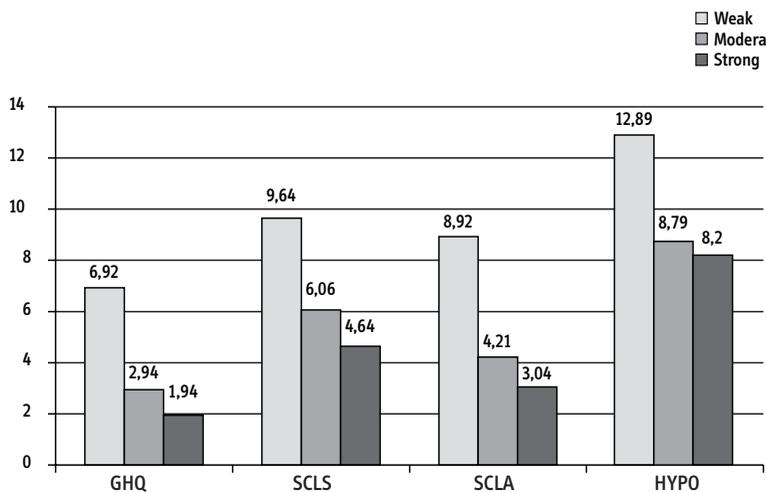


Figure 8. Stress symptoms and sense of coherence, group means.

Table 43. Stress symptoms and social support, group means.

Symptoms	Weak social support	Moderate social support	Strong social support	F	df	p
General psych.health	5.15	3.80	2.95	9.44	2, 636	.001
Somatization	8.76	6.59	5.25	12.74	2, 636	.001
Anxiety	7.07	5.42	3.85	16.89	2, 636	.001
Hypochondr.	11.21	9.86	8.88	4.25	2, 636	.001

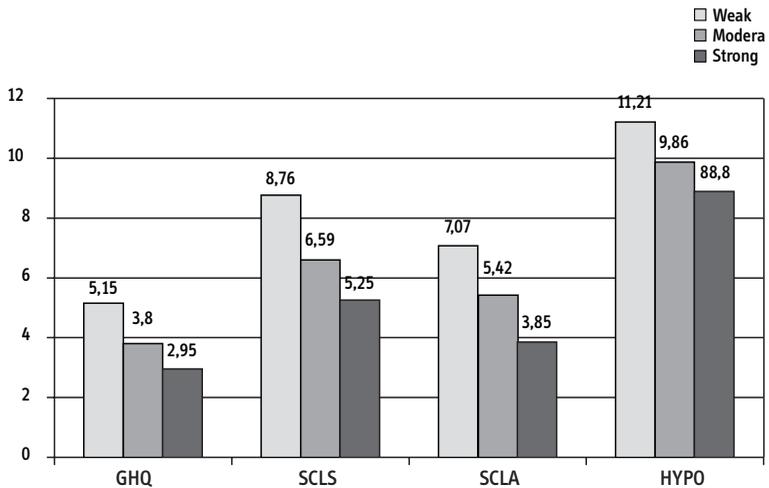


Figure 9. Stress symptoms and social support, group means.

Table 44. Stress symptoms and impression management, group means.

Symptoms	Low impr. mgment	Moderate impr. mgmt.	High impr. mgmt.	F	df	p
General psych. Health	4.73	4.09	3.11	5.83	2, 636	.01
Somatization	7.17	7.12	6.29	5.60	2, 636	.01
Anxiety	6.42	6.19	3.95	12.89	2, 636	.001
Hypochondr.	10.60	10.05	9.30	8.01	2, 636	.001

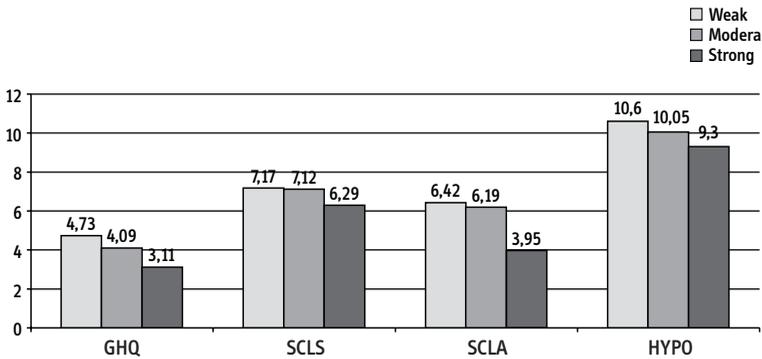


Figure 10. Stress symptoms and impression management, group means.

Table 45. Stress symptoms and self-deception, group means.

Symptoms	Low self-deception	Moder. self-deception	High self-deception	F	df	p
General psych.health	5.33	3.70	2.92	11.97	2, 638	.001
Somatization	8.35	6.84	5.47	16.33	2, 638	.001
Anxiety	7.45	5.16	3.80	23.16	2, 638	.001
Hypochondr.	10.96	10.39	8.84	9.23	2, 638	.001

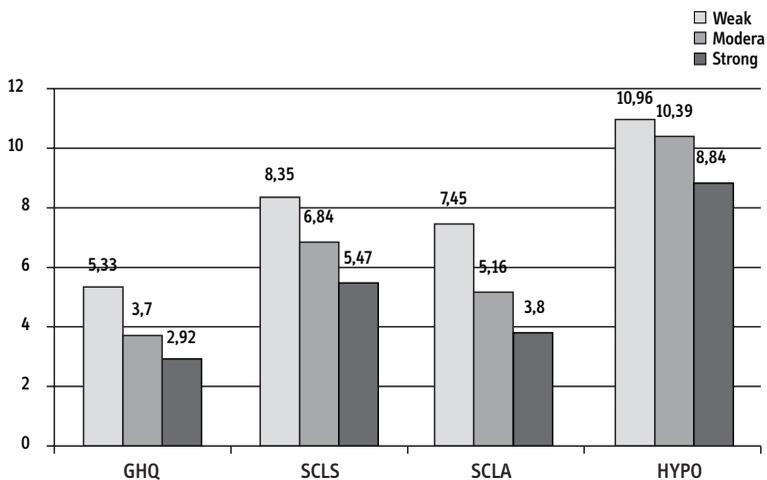


Figure 11. Stress symptoms and self-deception, group means.

The relations between stress symptoms and other variables are shown in figures 13, 14, 15 and 16 in the appendices.

The scales measuring psychological symptoms were put into regression analyses. In a regression model 33 % of the variance of the somatization scale was explained by life event scale, sense of coherence, social support, age and general psychological well-being ($\beta_{\text{Life event scale}}$.148; $p < .001$; $\beta_{\text{Sense of Coherence}}$ -.224; $p < .001$; $\beta_{\text{Social support}}$ -.09; $p < .05$; β_{Age} .229; $p < .001$; $\beta_{\text{General psychological well-being}}$.309; $p < .001$; $R^2 = .33$), self-esteem was not significant in explaining somatization. As physical illnesses were not assessed in this survey, it is possible that the relation between age and somatic symptoms is explained by the simple fact that older people usually have more physical illnesses than younger persons. From individual factors sense of coherence and general psychological well-being are to be seen as lower level of somatic symptoms. From situational or environmental factors, once again negative life events, but also lack of social support on the other hand increase the amount of somatic complaints.

In a regression model explaining anxiety symptoms, 55 % of anxiety was explained by negative life events, sense of coherence, social support, age, general psychological well-being and hypochondriasis ($\beta_{\text{Life event scale}}$.055; $p < .001$; $\beta_{\text{Sense of Coherence}}$ -.166; $p < .001$; $\beta_{\text{Social support}}$ -.083; $p < .01$; β_{Age} -.072; $p < .01$; $\beta_{\text{General psychological well-being}}$.288; $p < .001$; $\beta_{\text{Hypochondria}}$.425; $p < .001$; $R^2 = .55$). In a regression analysis explaining hypochondria 27 % of variance was explained by sense of coherence, age and general psychological well-being ($\beta_{\text{Sense of Coherence}}$ -.249; $p < .001$; β_{Age} .223; $p < .001$; $\beta_{\text{General psychological well-being}}$.244; $p < .001$; $R^2 = .33$), social support and self-esteem were not significant in this model. Again, the correlation of age with worry of health may be explained by the greater incidence of physical illnesses in old age. Still, sense of coherence and general psychological well-being are individual factors explaining lower level of stress symptoms on all scales used in this survey. Negative life events and social support are related to

somatic and anxiety symptoms but not to hypochondria. When explaining general psychological well-being 15 % of variance was explained by sense of coherence and self-esteem ($\beta_{\text{Sense of Coherence}}$ -.264; $p < .001$; ($\beta_{\text{Self-esteem}}$ -.162; $p < .001$; $R^2 = .15$). Thus sense of coherence seems to have a direct effect on somatic and anxiety symptoms, but self-esteem seems to function by supporting general psychological well-being that is related to the lack of symptoms on other scales used here.

The relations between coping strategies and sense of coherence, self-deception and impression management were studied. Subjects with strong sense of coherence and self-esteem had less of emotion-centered coping than did those subjects who had lower sense of coherence and self-esteem. The problem-focused coping strategy was the other way round: those with strong sense of coherence, self-deception and impression management had also more of problem-focused coping (Table 46).

In regression analyses the variance of coping strategies was explained. In a regression model 15 % of the variance of problem-focused coping was explained by sense of coherence, self-deception and self-esteem ($\beta_{\text{Sense of Coherence}}$ -.139; $p < .05$; $\beta_{\text{Self-deception}}$ -.165; $p < .01$; $\beta_{\text{Self-esteem}}$ -.127; $p < .05$; $R^2 = .15$), impression management was non-significant in this model. 9 % of the variance of the emotion-centered coping was explained by self-deception, hypochondria and worry for Chernobyl accident ($\beta_{\text{Self-deception}}$ -.096; $p < .01$; $\beta_{\text{Worry for Chernobyl}}$.103; $p < .01$; $\beta_{\text{Hypochondria}}$ -.157; $p < .001$), anxiety and sense of coherence were non-significant in this model.

Table 46. The relations between coping strategies, sense of coherence, self-deception and impression management, group means.

Mode of coping	Weak sense of coher.	Moderate sense of coh.	Strong sense of coher.	F	df	p
Emotion-foc.	16.78	16.92	18.01	9.46	2, 548	.001
Problem-foc.	11.02	10.17	9.53	11.39	2, 548	.001
Mode of coping	Low self-deception	Moderate self-decept.	High self-deception	F	df	p
Emotion-foc.	16.88	16.84	17.68	5.06	2, 546	.01
Problem-foc.	11.28	9.69	9.71	18.40	2, 546	.001
Mode of coping	Low impression management	Moderate impression management	High impression management	F	df	p
Emotion-foc.	17.28	17.04	17.19	1.72	2, 546	ns.
Problem-foc.	10.93	10.24	9.54	7.75	2, 546	.001

Lower mean=more coping

7.6.1 “Healthy” subjects

The respondents were divided into three groups on the basis of their health and general well-being: healthy subjects, sick subjects and others. Variables used were General Health Questionnaire, SCL-90R-somatization, SCL-90R-anxiety, hypochondria and self-esteem. In the group of healthy none of the subjects have symptoms on any of the four symptom scales and they have highest value on the three-class self-esteem variable. In the group of sick all subjects have symptoms on all symptom scales and they have low or moderate self-esteem. The group others remain between these two groups: the respondents have symptoms on some scale and their self-esteem may be low, moderate or high. The frequencies of the respondents were following: healthy 146 subjects, sick 49 subjects and others 471 subjects.

19 % of women belong to the healthy group, 25 % of men are healthy. Only 13 % of the oldest age group are healthy, in other age groups the proportion of healthy subjects is 25 % each.

These three groups were compared to each other and an almost significant difference was found in the interpretation of the situation. Healthy subjects had more often interpreted the situation to be an accident, the group others interpreted the situation more often to be a threatening accident ($\chi^2=17.01$; $df=8$, 658; $p < .05$). More of the healthy subjects (71 %) than of sick (53 %) or others (68 %) believed that protection can decrease a lot or in some amount negative consequences of a nuclear accident ($\chi^2=16.47$; $df=8$, 664; $p < .05$).

Healthy subjects had smallest number of negative life events, sick had the highest number of them ($F=12.29$; $df=2$, 491; $p < .001$). Healthy subjects had the largest amount of social support, sick subjects had least of it ($F=21.78$; $df=2$, 650; $p < .001$). Healthy subjects also had highest level of self-deception ($F=20.26$; $df=2$, 652; $p < .001$) and of impression management ($F=9.08$; $df=2$, 652; $p < .001$), sick subjects had least of them. This result is consistent with Shelley Taylors (1989) finding that some amount of self-deception is typical of healthy people. Self-deception seems to protect from stress symptoms. It seems that the general resistance resources that Antonovsky (1979) describes in his model of salutogenesis include in this data in addition of more commonly known self-esteem, sense of coherence, problem-focused coping and social support also some amount of self-deception that helps to maintain positive illusions about oneself and combined with other resistance resources helps to buffer stress symptoms.

8 Discussion

The sample for the empirical study here was collected three months after the incident at the Sosnovyi Bor nuclear power plant. The incident was small and caused no danger, but aroused worry in Finnish people. Because of the clearly non-traumatic quality of the incident the delay in the data collection can be criticized. It is possible that after three months the subjects did not have clear memories of their reactions at the time of the incident. However, this is one of the main problems in disaster studies in general. A disaster or an accident happens accidentally, with no warning or a short time of warning giving not enough time for planning and preparing a study of it in advance.

The return rate in this study was 55 %, of the usual level of mailed questionnaire studies in Finland. Here, as in other studies, the return rate makes the researcher wonder if the proportion of non-respondents causes a bias in the results. In the present sample single and divorced persons were slightly overrepresented among the non-respondents. No other significant differences were found between respondents and non-respondents and the sample as such represents well the Finnish population.

The questions measuring levels of worry and interpretation of situation were subjective and thus give room for different interpretations of the concepts and terms used. A difference in interpretations of the situation between young and elderly people may as well be a difference in their use of the terms "incident"

and "accident" as in their different interpretation of the level of seriousness of the situation. The same criticism can, however, be directed to all subjective measures which are the main tools in social psychological research. The problem of subjectivity is always present and has to be kept in mind when evaluating the results.

The differences found in the results between the sample towns arouses the question of the generalizability of the results in Finnish population. Helsinki is the largest town in Finland and as the capital may be slightly different from other towns in Finland. Kotka is a typical small town on the coast the Gulf of Finland. It is different from other towns in the level of preparedness for radiation accidents. Subjects in Kotka are probably more aware of the risks and proper protection in case of a radiation accident. The risks related to Russian nuclear power plants have however been under discussion in mass media since the 1990's. Hämeenlinna and Varkaus can be described to be typical Finnish small towns and while some caution may be in order regarding conclusions drawn from results from Helsinki and Kotka, this does not apply to Hämeenlinna and Varkaus. It can quite safely be said that the results received from these two towns can be applied to the rest of Finland. Finland's original history and culture as a neighbour of Russia and Soviet Union makes it unique among European countries which limits the generalisation of the results to other countries.

8.1 Interpretation of the situation

When studying the perception and interpretation of the incident at nuclear power plant in Sosnovyi Bor it has to be done considering the different factors affecting it. In figure 12 psychosocial model of processing of traumatic stress developed by Green, Wilson and Lindy is modified to better fit this situation.

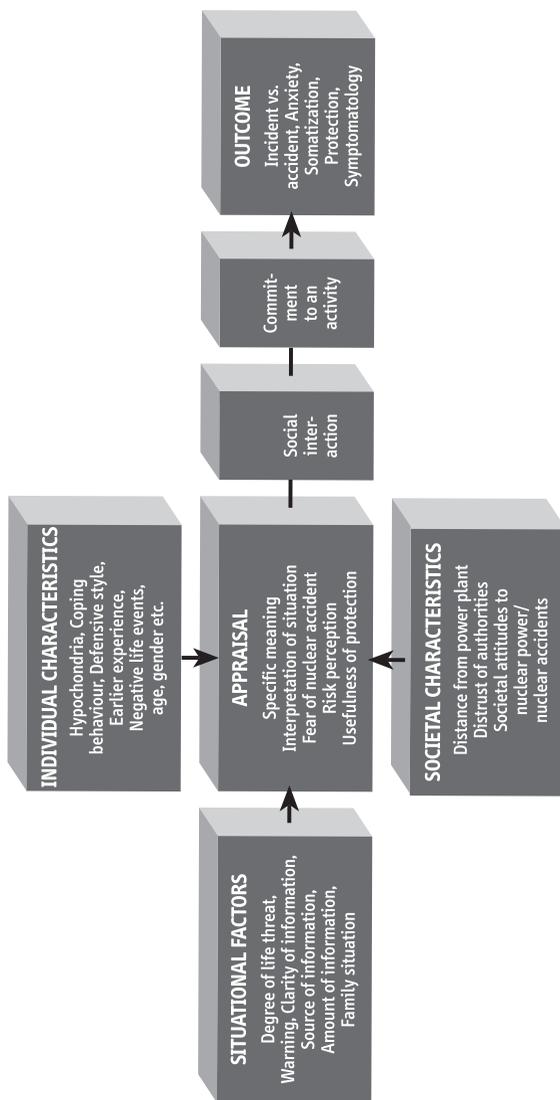


Figure 12. The psychosocial model of cognitive processing of a nuclear threat.

In the case of a nuclear accident where nothing concrete seems to happen, the importance of psychological and social factors increases. In 1992 six years had gone from the Chernobyl accident. During these years Soviet Union had dissolved its existence. The economic situation in Russia was difficult and there had been articles and discussions in mass media also on the security and circumstances of nuclear power plants in Russia. There can be said to be an atmosphere of concern about this issue in Finland.

From the history of nuclear images (see ch. 2) we know that an image of doomsday has been connected to nuclear energy almost since the discovery of radioactivity. The characteristics lay people use in evaluating riskiness of different activities are such that nuclear power is located in the high risk end of the continuum. It has a great dread element, it includes an opportunity for catastrophic consequences and the health effects can reach out to future generations. As nuclear energy is invented and used by man, it should be controlled by man, too. An accident or an incident at a nuclear power plant thus means a failure in the system. (Baum et al., 1991.) The Chernobyl disaster was serious and it is easily available as an example to come to mind in connection of problems in nuclear power plants: it may have signal value in confirming the likelihood of future mishaps. If Finnish people have a mental model of nuclear accidents it is very probably based on the Chernobyl accident which is then used as a model with which to compare future incidents. According to research results an accident arouses less fear when the agent of the accident is inside the community (Fitchen, 1987). In this case the agent of the hazard is outside the Finnish community, geographically not very far but psychologically and culturally distant. Trust is said to diminish with increasing distance. The benefits of Russian nuclear power plants don't seem to come to Finland and the hazard caused by them is not voluntary for us.

What about trust in authorities? Because of impossibility of own perceptions people are totally dependent on information delivered by mass media and authorities. Trust has become a central issue. According to Giddens the change from modern

society to risk society means a shift in trust-relations: in risk society the matter is trust in expert systems (Beck, Giddens and Lash, 1994). The threat of nuclear accident is a crystallization of risk society. There exists a worry that maybe the Finnish authorities don't tell us the truth about the seriousness of the situation. Concerning the Russian authorities there is the belief coming from Soviet times that they do not tell the truth about accidents. As a last societal characteristic, the distance from Finnish south coast to Sosnovyi Bor is short.

In considering the research results found here on the interpretation of the situation, the hypothesis of the effect of geographical distance was confirmed. Respondents from sample towns located closer to the power plant interpreted the situation to be more serious than respondents in towns with greater distance. This confirms earlier results found from TMI accident by several authors and results from risk perception of dam break in Portugal by Lima (1997). In Lima's study dam break risk was seen as more dreadful in areas close to the dam. At the same time in these areas the risk was seen as more controllable, however. In both cases the perceived threat was connected to the geographical distance from the threat. Objectively, the risk in nuclear accident is very much influenced by weather conditions, but subjectively people perceive the risk according to the geographical distance that is easier to perceive and understand than varying weather conditions. The geographical distance is also the only factor possible to perceive and evaluate by a person himself, maybe giving a minimal sense of control and predictability that are so important for the well-being of a person. According to Lazarus (Monat and Lazarus, 1991) one part of the primary appraisal process is the evaluation of personal relevance of the threat that here seems to be very much based on the geographical distance from the power plant.

Another factor significantly affecting the interpretation of the situation is the source of information. The main sources of information in the case of the Sosnovyi Bor nuclear incident were the mass media on the one hand and the respondent's own social network on the other hand. The information received from the

mass media was ambiguous at least in the morning. Nigg's (1987) conclusion is confirmed that in connection of nuclear accidents an insecure situation will be interpreted as more serious than it is, in contrary to other kinds of accidents that usually are interpreted as less serious than they are. Nigg's finding on the process of interpreting the situation gets confirmation in this study as well. The mass media was the information source that was trusted most, but the interaction with own social network seems to have had an important part in the process. Nigg concluded that the mass media provide the facts but social interaction changes them to behavioral alternatives. Here it seems that the mass media provided the facts but the interpretation of the seriousness of the situation was defined in discussions with social network. Social network seemed here to confirm an interpretation of the situation as more serious compared to an interpretation made by a person himself. This finding is contrary to earlier research results: in most studies on accidents the result found has been that when alone a person usually reacts more quickly and takes the situation to be more serious than in the company of other people.

In regression models predictive values of different variables in explaining the variance were studied. They showed that in sample towns slightly different factors explained the variation in the interpretation of the situation (i.e. seriousness). In Kotka, located closest to the power plant, most of the variance explained by the regression model was explained by source of information and fear and risk perceived from Russian nuclear power plants in general. Located in south coast and near the border with Russia, people in Kotka evaluate their personal risk from these power plants as being high. In Helsinki, in addition to the source of information and perceived risk from the Russian power plants, also the time when a person received the information and if he/she had a family, affected the interpretation. It is probable that in the morning there was more in clarity and ambiguity in the information than in the afternoon, when it was more certain that no radioactive release had taken place. The importance of family for the interpretation is understandable, there probably is a very

general schema of "family in danger" that dictates the primacy of one's family's security over most other things. In Helsinki the number of inhabitants with no family is larger than in other parts of Finland which may explain that the difference between these groups grew significant. According to schema theory in an ambiguous situation a person's needs and expectations determine which schemas are accessible. Some schemas are more accessible to particular individuals and for persons with a family the need for security is probably stronger than for single persons only responsible for themselves.

In Hämeenlinna and Varkaus, located in inner country and farther away from the power plant, only 9 % of variance was explained by the regression model. The source of information and perception of risk from Russian nuclear power plants were among variables explaining the interpretation, but in addition of them a third variable emerged as significant. Other negative life events explained some of the variation in interpretation of the situation. A question arises if several negative life events have shattered a persons' feeling of invulnerability thus making them feel world as an unsafe place and increasing the tendency to interpret future incidents according to this feeling of vulnerability? Recent experience affects selection of schema for interpreting new information and could thus explain this relation.

Maybe most important in these results is what was not found. Although not a hypothesis in this study, a theme arising under discussion from time to time is if it is "rational" to be afraid of a nuclear incident like the one in Sosnovyi Bor or if the persons being afraid of them are hysterical, hypochondriacs or otherwise anxious persons being worried of almost anything. No significant differences were found in the interpretation of the situation on the basis of any psychological factors. Contrary to commonly held beliefs it seems that persons who are more worried of these incidents are not psychologically different from persons being less worried. The difference in interpretations is based on the evaluated risk that is based on geographical distance from the power plant. Discussion with own social network seems to confirm the perceived seriousness of the incident and the importance

of social discussions is greater in towns located closer to the power plant. It is not the psychological constellation of these people but the social and psychological situation where they found themselves: in a very ambiguous situation receiving contradictory information and including potentially very threatful consequences. The rationality of this fear can be discussed but it depends heavily on the definition of rationality. Classical decision making theories are not helpful here as they mainly deal with the problem of choice between alternative options whereas here the main problem is if the situation really is dangerous or not. Classical decision theories could help in a situation where the level of threat is confirmed, different alternative protective measures have been listed together with their consequences and the problem would be to make a rational choice between the known alternatives. In nuclear accidents that kind of situation seldom emerges: the primary appraisal is always difficult as it was here.

8.2 Coping with the threat

Most respondents in this study did not change their behavior even when they interpreted the situation to be serious. The perceived seriousness was, however, related to information seeking. Almost two thirds continued whatever they were doing and one quarter started to seek more information. A low percentage initiated protection. The research hypothesis on the role of schematic activity in threatful situation was disconfirmed. Being involved in an activity was not related to lack of protective activities. However, the question may not be relevant in a situation that does not demand quick responses like a house fire, for example. There was time enough for people to finish whatever they were doing and still seek information and discuss the situation with others. This question still needs more research in a relevant context.

How did the respondents cope with the threat then? The typical response was seeking more information from own social network. An earlier research result was disconfirmed: the differ-

ence between men and women in interpreting the situation. In house fires women usually interpret first cues of the fire as more serious than men do e.g. (Canter, 1980). It seems possible that in connection of "ordinary" accidents men believe in being able to control the situation more than women do. In this incident, however, there were no differences between genders, neither of them has sense of control over the situation. There was a difference in behavior, however. Women tried more than men to find more information on the situation thus showing more worry even though their definitions of the situation did not differ. In discussing coping strategies Lazarus (Smith and Lazarus, 1993) has classified information seeking as problem-focused coping which seemed to be the most typical response here. Almost half of the respondents used problem-focused coping at least in a passive way, by listening to radio. It is difficult to evaluate to what extent discussion with other people had an element of emotion-focused coping by relieving the anxiety possibly caused by the threat. Almost half of the respondents informed someone else about the accident and almost half of them took some kind of actions because of it, six percent kept children inside.

The reasons given for action/non-action showed results similar to TMI studies. The most important reason for not protecting was an evaluation of the situation as not dangerous. Over ten percent were waiting for more information when few believed that protection was already too late. This shows again how the ambiguity and uncertainty of the danger can lead to different behaviour: it may be reason for acting as well as for not acting. The main difference was once again found between the sample towns. According to the hypothesis in the towns located closer to the plant more respondents started protective activities than in towns farther away from the plant. Those who started protective actions were analysed separately but no differences were found that could explain the difference of their behaviour from other respondents. An important precondition for action is belief in control and in possibility to affect the threat (De Marchi and Ungaro, 1987).

Respondents' reactions to a possible evacuation were asked. Over ten percent believed at some point that evacuation might have been necessary for them during the Sosnovyi Bor incident. A significant difference was found between sample towns in the goal of evacuation. In Kotka the proportion of insecure persons was smallest and the amount of those who would follow authorities' instructions was largest. Those who believed in the possibility of their own evacuation sought more information than others and had an own evacuation plan more often. In Varkaus the percentage of "don't know" answers was largest together with an ambiguous "towards north". Some of the differences are understandable on the basis of different geographical locations, but the importance of detailed, concrete instructions in Kotka is easy to perceive here, too: in Kotka people trust their local authorities and know what they should do in case of a nuclear accident. For them a successful secondary appraisal was possible.

Persons having an evacuation plan were compared to those who didn't have one. The only significant difference in psychological factors found between them was in the amount of problem-focused coping. It seems that those who were worried of the incident were usually able to cope with their fear: they had an evacuation plan and if they didn't they prepared one after the Sosnovyi Bor incident. This difference was significant in Kotka and Helsinki where this issue seemed to be more salient. Persons having an evacuation plan also found emergency preparedness important, believed that protection would decrease the harmful consequences of disaster and felt that they had enough information on disasters. According to Horowitz (1997) healing, working through or functional coping with an event can happen through introduction of a modulating element into preexisting internal model. Prince-Embury and Rooney (1995) considered a cognition of emergency preparedness to be such an element in connection of TMI accident. It sounds likely that here too, emergency preparedness gives a sense of control assisting in successful coping with the incident.

A few persons informed that they would have stayed at home even in case of a general evacuation order. More important, however, is the fact that over half of respondents answered that they would first go home and gather the family and then leave together by own car. This is consistent with the assumption of a "family in danger" schema that would predict that taking care of own family is the first priority. Etzioni (1992) states that most choices people make are based on normative affective considerations. Here the principle of exclusion of logical-empirical considerations seems to work: leaving the family is not even considered because that is morally and emotionally unthinkable.

The use of own car in evacuation probably increases one's sense of control and predictability by making possible to decide the time of leaving and the goal of evacuation in addition to the company chosen. There are evacuation goals named by authorities for Finns. However, we don't know if the orders would be followed or if people would choose to go to relatives or summer cottages as they did in TMI and as they said they would do in this study. It seems that mainly young, single persons would use public transport and shelters provided by authorities.

8.3 Information delivery

A central aspect of the process of defining the situation in nuclear accidents is information delivery and trust on authorities. People always evaluate both the contents of a message and the source of a message. If no information is delivered or it is delivered late, the information sources are still evaluated. If officials are late or do not give information, this will arouse or strengthen the belief that they are unreliable. This belief is soon projected to the future and to the past, and it becomes difficult to modify. Reliability results from former positive experiences. (De Marchi & Ungaro, 1987.)

Discontent with information found consisted of three distinct factor dimensions in this data. They were discontent with timing of information, discontent with the amount or belittling quality

of information and discontent with clarity and reliability of information. There was no significant difference between information from authorities and from mass media, but these were loaded on same factors. Lack of reliability and clarity of information was connected with stress symptoms, showing that a successful primary appraisal is the fundamental question in nuclear accidents. Negative correlation of psychological coping and discontent with timing and amount of information indicates that the use of psychological coping strategies may help to cope successfully with the delay of information, but not with the unclarity of information. (Eränen, 1997.)

It seems clear that the delivery of information is crucial to coping within the context of nuclear power plant accidents. Respondents indicate that they want to have more information on smaller incidents as well as during major accidents. It is possible that the reliability of information may be doubted, while at the same time, there is a desire for more information. This is what seemed to happen in Russia after the Chernobyl accident (van den Bout, 1995). What people in fact need, in threatening situations, is clear, understandable and reliable information. Excessive information does not guarantee a clearer image of the situation, on the contrary, it may be misleading. The problem may be to show that the information is, indeed, reliable. (Eränen, 1997.)

Stress symptom levels in the sample were within the normal range in 70-80 % of respondents on all the scales used in this study. This shows that even though people may be acutely stressed in a nuclear incident, it does not have effects lasting over a month. Elevated stress symptom levels were generally not associated with factors connected to the incident. However, the significant difference in anxiety levels and stress symptoms between those who were contented vs. discontented with clarity of information confirms that an unsuccessful primary appraisal increases stress. The contradictory information was found to be connected with stress symptoms after the TMI accident. After the TMI nuclear accident stress symptom levels were higher in those subjects who lived close to the power plant, although the difference was not statistically significant in the long-term follow-up.

In the Sosnovyi Bor incident, it was soon confirmed that there was no real danger, and there was no difference in levels of stress symptoms between respondents in different sample towns. The lack of clear information leading to unsuccessful primary appraisal could probably in a real danger cause elevated stress levels that would last beyond the acute period. (Eränen, 1997.) In follow-up studies of the TMI accident it was found that level of psychological symptoms decreases sooner than physiological indicators of stress, like elevated levels of adrenalin and noradrenalin. As physiological measurements were not used here, we cannot be sure if there were stress symptoms visible on physiological level only.

Being satisfied with instructions that enabled successful secondary appraisal had no connection with stress symptom levels here. Advance information is important and people are more confident with their authorities because of that, but it is possible that its helpful effects would only show up when the primary appraisal has been successful, too. (Eränen, 1997.)

8.4 Stress symptoms and resiliency

Stress symptoms in this data were mainly connected to negative life events. Those who had experienced many negative life events during the last year had more symptoms on all scales used here.

Several psychological or individual characteristics were connected to stress symptoms. According to Antonovsky, sense of coherence is developed by life experiences. For a strong sense of coherence to develop, life experiences must be predictable and rewarding, yet with some amount of frustration and punishment. If life experiences shape a person's sense of coherence, what then shapes his/her life experiences? Antonovsky states that people have a tendency to get into life experiences that confirm their previous level of sense of coherence. As in this data, there is in life usually variation in the amount of stressful events different individuals experience. But according to Antonovsky, the exposure to stressors does not vary from very low to very high, but

rather from fairly serious to unbearable suffering. What is important, is that people differ in the amount they are able to contain and cope with these stressors and conflicts. Antonovsky calls general resistance resources those factors that help a person to find specific resources needed to cope with a stressor or to avoid a stressor.

Here, we divided the sample into three groups on the basis of their health and general well-being and studied them separately. In the group of "healthy", subjects have high self-esteem and strong sense of coherence. They have no symptoms on any of the scales measuring psychological well-being. They have the largest amount of social support. It seems that they are the group best prepared for stressful life events and having the best resources to cope with them. But they also have the smallest amount of negative life events.

The group of "sick" subjects here have low self-esteem and they have a weak sense of coherence. They have only little of social support, but they have a lot of symptoms on all the scales on psychological symptoms used here. They have the least of several kind of psychological and social resources, but they have the largest amount of negative life events to cope with.

High self-esteem, strong sense of coherence and high level of social support seem to prevent or buffer stress. These "healthy" persons also use more of problem-focused coping that in most studies is found to be more effective than emotion-focused coping strategies. In this data, the stress symptoms found were not related to the Sosnovyi Bor incident that turned out not to have caused any threat to health. However, if a more dangerous nuclear accident would happen, it is possible that it could generate anxiety and stress symptoms in the population. There is a small group that is well prepared, has several psychological and social resources to cope with the stress. There is a group of "normal" or "moderate" persons who have some psychological and social resources to cope with stressors. This group could increase their level of preparedness through getting more instructions. They probably would get benefit from some professional help. Then there is the small group of "sick" persons who have very little of

any social and psychological resources, but have several stressors in their life causing them psychological symptoms. This group would probably suffer the most of the negative psychological effects of a nuclear accident, too.

In this study level of depression was not measured, but it has been found to be related to the amount of self-deception that was measured here. Low level of self-deception has usually been connected to high level of depression. Taylor (1989) concludes that some amount of self-deception, positive illusions, are necessary for psychological well-being. That was confirmed here, too. Self-deception can be categorized to belong to the group of psychological resistance resources. In this data the group healthy used most of it and the group sick had least of it, too.

It seems that a nuclear incident is to most Finnish people a threat that is taken seriously, especially when an incident happens behind the border, in Russia. It raises worry and concern in most people specially in areas located near the power plants and many have prepared for a serious accident. Clear and understandable information from local authorities helps to prepare for an accident and increases confidence in the authorities. Use of problem-focused coping strategies, like having first-aid training and having an own evacuation plan seems to support and prepare psychologically for a nuclear accident, too. Information delivery for nuclear accidents and preparation for them does not arise anxiety or more fear of accidents. On the contrary, those persons who are well prepared and have enough of information and instructions for a nuclear accident, have less stress symptoms in spite of their perception of high risk from nuclear power plant accidents.

Attention should be given to the credibility of authorities. In a nuclear threat people have to rely on their authorities, because there is no other choice.

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Appendix 1

THE NUCLEAR ACCIDENT APPRAISAL QUESTIONNAIRE

Please answer the following questions by circling the number next to the most appropriate answer, or by placing your response in the space provided.

For example: gender: female 1 male 2,

If you are a woman circle number 1, if you are a man, circle number 2. If you make a mistake, cross the mistaken alternative and circle the correct one.

The questionnaire results are absolutely confidential and the information you provide is recorded only as statistics. Individuals cannot be recognised from the information provided.

1. YEAR OF BIRTH _____ 2. GENDER 1 Female 2 Male

3. HOMETOWN _____

4. WHAT IS THE HIGHEST LEVEL OF EDUCATION YOU HAVE COMPLETED:

- | | |
|------------------------------------|----------------------------------|
| 1 Completed primary school | 5 Polytechnic qualification |
| 2 Completed intermediate school | 6 Completed occupational courses |
| 3 Partially completed intermediate | 7 University qualification |
| 4 Graduated high school | |

5. WHAT IS YOUR OCCUPATION? _____

6. WHAT IS YOUR MARITAL STATUS

- 1 single 2 married 3 de facto relationship 4 divorced 5 widowed

7. WHAT IS THE NUMBER OF CHILDREN IN YOUR FAMILY:

- How many? Under 7 _____ Over 15 _____
7 - 15 _____ No children _____

THE INCIDENT AT THE SOSNOVYI BOR NUCLEAR POWER PLANT

On the 24th May there was an incident at the Sosnovyi Bor nuclear power plant in Russia near St. Petersburg. As a consequence of the incident radioactive substances were released outside the power plant.

8. WHERE DID YOU FIRST HEAR OF WHAT HAD HAPPENED?

- 1 from a friend 3 from a relative 5 on the radio 7 in a newspaper
2 from a coworker 4 from a family member 6 on the television

9. WHEN DID YOU FIRST HEAR OF WHAT HAD HAPPENED?

- 1 on the same day at _____ o'clock
2 on the next day
3 later, about _____

10. WHERE WERE YOU WHEN YOU FIRST HEARD ABOUT THE INCIDENT AT THE POWER PLANT?

- 1 at home 2 at work 3 on the way to work 4 at school
5 somewhere else, where _____

11. IN WHOSE COMPANY WERE YOU WHEN YOU RECEIVED THE INFORMATION OF THE INCIDENT?

- 1 alone 4 with a coworker
2 with my family 5 among unknown people (in a bus, in an office etc.)
3 with a friend

12. WHAT WERE YOU DOING WHEN YOU FIRST HEARD OF THE INCIDENT?

- 1 nothing special 4 talking with a friend
2 doing housework 5 working
3 eating 6 something else, what _____

13. WHEN YOU HEARD OF AN INCIDENT FOR THE FIRST TIME, WHAT AND WHERE DID YOU HEAR IT HAD HAPPENED?

(you can also circle several alternatives)

Where

What

- 1 it happened in Russia
- 2 near St. Petersburg has happened
- 3 somewhere has happened, where

- 1 an incident
- 2 a serious incident
- 3 an accident
- 4 a threatening accident
- 5 a serious accident
- 6 something else _____

14. WHAT DID YOU DO IMMEDIATELY AFTER HEARING OF THE INCIDENT? (you can also circle several alternatives)

- 1 I continued what I was doing
- 2 I informed someone else of what had happened

- 3 I tried to find more information
- 4 I started protective activities

15. IF YOU INFORMED SOMEONE ELSE OF THE INCIDENT, WHO WAS THIS? (you can also circle several alternatives)

- 1 a family member
- 2 a relative
- 3 a friend
- 4 a coworker

16. IF YOU TRIED TO FIND MORE INFORMATION ON THE INCIDENT, WHERE DID YOU LOOK FOR IT? (you can also circle several alternatives)

- 1 a family member
- 2 a relative
- 3 a friend
- 4 coworker
- 5 I called the police
- 11 something else, what _____

- 6 I called 911
- 7 I called a radio station
- 8 I called authorities for radiation protection
- 9 I called the fire station
- 10 I called the health center

17. IF YOU STARTED PROTECTIVE ACTIVITIES, WHAT OF THE FOLLOWING POSSIBILITIES DID YOU APPLY?

- 1 I stayed inside
- 2 I kept the children inside
- 3 I started to listen to news on the radio
- 7 something else, what _____

- 4 I went to buy iodine tablets
- 5 I took iodine tablets
- 6 I went to a shelter

18. WHY DID YOU DECIDE TO PRACTICE OR NOT TO PRACTICE PROTECTIVE ACTIVITIES?

INFORMATION DELIVERY

19. THROUGH WHICH MASS MEDIA DID YOU RECIEVE INFORMATION ON THE INCIDENT?

1 radio 2 television 3 newspapers 4 afternoonpapers

20. HOW OFTEN DID YOU FOLLOW NEWS RELEASES?

- 1 I watched all the news on tv
- 2 I listened to all the news on the radio
- 3 I watched the news on tv at least three times a day
- 4 I listened to the news on the radio at least three times a day
- 5 I followed news 1 -3 times a day
- 6 I did not follow news

INFORMATION DELIVERY BY AUTHORITIES

21. DID THE AUTHORITIES RELEASE INFORMATION ON THE INCIDENT

1 too late 2 early enough 3 too early

22. IN WHAT WAY DID THE AUTHORITIES DESCRIBE THE INCIDENT IN THEIR INFORMATION?

1 in an exaggerating way 2 realistically 3 belittling

23. HOW MUCH DID THE AUTHORITIES RELEASE INFORMATION OF THE INCIDENT?

1 too much 2 in the right amount 3 too little

24. DID YOU TRUST ON THE INFORMATION DELIVERED BY THE AUTHORITIES?

1 totally 2 almost everything 3 partly 4 little 5 not at all

25. WAS THE INFORMATION RELEASED BY THE AUTHORITIES

- | | | |
|---------------|-----------------|-----------------|
| 1 very clear | 3 clear | 5 confusing |
| 2 quite clear | 4 contradictory | 6 too ambiguous |

26. DID THE AUTHORITIES GIVE ADVICE FOR PROTECTION AGAINST RADIATION

- 1 too much 2 in the right amount 3 too little 4 I don't know

27. ON WHAT KIND OF THREATS SHOULD THE AUTHORITIES DELIVER INFORMATION?

- | | |
|----------------------------|------------------------------|
| 1 even on a small incident | 3 a threatening accident |
| 2 a serious incident | 4 only on a serious accident |

INFORMATION DELIVERY FROM MASS MEDIA

28. DID THE MASS MEDIA DELIVER INFORMATION ON THE INCIDENT

- 1 too late 2 early enough 3 too early

29. WAS THE INFORMATION DELIVERED BY THE MASS MEDIA

- 1 exaggerating 2 realistic 3 belittling

30. DID THE MASS MEDIA DELIVER INFORMATION ON THE INCIDENT

- 1 too much 2 in the right amount 3 too little

31. DID YOU TRUST ON THE INFORMATION RELEASED BY THE MASS MEDIA

- 1 totally 2 almost everything 3 partly 4 little 5 not at all

32. WAS THE INFORMATION RELEASED BY THE MASS MEDIA

- | | | |
|---------------|-------------|-----------------|
| 1 very clear | 3 clear | 5 contradictory |
| 2 quite clear | 4 confusing | 6 too ambiguous |

33. ON WHAT KIND OF THREATS SHOULD THE MASS MEDIA DELIVER INFORMATION

- 1 even on a small incident
- 2 a serious incident

- 3 a threatening accident
- 4 only on a serious accident

34. WHICH INFORMATION SOURCE DID YOU TRUST MOST AFTER THE SOSNOVYI BOR INCIDENT

- 1 a family member
- 2 a relative
- 3 a friend
- 4 a coworker

- 5 Yleisradio
- 6 another radio channel
- 7 television
- 8 newspapers

- 9 Center for radiation protection
 - 10 Ministry of Interior
 - 11 local authorities
 - 12 something else, like
-

35. IF THE INFORMATION DELIVERY WAS MISSING OR OF POOR QUALITY, WHO WAS PRIMARILY RESPONSIBLE FOR THIS (you can also circle several alternatives)

- 1 Center for radiation protection
- 2 Ministry of Interior
- 3 the government

- 4 the parliament
- 5 newspapers
- 6 radio

- 7 television
- 8 Russian authorities
- 9 difficult situation in Russia

EVACUATION PLANS

36. DID YOU BELIEVE DURING THE SOSNOVYI BOR INCIDENT THAT IT MIGHT BE NECESSARY FOR YOU TO EVACUATE?

1 yes

2 no

37. DO YOU HAVE AN EVACUATION PLAN OF YOUR OWN?

1 yes

2 no

38. IF YOU DID NOT HAVE AN EVACUATION PLAN, HAVE YOU MADE ONE AFTER THE SOSNOVYI BOR INCIDENT?

1 yes

2 no

IF THE SOSNOVYI BOR INCIDENT HAD TURNED OUT TO BE SO SERIOUS THAT EVACUATION OF YOUR HOMETOWN WOULD HAVE BEEN NECESSARY

39. WHERE WOULD YOU HAVE GONE? _____
40. BY WHAT VEHICLE WOULD YOU HAVE TRAVELED? _____
41. WITH WHOM WOULD YOU HAVE TRAVELED? _____
42. WHAT OBJECTS WOULD YOU HAVE TAKEN WITH YOU? _____
- _____

43. IF AN EVACUATION ORDER WOULD HAVE BEEN GIVEN DURING THE WORKING HOURS AND WITH E.G. ONE HOUR FOR PREPARATIONS, WHAT WOULD YOU HAVE DONE
- _____
- _____

DO YOU REMEMBER CHERNOBYL?

44. A SERIOUS ACCIDENT AT THE CHERNOBYL NUCLEAR POWER PLANT TOOK PLACE IN 1986. WHEN YOU THINK ABOUT WHAT HAPPENED THEN, DO YOU THINK THAT THE INFORMATION ON THE ACCIDENT WAS RELEASED

1 early enough 2 too late 3 I don't remember

45. HOW MUCH INFORMATION WAS THERE ON THE CHERNOBYL ACCIDENT

1 too much 2 enough 3 too little 4 I don't remember

46. WAS THE INFORMATION ON THE CHERNOBYL ACCIDENT

1 difficult to understand 2 contradictory 3 clear 4 I don't remember

47. DID YOU TRUST THE INFORMATION RELEASED THEN

1 totally 2 almost everything 3 partly 4 little 5 not at all
6 I don't remember

48. WAS THE AMOUNT OF INSTRUCTIONS AND PRACTICAL ADVICE FOR PROTECTION AGAINST RADIOACTIVE SUBSTANCES AFTER THE CHERNOBYL ACCIDENT

1 too much 2 in the right amount 3 too little 4 I don't remember

49. WERE THE INSTRUCTIONS RELEASED

1 too late 2 at the right time 3 too early 4 I don't remember

50. IF YOU FIND THE INFORMATION AFTER THE CHERNOBYL ACCIDENT TO HAVE BEEN INADEQUATE, WAS IT BECAUSE OF (you can also circle several alternatives)

1 Finnish authorities 3 mass media
2 Russian authorities 4 I don't know

51. DID YOU START TO TAKE PROTECTIVE ACTIVITIES AFTER THE CHERNOBYL ACCIDENT?

1 no 4 I avoided using rain water
2 I stayed inside 5 I avoided using mushrooms, berries and vegetables
3 I kept the children inside 6 I avoided eating fish from lakes
7 I don't remember

52. ARE YOU STILL WORRIED BECAUSE OF THE CONSEQUENCES OF THE CHERNOBYL ACCIDENT

1 to the health of the local people 3 to the environment
2 to the health of other people, too (Finns, e.g) 4 I am not worried

RISKS FROM CONTEMPORARY NUCLEAR POWER PLANTS AND POSSIBLE PROTECTION

53. DO YOU THINK THAT RUSSIAN NUCLEAR POWER PLANTS ARE TO YOURSELF AND YOUR CLOSE ONES

1 a serious risk 3 a small risk
2 quite a serious risk 4 a very small risk 5 I don't know

54. ARE YOU AFRAID OF THE CONSEQUENCES OF AN ACCIDENT TAKING PLACE IN RUSSIAN NUCLEAR POWER PLANTS ON YOURSELF OR ON YOUR CLOSE ONES?

1 not at all 2 a little 3 somewhat 4 very much 5 I don't know

55. DO YOU THINK YOU HAVE HAD INFORMATION AS PREPARATION FOR A DISASTER

1 in the right amount 2 too little 3 too much 4 I don't know

56. DO YOU THINK THAT PROTECTION IN CASE OF A NUCLEAR ACCIDENT WOULD DECREASE THE HARM CAUSED TO YOU?

1 not at all 2 a little 3 somewhat 4 very much 5 I don't know

57. HOW IMPORTANT IS IT TO BE PREPARED FOR DISASTERS IN YOUR COMMUNITY?

1 very important 2 important 3 not important 4 I don't know

58. SHOULD THE DISASTER PREPAREDNESS IN YOUR COMMUNITY

1 be improved 2 stay as it is 3 be decreased 4 I don't know

59. WHERE DO YOU GET INFORMATION ON EMERGENCY PREPAREDNESS IN CASE YOU NEED IT?

60. DO YOU KNOW WHAT TO DO IN CASE OF AN EMERGENCY?

1 I don't know 2 yes, I know, to

61. DO YOU KNOW WHAT YOU YOURSELF WOULD DO IN CASE OF AN EMERGENCY?

1 I don't know 2 yes, I would

62. DO YOU KNOW WHERE YOUR NEAREST SHELTER IS?

1 yes 2 no

63. WHAT RISKS AND ACCIDENTS DO YOU FIND PROBABLE IN YOUR OWN COMMUNITY?

64. WHAT OBJECTS/VALUABLES DO YOU THINK SHOULD BE EASILY ACCESSED IN CASE OF A DISASTER?

65. DO YOU HAVE A PERSONAL PLAN IN CASE OF A DISASTER?

1 yes

2 no

66. HAVE YOU HAD A FIRST-AID TRAINING COURSE?

1 yes

2 no

67. DO YOU FIND IT IMPORTANT TO HAVE FIRST AID TRAINING?

1 yes

2 no

68. DO YOU HAVE PERSONAL EXPERIENCE OF AN ACCIDENT?

1 not at all

3 a quite serious accident

2 a serious accident

4 a small accident

Appendix 2

Rotated factor matrix of items referring to coping strategies.
Two composite variables were constructed.

Rotated Factor Matrix:

	FACTOR 1	FACTOR 2
VAIHTOEH	-.01844	.59722
MALTTI	.23197	-.03274
RATKAISU	.08548	.71643
HUOMIOI	.49575	.16831
KESKITAN	.76051	.02125
TOSIASIA	.59355	.27314
LISATIET	.02242	.63958
ILMAISEN	.27297	.39336
PUHUNASI	-.01869	.71139
TEENRUTI	.61285	.24003
HARRASTU	.72430	-.02762
YRITANOL	.74566	-.12093

Rotated factor matrix of items referring to information delivery by
authorities or mass media. Four composite variables were constructed.

Rotated Factor Matrix:

	FACTOR 1	FACTOR 2	FACTOR 3	FACTOR 4
VOTIEDOT	-.26024	-.20951	.06152	.78756
KERTTOVO	.34659	.64753	-.15493	-.00579
ANTOIVO	.39050	.54923	-.09715	-.23889
LUOTVO	.69374	.36411	-.06411	.03747
OLIVAT	.73550	.18504	-.08570	-.08010
VOANTOHJ	.21809	.18425	.17907	-.01189
MILLAIVO	-.05076	-.08807	.91906	.05976
KERTOTV	-.15458	-.28465	.06937	.79279
TVANTAMA	.02868	.84205	-.04493	.02370
KERTOITV	.14101	.68224	.00355	-.18565
LUOTITTV	.75520	.12769	.11026	.01105
TANTTIE	.72822	.01517	.03920	-.13340
MILVAATV	.02719	-.10674	.92371	-.00739
TIETOLA	-.07189	-.20839	.05622	-.34583
HUONOT	.31227	.06535	-.03260	-.17615

Appendix 3

Table 47. The relations between psychological variables and satisfaction with reliability and clarity of information delivery, mean values.

	Satisfied	Quite satisfied	Dissatisfied	df	F	p <
Life events	4,05	4,23	6,40	2,553	10.57	.001
Sense of Coherence	49,14	50,12	46,88	2,553	7.07	.01
Psychological symptoms	3,58	3,50	5,39	2,553	5.70	.01
Anxiety	5,38	4,85	6,76	2,627	5.83	.01
Hypochondria	8,96	9,33	11,62	2,627	5.83	.01
Fear of consequences of nucl. Accid.	2,83	3,03	3,28	2,606	9.87	.001
Perception of risk from Russian nuclear power plants**	1,98	1,80	1,58	2,592	7.50	.01

Table 48. The relations between psychological variables and satisfaction with the amount and quality of information delivery, mean values.

	Too much	Right amount	Too little	df	F	p<
Life events	3,79	4,12	5,75	2,479	6.78	.01
Problem- focused coping	11,58	10,33	9,92	2,479	4.88	0.01
Fear of consequences of nuc.pow. accidents in Russia	2,85	2,92	3,28	2,599	9.45	.001
Perception of risk from Russian nuclear power plants **	2,04	1,85	1,62	2,585	4.38	.01

Table 49. The relations between psychological variables and satisfaction with timing of information delivery

	Satisfied	Quite satisfied	Dissatisfied	df	F	p <
Problem- * focused coping	10,68	10,43	9,69	2,541	8.01	.001
Fear of consequences of nuclear accidents	2,87	3,10	3,24	2,610	14.85	.001
Perception of risk from Russian nuclear power plants **	1,95	1,69	1,64	2,594	10.91	.001

* smaller number = more use of coping

** smaller number = perceives higher risk

Appendix 4

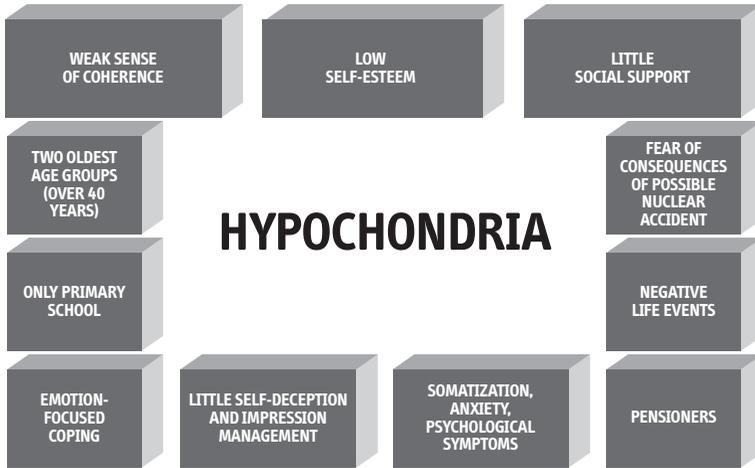


Figure 13. Factors related to hypochondria.

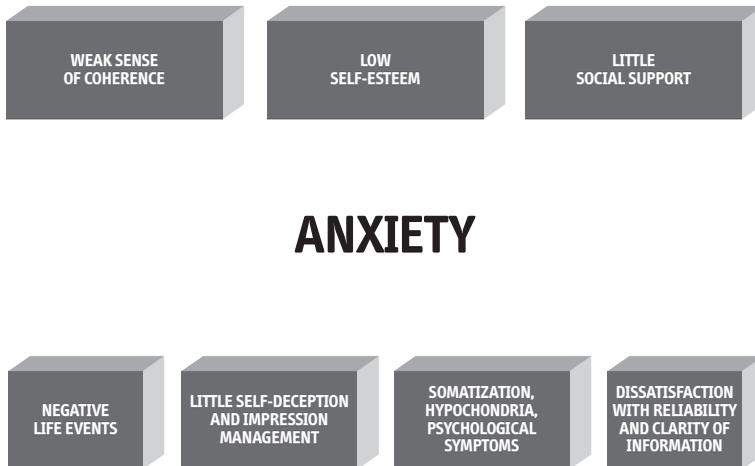


Figure 14. Factors related to anxiety.



SOMATIZATION



Figure 15. Factors related to somatization.



PSYCHOLOGICAL SYMPTOMS

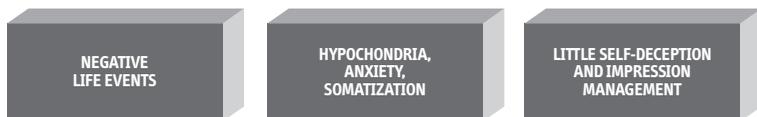


Figure 16. Factors related to psychological symptoms.