RIVM rapport 300060001 / 2004

The influence of outrage and technical detail on the perception of environmental health risks

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This investigation has been performed within the framework of project V/300060, Focal Point Environmental Medicine.

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“There is no reality, only perception”

Philip C. McGraw, Ph. D

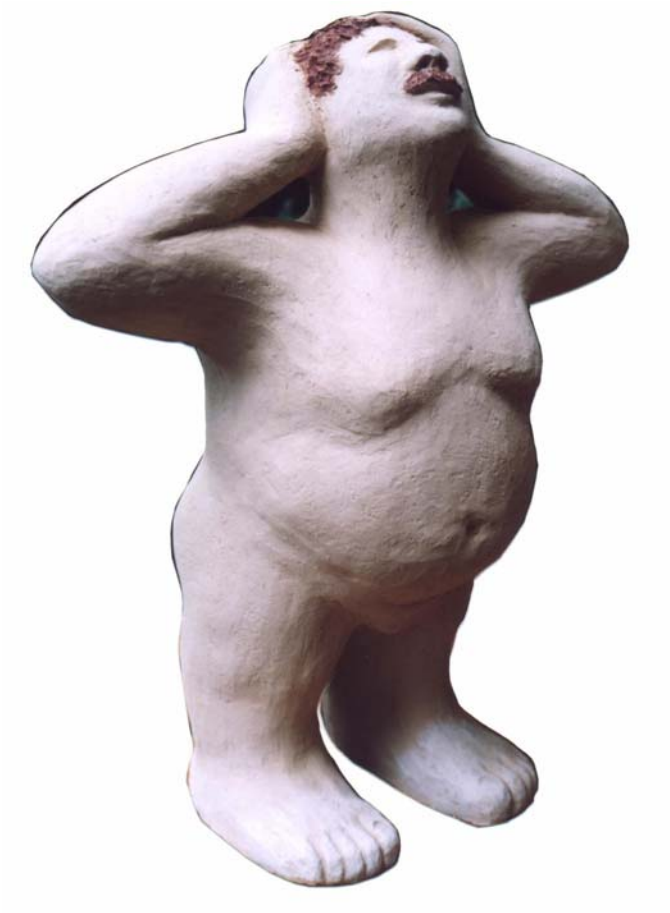

Illustration: “Samen spetterende start”
Part of a group of sculptures in Chamotte-clay
by Elly Pol – Jochems, 2003.

Abstract

Differences in risk perception between a professional assessing a risk and a concerned community affected by this risk have been shown to be important obstacles in the communication of environmental health risks. The study reported here aimed at gaining insight into factors that influence people's concerns about risk and that may determine their risk perception. The study focused specifically on the potential influence of the amount of technical detail and outrage provided in risk messages.

This study made use of four fictional newspaper stories, with manipulated outrage factors and numbers of technical (risk) details. Four versions, i.e. low technical detail and low outrage; low technical detail and high outrage; high technical detail and low outrage and high technical detail and high outrage were made of each story. The study participants received one version of each story and were asked to imagine that the stories had appeared in their local newspapers, and that they were faced with the situations described. For each story, participants filled in a questionnaire showing their personal assessment of the situation.

By manipulating outrage and technical detail, singularly or in combination, it was possible to study how these factors influenced risk perception. Analyses indicated neither a significant relation between outrage and risk perception (except for people's perception of the controllability of the risk), nor between technical detail and risk perception. Neither did the manipulations significantly affect people's risk acceptance. Other factors–such as a person's gender, age, education, previous familiarity with the risk, one's natural tendency to take or avoid risks and whether or not the person had children– proved to be much stronger predictors of people's risk perception and acceptability, but these factors were all beyond the control of the agency or corporate communicator.

Rapport in het kort

Titel: *The influence of outrage and technical detail on the preception of environmental health risks.*

Er bestaan duidelijke verschillen tussen de manier waarop de bevolking tegen de gezondheidsrisico's van milieuverontreiniging aankijkt en de manier waarop experts dat doen. Dat is van belang, omdat dat gevolgen kan hebben voor de manier waarop berichten over dergelijke risico's het beste kunnen worden opgeschreven en naar buiten gebracht.
Dit onderzoek probeert daar meer zicht op te krijgen door uiteenlopende teksten over een milieuprobleem voor te leggen aan proefpersonen om te zien hoe zij daarop reageren. De teksten, geschreven als krantenartikelen, werden met opzet voorzien van veel of weinig details en van (veel of weinig) "ergernis-opwekkende" passages. Hiermee kon worden nagegaan of de formulering van de boodschap van invloed is op de manier waarop de proefpersonen de risico's beoordeelden.
De bewust aangebrachte verschillen in de tekst bleken uiteindelijk minder invloed te hebben dan bijvoorbeeld geslacht, leeftijd, opleidingsniveau of het hebben van kinderen. In het rapport worden de mogelijke oorzaken van deze bevinding beschreven, in het licht van wat daarover uit eerder onderzoek bekend is.

Preface

A research institute as the RIVM is expected to report quickly, accurately and detailed. Besides this, there seems to be a decreasing tendency to accept the consequences of accidents or disasters and a growing inclination to point to the culprit. This is why we should ask ourselves how research results should best be communicated to a concerned public. When residents see that officials are sensitive to their concerns about environmental problems, do public concerns about risk decrease? What happens when government staff members do not respect public concerns? When they provide more detailed technical information about the problem, do public responses change? These questions prompted a study to examine ways to manipulate the outrage and amount of technical details in risk communication and to study the effects of this manipulation (if any) on people's risk perception.

The study presented here was carried out as the final project of my study on Environmental Health Science at the University of Maastricht. I want to take the opportunity to address a special word of thanks to the university and my faculty supervisors, Ree Meertens and Wim Passchier, for their guidance, feedback and thorough comments. I also wish to express my gratitude to Mark van Bruggen, my supervisor at the RIVM and external reviewer of this thesis, whose valuable remarks and suggestions have improved my report. Furthermore, I would like to thank everybody at RIVM/IMD. I thoroughly enjoyed my working experience there, including the famous tea breaks, the daily forest-walks during lunchtime and our market visits.

As with any scientific research, the role of empirical data is invaluable. I am therefore also indebted to the local community groups who were willing to participate in the study and for their patience in completing the somewhat lengthy questionnaire.

Debby Jochems
Utrecht, August 2004

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Samenvatting

Verschillen tussen een bevolking die door een bepaald risico getroffen is en mensen die beroepsmatig een risico moeten beoordelen, blijken vaak obstakels te zijn in de risico-communicatie. Het hier gerapporteerde onderzoek tracht inzicht te verkrijgen in de factoren die de bezorgdheid van mensen over een risico kunnen beïnvloeden. Het onderzoek richt zich met name op de invloed van de hoeveelheid technische (risico) details en de hoeveelheid 'outrage' (woede of onlust oproepend) in een risico-bericht.
Voor dit onderzoek werden vier fictieve krantenartikelen geschreven. Van elk van deze artikelen werden vier versies gemaakt (te weten: weinig technische details en een lage outrage; weinig technische details en een hoge outrage; veel technische details en een lage outrage; veel technische details en een hoge outrage), dus zestien verhalen in totaal. Elke deelnemer ontving één versie van elk van de vier verhalen en werd gevraagd zich voor te stellen dat deze in de regionale krant hadden gestaan en dat hij of zij te maken had met de beschreven situatie. Na het lezen van elk verhaal, vulden de deelnemers een vragenlijst in met vragen betreffende hun perceptie van het specifieke, in het verhaal beschreven, risico.

De analyses toonden geen significante relatie aan tussen outrage en risico-perceptie (behalve wat betreft de beheersbaarheid van het risico), en evenmin tussen technische details en risico-perceptie. De manipulaties hadden ook geen significante invloed op de aanvaardbaarheid van het risico. Andere factoren zoals deelnemers' geslacht, leeftijd, opleidingsniveau, bekendheid met het risico, natuurlijke neiging om risico's te nemen of te mijden, en het feit of de deelnemers kinderen hadden – allemaal factoren waar een bedrijf of overheidsinstelling geen invloed op heeft – bleken betere voorspellers te zijn van de risico-perceptie. In het rapport worden de mogelijke oorzaken van deze bevinding verder uitgewerkt.

1. Introduction

Sometimes there is great social agitation about an environmental health risk. However, according to risk assessment experts, the risks that elicit such agitation are often not the risks that merit all the attention. In fact, if you make a list of environmental risks in the order of how many people they kill each year, then list them again in order of how alarming they are to the general public, the two lists will be very different[1]. The first list will also be very debatable; of course we do not really know how many deaths are attributable to, say, breathing-in second-hand smoke, being exposed to industrial emissions or living near power lines. But we do know enough to be nearly certain that second-hand smoke kills more people each year than exposure to industrial emissions does (at least in the Netherlands). The conclusion is inescapable: the risks that kill you are not necessarily the risks that anger and frighten you.[1]

So why do people worry more, for example, about industrial emissions than they generally do about second-hand smoke or aflatoxin in their peanut butter? Peter Sandman suggests that the explanation lies in the definition of a risk[1]. To the risk assessment experts, risk means expected annual mortality. But to the public (and even to the experts when they go home at night), risk means much more than that. Instead of focusing on the quantitative or probabilistic nature of a risk, the general public seems much more concerned with broader, qualitative attributes of risk, the so-called “outrage factors” (e.g. absence of supposed control over the hazard, the media attention a risk receives, whether or not people have a personal stake in the matter, and lack of trust in the information source).[2, 3] Not surprisingly, they rank risks differently.[1]

These differences in risk perception sometimes turn out to be important obstacles in the communication of environmental health risks. According to some, they may even increase the cost of environmental management and result in less protection of health and the environment. This raises the question on ways to influence the way people view (and assess) a risk. The study reported here tries to gain insight into the factors that can feed people’s concerns about a risk, and that may determine their risk perception. The study specifically focuses on the potential influence of the amount of technical (risk) details and the amount of outrage provided in a risk message. Once it is clear how (unnecessary) worries and agitation about a risk arise, one might be able to think of ways to prevent this, and to improve environmental health communication.

The background and purpose of the present study are further outlined in this introduction. In the first section, the different aspects that risk assessment experts and the general public use to determine their perception of a risk are explained. In the second section, the different notions of risk communication are discussed. The third section deals with the ways technical detail and outrage may affect people’s perception. And in the last section of this chapter, the present study is outlined.

1.1 Determinants of risk perception

The world is full of threats and it is impossible to thoroughly calculate the risks of all those threats the way risk assessment experts do in specific cases. Anyone doing this would simply not have time to do anything else. In order to quickly assess threats and to learn to live with them, people consider every threat, and evaluate whether they could become victims of the threat and if it is possible to prevent a threat from happening.[4]

Many aspects determine whether or not people think they could fall victim to a threat and, in everyday life, risk assessment experts also assess threats by many aspects.[4] But there are significant differences in the aspects that the general public and risk assessment experts use to assess a risk. The experts are usually seen as purveying risk assessments characterized as objective, analytic, wise and rational; based on the "real risks"[5]. Judging and regulating risks should, according to these experts, be based on their relative seriousness (probability, nature and magnitude of harm).

In contrast, the public is usually seen by these experts to rely on "perceptions of risk" that are subjective, often hypothetical, emotional, foolish and irrational[5]. However, this emphasis on different aspects explains why they have reached judgments different from those of the experts as to which risks most merit public concern and regulatory attention[2]. In many cases, these different judgments of experts and the general public have led to polarized views, controversy, and overt conflict between the experts and concerned citizens[5]. In order to explain and perhaps resolve these conflicts, one has to start by looking at the specific aspects that determine a person's perception of a risk.

Since the eighties, a lot of research has been done on factors that may determine risk perception. In most cases this was done through questionnaire-research; the research focusing on the extent to which a risk correlated with the judgment of various determinants of risk perception. It appeared that the extent to which people are familiar with the risk, and the controllability of a risky activity could influence people's risk perception.[6, 7] In the nineties, trust in the source of information was added to this list.[8]
But there are more aspects, and attempts have been made to group these various aspects, but so far, no agreement has been reached over a general classification. However, differences in the classifications are small, and each scientist names almost the same aspects or group of aspects.[4] Three main groups of aspects determining people's perception of a risk are:

- the technical aspects of a risk;
- the non-technical (more sociological) aspects of a risk;
- personal aspects of the person assessing the risk.

Peter Sandman and others have proposed the labels "hazard" and "outrage" to refer, respectively, to the technical and the non-technical aspects of risk. Using different vocabulary, many others have also noted and studied the importance of these aspects of risk perception.[1, 5, 9, 10, 11, 12, 13, 14]

To start with the experts; risk assessment experts (mainly) use *technical aspects* (i.e. specific risk information) to assess a risk; in general, they define risks in the language and procedures of science itself. When they calculate environmental health risks, they generally take the following steps: evaluating a substance's toxicity, assessing the exposure to people, and estimating the likelihood of harmful health effects, after which they arrive at a level of hazard (usually expressed in a statistical figure[6]). According to Peter Sandman the equation looks like this: [1]

RISK = HAZARD

The general public, in contrast, seems less aware of this quantitative or probabilistic nature of a risk, since they do not know all the technical details. This view about the general public is widely shared by technical experts, and is tacitly accepted by much research documenting the public's low "science literacy".[2, 3, 6, 13, 15] The public responds less to the magnitude of a risk (or the knowledge about magnitude as obtained from the media) than to broader, qualitative attributes of risk such as values, emotions, power relations and the need for action; all *non-technical aspects* of a risk. That is why Peter Sandman developed this alternative risk equation: [1]

RISK = HAZARD + OUTRAGE

This equation reflects the observation that an individual's perception or assessment of risk is based on a combination of hazard (e.g. mortality and morbidity statistics) and outrage factors. According to Peter Sandman, the "outrage factors" make up the (non-technical) aspects of risk that experts usually tend to ignore or fail to acknowledge. They include:

Voluntariness
People need and value choice. Risks from activities considered to be involuntary or coerced (e.g. exposure to chemicals) are judged to be greater, and therefore less readily accepted, than risks from activities that are seen to be voluntary (e.g. sunbathing).[6, 16]

Controllability
People feel better when they are in (supposed) control of a situation. This becomes clear in driving a car, where almost everybody prefers to sit behind the wheel because, behind the wheel, the driver feels to be in control of the situation.[4] Usually, risks from activities viewed as lacking control over, or under the control of, others (e.g. releases of toxic chemicals by industrial facilities) are judged to be greater, and are less readily accepted, than those from activities that appear to be under the control of the individual (e.g. driving a car). When prevention and mitigation are in the individual's hands, the perceived risk (though not the hazard) is much lower than when these are in the hands of a government agency.[1, 16]

Fairness
Risks from activities believed to be unfair or to involve unfair processes (e.g. inequities related to the siting of industrial facilities) are judged to be greater than risks from fair activities.[16]

Benefits
People who must endure greater risks than their neighbors and without access to greater benefits are naturally outraged. Risks from activities that seem to have unclear, questionable, or diffuse personal or economic benefits (e.g. waste disposal facilities) are judged to be greater than risks from activities that have clear benefits (e.g. jobs).[1, 16]

Personal stake
Risks from activities viewed by people to place them (or their families) personally and directly at risk (e.g. living near a waste disposal site) are judged to be greater than risks from activities that appear to pose no direct or personal threat (e.g. disposal of waste in remote areas).[16]

Memorability
A memorable accident makes the risk easier to imagine, and thus more risky. Nuclear radiation hazards, for example, are associated with the very memorable atomic bomb. A potent symbol can have the same effect[1, 6]

Delayed effects
Risks from activities that may have delayed effects (e.g. long latency periods between exposure and adverse health effects) are judged to be greater than risks from activities viewed as having immediate effects.[16]

Effects on children
Risks from activities that appear to put children specifically at risk (e.g. children or pregnant women exposed to radiation) are judged to be greater than risks from activities that do not.[16]

Effects on future generations
Risks from activities that seem to pose a threat to future generations (e.g. adverse genetic effects due to exposure to toxic chemicals) are judged to be greater than risks from activities that do not.[16]

Dread
Risks from activities that evoke fear, terror, or anxiety (e.g. exposure to cancer-causing agents) are judged to be greater than risks from activities that do not arouse such feelings or emotions (e.g. common colds). The long latency of most cancers and the undetectability of most carcinogens add to the dread.[1, 16]

Reversibility
Risks from activities considered to have potentially irreversible adverse effects (e.g. birth effects from exposure to a toxic substance) are judged to be greater than risks from activities considered to have reversible adverse effects.[16]

Natural versus human / technological origin
Risks generated by human action, failure or incompetence (e.g. industrial accidents caused by negligence, inadequate safeguards, or operator error) are judged to be greater than risks believed to be caused by nature or "Acts of God". Compare, for example, exposure to radon in building materials with exposure to geological radon. Also, hazards related to a technological source (e.g. power lines) generally raise more concern.[16]

Uncertainty
Uncertainty about who is at risk and disagreement among experts can provoke outrage. Risks from activities that are relatively unknown or that pose highly uncertain risks (e.g. risks from biotechnology and genetic engineering) are judged to be greater than risks from activities that appear to be relatively well-known to science (e.g. cigarette smoking).[6, 16]

Understanding
Poorly understood risks are judged to be greater than risks that are well understood or self-explanatory (such as slipping on ice).[16]

Familiarity
Risks from activities viewed as exotic, unfamiliar (such as from chemical leaks) are judged to be greater than risks from activities viewed as familiar (such as one's home, car and jar of peanut butter). Seeing people in protective "moonsuits" in the neighborhood gathering samples, for example, can be a source of commotion and fear, if the citizens in the community are not informed about this in advance.[1, 6, 16]

Media attention
When people assess threats, they (as experts) use risk information. This information, however, usually does not come from scientifically reliable sources, but from newspapers or television programs. These media generally give their own interpretation of risks.[4] Another aspect found was that risks from activities that receive considerable media coverage (e.g. leaks at chemical plants) are usually judged to be greater than risks from activities that generate little media attention (e.g. household accidents).[16]

Ethical / moral nature

Risks from activities believed to be ethically objectionable or morally wrong (e.g. forcing pollution-generating activities on an economically distressed community) are generally judged to be greater than risks from ethically neutral activities (e.g. side-effects of medication). Talking about cost-risk tradeoffs sounds very callous when the risk is morally relevant. Imagine a police chief insisting that an occasional child-molester is an "acceptable risk".[1, 16]

Trustworthiness of the sources

Risks from activities associated with individuals, institutions or organizations lacking in trust and credibility (e.g. industries with poor environmental track records) are judged to be greater than risks from activities associated with trustworthy and credible institutions (e.g. regulatory agencies that achieve high levels of compliance among regulated groups).[16]

Responsiveness of the process

Does the (local) government or agency handling the risk, tell the community what is going on before the real decisions are made, and does government respond to community concerns? People and organizations perceived as benefiting from a hazard, or as not having told the truth about it, are not readily trusted.[1, 6] Furthermore, as just mentioned, risks associated with these individuals or organizations lacking in trust, are generally judged to be greater than risks from activities associated with trustworthy individuals or organizations.

Diffusion in time and space, and chronic versus right here and now / catastrophic potential

Risks from activities viewed as having the potential to cause a significant number of deaths and injuries grouped in time and space (e.g. deaths and injuries resulting from a major industrial explosion) are judged to be greater than risks from activities that cause deaths and injuries that are scattered or random in time and space (e.g.car accidents). For example: hazard A kills 50 anonymous people a year across the country and hazard B has one chance in 10 of wiping out its neighborhood of 500 people sometime in the next decade. Risk assessment tells us the two have the same expected annual mortality: 50. "Outrage assessment" tells us A is probably acceptable and B certainly is not.[1, 16]

History of accidents

Risks from activities with a history of major accidents or frequent minor accidents (e.g. leaks at waste disposal facilities) generally evoke more outrage than risks from those with little or no such history (e.g. vaccinations).[16]

Victim identity
Risks from activities that produce identifiable victims (e.g. a child who falls down a well) are judged to be greater than risks from activities that produce statistical victims (e.g. statistical profiles of car accident victims).[16]

Outrage often takes on strong emotional overtones. It predisposes an individual to react emotionally (e.g. with fear or anger), which can, in turn, significantly amplify levels of worry. Outrage also tends to distort a hazard. But outrage factors not only distort hazard perception; they are also independent components of the risk in question, and accordingly, form an intrinsic part of what people mean by risk. They describe why people worry more about, for example, industrial emissions than aflatoxin in peanut butter.[1, 6, 16] In Peter Sandman's terminology, "hazard" is a function of risk magnitude and probability, while "outrage" is a function of whether people feel the authorities can be trusted or whether control over risk management is shared with affected communities, etcetera[2]. Supporters of this distinction argue that hazard and outrage are both components of risk deserving attention, and that lay-people have had as little success communicating what they consider significant about risks to the experts as the experts have had communicating to the public.[2]

As already mentioned, there is also a third group of aspects that can influence people's risk perception. These are *personal aspects* of the person assessing the risk– aspects such as gender, age, education, attitude, sensitivity, specific fears and one's natural tendency to avoid or seek risks.[8, 17, 18] For some of these aspects, the most influential way is not yet fully understood. However, one of the most consistent findings from research on people's perceptions of risk is that women express far greater concern than men with regard to a large number of health and environmental risks.[19] A study of the Canadian public found that women's perceptions of risk were higher than men's for thirty-seven out of thirty-eight risks studied (the lone exception being heart pacemakers). Surveys in the United States and France show strong gender differences, similar to surveys in Canada.[19] One hypothesis mentions that these differences in risk perception are due to a woman's lack of knowledge on and familiarity with science and technology, particularly with regard to nuclear and chemical hazards.[19] Women are discouraged from studying science and therefore there are relatively few women scientists and engineers. However, a study conducted by Barke et al. among men and women scientists found women physical scientists' judgement of risks from nuclear technologies as being higher than the judgement of men physical scientists.[19] These women certainly had no lack in knowledge[5] . Therefore, Barke et al. concluded that the differences in perceived risk between men and women have deep roots that are not readily eliminated by virtue of similar types and levels of scientific training. These roots extend into normative beliefs about how society should allocate risks and about assessments of society's capability for managing risks. Thus, the assumption that differences in risk perception between men and women are simply a byproduct of ignorance or irrationality is implausible.[19]

A second approach to explaining these gender differences in risk perception has been to focus on biological and social factors. For example, women have been characterized as being more

concerned about human health and safety because they give birth and are socialized to nurture and maintain life. They have been characterized as physically more vulnerable to violence, such as rape, and this may sensitize them to other risks. The combination of biology and social experience has been put forward as the source of a "different voice" that is distinct to women.[5]

Another aspect often found in risk perception literature is the suggestion that individual differences in people's tendency to take risks can influence people's judgment of risk and risk taking. Risk avoiders and risk takers focus on different aspects of information.[18] Their willingness to take risks, whether in personal life or in societal decisions, might affect their reactions to a specific risk.[20]

To summarize: risk assessment experts and the public tend to focus on different aspects of risk in order to assess it. Experts mainly focus on technical details of a risk while lay-people pay more attention to broader, qualitative attributes of a risk, and personal aspects may also play a role. (In addition: lay-people may also rely on different (technical) knowledge in their determination of the hazard than the risk assessment experts do). These different ways to assess a risk often result in differences in the perception of a risk. Differences in risk perception between those professionally judging a risk, on the one hand, and a concerned community affected by the risk on the other, turn out to be important obstacles in the communication of environmental health risks.[21] These differences sometimes lead to conflict, and according to some, these conflicts may result in less protection of health and the environment.[22] This raises the question if one can influence the way experts and lay-people view (and assess) a risk. And, if so, can this influence diminish the obstacles in the communication of risks, and thereby prevent conflicts? In a 2001 report, the Health Council of the Netherlands stated that knowledge on the way different aspects can influence risk perception can improve risk communication.[8] But first, let us first discuss the different notions on risk communication.

1.2 Risk communication

Risk communication as activity is as old as humankind itself. The cavewoman who growled a warning to her caveman about an approaching bear, was already practicing risk communication. However, interest in risk communication in Western countries only started to grow in the second half of the eighties. The fast industrialization after World War II has brought an enormous flow of new products and technologies. The downsides of the large-scale industrialization and technological developments, worldwide damage to the environment and an increase of mass destruction weapons, have been present since the sixties: At the same time, society has become much more complex, and trust in the government and corporations has been declining.[23] All these ingredients together explain why the interest in risk communication grew.

A critical, well-educated population is confronted with a growing number of threats in an increasingly complicated world, while trust in responsible authorities to control these threats is declining. Not only does society nowadays demand more explanations, it also wants to co-decide or even stop certain developments.[23] Governments and corporations come across more and more critical and people and have more trouble realizing their plans. In this constellation, for many stakeholders, risk communication is a way to a solution. Responsible authorities and industrial companies see opportunities in risk communication to overcome opposition and to restore trust, and citizens and critical non-governmental organizations see risk communication as a means to gain more influence.[23] Considering the differences in the way risk assessment experts (usually engaged by authorities and corporations) and the general public assess risks (as discussed in the previous section), risk communication could therefore be a used as an instrument to bridge the differences between the scientific perspective and the social perspective.[8]

The first formal definitions of risk communication were formed in the second part of the eighties. One of the first to give a definition was Covello et al.: "any purposeful exchange of scientific information between interested parties regarding health or environmental risks"[23, 24]. Later on, this and somewhat similar definitions were highly criticized. The critique mainly focused on the emphasis of the scientific information and the (one-way) information flow from experts to lay-people (though the definition of Covello was quite progressive for its time in using the words "exchange of information" instead of underlining the one-way information flow). Other definitions have tried to overcome this, as with the (often cited) definition of the US National Research Council: "Risk communication is an interactive process of exchange of information and opinion among individuals, groups and institutions. It involves multiple messages about the nature of risk and other messages, not strictly about risk, that express concerns, opinions, or reactions to risk messages or to legal and institutional arrangements for risk management." [25] This definition gives more room to the non-scientific expressions of information and strongly emphasizes interaction. This emphasis points out an important difference between two groups regarding their opinions concerning risk communication. These two groups are what Woudenberg calls: the education-camp and the interaction-camp.[23]

The education-camp see risk communication mainly as a means for simplifying complicated technical information in order to distribute this simplified information to lay-people.[23] The idea behind this is that concerns occur due to misunderstandings and lack of insight, and that if one would only explain something clearly enough to the public, people will come to a conclusion about an environmental threat by themselves.[8, 23]

On the other hand, the second or interaction-camp, see risk communication as an instrument in a power conflict. In this approach, there is a imbalance of power, because a government or a company has the means, the knowledge and the information to get a certain situation or technology accepted. The problem is not (solely) that threatened parties do not understand the information, but that they are not given the possibility to (fully) take part in the decision-

making process.[23] In this view, risk communication is a process of participation and interaction between stakeholders, focused on the promotion of mutual understanding and trust.[8]

These two camps have their own share of ardent supporters. But the soup is not always eaten as hot as these two camps may serve it. The distinction between "educating" and "power sharing" is not only based on personal preference, but also on the type of activity and the specific stage the activity is in.[23]

1.3 The effects of technical detail and outrage

This section continues with an outline of the current scientific knowledge about the possible effects of technical detail and outrage on risk perception. A concept often found in the literature, focuses on the statement (sometimes made by risk assessment experts) that the public simply does not know all the technical information, and that it is fueling the controversies. The right risk communication approach would therefore be to educate the public about the toxicity, exposure routes, and health effects of chemicals. Controversies about risks can (according to this view) be avoided by communicating technical information more effectively, especially via the mass media.[2] This approach shows strong resemblance to Woudenberg's education-camp.

However, Allan Mazur has argued that the more people see or hear about the risks of a technology, e.g. as measured in overall media coverage of the topic, the more concerned they will become.[26] This effect, he suggested, would occur whether the coverage was positive or negative; the mere mention of risks, well-managed or poorly managed, was enough to make the risks more memorable and thus increase public estimates of risk. The same effect might occur when technical information appears in a single news story, if readers construed the inclusion of such information as a signal that the issue deserves considerable attention and concern. This signal would be all the stronger because technical information is not a common attribute of most news stories.[22] Alternatively, inclusion of technical jargon could be interpreted as an attempt to hide something, justifying and provoking extra concern. Some studies contradicted Mazur's thesis for effects of overall media coverage; other hypotheses have not been tested.[22, 27]

Yet another possibility is that technical content might interact with other attributes of the news story to affect risk perceptions. For example, technical detail might make a story more credible, hence a frightening story, scarier and a calming story, more reassuring.[22] One test of this hypothesis found no such interaction, and no direct effect of technical detail on readers' alarm or comfort.[27]

Clearly, there are several, potentially contradictory, plausible effects of technical information on risk perception. In addition, there are several possible kinds of technical information that might exert these effects.[22] Officials and experts who call for public education rarely specify

which kind of data they expect to work and may not know themselves how to proceed. However, it is difficult to imagine circumstances under which officials would fail to tell the public about potential exposure routes and health effects of chemicals involved in an environmental spill, for example. So, the pertinent comparison is not between zero and some, but between some and more (or different) information.[22]

A competing concept maintains that the public responds less to the seriousness of a risk (or its knowledge about seriousness, as obtained from the media) than to such factors as trust, control and fairness (outrage factors).[2] According to this view the solution to conflict is to address citizen's concerns.[3] This approach does show some resemblance to Woudenberg's interaction-camp; however, the emphasis of this approach, as presented in a number of publications, is not necessarily on the actual sharing of power to make decisions about the risk, as it is with the interaction-camp. According to this theory, the solution is implicit in the re-framing of the problem. Since the public responds more to outrage than to hazard, risk managers must work to make serious hazards more outrageous (e.g. a campaign to increase public concern about second-hand cigarette smoke by feeding the outrage), and modest hazards less outrageous. When people are treated with fairness, honesty and respect, they are a lot less likely to misperceive small hazards. At that point risk communication can help explain the hazard. But when people are not treated with fairness and honesty and respect, there is little risk communication can do to keep them from raising hell, regardless of the extent of the hazard.[1] However, there is a peculiar paradox here. Many risk managers resist the pressure to consider outrage in making (risk) management decisions; they insist that "the data" alone, not the "irrational" public, should determine policy.[1]

If one tried to use risk communication as a means to bridge the differences between the perspective of risk assessment experts and the perspective of lay-people, which of these two theories would be more effective: giving the people more technical details on the risk or focusing on the outrage factors? A research institute such as the National Institute for Public Health and the Environment (RIVM) is always expected to report faster, more accurately and more detailed. Next to this, there seems to be a decreasing tendency to accept the consequences of accidents or disasters and a growing inclination to point out the culprit. Therefore one can ask oneself how research results should best be reported to the concerned public.[3] When citizens see officials as sensitive to their concerns about environmental problems, do public concerns about risk decrease? What happens when government staff do not respect public concerns? Do public responses change if they provide more detailed technical information about the problem? [20] These questions prompted a study: 1) to examine ways to manipulate the outrage and amount of technical detail in risk communication and 2) to study the effects of these manipulations (if any) on people's risk perception.

1.4 This study

Except for Sandman's experiments (which will be discussed in the next chapter), the predominant strategy in much research on risk perception has been to ask people to rate the risk of an assortment of hazards, and then to rate the same hazards on several other attributes thought by the investigators to be related to risk perception. Statistical analysis of the ratings then reveals the relationships between risk perception and the risk attributes under investigation. However, this strategy holds several disadvantages. The methodology omits the social context in which risk judgements are made, although we know that judgements about risk in the abstract can be very different from judgements about specific, personally relevant risk situations. Furthermore, when large numbers of risk ratings are factor-analyzed much can be learned about the sources of risk perception, but the imputation of causality is unjustified. And finally, some factors in risk perception, including important outrage variables, are so tied to situations that they simply can not be studied from lists of hazards.[2] Not only for this reason and the fact that outrage factors are not only characteristics of the hazard itself, but also, for example, because of an agency's or company's approach to managing the hazard, most of the outrage factors have been difficult to study via the above-mentioned methodology.

Ideally, one would study risk perception in an experimental field situation. However, due to practical and ethical restrictions, experimental studies in real situations (in which one part of the community is involved in the process of risk communication and the other part is not involved, for example) are not possible.[8] Furthermore, one can not experimentally manipulate the attributes of existing hazardous substances, activities and technologies. Ethics and logistics prevent exposing people to hazards varied systematically by attribute, alternatively, communities facing environmental problems cooperate by changing one (outrage) attribute at a time. Simulation is one way to take advantage of the inferential power provided by experimental research to study situational variables.[2]

The goal of the study presented in this thesis is to determine what factors may determine people's risk perception; how one can best (effectively) manipulate outrage and technical detail in risk communication and what type of risks are best suited for these manipulations. The effects of these manipulations (if any) on people's risk perception are also examined.

In the study an effort was made to create hypothetical hazard situations realistic enough to elicit risk judgements like those that would occur with actual hazards. The participants were asked to read four fictional stories and to imagine that the stories had appeared in their local newspapers and that their own community was faced with the situation described. After reading each story, participants are asked to fill in a questionnaire, measuring their perception of the risk described. The study uses a news story format because the mass media are widely used by officials to disseminate environmental information.[2]

The stories have been manipulated both on outrage factors and technical detail. By manipulating some of the outrage factors, the effect of outrage on risk perception can be studied. It is expected that people who read the high outrage version of a story perceive the risk as more serious than the people with the low outrage version. By manipulating the volume of technical details (for example, the details given on exposure routes and health effects), the story's effect on people's risk perception can be studied. As mentioned, technical detail might make a story more credible, hence a frightening story scarier and a calming story more reassuring.[22] Therefore, the specific effect of technical detail on people's risk perception may differ for different types of risk.

The hypotheses to be tested in this study:

I. People who are confronted with more technical details about the risk in the study story react differently to the same risk than people who are confronted with fewer technical details about the risk. (the specific way in which this may occur will be examined).
II. When people are confronted with more outrage in the study story, they will perceive the risk as being more serious (i.e. their perception will increase) than people who are confronted with less outrage in the study story.

The next chapter mentions previous studies performed to determine factors influencing people's risk perception. The third chapter discusses the analytical and statistical methods and materials used in this study. Chapter 4 shows the results of the study. Chapter 5 comprises a discussion of the implications of these results, and a comparison with other studies is made. Recommendations for future studies on this topic are given and the conclusions that can be drawn based on the results of this study are also listed in this chapter.

2. Previous studies

In this chapter, previous experimental studies performed to determine factors influencing people's risk perception will be discussed. These studies will then be compared with the present study.

Peter Sandman et al. have conducted three experimental studies employing fictional news stories to compare the effects on reader risk perceptions of two situations: 1) one in which agency communication behaviour was reported to be responsive to citizens' risk concerns and 2) one in which the agency was reported to be unresponsive.[2] Beyond this study, there are hardly any empirical research studies reported on the potential influence of the outrage and hazard components of risk on public responses.

Two mock newspaper stories were written by Sandman's group for the *first experiment*, each with two versions. One story dealt with barrels of (used) chemicals dumped in a community, while the other dealt with plans to build a hazardous waste incinerator. In each case a government agency rather than a corporation was responsible for dealing with the issue. Among the factors varied in the fictional news stories were agency secretiveness / openness, acknowledging that there was some small risk, and respect for community concerns. However, both versions of each story had the same information about the risk itself.[2] Subjects, recruited door-to-door, were asked to read the two stories (one on the "barrels" and one on the "incinerator") . They were then to send back the questionnaire (measuring their perception of the risk described) within a day or two in the stamped envelope, addressed to the Rutgers University, which had been handed to them with the two stories. With 86 people participating in the study, the net response rate was 59%.[2]

Although the outrage manipulation produced significantly different perceptions of agency trustworthiness and secrecy (P's .0001) in the story about the barrels as intended, the experiment had only a weak outrage effect on risk perception (perceived seriousness) for the "barrels" story ($P < .08$) and none for the "incinerator" story (in which the outrage manipulation had not appeared to be effective). The researchers concluded that a stronger manipulation of trust and secrecy might have had more impact on risk perception. Another possibility, they suggested, was that subjects had adopted an atypically rational orientation to the task, looking back at the articles and noting only the sentences directly relevant to the risk. Both of these possibilities were addressed following the design used in their second experiment.[2]

For the *second experiment*, only a revision of the "barrels" story from the first experiment was used. The outrage manipulation was made stronger. Story versions now included two kinds of reported behavior: 1) that of the agency spokesperson and 2) that of neighborhood residents.[2] The key change in procedure was that for this experiment, subjects were no longer permitted to review the story when answering the questions and were also asked to

complete the questionnaire on the spot instead of returning it by mail. Again participants were recruited door-to-door; 156 New Jersey residents participated.

In this experiment the outrage manipulation had a powerful impact on subject's risk perception (.0001); when the agency was depicted as being untrustworthy and secretive, and the community as outraged, subjects rated the risk much more seriously and their responses to the risk as being much more frightened. Despite identical technical information about the risk, "outrageous" agency behavior and an outraged community strongly influenced perceived risk. It is of course possible that in the high outrage condition, readers were less inclined to believe the technical information provided by the agency than readers in the low outrage condition.[2]

In the *third experiment*, participants were asked to read a story about a chemical spill caused by lightning in a storage tank. Part of the released substance (which, in high concentrations, can cause health problems) may or may not have entered gardens and water wells of neighborhood residents. Residents were interviewed about the way local authorities were dealing with the situation.

To clarify the impact of the outrage manipulation, three experimental variables were manipulated. The seriousness manipulation varied the estimated toxicity of the released substance, the estimated exposures resulting from the spill, and the number of people exposed. The outrage manipulation was (according to the researchers) more extreme than in the first experiment, but much less extreme than in the second. As in the second experiment on reported community outrage, not just the agency spokesperson's behavior was manipulated, but the manipulations were also less extreme.[22] The technical detail manipulation consisted of adding several paragraphs of information on exposure pathways and toxicological studies, absent in the low-technical detail condition and present in the high-technical detail condition.[2]

The questionnaire contained 13 questions; comprising 7 questions about people's risk aversion and some demographics, and 6 questions about the story. One manipulation check was used for each of the three experimental variables, and all questions were 6-point Likert-type items, with a 7th option of "no opinion". For the design, five stories were used. Both outrage and technical detail were varied in high and low versions, while keeping magnitude low. This provided four different stories. A fifth story combined high magnitude with low outrage and low detail.[22]

Subjects were again recruited door-to-door (88% response from 676 contacts). Half of the subjects received the story first, then a six-item survey instrument, and finally a risk aversion / demographic questionnaire. The other half first received the questionnaire, then the story, and, finally, the survey instrument.[22] No order effects were found.[2] All subjects were asked to return the story before receiving the survey so as to avoid any rereading of the story in search of "correct" answers.[22]

Results indicated that the technical detail manipulation did not significantly affect any dependent measure, including perceived risk. There was also no effect of the technical detail manipulation on the manipulation check "perceived detail".[22] However, perceived detail significantly correlated with the perceived appropriateness of agency behavior ($P < .0001$). It also was affected by the outrage manipulation. People who read high outrage stories saw them as containing much less detail ($P < .01$) than did those who read low outrage stories.[22] Perhaps people concluded that proper agency behaviour on other points would imply sufficiently detailed information, though the direction of causation here is speculative, since the research design could not assess temporal priority of variables.[22]

The outrage manipulation significantly affected affective and cognitive components of perceived risk. Subjects who read high outrage news stories saw agency behavior as much less appropriate than subjects who read low outrage stories; the difference was more than one scale point on the 6-point scale, significant at $P < .0001$. Furthermore, outrage had a significant effect on perceived risk ($P < .01$). Subjects who read high outrage stories saw the risk as more important, serious and worrisome than did those who read low outrage stories.[2] However, Sandman et al. found that certain factors such as education, gender and risk aversion (all factors beyond the control of the agency or corporate communicator) are, in fact, strong predictors of risk perception.[2]

In conclusion, of all the three variables examined in these experiments, outrage was the most powerful in its impact on risk perception. Studies suggest that an agency or company that deals responsively, openly, and respectfully, with concerned citizens, and succeeds in avoiding hostile public reactions, is likely to reduce risk perceptions by doing so, much more than by providing technical information or even by reducing the technical risk by several orders of magnitude.[2] Nonetheless, the analysis in the third experiment shows that outrage is a significant, but by no means a strong predictor of risk perception. All the factors assessed in this research together accounted for relatively small percentages of the variance in perceived risk. Clearly, many other factors, as yet unknown, are at work.[2]

The study presented in this thesis is, to a certain extent, an elaboration on Sandman's three experiments. As mentioned in the first chapter, this study will test four different types of risk to see which type of risk is best suited to manipulate. In order to check the effectiveness of the technical detail and outrage manipulation, a total of eight questions will be asked to measure this (Sandman only used one variable per manipulation to measure effectiveness).

Participants' perception of a risk, will also be measured with several questions and their (dis)agreement on four statements. Another aspect examined in this study was to see if the volume of technical details and outrage given in a newspaper article affect the acceptability of the risk described. This was not measured in Sandman's study. Furthermore, in the present study, people's tendency to take or avoid risks will be measured by the two methods Sandman used; however, another method measuring risk taking tendency was also added to the questionnaire. Other potential confounders, such as previous familiarity with the risk

described, will also be measured in this study. As mentioned above, in his first experiment Sandman asked his participants to indicate which of twelve suggested emotions they felt. In his second experiment, Sandman only used six of the initial twelve emotions, and for the third experiment, the emotion checklist was not used. In this study, all twelve emotions, initially used by Sandman, are listed. However, participants were not asked to choose some of the emotions but to rate all twelve on a 7-point Likert scale in terms of how much they think they would experience them if placed in the situation described in the story.

The analytical and statistical methods and materials used in this study will be further discussed in the next chapter.

3. Methods

This chapter describes the analytical and statistical methods and materials used in this study, beginning with a short description of the participants entering the study and the procedures used to carry out the study (section 3.1). The manipulations will then be discussed (section 3.2), followed by descriptions of the four fictional newspaper stories used in this study (section 3.3). In section 3.4, the questionnaire used to measure people's impressions of the risk is discussed and the chapter ends with section 3.5, in which the potential confounders / covariates taken into account are listed.

3.1 Subjects and procedures

Local community groups (brass bands, choirs, carnival groups) were approached by e-mail, which was sent to the contact mentioned on the group's Internet site. The groups were asked if they were interested in participating in a University of Maastricht study on risk perception. In the e-mail, the study was briefly explained and the token amount of €5.00 for each participant as a thank-you for their help was mentioned. The standard introductory e-mail that was sent to the groups can be found in Appendix 1.

Groups replying that they were interested in participating were then visited at one of their rehearsal / training sessions, during which the whole group entered the study.[*] Before handing out the study packages containing the four stories and the questionnaire (see sections 3.3 and 3.4, respectively), some instructions were given. Participants were told that the aim of the study was to investigate people's first impression of a risk as mentioned in a newspaper article, after which the order in which the study package had been built up was shortly explained. Participants were specifically asked not to look back at the article while answering the questions. This was to prevent subjects from re-reading the story in search of the "right" answers. It was therefore specifically stated that "we are interested in the first impression of the article, and that there are no right nor wrong answers to give". And that, "although it might be intriguing to compare one's answers with the ones your neighbor is giving, chances are that he or she has been handed a study package that is slightly different from the one you have been given". "These differences are important for the study, so please do not compare and discuss your answers before you have returned your questionnaire, since that might affect the study results."

Participants were asked to sign an informed consent, stating that they were not in any way being pressured into participating in the study, and that they were aware of the fact that they

[*] At the end of the data-collecting period, a total of nine groups had participated in the study. The groups were all local community groups, ranging from brass bands and choirs to a women's recreational club. All groups (with mostly indigenous members) came from relatively small towns located in the south-eastern part of the Netherlands (Limburg), namely: Brunssum, Doenrade, Nuth, Sittard, and Wijnandsrade.

can end the experiment at any time, without giving grounds for doing so. They were also told that for every completely filled-in questionnaire, the University of Maastricht would donate €5.00 their participating group. Before handing out the study packages, the signed informed consent forms were collected to guarantee anonymity. The informed consent form used in this study can be found in Appendix 2.

After all participants had handed back their study packages, the number of completely answered questionnaires was counted, and the participant rewards were paid into the group's joint account. Data collection took place between December 2002 and February 2003. At the end of the data-collecting period, 192 people had participated in the study. The (estimated) average time it took a person to participate in the study was about 45 minutes.

Pre-stratification procedure

Pre-stratification (dividing people into strata based on certain specifics, before randomization) occurred on a gender basis. There are four study groups: each group consisting of 24 males and 24 females, making the total number of study participants 192 (96 males, 96 females). The decision to pre-stratify was made on the basis of the expected strong effect gender would have. This is also why gender will be entered into the model as a dependent variable during the statistical analyses (see chapter 4). Before handing out the study packages, two piles were made: one for the men and one for the women. Each pile consisted of all four types of study packages (see section 3.3). After pre-stratification, participants were randomly assigned to one of the four study groups by giving the upper study package from the specific pile. Each study group received the stories in the same order (also see Table 3.2 of section 3.3).

After all nine participating community groups were visited, a total of 187 people had participated in the study. To balance the study design (i.e. 24 men and 24 women in each study group), five more men were added to the study. These five individuals were recruited at a social function.

3.2 Manipulation

Four fictional newspaper stories were written for this study and since each story was manipulated on both outrage factors and amount of technical (risk) detail, four versions were made of each story (see Table 3.1).

Table 3.1: The four story versions

Version	*Outrage*	*Technical details*
1	Low	Low
2	Low	High
3	High	Low
4	High	High

By manipulating some of the *outrage factors*, we can study the effect of outrage on risk perception. It is expected that subjects who read the high outrage version of a story perceive the risk as more serious and the behavior of the person (or agency) managing the risk as less appropriate than subjects who read the low outrage version. Among the factors varied in the fictional news stories are degree of agency openness, respect for community concerns, and promptness and completeness in releasing risk information. Furthermore, the community's reported response (angry, suspicious and frightened or grateful, trusting and calm) was also varied. This response was expressed in the stories using "person-in-the-street" reactions to the risk. These reactions to government statements are typical of news stories on environmental health issues.[2]

By manipulating *technical detail* (relatively high on details versus relatively low on details), the effect of the amount of detail given on people's risk perception can be studied. It is possible that subjects who read the highly technical detailed version of a story somehow feel comforted in knowing those details, and therefore perceive the risk as being less serious. It could also be argued that people will be scared off by "all that technical stuff" and therefore perceive the risk as more serious. This is the manipulation variable that an agency might have more control over; some outrage factors are more or less beyond the control of an agency (e.g. the origin of the risk).

3.3 The stories

All subjects received the four stories in the same order. Only the version of the stories they read was varied. Real newspaper stories about the environment carry relatively little technical information (compared to an information brochure, for example).[22] But three of the four stories used in this study were based on real newspaper articles, so the highly detailed stories in this study gave no more details than plausible for highly detailed news stories in real newspapers.[28-36] The other story was based on the storyline that Sandman et al.[2] used in their study (see chapter 2 about previous studies as well).

Story topics were carefully selected to make sure all the stories discussed different types of environmental health risks. The first story deals with the possible association between power (transmission) lines and childhood leukemia, while the second focuses on a spill at a chemical plant called Chemilak and the resulting response by local authorities. The third story is about a toxin (DON) produced by fungi that may occur in various cereal crops and can cause growth reduction in children, while the last story deals with nuisance and possible health effects brought on by the odor of local manure.

After creating the four stories, the story about the powerlines seemed, intuitively, the best, i.e. the one with the strongest manipulation. Since this story might therefore be the most effective in this study, it was decided that participants would be given this story first. While reading

the first story, there were no carry-over effects, which might be expected while reading the second, third or fourth story.

Each subject was assigned to one of the four study groups (A, B, C and D) and was given the four stories to read (one version per story). See Table 3.2.

Table 3.2: Study design

Study group	*Power lines*	*Chemilak*	*DON*	*Manure silo*
A	1	2	3	4
B	2	3	4	1
C	3	4	1	2
D	4	1	2	3

1 = low outrage + low technical detail; 2 = low outrage + high technical detail;
3 = high outrage + low technical detail; 4 = high outrage + high technical detail.

Participants were asked to imagine that the stories had appeared in their local newspapers, and that they were faced with the situations described. The stories were presented in narrow newspaper columns and emulated newspaper writing style.

3.3.1 Outline of the four stories

Story 1: Possible association between power (transmission) lines and leukemia
As mentioned, the first article deals with the possible association between power (transmission) lines and childhood leukemia. In the story, a British scientist claims to have found evidence that children living nearby power pylons have an increased risk of leukemia. The article continues by mentioning that a couple of months ago, three children, all living in the small Dutch town of Roterdalen, were diagnosed with leukemia. Concerned residents suspected an association with the power lines in their town. City councilor Pastersen is asked for comments. Table 3.3 shows three paragraphs of this story: the “low outrage, low technical detail” condition and the “high outrage, high technical detail” condition. A full format of this story and the four story versions are included in Appendices 3 and 4.

Table 3.3: Passages of version 1 (low outrage + low technical detail) and version 4 (high outrage + high technical detail) for the story about the possible association between power lines and leukemia

Low outrage + low technical detail	High outrage + high technical detail
"Possible association between power lines and cancer" - from our correspondent - … Leukemia may occur at any age and is a type of blood cancer. … Authorities in Roterdalen ordered an investigation after three cases of childhood leukemia had occurred in the town. At the time, concerned local residents suspected an association between the cases and the power lines running through the city. Recently, the results of this study were made public. City councilor Mr. Pastersen: "For the Dutch situation, it is roughly estimated that, at the most once every ten years, an additional case of leukemia mortality will occur among a child living near a power pylon. Please take this number with a pinch of salt, but it at least gives you an idea of the magnitude of the effect we are talking about. Apart from this, the three children in our community fortunately seem to be responding to the chemotherapy."	**"Association between power lines and cancer found"** - from our correspondent - … Leukemia may occur at any age and is a type of blood cancer. This means that there is a tumor, caused by a certain type of cells in the blood: the white blood cells. With leukemia, these white blood cells multiply uncontrolled. This disrupts the normal composition of the blood. … Authorities in Roterdalen have always dismissed a possible association between the three childhood leukemia cases and the powerlines in the town. They refer to a study stating that, for the Dutch situation, one additional mortality case of leukemia occurs , at the most once every ten years, among children living near a power pylon. "Those three incidental cases are no reason to get upset. Besides, it would be highly unlikely. Surely that one extra child would not just happen to die in our little town?", states a matter-of fact city councilor, Mr. Pastersen, in Roterdalen.

Story 2: Possibility of chemical substance occurring in local gardens due to leakage from a Chemilak tank

The second story participants were asked to read was about a chemical spill caused by lightning in a storage tank. Part of the released substance (which in high concentrations can cause health problems) may have entered gardens of local residents; therefore Gerard Vangart, a spokesperson for the local authorities, advised residents to keep children and pets

out of the mud puddles until the water had evaporated. Local residents were interviewed about the way authorities were dealing with the situation. This story is loosely based on the storyline that Sandman et al.[2] had used for their third experiment (see chapter 2 on previous studies).

Story 3: DON in bread
The third story is about the toxin DON (Deoxynivalenol) which is produced by fungi that may occur in various cereal crops. A recent study by the RIVM indicates that especially young children can exceed the tolerable daily intake, which can lead to a stagnation in growth.[35] During the processing of cereal in bread and other food products, DON is hardly broken down. Indeed, the fungus disappears, but the toxin does not. However if, after intensifying inspection on cereal storage and adaptation of cultivation techniques, the standard is still exceeded, RIVM investigators still recommend to keep feeding the risk group (toddlers) cereals and bread. Health damage caused by DON is probably negligible compared to the damage caused by avoiding a daily dose of cereals.

Story 4: Health complaints caused by manure
The last story is about farmer Maars, whose neighbors are annoyed by his manure silo. Maars placed the silo on his property to make some money by spreading manure from farmers dealing with surplus elsewhere in the Netherlands. His neighbors are complaining about the smell, and experience some health effects they ascribe to the nuisance. Maars states that his manure does not stink. The town council does not take action against the farmer, because, according to the town council, Maars meets governmental requirements. However, the town council did record the complaints in some cases. Neighbors decided to sue Maars, and last month, the court ordered in summary proceedings that Maars had built his silo unlawfully, and ordered him to compensate the damages. Maars immediately stated that he would lodge an appeal. This appeal is due to come up in court on December 15th.

Further information about the four stories and their four (manipulation) versions can be found in Appendices 3-7.

3.4 The instrument

The questionnaire included 119 questions. Most were 7-point Likert-type items. Participants were asked for their gender, date of birth, highest level of education and whether or not they have children (see Appendix 8). Before reading the first story, they were also asked to give their opinion on some statements, measuring their risk aversion (see also section 3.5 on the potential cofounders taken into consideration).

A list of questions concerning the described risk was given out after reading each story. First, the two manipulations were checked, followed by questions about the perception of the risk and the consequences people assigned the described risk. After that, there were some general questions about the risk (e.g. whether or not people were familiar with the described risk

beforehand, and some story-specific questions. See Table 3.4 for a format of the questionnaire.

Table 3.4: The questionnaire format used with each story

Technical detail manipulation check – How accurate is the information in the story about the possible health effects and the grounds for these effects? – How detailed is the information in the story about the possible health effects and the grounds for these effects? – How detailed is the information in the story about the ways people might be exposed to the risk?
Outrage manipulation check – What do you think of the way the spokesperson / company / city council dealt with the situation? – Did the spokesperson come across as trustworthy? – Were the citizens rightfully worried? – How much trust do you have in the spokesperson / company / city council's approach of the situation? – Do you think that information is being withheld?
Perceived risk – What is your impression of the seriousness of the situation described? – How worried would you be if you were in the same situation as described? – How large would you say is the chance of developing health effects due to the described risk? – Do you find the risk described scary? – Do you find the risk described to be voluntary or involuntary? – Do you think the risk is controllable? – Do you think people are clearly in danger from the described risk?
Consequences – Do you find the described risk reasonable? – Do you find the described risk acceptable for the community?
Residual variables – Do you find the text used in the newspaper article comprehensible? – Do you find the scientific information clearly described? – Were you already familiar with the described risk, or did you first read about it today? – Do you think that, based on what you just read, the risk is thoroughly investigated / dealt with? – Do you think that science at this moment gives clear answers to the questions brought on by the described risk?

Story-specific questions

- Does Doll's study clearly ascertain an association between powerlines and leukemia? (story 1)
- Should Chemilak be shut down? (story 2)
- Do you consider Dutch bread safe for consumption? (story 3)
- Should children eat less bread? (story 3)
- Should the farmer cancel his activities? (story 4)

The risk target (i.e. the potential "victim" of the risk) is of paramount importance in risk studies, yet, in many risk perception studies the target is not explicitly spelled out. This means that those studies probably miss out on the need to understand perceived personal risk, and introduces some uncertainty as to what target they actually do study.[17] People do not make the same estimate when they rate the risk placed upon themselves, their family, or people in general. Therefore, when studying risk perception, it is important to clearly state what it is you want the subject's opinion of.[17] In this study, people will be asked specifically to give their perception of the risk, considering themselves as potential victims of the risk. Except for the third story, in which the described risk only seems to put children in potential danger, people in this part of the questionnaire are asked to give their perception of the risk concerning small children.

As mentioned before, outrage can take on strong emotional overtones. To measure this effect, twelve different kinds of emotions were listed, and participants were asked to indicate to what extent they expected themselves to go through these emotions if they had to face the situation described in the article. The emotions they were asked to rate were anger, helplessness, fright, alarm, concern, confusion, annoyance, safety, carefree feeling, relief, indifference and pleasure.
Furthermore, after each story, four interview clippings were cited with possible reactions from people as they could have been given in an interview about the risk described in the newspaper article. Participants were asked to indicate for each interview clipping how much they shared the reaction described. Table 3.5 shows the interview clippings, where the same clippings were used for each story.

At the end of the study (after reading all four stories and answering the questions concerning those stories), three more questions followed. First, participants were asked to compare the four risks they had just read about, and to rank them from 1 (for the most worrisome risk) to 4 (for the least worrisome risk). Secondly, participants were asked to imagine a scale from one to hundred. Participants were then asked which of the four risks they would place highest on the scale, no. 100 being the largest risk, and which risk they would place on the bottom of the scale, no. 1 being the smallest risk. For the third question, participants had to assign the two remaining risks on the scale from 2 to 99 to the figure that they thought best indicated the magnitude of that risk, taking into account the two risks placed on the scale in the previous question.

Table 3.5: Interview clippings used in questionnaire for each story

1	*"Oh no, I am not at all worried about this risk. Please! If I had to worry about that…! I have much better things to do! Besides, chances of getting sick because of that, are so small."*
2	*"Hmm, well what should I say about that. Sure, chances are very small, but despite all that, I am not really comfortable with it."*
3	*"I don't like it, I mean… come on, this risk isn't just anything? Frankly, I am quite scared; imagine that you would really end up getting sick…."*
4	*"Yes, well I am very worried about this. We are talking about a very big risk, here. Seriously… I am greatly concerned about the effects this risk can cause."*

Before the start of the study, the study package (which includes four stories and the questionnaire) was first pre-tested by six people (of different gender, age and education). This resulted in some small alterations (i.e. the rephrasing of the last two questions in the questionnaire). For the complete questionnaire go to appendix 8.

3.5 Potential confounders taken into account

As mentioned, the participants also answered questions about some personal attributes that might affect their reactions to these stories. Their willingness to take risks, whether in personal life or in societal decisions, might affect their reactions. As in Sandman's study (see chapter 2 too on previous studies), two dimensions of risk aversion were assessed using the same two items for each dimension.[2] Each item consisted of a statement about an environmental risk with which subjects were asked to rate their agreement or disagreement on 7-point Likert-type scales. Choices ranged from 1 = "totally disagree"; 7 = "totally agree". A risk aversion score was derived for each dimension by calculating the average score for the two items measuring that dimension. They were asked how much they agreed, for example, with the statements, "The public has the right to demand zero pollution from industry" (societal) and " I try to avoid all food additives and preservatives" (personal).[22]

Next to this, the Risk Scale, developed by Lion, was used to determine whether the participant tended to be a thrill-seeker or a risk-avoider.[18] The Risk Scale was developed to measure the general tendency to take risks.[18] The scale consists of seven items, created to tap different aspects of risk taking. In its original form, the items were rated on nine-point scales,

but for the uniformity of this study questionnaire, a seven-point Likert scale is used. The scale ranges from 1 = “totally disagree”; 7 = “totally agree”, except for the last item, which ranges from 1 = “risk avoider”; 7 = “risk seeker”. The seven items are: “Safety first; I do not take risks with my health; I prefer to avoid risks; I take risks regularly; I really dislike not knowing what is going to happen; I usually view risks as a challenge” and “I view myself as a risk avoider / risk seeker”.

Questions were also asked about personal aspects: people’s gender (see section 1.1), age, education, whether or not they had children and whether or not they were already familiar with the risk described.

The statistical analyses were performed using SPSS 11.0. Analyses of variance in the data was done for each story separately using the (fixed) variables for outrage (high or low), technical detail (high or low) and gender. The purpose of analysis of variance is to test differences in means (for groups or variables) for statistical significance. This is accomplished by analysing the variance, that is, by partitioning the total variance into the component that is due to true random error (i.e. within-group variability) and the components due to differences between means (i.e. the between-groups variability). These latter variance components are then tested for statistical significance, and, if significant, the null hypothesis (that there are no mean differences between groups or treatments in the population), is rejected, and the alternative hypothesis that the means (in the population) are different from each other, is accepted.

Analyses were performed for each question separately. The idea of combining answers (to scales) for the statistical analyses was initially considered, but was decided against since one of the goals of this study is to gain insight into how one could best (effectively) manipulate outrage and technical detail in risk communication. In order to do so, the different aspects manipulated for this purpose need to be individually examined on their effectiveness, to see what specific part of the manipulation was effective and what not. Also note that outrage is, in fact, a cluster of related (and perhaps not so closely related) variables. The questions measuring the effectiveness of the manipulated outrage factors can not all be combined into one single scale, since these questions may range from (for example) expressions of anger to expressions of fear.

4. Results

This chapter shows the results of the study. Certain descriptives of the study population are presented first (section 4.1). This is followed by the results of checking the effectiveness of the technical detail manipulation and the outrage manipulation of each story, which are extensively presented in section 4.2 and section 4.3, respectively, since one goal of this study was to examine how one can best (effectively) manipulate outrage and technical detail in risk communication.

Based on these results, the story (i.e. type of risk) most effective in terms of both types of manipulations, will be selected for further analyses to see if the manipulations and the covariates have influenced people's perception of the risk (section 4.4) and the acceptability of the risk (section 4.5). Sections 4.6 and 4.7 show the results of analyses on the variables measured by the emotion checklist and the interview clippings.

4.1 Certain descriptives of the study population

Some background variables of the study population are presented in table 4.1. These data of the four study groups (i.e. the outrage and technical detail manipulation) are statistically compared to find out if the groups significantly differ from each other, based on these background data.

The four study groups did not significantly differ from each other on the basis of age, having children, education and their tendency to take or avoid risks. The average age of the study population was 43 (range: 18-78). Sixty-five per cent of the participants had children (men: 67%, women: 64%). The participating men were higher educated (average score 3.90, for women: 3.56), but this difference was not significant (P = .101). As mentioned, the groups taken together did not significantly differ from each other on the basis of their tendency to take or avoid risks. The scores ranged from 2.43 to 7 for the Risk Scale and from 1 to 7 for both societal and personal risk aversion. Further analyses did, however, show that the participating women were significantly more risk-avoiding than the men according to all three measuring methods (i.e. for the Risk Scale: $F(1.188) = 8.734$ and $P = .004$, with an average score for men of 4.76 and 5.15 for women. For the questions concerning societal risk aversion, $F(1.188) = 8.518$ and $P = .004$, assume average scores for men of 5.07 and for women 5.72 for women. For the questions concerning personal risk aversion: $F(1.188) = 11.276$ and $P = .001$, showed an average score for men of 3.82 and 4.64 for women), as expected.

Furthermore, for all four risk-stories in this study, previous familiarity with the described risk was measured. This variable was then used as a potential covariate in all statistical analyses (see section 3.5). The idea behind this is that participants who are already very familiar with the described risk before this study might be less susceptible to the manipulation on the basis of their previous affirmations of (or experience with) the specific risk.

Table 4.1: Some background data (age, having children, education, and people's tendency to avoid risks as measured by the Risk Scale (societal and personal risk aversion questions) of the study population specified for the outrage and technical detail manipulation.

	Average	*df* *	*F*	*Sig.*
Age	43 years old			
- outrage		1	0.106	.745
- technical detail		1	0.792	.375
Having children	65% of the participants have children			
- outrage		1	1.112	.293
- technical detail		1	0.023	.880
	Average	*df* *	*F*	*Sig.*
Education	3.73 on a scale ranging from 0 (no or very little education) to 6 (university)			
- outrage		1	0.096	.757
- technical detail		1	0.043	.837
Risk Scale	4.96 on a scale ranging from 1 (thrill seeking) to 7 (risk avoiding)			
- outrage		1	0.064	.800
- technical detail		1	1.835	.177
Societal risk aversion	5.39 on a scale ranging from 1 (social risk seeking) to 7 (social risk avoiding)			
- outrage		1	0.152	.698
- technical detail		1	0.118	.732
Personal risk aversion	4.23 on a scale ranging from 1 (personal risk seeking) to 7 (personal risk avoiding)			
- outrage		1	1.312	.253
- technical detail		1	1.410	.237

* degrees of freedom in the error variances: 189

There were no a priori differences between the groups based on previous familiarity with the risks described in the first, third and fourth story (with respective Ps of $\geq .138$, $\geq .598$ and $\geq .073$). The average scores 4.10 (SD 2.239); 1.82 (SD 1512); and 3.70 (SD 2000) on a scale ranging from 1 (never heard of it) to 7 (very familiar). There were also no significant differences between men and women concerning previous familiarity with these three risks (P's $\geq .176$). However, despite the fact that participants were randomly assigned to one of the four study groups, it appeared that people in a "high technical detail" condition were already more familiar with the possible risk of lightning in a storage tank by which released chemicals could pour into nearby gardens. They knew this before they had read the specific study story (CHEM54**) for the technical detail manipulation; F(1.187) = 6.006 and

* The question-variables are coded with letters and figures; the letters refer to the specific story (i.e. story 1 = HSM, story 2 = CHEM, story 3 = DON, and story 4 = MEST), and the figures correspond with the specific number of the question as presented in the questionnaire.

P = .015, with an average score for the "low technical detail" condition of 2.01 and 2.68 for the "high technical detail" condition). There was, however, no significant difference between the outrage conditions or gender in terms of previous familiarity of the risk (Ps ≥ .154). The average score on this variable was 2.35 (std. deviation of 1.918).

For all four risk-stories in this study, participants were also asked if they had found the text used in the newspaper article comprehensible. There were no significant differences between the outrage and technical detail conditions in terms of participants' comprehensibility of the text. This holds for the first story (HSM16; P's ≥ .294, with a mean of 5.94 and a SD of 0.963), the third (DON66; P's ≥ .144, with a mean of .533 and a SD of 1.327), and the last story (MEST92; P's ≥ .259, with a mean of 6.04 and SD of 1.078). However, for the story about the chemical spill (the second story), participants who were confronted with more outrage in their study story, found the text used in the article significantly less comprehensible than participants who were confronted with less outrage (CHEM41; F(1.186) = 4.479 and P = .036, with a mean of .585 (.604 for the low outrage condition and 566 for the high outrage condition) and SD of 1.265). People's gender played no significant role in their comprehension of the text used in the four stories (P's ≥ .100).

4.2 Technical detail manipulation

The effectiveness of the technical detail manipulation was first examined. Did participants who read the "high technical detail" version of the story actually find the risk information more detailed than participants with the "low technical detail" version? The results are presented for the technical detail condition for each story below. Analyses of variance in the data was done for each story separately using the (fixed) variables outrage (high or low), technical detail (high or low) and gender. If there were no significant interactions between any of the fixed variables, the interaction terms would be removed from the model. Results for the outrage condition and gender are only presented here when significant differences (defined as probabilities for each test of P ≤ .05) between the study groups are found.

Story 1: Possible association between power (transmission) lines and leukemia

The manipulation of technical details was effective in the first story. Participants in the "high technical detail" condition found the information in the story about the possible health effects and the foundations of these health effects significantly more accurate (HSM19) and more detailed (HSM20) than participants in the "low technical detail" condition. The average score for the "high technical detail" condition on HSM19 was 4.16 versus 3.70 for the "low technical detail" condition (F(1.188) = 3.923 and P = .049). In all four study groups, women found the information about the health effects more accurate than men (F(1.188) = 5.909 and P = .016). The average score for women on HSM19 was 4.21 versus 3.65 for men. For HSM20, the average score for the "high technical detail" condition was 4.00 versus 3.44 for the "low technical detail" condition (F(1.187) = 7.035 and P = .009).

The third question (HSM21) checking the effectiveness of the technical detail manipulation, also found a significant difference between the two conditions (F(1.187) = 23.436 and P = .000); participants in the "high technical detail" condition found the information about the possible routes of exposure more detailed (average score 4.26) than participants in the "low technical detail" condition (average score 3.10). Furthermore, in all conditions, women found the information about the possible routes of exposure more detailed than men (F(1.187) = 5.750 and P = .017 with means of 3.39 for men and 3.97 for women).

Story 2: Possibility of chemical substances occurring in local gardens due to leakage from the Chemilak tank

The same effect of the technical detail manipulation was found in the second story, but the outrage manipulation also affected people's perception of the accuracy and the amount of detail given in the story. People in the "high outrage" condition found the information less accurate (CHEM44) and less detailed (CHEM45) than people in the "low outrage" condition. The average score for the "high outrage" condition on accuracy (CHEM44) was 3.29 versus 4.05 for the "low outrage" condition (F(1.86) = 10.027 and P = .002). While the average score for the "high technical detail" condition on CHEM44 was 4.07 versus 3.26 for the "low technical detail" condition (F(1.186) = 11.593 and P = .001). Furthermore, the average score for the "high outrage" condition on detailed ness (CHEM45) was 3.18 versus 3.75 for the "low outrage" condition (F(1.185) = 6.627 and P = .011). And the average score for the "high technical detail" condition on CHEM45 was 3.89 versus 3.02 for the "low technical detail" condition (F(1.185) = 15.412 and P = .000).

An interaction was found for CHEM46 (detailed information about possible exposure routes) between gender and the outrage and technical detail condition (outrage * technical detail * gender; F(1.183) = 4.530 and P = .035). Since the effectiveness of the technical detail manipulation is being examined here, further analyses for CHEM46 focused on the effect of the manipulation within the two outrage conditions (i.e. low and high) and within the male and female study population.

Analyses for the "low outrage" condition revealed an interaction between gender and the technical detail condition (technical detail * gender; F(1.91) = 4.538 and P = .036). Further analyses, specified for gender in the "low outrage" condition, indicated that the technical detail manipulation was effective for male participants who received the low outrage version of the study story (F(1.46) = 14.913 and P = .000). The men who received the "low outrage / low technical detail" condition found the information about the possible exposure routes less detailed than the men who received the "low outrage / high technical detail" condition (with an average score for men in the "low outrage / low technical detail" condition of 3.17 and 5.12 for men in the "low outrage / high technical detail" condition). The technical detail manipulation was not effective for female participants who received the low outrage version of the study story (F(1.45) = 1.045 and P = .312). Analyses for the "high outrage" condition indicated that the technical detail manipulation was effective for participants who were confronted with more outrage in their study story (F(1.93) = 10.483 and P = .002).

Participants who received the “high outrage / low technical detail” condition found the information about the possible exposure routes less detailed than participants who received the “high outrage / high technical detail” condition (with an average score for the “high outrage / low technical detail” condition of 2.98 and 3.98 for the “high outrage / high technical detail” condition).

Further analyses on CHEM46 (specified for gender) again indicated that the technical detail manipulation was effective on men (F(1.93) = 16.691 and P = .000). Men who received the “low technical detail” condition found the information about the possible exposure routes less detailed than men who had received the “high technical detail” condition (means: 3.08 and 4.44). However, the outrage manipulation also played a role in men’s perception of the details about the exposure routes. Men who received the “low outrage” condition found the information more detailed that men who received the “high outrage” condition (F(1.93) = 5.408 and P = .022; with means of 4.15 and 3.37). Further analyses also indicated that the women who were provided with more technical details about the risk found the information in the article about the exposure routes more detailed than women who did not receive these technical details (F(1.92) = 6.951 and P = .010; means of 3.52 and 4.38). However, women who received the “low outrage” condition, also indicated that they found the information in the article about the exposure routes more detailed (F(1.92) = 5.097 and P = .026; means: 4.32 and 3.58) as compared to the women who received the “high outrage” condition. So men and women appear to respond differently to outrage, when asked how detailed they thought the provided technical details were.

Story 3: DON in bread

In the third story, an interaction was found between the outrage and the technical detail condition for DON69 (accuracy of information on possible health effects; F(1.184) = 4.887 and P = .028). Further analyses for this variable showed that for people in the “low outrage” condition, the technical detail manipulation was not effective (P = .790). However, for people in the “high outrage” condition, the technical detail manipulation worked. The average score in the “high technical detail”/ “high outrage” condition was 4.42 versus 3.52 in the “low technical detail”/ “high outrage” condition (F(1.93) = 8.234 and P = .005).

For DON70 (amount of technical detail given on the possible health effects) the technical detail manipulation was effective (F(1.187) = 3.929 and P = .049). The average score for the low technical detail condition was 3.55 versus 3.97 in the high technical detail condition. In the third question (DON71) on checking the effectiveness of the technical detail manipulation in terms of detailed information of the possible exposure routes, no significant effect of the manipulation was found (F(1.187) = 0.524 and P = .470).

Story 4: Health complaints caused by manure

In the last story, the technical detail manipulation was ineffective. Participants in the “high technical detail” condition did not find the information in the story about the possible health effects. Neither did they find the grounds for these health effects and the information about

possible routes of exposure more accurate (MEST95) or more detailed (MEST96 and MEST97) than participants in the "low technical detail" condition (P's ≥ .170). However, women found the information about the ways people might experience odor nuisance caused by the manure silo more detailed than men (MEST97; F(1.187) = 13.439 and P = .000, with an average score for men 4.31 versus 5.11 for women). The outrage manipulation also seemed to influence whether or not people found the information about the routes of exposure detailed (F(1.187) = 12.858 and P = .000). People in the "high outrage" condition found the information significantly more detailed (the average score for the "high outrage" condition was 5.09 and 4.32 for the "low outrage" condition).

4.3 Outrage manipulation

Next, the effectiveness of the outrage manipulation was examined. Below are the results for the outrage condition for each story. Again, analysis of variance in the data was done for each story separately, using the (fixed) variables outrage (high or low), technical detail (high or low) and gender. If there were no significant interactions between any of the fixed variables, the interaction terms were removed from the model. Results for the technical detail condition and gender are only presented where significant differences between the study groups were found.

Story 1: Possible association between power (transmission) lines and leukemia

In the story about the possible association between power (transmission) lines and leukemia, the outrage manipulation did, to a certain extent, influence whether or not participants thought that the citizens of Roterdalen were rightfully worried (HSM24; F(1.188) = 3.622 and P = .059). Participants in the "high outrage" condition (average score 4.75) were less likely to state that they thought the citizens were rightfully worried, than participants in the "low outrage" condition (average score 5.16). Furthermore, women were more likely to state that the citizens of Roterdalen were rightfully worried than men (F(1.188) = 8.862 and P = .003, with an average score for men of 4.64 and an average score for women of 5.27).

The outrage manipulation had no significant effect on the idea that information was being withheld (HSM26: F(1182) = 1.477, P = .226, with the average score for the "low outrage" condition being 4.83 and 4.58 for the "high outrage" condition). However, in this analysis, an interaction was found between gender and technical detail (technical detail * gender; F(1.182) = 5.299 and P = .022). Further analyses indicated that women with more technical information about the risk were significantly less likely to think that information was kept from them, than women who were confronted with less technical detail (F(1.92) = 6.873 and P = .010; means: 531 and 4.55). This effect was not found for the male study population (F(1.92) = 0.439 and P = .509).

For the other variables checking the effectiveness of the outrage manipulation (HSM22, HSM23, and HSM25), the statistical models all contained a significant interaction term. These variables were further analyzed (specified for both the technical detail manipulation and gender) and the results of these analyses are presented in Table 4.2.

Table 4.2: Effectiveness of the outrage manipulation for story 1 – further analyses for the variables HSM22, HSM23, and HSM25 itemized for the technical detail manipulation and gender

HSM22 *What do you think of the way Mr. Pastersen dealt with the situation?* (1 = not good at all; 7 = very well)			
	Df	F	Sig.
- outrage	1	13.073	.000
- technical detail	1	0.449	.504
- gender	1	0.622	.431
- interaction technical detail * gender	1	9.247	.003
- error	183		
Analysis for the "low technical detail" condition			
- outrage	1	9.263	.003
- gender	1	7.092	.009
- error	93		
Analysis for the "high technical detail" condition			
- outrage	1	4.303	.041
- gender	1	2.601	.110
- error	92		
Analysis for men			
- outrage	1	4.027	.048
- technical detail	1	7.605	.007
- error	92		
Analysis for women			
- outrage	1	9.526	.003
- technical detail	1	2.576	.112
- error	93		
HSM23 *Did Mr. Pastersen come across as trustworthy?* (1 = not at all trustworthy; 7 = very trustworthy)			
	Df	F	Sig.
- outrage	1	14.359	.000
- technical detail	1	0.186	.666
- gender	1	0.002	.962
- interaction technical detail * gender	1	8.561	.004
- error	184		

Analysis for the "low technical detail" condition			
- outrage - gender - error	1 1 93	8.891 4.219	.004 .043
Analysis for the "high technical detail" condition			
- outrage - gender - error	1 1 93	5.698 4.436	.019 .038
Analysis for men			
- outrage - technical detail - error	1 1 93	7.984 6.430	.006 .013
Analysis for women			
- outrage - technical detail - error	1 1 93	6.645 2.808	.012 .097
HSM25 *How much trust do you have in the town council's approach of the situation?* (1 = no trust at all; 7 = a lot of trust)			
	Df	F	Sig.
- outrage - technical detail - gender - interaction technical detail * outrage * gender - error	1 1 1 1 184	1.907 1.200 0.002 4.593	.169 .275 .962 .033
Analysis for the "low technical detail" condition + men			
- outrage - error	1 46	5.022	.030
Analysis for the "low technical detail" condition + women			
- outrage - error	1 46	0.883	.352
Analysis for the "high technical detail" condition			
- outrage - gender - error	1 1 92	1.057 1.696	.307 .196

Initial analyses indicated significant differences between the groups in what they thought of the way Mr. Pastersen had dealt with the situation (HSM22; P = .000) and whether or not they thought Mr. Pastersen was trustworthy (HSM23; P = .000). People in the "high outrage" condition were generally less inclined to approve of the way Mr. Pastersen had dealt with the

situation (average score for the low outrage condition 3.93 versus 3.09 for the high outrage condition) and less inclined to trust him (average score for the low outrage condition of 3.81 versus 2.99 for the high outrage condition). These results should, however, be interpreted in the light of the significant interactions found in these analyses (see Table 4.2). For HSM22, in the "low technical detail condition", the average score on low outrage was 4.08 versus 3.08 on high outrage (P = .003); and in the "high technical detail condition", the average score on low outrage was 3.77 versus 3.10 for high outrage (P = .041). Furthermore, men were less pleased with the way Mr. Pastersen dealt with the situation if they were given more outrage (P = .048; means: 3.91 and 3.29) and more technical details (P = .007; means: 4.02 and 3.17) in their story. Women were also less pleased with the way Mr. Pastersen dealt with the situation if they were given more outrage (P = .001; means: 3.94 and 2.90).

For HSM23 (trustworthiness of Mr. Pastersen), in the "low technical detail" condition, the average score on low outrage was 3.92 versus 2.98 on high outrage (P = .004); in the "high technical detail" condition, the average score on low outrage was 3.71 versus 3.00 for high outrage (P = .019). Furthermore, women in the "high outrage" condition distrusted Mr. Pastersen more than women in the "low outrage" condition (HSM23; P = .012; means: 2.98 and 3.81). When men were given more technical details, their trust in Mr. Pastersen decreased (P = .013; means: 3.77 and 3.04). As with women, the outrage manipulation for men was also effective in manipulation of their trust in Mr. Pastersen (P = .006; means: 3.81 and 3.00); men who received the "high outrage" condition were less inclined to trust the man.

Initial analyses revealed no significant effect of the outrage manipulation in affecting people's trust in the approach of the town council (HSM25; P = .169, average score for the low outrage condition 3.55 versus 3.25 for the high outrage condition). Further analyses, however, showed that the outrage manipulation did affect men's trust in the approach of the town council if they were given the "low technical detail" condition (F(1.46) = 5.022 and P = .030). If these men were given more outrage, they were less likely to trust the approach. The average score for men in the "high outrage / low technical detail" condition on HSM25 was 3.21 versus 4.21 for men in the "low outrage / low technical detail" condition. This effect was not found for women (P = .352).

Story 2: Possibility of chemical substance in local gardens by the leakage tank, Chemilak

In the story about the chemical spill, the outrage manipulation was also effective. Participants in the "high outrage" condition found the handling of the situation by spokesperson Vangart significantly worse than those in the "low outrage" condition (CHEM47; F(1,187) = 299.179 and P = .000; means: 5.40 and 2.10). Furthermore, people in the "high outrage" condition were more convinced that information was being withhold (CHEM51; F(1.188) = 50.665 and P = .000; means: 3.64 and 5.42), found the handling of the situation by the town council significantly less thoroughly (CHEM63; F(1.188) = 218.727 and P = .000; means: 4.89 and

1.89) and the council itself less trustworthy (CHEM50; F(1.188) = 222.545 and P = .000; means: 5.05 and 2.09).
Initial analyses indicated significant differences between the groups in whether or not they thought Vangart was trustworthy (CHEM48 F(1.184) = 267.662 and P = .000); people in the "high outrage" condition were generally less inclined to trust Vangart (average score for the low outrage condition 5.24 versus 2.14 for the high outrage condition). This result should, however, be interpreted in the light of the significant interaction found in this analysis: between gender and the outrage condition (gender * outrage; F(1.184) = 4352 and P = .038). Further analyses showed that for both men and women, the outrage manipulation was effective. Men in the "high outrage" condition were less inclined to trust Vangart than men in the "low outrage" condition (F(1.93) = 81.066 and P = .000; average score for men in the low outrage condition was 4.85 versus 2.15 for men in the high outrage condition). Initial (further) analyses, specified for women, also indicated that the outrage manipulation had effectively affected women's perception of the trustworthiness of Vangart (F(1.92) = 232.338 and P = .000). Women in the "high outrage" condition (average score: 2.13) were less inclined to trust Vangart than women in the "low outrage" condition (average score: 5.62). But again, this result should be interpreted in light of the significant interaction found in this analysis: between the outrage and the technical detail condition (outrage * technical detail; F(192) = 5.565 and P = .020). Analyses then revealed that the outrage manipulation was effective for women in both technical detail conditions ("low technical detail" condition women: F(1.46) = 234.460 and P = .000; "high technical detail" condition women: F(1.46) = 61.968 and P = .000). When women in the "low technical detail" condition were confronted with more outrage, they were less inclined to trust Vangart (average score for women in the "low technical detail / low outrage" condition of 5.79 versus 1.75 for women in the "low technical detail / high outrage" condition). And when women in the "high technical detail" condition were confronted with more outrage, they were also less inclined to trust Vangart (average score for women in the "high technical detail / low outrage" condition of 5.46 versus 3.98 for women in the "high technical detail / high outrage" condition).

Story 3: DON in bread
In the third story, the outrage manipulation was also effective, though in none of the four experiment groups, were the parents mentioned in the article found to be significantly more rightfully worried, than in the other groups (DON73; P = .796). Trust in the health center (DON75) and the idea that information was being withheld (DON76) were, however, significantly related to the outrage version people read. People who read the "high outrage" version were less likely to trust the health care center (F(1.187) = 4.646 and P = .032; means: 4.27 and 3.83), but were, in fact, less inclined to think that information was being withhold (F(1.188) = 5.566 and P = .019; means: 3.76 and 4.33).

For the other two variables checking the effectiveness of the outrage manipulation (DON72 and DON89), an interaction was found between the outrage and the technical detail condition (DON72; F(1.182) = 4.309 and P = .039) and between gender and the outrage condition (DON89; F(1.183) = 5.503 and P = .020). Further analysis of DON89 showed that for men,

the outrage condition did not significantly influence their idea on how the chance of DON exposure was being tackled (P = .605). Women on the other hand, were significantly influenced in their opinion by the outrage condition (F(1.92) = 7.559 and P = .007): women in the "high outrage" condition were less likely to think that the chance of exposure had been thoroughly tackled (means: 3.94 and 3.04). Furthermore, further analysis of DON72 showed that for both people in the "low technical detail" and the "high technical detail" condition, the outrage manipulation was effective; participants who read the "high outrage" version of the story were less pleased with the attitude of the bakers as presented in the story. (For the "low technical detail" condition: F(1.91) = 44.568 and P = .000; means: 4.54 and 2.71. And for the "high technical detail" condition: F(1.93) = 15.145 and P = .000; means: 4.27 and 3.23). Therefore, the specific manipulation of the attitude of the bakers was successful.

Story 4: Health complaints caused by manure

In the final story, the outrage manipulation also worked. Especially manipulation of the way farmer Maars and the town council were presented in the story was very effective. People in the "high outrage" condition were less pleased with the way the farmer dealt with the situation (MEST98; F(1.185) = 63.652 and P = .000). The average score on this question for participants in the "high outrage" condition was 2.28 compared to 3.99 in the "low outrage" condition. Also, compared with people in the "low outrage" condition, people in the "high outrage" condition regarded the farmer as less trustworthy (MEST99; F(1.187) = 49.789 and P = .000, means: 4.11 and 2.47). When participants were given more outrage, their trust in the town council's approach of the situation decreased (MEST101; F(1.187) = 43.130 and P = .000, with means: 3.64 and 2.30). Furthermore, participants in the "high outrage" condition were significantly more inclined to think that the problem had not been thoroughly tackled (MEST114; F(1.188) = 31.887 and P = .000, with means: 3.82 and 2.58). Interaction was found between the outrage and technical detail condition, for MEST102; the variable measuring if people felt that information was being withheld (F(1.183) = 4.338 and P = .039). Further analyses indicated that the outrage manipulation was not effective in the "low technical detail" condition (P = .418). However, for the "high technical detail" condition, the outrage manipulation was very effective (F(1.92) = 14.029 and P = .000). Participants who read the "high outrage / high technical detail" version of the story, were significantly more inclined to think that information was being withheld (average score 4.21) than participants who read the "low outrage / high technical detail" version (average score: 2.96). Perhaps the way family Brammers acted in the story was not strongly enough manipulated, since no significant difference between the conditions on MEST100, asking people about what they thought of the way the Brammers dealt with the situation, was found (P = .171).

In conclusion: analyses showed that both the outrage and technical detail manipulation were successful for the first two stories. For the third story (DON in bread), the outrage manipulation also worked, but the technical detail manipulation only seemed to work for people in the "high outrage" condition. The technical detail manipulation was ineffective in the last story, though the outrage manipulation was very successful. Based on these results, the story about the possible association between power lines and leukemia (story 1), is

selected for further analyses to see if the manipulations have indeed influenced people's perception of the risk. The results of these analyses are presented in the following section.

4.4 The influence of outrage and technical details on risk perception

The story about the possible association between power lines and leukemia (story 1) was effective in terms of both the manipulations, and is therefore selected for further analyses to see if the manipulations influenced people's perception of the risk. Analysis of variance in the data was done, again using the (fixed) variables outrage (high or low), technical detail (high or low) and gender. If there were no significant interactions between any of the fixed variables, the interaction terms were removed from the model. All measured potential covariates that could influence a person's perception of a risk were initially entered in the statistical model(s), but were to be removed from the model one by one if they did not have a significant influence (always removing the covariate with the highest p-value) until only the significant covariates remained. The results of these statistical analyses on variables measuring people's risk perception are presented for both the outrage and the technical detail condition and gender; results for the covariates are only presented where significant differences were found. Table 4.3 shows the results.

Differences in the amount of technical detail provided in the story did not affect perceived risk (as measured by the questions listed in Table 4.3). Neither did manipulation of the outrage, except for the perception of the controllability of the risk (HSM34). Covariates such as gender, education, people's risk-taking tendency (as measured by the Risk Scale and the questions concerning societal and personal risk aversion), and previous familiarity with the risk appeared to be better predictors of people's risk perception. This was despite the fact that the manipulations were effective in terms of people actually seeing more technical detail, and actually being more outraged in the "high technical detail" and "high outrage" conditions, respectively. Generally, women were more worried about the situation and found the risk larger, less voluntary and more serious than men did. Participants with a relatively high level of education or a low tendency to avoid risks were less worried and found the risk less serious. People who were already familiar with the risk before participating in the study, found the risk more scary and the chance of children developing leukemia due to living near power lines greater than people who first learned about the possible association while participating in this study. Participants with children found the risk significantly less voluntary than participants who did not have children (means: 2.79 and 3.43).

Table 4.3: The effects of the outrage and technical detail manipulation, gender and other covariates, on participants' risk perception for story 1

HSM17 *What is your impression of the seriousness of the situation described?* (1 = not at all serious; 7 = very serious)			
	df	F	Sig.
- outrage	1	0.058	.810
- technical detail	1	0.915	.340
- gender	1	8.547	.004
- education	1	9.443	.002
- societal risk aversion	1	9.409	.002
- personal risk aversion	1	4.213	.042
- error	185		
HSM27 *How worried would you be if you were put in the same situation as described?* (1 = not at all worried; 7 = very worried)			
	df	F	Sig.
- outrage	1	0.602	.439
- technical detail	1	0.037	.849
- gender	1	12.408	.001
- risk scale	1	5.225	.023
- personal risk aversion	1	13.011	.000
- error	186		
HSM28 *How large would you say the chance is of children developing leukemia due to living near power lines?* (1 = not large at all; 7 = very large)			
	Df	F	Sig.
- outrage	1	1.412	.236
- technical detail	1	1.804	.181
- gender	1	11.346	.001
- education	1	6.244	.013
- societal risk aversion	1	4.079	.045
- personal risk aversion	1	9.165	.003
- previous familiarity	1	18.038	.000
- error	184		

(continuation of table 4.3)

HSM30 *Do you find the described risk scary?*
(1 = not at all scary; 7 = very scary)

	Df	F	Sig.
- outrage	1	0.313	.576
- technical detail	1	0.095	.759
- gender	1	3.640	.058
- risk scale	1	7.868	.006
- personal risk aversion	1	8.371	.004
- previous familiarity	1	12.421	.001
- error	185		

HSM33 *Do you find the described risk voluntary, or is it a risk to which people are involuntarily exposed?*
(1 = not at all voluntary; 7 = totally voluntary)

	Df	F	Sig.
- outrage	1	2.069	.152
- technical detail	1	0.235	.628
- gender	1	4.156	.043
- having children	1	5.759	.017
- error	187		

HSM34 *Do you think the risk is controllable?*
(1 = not at all controllable; 7 = very controllable)

	df	F	Sig.
- outrage	1	6.165	.014
- technical detail	1	1.903	.169
- gender	1	2.444	.120
- error	188		

HSM35 *Do you think people are clearly in danger from the risk described?*
(1 = not at all clear; 7 = very clear)

	df	F	Sig.
- outrage	1	3.626	.058
- technical detail	1	0.024	.878
- gender	1	0.483	.488
- education	1	5.005	.026
- societal risk aversion	1	5.899	.016
- personal risk aversion	1	7.135	.008
- previous familiarity	1	10.313	.002
- error	184		

As mentioned, only the idea of controllability of the risk (HSM34) was significantly influenced by the outrage manipulation. People in the "high outrage" condition were less likely to think that the risk was controllable ($F(1.188) = 6.165$ and $P = .014$; means: 4.66 and 4.09). Differences on one variable (HSM35) seemed to be marginally significant in terms of the outrage manipulation. Participants who received the "high outrage" condition found the people in the story to be less clearly in danger by the described risk, than participants who received the "low outrage" condition (means: 4.26 and 3.74). But again, other factors appeared to be better predictors in terms of people's risk perception. Participants with a relatively high level of education, a low tendency to avoid risks, or participants who were not previous familiar with the risk, were less likely to think that people were clearly in danger.

However, for both HSM27 and HSM28, analyses showed that the within-group variability (i.e. the error variance) was not equal across the study groups; the Levene's tests of homogeneity of variance had respective p-values of .040 and .042. The Levene's test measures the assumption that the variability in the dependent variable is expected to be about the same at all levels of the grouping variable (for grouped data) when one of the variables is discrete (i.e. the grouping variable) and the other is continuous (i.e. the dependent variable); a great deal of research has assessed the robustness (or lack of) of ANOVA and ANOVA-like analyses to violation of homogeneity of variance. These analyses of variance are fairly robust, and one can usually assume that (even with a small violation) the results will be accurate. However, Tabachnick and Fidell offer several options to deal with these violations.[37] One option is to use untransformed variables with a more stringent α level (for nominal $\alpha = .05$, use .025 with moderate violation and .01 with severe violation).[37] Applying a more stringent α level (.025, since there were only moderate violations) for HSM27 and HSM28 does not have much of an impact on the results (also see Table 4.3).
In conclusion; the technical detail and outrage manipulation generally did not seem to have a strong impact on people's perception of the risks described. Other factors, such as gender, education and people's tendency to avoid risks, prove to be much stronger predictors of people's risk perception.

4.5 The influence of outrage and technical details on risk acceptability

This section investigates the possible influence that the manipulations may have had on whether or not participants thought the possible risk developing leukemia due to living near power pylons was acceptable. Analysis of variance in the data was done using the (fixed) variables outrage (high or low), technical detail (high or low) and gender. If there were no significant interactions between any of the fixed variables, the interaction terms were removed from the model. Again, all potential covariates were initially entered into the statistical model(s), but were removed if they did not have a significant influence. The results of these statistical analyses on variables measuring people's risk acceptability are presented for both the outrage and the technical detail condition and gender; results for the covariates are only presented where significant differences were found.

People's risk acceptability was measured using two questions: 1) do you find the risk described reasonable (HSM31) and 2) do you find the risk described acceptable to the community (HSM32). Analyses showed that the manipulations did have a slight, though not significant, effect on the consequences people gave to the described risk. People tended to find the risk generally more reasonable and more acceptable for the community, if they were faced with more outrage, though, as mentioned, this effect is not significant (HSM31; $F(1.187) = 3.072$ and $P = .081$ for HSM32; $F(1.183) = 3.736$ and $P = .055$).

The same effect occurred when less technical details were given; the risk acceptability increased (HSM31; $F(1.187) = 3.687$ and $P = .056$ for HSM32; $F(1.183) = 3.349$ and $P = .069$). The average score for the "low outrage" condition on HSM31 was 3.64 (low technical detail: 3.85, high technical detail: 3.42); for the "high outrage" condition on HSM31 it was 4.06 (low technical detail: 4.27, high technical detail: 3.85). The average score for the "low outrage" condition on HSM32 was 3.59 (low technical detail: 3.71, high technical detail: 3.48); for the "high outrage" condition on HSM32 it was 4.09 (low technical detail: 4.34, high technical detail: 3.83).
Again, covariates such as age, having children, and people's risk-taking tendency (in this case: societal risk aversion) appear to be better predictors. For both variables; if people's natural tendency was to avoid risks, they were less likely to find the risk reasonable and/or acceptable for the community (HSM31; $F(1.187) = 9.416$ and $P = .002$ for HSM32; $F(1.183) = 13.791$ and $P = .000$). Older people and people with children were also less likely to state that they found the risk acceptable to the community (HSM32, age: $F(1.183) = 4.003$ and $P = .047$; and having children: $F(1,183) = 4.452$ and $P = .036$).

4.6 Checklist of emotions

As mentioned in section 3.4, there were some additional questions concerning certain emotions that might play a role in people's judgements about a risk. Participants were asked to indicate (on a 7-point Likert scale) to what extent they think they would go through certain emotions if they and their children were living next to a power pylon in Roterdalen. The answering scale ranged from "not at all" (1) to "very" (7). Below, the results for both sets of emotions are presented. The twelve emotions used in this study can be divided roughly into two categories: negative (angry, helpless, frightened, alarmed, concerned, confused, annoyed) and positive emotions (safe, carefree, relieved, indifferent and pleased).

Analyses of variance in the data was performed for each emotion, using the (fixed) variables outrage (high or low), technical detail (high or low) and gender. If there were no significant interactions between any of the fixed variables, the interaction terms were removed from the model. All potential covariates measured, that could influence a person's perception (or perhaps emotion) of a risk were initially entered in the statistical model, but were to be removed from the model if they did not have a significant influence. The results of these statistical analyses are presented for both the outrage and the technical detail condition and gender; results for the covariates are only presented where significant differences were found.

Negative emotions

- *Angry*

  A significant interaction was found between gender and the outrage and technical detail condition (outrage * technical detail * gender; F(1.173) = 5.001 and P = .027). Analyses for the "low outrage" condition showed no significant differences between the technical detail conditions in terms of participants being angry (F(1.89) = 0.094 and P = .759), but men in the "low outrage" condition indicated being significantly less angry than women in the "low outrage" condition (F(1.89) = 8.605, P = .004, with means: 4.40 and 4.81). Analyses for the "high outrage" condition revealed a significant interaction between gender and the technical detail condition (technical detail * gender; F(1.83) = 5.262 and P = .024). Further analyses only indicated significant differences in the "high outrage / high technical detail" condition; men in this study-group were significantly less angry than women (F(1.43) = 30.432, P = .000, with means: 2.70 and 4.87).

  Analyses for the "low technical detail" condition showed no significant differences between the outrage conditions in terms of participants being angry (F(1.90) = 0.649 and P = .423). Analyses for the "high technical detail" condition revealed a significant interaction between gender and the outrage condition (outrage * gender; F(1.83) = 10.832 and P = .001). Further analyses only indicated significant differences in the "high technical detail / high outrage" condition; men in this study group were significantly less angry than women (F(1.43) = 30.432, P = .000, again, with means: 2.70 and 4.87).
  Further analyses, specified for gender, indicated that when asked if the risk described in the story made the participants angry, the manipulations only seemed to influence men. Remarkably, men in the "high technical detail" condition stated being less angry if they were confronted with more outrage (F(1.44) = 21.586, P = .000, with means: 4.46 and 2.70). Analyses also showed that men in the "high outrage" condition were less angry when they received more technical details (F(1.43) = 5.683, P = .022, with an average score for the "low technical detail / high outrage" condition of 3.79 versus 2.70 for the "high technical detail / high outrage" condition).

- *Frightened*

  The outrage condition had a significant influence on whether or not people felt frightened by the described risk. However, unexpectedly, people who read the high outrage version felt less frightened than people reading the low outrage version (F(1.180) = 4.436, P = .037, with an average score for low outrage of 4.21 versus 3.62 for high outrage). Furthermore, women were more frightened than men (F(1.180) = 13.477, P = .000, with an average score of 3.31 for men versus 4.54 for women). The technical detail manipulation had no influence on this emotion (P = .838).

– *Alarmed*
A comparable unexpected effect brought on by the outrage condition was found for the extent to which people felt alarmed. When given more outrage, people indicated to be less alarmed ($F(1.183) = 8.023$, $P = .005$, with an average score for low outrage 5.10 versus 4.43 for high outrage). The amount of technical detail was of no influence ($P = .987$), though, gender did influence people's score on this emotion; in all four study groups, women were significantly more alarmed than men ($F(1.183) = 5.716$, $P = .018$, with an average score of 4,40 for men and 5,12 for women). The Levene's test for analyses on "alarmed" was .045. Applying a more stringent α level (in this case .025), as suggested by Tabachnick and Fidell [37] , did not affect the results.

– *Annoyed*
When given more outrage, people indicated being less annoyed ($F(1.182) = 4.600$, $P = .033$, with an average score for low outrage of 4.43 versus 3.75 for high outrage); again, an effect in an unexpected direction. Here too, the technical detail manipulation had no effect ($P = .757$).

– *Helpless, concerned or confused*
Neither manipulation had an effect on whether or not people felt helpless ($P's \geq .120$; with an overall average score of 4.04); concerned ($P's \geq .094$; with an overall average score of 4.83), or confused ($P's \geq .231$, with an overall average score of 3.21). The participant's gender did, however, significantly influence the score on some of these emotions. After reading either of the four story versions about the possible association between power lines and leukemia, women felt significantly more concerned ($F(1.183) = 9.670$, $P = .002$, with an average score for men of 4.35 versus 5.31 for women) and more confused than men ($F(1.183) = 5.673$, $P = .018$, with an average score for men of 2.77 versus 3.64 for women). The Levene's test indicated that the error variance of the dependent variables "helpless" and "confused" were not equal across the groups (for "helpless", the p-value on the Levene's test was .009 and for "confused" the p-value was .001). Therefore, analyses were performed again, this time applying a more stringent α level (for these cases $\alpha = .01$). These analyses (results not presented here) did not significantly change the previous results; the manipulations were still ineffective (for "helpless", the covariate "personal risk aversion" was removed from the model, and the p-values of the outrage and technical detail manipulations became $\geq .083$; for "confused", these p-values remained $\geq .231$).

In general, participants who tend to be risk-avoiding, indicated that they were feeling significantly more angry (e.g. for the low outrage condition $F(1.89) = 5.839$ and $P = .004$), more helpless ($F(1.182) = 6.075$, $P = .015$), more frightened ($F(1.180) = 11.387$, $P = .001$), more alarmed ($F(1.183) = 9.281$, $P = .003$), more concerned ($F(1.183) = 11.117$, $P = .001$), more confused ($F(1.183) = 9.169$, $P = .007$) and /or more annoyed ($F(1.182) = 11.475$, $P = .001$), than participants with a low score for one or more of the three variables measuring risk aversion (i.e. the Risk

Scale and the questions concerning societal and personal risk aversion). Furthermore, when people were already very familiar with the risk before participating in the experiment, they indicated that they were more concerned about the risk ($F(1.183) = 6.473$ and $P = .012$). Highly educated people found the risk less confusing than people with a lower level of education ($F(1.183) = 7.379$ and $P = .007$).

Positive emotions

- *Carefree*

  A significant interaction was found between gender and the technical detail condition (technical detail * gender; $F(1.175) = 5.528$ and $P = .020$). Analyses for the "low technical detail" condition showed no significant differences between the two outrage conditions in terms of participants being carefree ($F(1.91) = 0.445$ and $P = .507$), but men in the "low technical detail" condition indicated being significantly more carefree than women in the "low technical detail" condition ($F(1.91) = 5.701$, $P = .019$, with means: 3.62 and 2.63). For participants in the "high technical detail" condition, the outrage manipulation was effective in terms of influencing the feeling of being carefree. People who received the "high outrage / high technical detail" condition felt significantly less carefree than people who received the "low outrage / high technical detail" condition ($F(1.92) = 4.350$, $P = .040$ with means: 3.42 and 2.72). Men specifically felt less carefree if they received the "high outrage" condition ($F(1.91) = 8.285$, $P = .005$ with means: 3.77 and 3.00). The men also felt less carefree if they received more technical details about the risk ($F(1.91) = 6.070$, $P = .016$, with means: 3.62 and 3.15). Women were not influenced by the manipulations ($P's \geq .311$; overall average score was 2.81).

- *Safe, indifferent, relieved or pleased*

  Neither the outrage nor the technical detail manipulation had an effect on whether or not people felt safe ($P's \geq .348$; overall average score 2.95), indifferent ($P's \geq .514$; overall average score 2.81), relieved ($P's \geq .102$; overall average score 2.59) or pleased ($P's \geq .884$; overall average score 2.53). For analyses of the emotion "pleased", the more stringent α level of .01 was chosen, since the assumption of homogeneity of variance had been violated (Levene's test of equality of error variances was .012).

  After reading about the possible association between power lines and leukemia, women felt less safe ($F(1.182) = 5.783$, $P = .017$, with an average score for men of 3.31 versus 2.59 for women) and less indifferent than men ($F(1.184) = 12.378$, $P = .001$, with an average score for men of 3.19 versus 2.44 for women).
  In general, participants who tend to be risk-avoiding, indicated that they were feeling less safe ($F(1,182) = 3.956$, $P = .048$) than participants with a low score on the Risk Scale. In addition; risk-avoiding men were also less relieved ($F(1.89) = 14.142$, $P = .000$), but both older men and women were more relieved than the younger participants (analysis for men: $F(1.89) = 10.722$ and $P = .002$; analysis for women:

F(1.90) = 6.007 and P = .016). Furthermore, older men felt significantly more carefree than younger men (F(1.91) = 21.322 and P = .000). Older participants generally felt safer (F(1.182) = 5.079 and P = .025) and more pleased (F(1.183) = 11.329 and P = .001) than younger participants.

Whether or not participants had children, seemed to strongly influence their responds on all these "positive" emotions. Participants who did not have any children generally felt safer (F(F1.182) = 5.826, P = .017, with an average score for people with children of 2.83 versus 3.16 for people with no children) and more indifferent to the risk (F(1,184) = 18.744, P = .000, with an average score for people with children of 2.47 versus 3.45 for people with no children). Furthermore, people without children felt more pleased (F(1.183) = 6.668, P = .011, with an average score for people with children of 2.48 versus 2.63 for people with no children). Women without children also felt more carefree (F(1.91) = 5.410, P = .022, with an average score for women with children of 2.53 versus 3.29 for women without children) and more relieved (F(1.90) = 6.920, P = .010, with an average score for women with children of 2.08 versus 2.60 for women without children) than women with children.

Overall, the outrage condition seemed to have an unexpected effect on the experience of "negative" emotions. When given more outrage, people felt significantly less angry, less frightened, less alarmed and less annoyed. The outrage condition did, however, have the expected effect on the experience of feeling carefree. Participants in the "low outrage" conditions felt significantly more carefree than participants in the "high outrage" conditions. People with a general tendency to avoid risks, felt significantly more negative about the described risk, as did women. When people were older, they generally felt more positive about the risk, but the major influence on the experience of "positive" feelings turned out to be whether or not the participant had children. Participants without children felt significantly more positive about the risk than participants with children.

4.7 Interview clippings

Next to the emotion checklist, participants were asked to indicate how much they shared the reaction expressed in one of four statements (see also Table 3.5, section 3.4), based on the risk described the article about the possible association between power lines and leukemia. Analysis of variance in the data was performed for each clipping, using the (fixed) variables outrage (high or low), technical detail (high or low) and gender. Again, if there were no significant interactions between any of the fixed variables, the interaction terms were removed from the model. The results of these statistical analyses are presented for both the outrage and the technical detail condition and gender.

Analyses for the first clipping ("Oh no, I am not at all worried about this risk. Please! If I had to worry about that…! I have much better things to do! Besides, chances of getting sick because of that are so small"), revealed no significant effect of either the outrage or the

technical detail manipulation (P's ≥ .716). Gender proved to be a better predictor of participants' (dis)agreement with this clipping. Men were more likely to agree with the clipping (stating that they were not worried) than women (F(1.187) = 9.292 and P = .003, with means: 4.06 and 3.31).

Analyses for the second clipping ("Hmm, well what should I say about that. Sure, chances are very small, but despite all that, I am not really comfortable with it.") also revealed no significant effect of either the outrage or the technical detail manipulation (P's ≥ .057). Gender too did not play any significant role in participants' (dis)agreement with this clipping (F(1.187) = 3.197 en P = .075).

Analyses for the third clipping ("I don't like it, I mean… come on, this risk isn't just nothing? Frankly, I am quite scared; imagine that you would really end up being sick with something…"), indicated a significant influence of the outrage manipulation on participants' (dis)agreement with the interview clipping (F(1.188) = 4.115 and P = .044). Participants who were confronted with more outrage in their study story were significantly less likely to agree with the statement made in the clipping (means: 4.35 versus 4.88 for the "low outrage" condition). Gender also affected participants' (dis)agreement with this clipping. Men were less likely to agree with the third clipping than women (F(1.188) = 8.066 and P = .005, with means: 4.25 for men and 4.98 for women). The technical detail manipulation played no significant role in participants' (dis)agreement with this clipping (P = .418).

For the analyses for the fourth clipping, participants were asked to indicate how much they shared the reaction ("Yes, well I am very worried about this. We are talking about a very big risk, here. Seriously… I am greatly concerned about the effects this risk can cause."), the outrage condition seemed to play a role (F(1.187) = 5.561 and P = .019). However, unexpectedly, participants who received the "high outrage" condition were less likely to agree with this statement (mean score 3.42) than people in the "low outrage" condition (mean score 4.12). It appears that people in the "high outrage" condition are less (extremely) worried about the risk than people in the "low outrage" condition. The technical detail manipulation played no significant role in participants' (dis)agreement with this clipping (P = .640).

To a certain extent, gender may have affected participants' (dis)agreement with this clipping. Men were less likely to agree with this last clipping than women (F(1.187) = 3.808 and P = .052, with means: 3.47 for men and 4.05 for women). However, for analysis of this last clipping, the more stringent α level of .025 was chosen, since the assumption of homogeneity of variance was violated (Levene's test of equality of error variances was .034).

5. Discussion

The study reported here tried to gain insight into the factors that can feed people's concerns about a risk, and that may determine their risk perception. The study specifically focused on the potential influence of the amount of technical (risk) detail and the amount of outrage provided in a risk message.

First, the effects of technical detail and outrage on risk perception and other measures of agitation, as measured in this study (e.g. risk acceptability, the emotion checklist) will be discussed (section 5.1). After that, the discussion focuses on other factors (measured but not manipulated) that can influence people's risk perceptions, agitation, emotions and risk acceptability (section 5.2). This is followed by a discussion about the effectiveness of the manipulations, and how one can best manipulate a risk in terms of outrage and technical details (section 5.3). The chapter ends with some remarks about the study, such as considerations about possible shortcomings, some general comments and recommendations for future studies.

5.1 The effect of technical details and outrage on risk perception

Of the four created stories, the story about the power lines appeared (intuitively) to be the most strongly manipulated and, since this story might therefore be the most effective for this study, it was decided that participants would be given this story first. Statistical analyses showed that both the outrage and technical detail manipulation were successful for the first two stories. For the third story (DON in bread), the outrage manipulation also worked, but the technical detail manipulation only seemed to work for people in the "high outrage" condition. The technical detail manipulation was ineffective in the last story, though the outrage manipulation was very successful. Since the results showed that the first story was indeed very effective in terms of the manipulations, this story (about the possible association between power lines and leukemia), was selected for further analyses to examine the influence of the manipulations on people's agitation about the risk. Reason for choosing this story over the second story (which was also effectively manipulated), is that for the first story, people's perception of the described risk was not influenced by possible carry-over effects from the manipulations of other stories (since there were no previous stories).

Studying the effect of the technical detail and outrage manipulation on *risk perception* offers several challenges. One must determine what effects should be expected and what kind of information is pertinent. Scientists advocating more communication of technical information to the public often presume that information will lead citizens to see risks the same way experts do. Scholars who document the public's lack of knowledge about science also imply that improving scientific literacy will often reduce disagreements between experts and

citizens.[22] In addition, it is expected that people who are confronted with more outrage, will perceive the risk as more serious than people who are confronted with less outrage. However, although there were significant differences between the four study groups in terms of perceiving (more or less) technical details, and perceiving outrageous behavior (i.e. effective manipulations), the results indicate that neither outrage nor the amount of technical details provided in the story about the possible association between power lines and leukemia are strong predictors of people's risk perception. Except for people's perception of the controllability of the risk, no significant effect of the manipulations in the first story was found on the risk perception variables measured. Participants in the "high outrage" condition were less likely to think that the risk was controllable. However, they were apparently not significantly influenced by the manipulations in their perception of the seriousness of the situation, i.e. whether or not they would be worried about the risk when put in the described situation:

- in their estimate of the chance of children developing leukemia due to living near power lines;
- in whether or not they considered the risk to be scary;
- in whether or not they found the risk to be voluntarily;
- in whether or not they thought people were clearly in danger by the risk.

People's gender was one of the most strong influences on their perception of the risk of developing leukemia due to living near power lines. Women were significantly more worried, found the situation more serious and the chance of developing leukemia greater than men. In addition to people's gender; people's education, previous familiarity with the risk, and risk aversion (all factors beyond the control of the agency or corporate communicator) appeared to be much better predictors of people's risk perception.

In Sandman's third experiment (see also chapter 2), the technical detail manipulation did not significantly affect any dependent measure, including perceived risk. There was also no effect of the technical detail manipulation on the manipulation check, "perceived detail". The fact that Sandman's technical detail manipulation was not effective (participants did not perceive the "high technical detail" versions, since, in fact, more detailed versions than the "low technical detail" versions may explain why he did not find the manipulation to have a significant influence on people's risk perception. In this study, the technical detail manipulation was effective but still, the amount of technical detail provided in the risk message did not significantly influence people's perception of the risk. This *could* indicate that the amount of technical detail provided in a risk message would have no influence on risk perception. Further research (with effective manipulation) is needed to confirm this statement.

For Sandman's third experiment, the outrage manipulation was effective; subjects who read "high outrage" news stories saw agency behavior as much less appropriate than subjects who read low outrage stories. This effective outrage manipulation also significantly affected people's perception of the risk; when provided with more outrage, subjects saw the risk as more important, serious and worrisome than did those who read low outrage stories.[2]

One reason why the effect of outrage on risk perception, as found in Sandman's study, was not found in the present study, may be that in terms of risk perception, the Dutch population (or at least the selection of this population entering this study) responds differently to risk information or outrage than the American population due to cultural differences. Cross-national studies have suggested that the relationship between trust (i.e. an outrage factor) and perceived risk are not as clear as one would expect. For example, while French citizens, as reported in a study by Poumadère, were more trusting than the Americans, they perceived the risks as being larger.[38] This a paradoxical result, since the common assumption in risk research is that higher levels of trust are associated with lower levels of perceived risk.[39] In a recently publicized study, the relationship between trust and risk perception was investigated, within and across four European countries.[39] The results of this study indicated that in some countries (especially in the United Kingdom, and to some extent in Sweden) trust was a very important variable in explaining perceived risk, while its contribution was close to negligible in other countries (i.e. in Spain and France). Correlation between trust and risk perception also varied, depending on the type of risk and trust measure.[39] These studies imply that cultural differences between populations possibly explain why outrage plays a role in risk perception for some but not for all. Furthermore, in the (European) cross-national study it was concluded that trust may be an element in models explaining risk perception, but that it is not as powerful as often argued in risk perception literature.[39] The results of present study underline this. It should also be noted that the present study was carried out more than ten years after Sandman's experiments took place. Over time, the influence of outrage on risk perception could also have changed.

Among other aspects that may differ between the participants in the present study and Sandman's study, is previous familiarity with the described risk. In the present study, previous familiarity proved to be a strong predictor in people's risk perception, as found for three of the risk perception variables measured. People who were already relatively familiar with the described risk, found the chance of children developing leukemia due to living near power lines larger, the described risk scarier and the children clearly in more danger by the risk than people who were not familiar with the possible association between power lines and leukemia. The (European) cross-national study also noted the importance of (existing previous) knowledge about a risk. Sandman's study did not measure previous familiarity with the risk.

A third possible reason why the effect of outrage on risk perception, as found in Sandman's study, was not found in the present study, is the fact that the stories used to ascertain the possible effect of outrage on risk perception were different. In Sandman's study the story was about a spill at a chemical plant; in the present study, the (further) examined story was about the possible association between power lines and leukemia. As just mentioned, the European cross-national study found that correlation between trust and risk perception also varied depending on the type of risk.

In terms of *risk acceptability*, the outrage and amount of technical detail provided in the story were also not strong predictors. Again, (non-influential) factors such as age, having children and people's risk-taking tendency appear to be better predictors of risk acceptability. This may imply that providing people with more information about the risk will not always lead to a higher acceptability, as some risk managers argue. It may also imply that in an "outrageous" situation, this outrage will not always lead to a decline in acceptability, as some people argue.

Studies suggest that a highly outrageous situation might influence people's risk perception in a way that those who become outraged about a risk tend to perceive the risk as more serious (though this was not the case in this study). However, this may not lead directly to a decline in risk acceptability. Or, as Sjöberg states, it is simplistic just to assume that a high level of perceived risk carries with it demands for risk mitigation.[17] A study to further investigate the link between people's risk perception and people's risk acceptability in this context might be useful.

When people's perception of the possible association between power lines and leukemia was measured with a list of twelve *emotions*, and participants had to indicate to what extent they expected to go through these emotions when they themselves would be faced with the risk, the outrage condition had an unexpected effect on the experience of "negative" emotions. One would expect that people who read the high outrage version of a story would become more angry, frightened, annoyed and alarmed, in other words, more outraged about the situation. However, results from this study show that providing participants with more outrage in the story only seemed, somehow, to calm them down. Further analyses (not presented here), showed that this effect was mainly caused by the answers of the men in the "high technical detail / high outrage" group. For example; men indicated to be less angry in the "high outrage" condition, if they were given more technical details. Based on previous analyses, this effect was highly unexpected; looking back at the analyses for the effectiveness of the outrage manipulation, results indicated that for men, the outrage seems to be fueled when given more technical details. The outrage condition did, however, have the expected effect on the experience of feeling carefree. Participants in the "low outrage" conditions felt significantly more carefree than participants in the "high outrage" conditions. In terms of the technical detail manipulation, the analyses indicated that the amount of technical detail provided in a story hardly seemed to influence the experience of the tested emotions.

It is difficult to compare these results with the results of Sandman's study. For his first experiment (see chapter 2), Sandman presented participants a list of twelve emotions (the same twelve as used in the present study), describing how someone might feel if he or she was to face the risk described. Participants could choose as many items as they liked to describe how they thought they would feel. In his second experiment, Sandman only used six of the initial twelve emotions (angry, frightened, safe, alarmed, concerned and annoyed), and for his third experiment, the emotion checklist was not used at all. In the present study, all twelve emotions, initially used by Sandman, are listed, but participants were asked to rate *all*

twelve emotions on a 7-point Likert scale. Sandman found that when the agency and community were depicted as mutually respectful and cooperative, subjects described their own reactions as concerned rather than frightened or unsafe. For future studies, it might be useful to present the emotions in a random order distributed throughout the questionnaire (instead of in rows and always in the same order).

There were some significant differences between the study groups with regard to their answers on the *interview clippings*. For the four clippings, the worries expressed in the interview clipping increased with every clipping. Since the common assumption in risk research is that higher levels of outrage are associated with higher levels of perceived risk, one would expect people in the "high outrage" condition to be more likely to agree with the last clipping expressing extreme worries about the risk ("Yes, well I am very worried about this. We are talking about a very big risk, here. Seriously… I am greatly concerned about the effects this risk can cause") than people in the "low outrage" condition. People in the "low outrage" condition would be more likely to agree with the first clipping ("Hmm, well what should I say about that. Sure, chances are very small, but despite all that, I am not really comfortable with it"), than people in the "high outrage" condition. However, unexpectedly, participants who received the "high outrage" condition were less likely to agree with this last (and most extreme) statement than people in the "low outrage" condition. It appeared that people in the "high outrage" condition are less (extremely) worried about the risk that people in the "low outrage" condition. The same effect was found for the third (somewhat moderate) statement. But, in hindsight, possible contrasts in perception between the four study groups, perhaps would have been more effectively measured if people were allowed to choose the clipping (one out of the four) with which they felt most connected, instead of having to rate all four. It might also be useful to present four clippings in a random order spread out in the questionnaire (instead of in a row with increasing worries expressed), so that participants can not (easily) compare the clippings before rating them.

5.2 The effect of other factors on risk perception, measured but not manipulated

Most variables in this study measuring risk perception, agitation, emotions and risk acceptability were strongly influenced by personal aspects of the participants. Next to the role of gender (which is already discussed in previous sections of this thesis), other factors measured in this study played a large role in determining people's risk perception. Participants who had a strong tendency to avoid risks (as measured by the Risk Scale and the questions concerning societal and personal risk aversion) were generally more worried and scared of the risk described. However, though risk aversion, risk tolerance and risk-seeking are often assumed to be enduring traits of character (in individuals and in cultures), the variations are more impressive than the consistencies.[40] Concern about personal risk (like cholesterol) shows only modest correlation with concern about societal risks (like industrial effluent). When the domain of "risk" is extended even further, the correlation may disappear

or even be reversed. Quite different groups lead the way for concern about environmental risks (global warming, toxic waste dumps), economic risks (recession, unemployment) and social risks (family values, violent crime).[40] Furthermore, participants who were already very familiar with the described risk before this study, found the risk more scary, the chance of children developing leukemia due to living near power lines larger, and people more clearly placed in danger by living near power lines, than participants who first learned about the possible association while participating in this study. This effect might be caused by the participant's previous affirmations of (or experience with) the risk, and it clearly indicates that previous familiarity with a risk strongly influences people's risk perception.

A study by Sjöberg found that education is only weakly related to risk perception, hence not a seriously biasing factor.[41] Analyses of the risk perception variables for the story about a possible association between power lines and leukemia showed that education played a serious role in influencing people's risk perception. People with a relatively high education found the described situation to be less serious, the chance of children developing leukemia due to living near power lines to be smaller and people less clearly endangered the risk. The mechanism behind the influence of people's level of education on their risk perception has not yet been fully determined. Some argue that people with a relatively high level of education have a better understanding of risks in general, or that they are less exposed to risks (as compared to people with a relative low level of education, ergo low social economic status) and therefore do not worry much about risks in general.[42]

As with the role of people's education, the role of one's age on people's risk perception is not completely understood. Some argue that older people become more risk-avoiding and have a (natural) higher perception of risks. Others state that when people get older, they gain more life experience, which, in turn, lowers their (general) perception of risks. Results of analyses of the emotion checklist seem to support the second theory, since the analyses revealed that older participants generally felt more positive / optimistic about the risk described.

However, the major influence on the experience of "positive" feelings turned out to be whether or not the participant had children. Participants without children, felt significantly more optimistic about the possible association between power lines and childhood leukemia than participants with children. Parents are probably better at imagining being placed in the situation described, and having to deal with the risk described, than people who do not have children.

5.3 The effectiveness of the manipulations

As mentioned, this study specifically focused on the potential influence of the amount of technical (risk) detail and the amount of outrage provided in a risk message and how one could best manipulate a risk in terms of outrage and technical details. First, the effectiveness of the manipulation of the amount of technical detail in a risk message will be further

discussed. After that, the effectiveness of the manipulation of the amount of outrage will be discussed.

The first hypothesis tested in this study was that people who receive more *technical details* about the risk in the study story, react differently to the same risk, than people who receive less technical detail about the risk. As mentioned, before testing the effect of technical detail on the risk perception, one must determine whether lay people recognize technical detail as defined by experts. So, in order to examine the effect of the technical detail manipulation, the first question is: are the sections that contain more detail according to experts seen by lay readers as such? This is also important because it affects the value of providing technical information to citizens. If the public cannot recognize expert-defined detail as indeed more detailed, presenting the data as being more detailed may backfire if citizens want details. They will believe their demand evoked no response and may react with anger.[22] Alternatively, if readers do not notice greater detail, more information could be put into a story without people feeling that they are asked to do a lot of mental work.[22]

The study results show that the technical detail manipulation was very effective in the first story. Participants who received more technical details found the information in the story about possible health effects and exposure routes significantly more accurate and more detailed than participants confronted with fewer technical details. For the second story (which was loosely based on a story Peter Sandman used in his study (see also chapter 2, third experiment), the technical detail manipulation also played a large role in people's perception of the accuracy and the amount of detail given in the story. Though the outline of the story used in both studies was largely the same, in Sandman's study, no significant effects of the technical detail manipulation were found for any dependent measure, not even on the "manipulation check" variable.

However, the outrage manipulation in the second story also played a part in the effectiveness of the technical detail manipulation. People who were confronted with more outrage in their story found the information less accurate and less detailed than people with less outrage in the story. This finding is consistent with the finding in Peter Sandman's third experiment: subjects who read high outrage stories judged that they had significantly less technical detail than subjects who read low outrage stories. Sandman concluded this to suggest that if an agency or company behaves otherwise satisfactorily, people tend to assume that it is providing enough information as well. However, if its behavior is improper or offensive, the information given is more likely to be thought insufficient.[2] So perhaps "outrageous" agency behavior makes people distrust the technical details coming from the agency, distracts them from the details actually present, or makes them require more details than they would have required had agency behavior been more responsive.[2]

This replicates a familiar pattern in risk controversies, where the key technical information often comes from sources that are also managing the risk, and whose courtesy, compassion, openness, and the like may determine whether the technical information is accepted.[2] To a

certain extent, this concept may have played a role in the present study as well, however, it would be interesting to see if the effect of the outrage manipulation on people's observance of the amount and accuracy of technical details provided also occurs when the technical information about the risk comes from neutral parties, instead of from a source associated with "outrageous" behavior. If, in fact, technical information is accepted on the basis of the way the source of information is managing the risk, the outrage manipulation should not interfere with the observance of the amount and accuracy of technical details provided, at lease, if these details have come from an impartial source (unless the outrage aimed at the person, company or institute managing the risk, would "rub off" on the impartial source communicating the risk).

For the third story in this study, the risk information in the article about possible health effects and exposure routes of DON was primarily and explicitly provided by the RIVM and the Health Council of the Netherlands (sources that were not involved in the outrage manipulation). The results show that the technical manipulation only seemed to affect people's observance of the accuracy and the amount of detail provided about the risk when they were confronted with more outrage in their story version. Participants only saw more technical details when they were also confronted with more outrage in their story.

Though it was not specifically examined, it seemed that the successful outrage manipulation of the attitude of the bakers and the health center in the third story did not have a negative effect on people's perception of the role of the RIVM and Health Council in the story. Further analyses (not presented here) showed no significant differences between the four study groups in their response, when participants were asked if children should eat less bread because of DON (DON87; P's $\geq$ .306, the overall average score was 2.51). Generally, participants strongly stated that children should not eat less bread because of the fungus toxin. This indicates that participants are clearly adopting the advice of both the RIVM and the Health Council given in the article, especially considering the fact that hardly any of the participants were previously familiar with the risk (see section 3.5). This could also indicate that the outrage manipulation (focused on other aspects) did not "rub off" on the institutes; if people were to be outraged at these two institutes, the advice probably would not have been so easily accepted. So, assuming that these institutes are, in fact, seen as neutral parties, the outrage originally focused on other parties did not make people blind to the amount and accuracy of technical detail given by neutral parties. In fact, for this story, one could even argue that providing more outrage in the story might have made participants more alert to the technical details provided by the two institutes.

In the final story, the technical detail manipulation was nearly ineffective; two of the three variables checking the effectiveness of the technical detail manipulation did not find a significant P-value for technical detail. However, concerning the information about the exposure routes, women were more susceptible to the technical detail manipulation than men. Furthermore, for this story, the outrage manipulation also played a part in people's observance of technical details. However, in contrast with the conclusions of the analyses for

the second story, people in the "high outrage" condition of the fourth story found the information about the health complaints caused by manure, significantly more detailed. In this last story the technical risk information about the health effects and exposure routes was mainly provided by family doctor Lans. His role in the story was not manipulated, so he might also be considered a neutral party. Therefore, these results may, again, imply that providing more outrage in the story might have made participants more alert of the technical details provided by the neutral party.

The results of this study underline Sandman's suggestion that the role of outrage in people's observance of technical details appears to be dependent on the behavior of the source providing the risk information. Not only does this mean that if an agency or company managing the risk behaves improperly or offensively the information they give is more likely to be thought insufficient. However, it also means that in a highly outraged situation, people might become more alert to the amount of technical detail provided to them, provided it is a neutral party providing the risk information (with no direct role in managing the risk).

The second hypothesis tested in this study was that people who are confronted with more *outrage* in the study story, react differently to the same risk than people who are confronted with less outrage. Before testing this effect of outrage on the risk perception, one must first determine whether lay people are in fact more outraged when provided with a more "outrageous" story. In the story about the possible association between power (transmission) lines and leukemia, the outrage manipulation affected people's trust in the approach of the town council, people's trust in Mr. Pastersen and people's thoughts of the way Mr. Pastersen dealt with the situation. However, when provided with more technical details about the risk women were less outraged at Mr. Pastersen, both in the way he acted and in his trustworthiness, even if they were provided with the "high outrage" condition of the story.

Remarkably, the influence of providing more technical detail in order to reduce the outrage, as found by women, did not work for men at all. In fact, when men were given more technical details they were less inclined to trust Mr. Pastersen and the way he dealt with the situation. It appears that when women are given more technical details about the risk, it somehow calms them down in terms of outrage, while for men, the outrage seems fueled when given more technical detail. Numerous studies have found differences between men and women in terms of risk perception, but so far, none of these studies have examined the differences in people's (perception of) outrage, due to influences by the amount of technical detail provided.

The outrage manipulation in the first story was not effective on feelings of information being withheld. However, when faced with more technical details, women were less inclined to think that information was kept from them. Of course, it could be argued that when given more information about a risk, one is less likely to think that information is being withheld, even when faced with more outrage. But this concept only worked for women; men were not

significantly influenced by the outrage or the technical detail manipulation in terms of suspecting information about the risk to be withheld.

The outrage manipulation did not significantly influence whether or not participants thought that the citizens of Roterdalen were rightfully worried. However, in hindsight, this manipulation-check question may not have been clearly stated. If the citizens of Roterdalen (as mentioned in the article) seem less concerned in the "low outrage" condition, participants who read this "low outrage" version of the story will be likely to agree with the (relatively low) amount of worries expressed by the citizens, and indicate that (to them) the citizens of Roterdalen seemed rightfully worried. If the citizens of Roterdalen seem more concerned in the "high outrage" condition, participants who read the "high outrage" version of the story will also be likely to agree with the (relatively high) amount of worries expressed by the citizens, and also indicate that (to them) the citizens of Roterdalen seemed rightfully worried. Therefore, in both outrage conditions participants may state that the citizens were rightfully worried, but they may refer to a different level of concern they find appropriate (i.e. rightful).

In the second story, the outrage manipulation worked perfectly. This was in accordance with the findings of Peter Sandman's study on (roughly) the same story. The third story also was effectively manipulated in terms of outrage, specifically on the role of the health center and the bakers. Initially unexpected was the finding that, when faced with more outrage, participants were less inclined to think that information was being withhold.

However, as previously mentioned, the risk information in this story came from neutral parties, and when the participants were faced with more outrage, they appeared to be more alert to the technical details provided in the story, so the fact that these participants were less inclined to think that information was being withhold, might have had something to do with the fact that the information came from neutral parties (not apparently affected by the outrage directed to others), or with the fact that these participants with the "high outrage" version were already under the impression they were handed a significant amount of risk information.

In the fourth story, the outrage manipulation significantly influenced people's perception of the way they viewed farmer Maars and the town council and whether they thought information was being withheld. Only here, participants provided with *more* outrage, were more inclined to think that information was kept from them. This might be due to the fact that the technical detail manipulation in this story was not very effective (while the outrage manipulation, in contrast, was perhaps a bit extreme).

In order to effectively manipulate the amount of technical detail, the difference between the "low" and "high technical detail" condition, must be relatively large and the information provided in the "high technical detail" condition must be informative for the manipulation to be effective.

In this study, people were very perceptive of outrageous behaviour. Although the outrage manipulation may have been somewhat strong (in some cases), it is not unlikely that these situations may occur in real risk situations. Especially the response of a person of company handling the risk, was easily and effectively to manipulate. Responses from people exposed to risk were less effectively manipulated. In future studies, one should consider making the contrast between these "person-in-the-street" responses more extreme.

These considerations, however, provide no guarantee that by effectively manipulating outrage and technical detail, one can directly influence people's perception of the risk. Further research is needed to see if these effects *do* occur in other (experimental) settings.

It should also be noted that outrage is, in fact, a cluster of related (and perhaps not so closely related) variables and that not all these variables have been manipulated in this study. Furthermore, the technical detail manipulation also consists of a cluster of variables, not all measured in this study (e.g. various sorts of content, variations in tone and clarity). To develop a powerful explanatory model of these effects of outrage on risk perception and thereby gain knowledge about how best to manipulate risks, these variables must be teased apart experimentally to measure their effects independently. In addition, a lot seems to depend on certain demographics of the audience that (all together) can not easily be manipulated, but that do play a major role in people perceiving outrageous behavior or the amount of technical details provided to them in a risk message.

5.4 General comments on this study

Participants were recruited by e-mail notices sent to local community groups asking the groups if they were interested in taking part in the study. This mode of participant selection was chosen because of easy access to a large group of people. In the introductory e-mail, it was suggested that the group could lard their group account, since a reward of €5,00 for each participant was offered as a thank you for their help. This evoked a high response rate. Another benefit of this approach is that all group members could enter the study at the same time, and people who usually would not participate in such studies, were perhaps a bit "peer-pressured" into participating. The groups would gather in their practice halls (most participating groups were local brass bands or choirs), and participate in the study before the start of their rehearsal. One downside of this approach is that it may have led to selection bias. It is not unlikely that people who join such a recreational group have somewhat other characteristics that the general public has. However, the possible effect of the selection bias is not expected to play a serious role in this study; there is no reason to assume that people who join a community group (and are therefore perhaps more "social" than other people) would respond differently to risk information than others. In general, the study group did not appear to be very different from the general adult Dutch population in terms of some of the measured demographics (data compared with information obtained by Statistics Netherlands [43]).

The research reported here used responses to hypothetical situations. It is impossible to say how realistic participants found these simulations and how realistically they responded to them. It seems likely that the effects of outrage on risk perception were diminished by the fictional nature of this study.[2] However, no research findings back up this supposition.[44] Furthermore, real risk situations develop over days, months or even years, in which people have time to contemplate about the risk and confer with others about it. This study compressed these histories into written materials that take only a few minutes to read. Prolonged exposure to a risk controversy may make people more responsive to outrage factors than they were in this research.[2] Yet, no studies demonstrate or dispute this point either.[44]

With the use of fictional news stories, some problems concerning generalisation of the study results are introduced. The study compared the effects of outrage, as reflected in the stories with technical detail given in the stories, but other, more personal, vehicles might work very differently. People who attend a public meeting, receive an informational brochure, or telephone an agency with questions can acquire far more technical detail than the few extra paragraphs in the "high technical detail" versions of the stories. Furthermore, they acquire it in a very different setting. Similarly, each of these settings might convey agency responsiveness or unresponsiveness and community acceptance or outrage very differently. The effects of outrage vis-à-vis technical detail and other variables need to be studied in contexts other than newspaper journalism.[2]

Again, note that outrage is in fact a cluster of related (and perhaps not so closely related) variables. Peter Sandman and colleagues have applied the term "outrage" to a far wider range of variables than the ones manipulated in this study, including ' inter-actional' ones, like voluntariness, familiarity, dread and the like. For development of a powerful explanatory model of these effects of outrage on risk perception, these variables must be teased apart experimentally to measure their effects independently.[2] However, although the outrage variables manipulated in this study may have joint, separate, or even offsetting effects on risk perception, it would be useful to determine whether outrage in general affects risk perception, before designing studies to tease apart its constituents. Presumed controllability over a risk, for example, is also considered an outrage factor (see section 1.1). Although the controllability over the risk was not manipulated in the story about the possible association between leukemia and power lines, results indicated that the outrage manipulation of other outrage factors clearly influenced people's ideas about the controllability.

Furthermore, the technical detail manipulation also consists of a cluster of variables, not all measured in this study. Technical detail includes various sorts of content (detail on exposure, toxicity, epidemiology, etcetera), as well as variations in tone, clarity and the like.[2]

In addition, a lot seems to depend on certain demographics of the audience that, all together, can not (easily) be manipulated. If an audience is already very familiar with the risk, changing their risk perception via a newspaper article becomes a more difficult task. The

source providing the risk information also seems to play a part. Furthermore, people's gender strongly influences their risk perception. Assuming it would be wise to keep the public's outrage about a risk situation low, an all-women audience, where more technical details were provided about the risk, might serve to calm these women down in their outrage (as these study results indicate) and, perhaps subsequently, also in their risk perception (though not found in this study). With an all-men audience, the risk communicator could better be a bit reserved when releasing technical details about the risk, since these technical details might fuel the men's outrage. Of course, a one-gender-audience hardly ever occurs, so these suggestions are not very practical. Further research should, however, also keep in mind *these* gender differences when determining the impact of outrage and technical detail on risk perception.

As mentioned, the results of this study indicate that the technical details provided in a risk message may play a role in feeding people's outrage. Women are generally calmed down in their outrage when they provided with more technical details, while men, when provided with more technical details, become more outraged about the spokesperson or company handling the risk. If the company or government managing the risk has elicited outrage among the public, it might be wise to bring a neutral party (e.g. a research institute such as the RIVM) in to communicate the technical information about a risk to the public. Risk information from a neutral source is more readily accepted, and in a highly outraged situation, people might even become more alert to the amount of technical details provided to them, if it is a neutral party providing the risk information (with no direct role in managing the risk). It should, however, be clear to the public that this neutral party has no stake in the situation, and an effort must be made to make sure that the outrage directed to the risk managers is not "rubbed off" on the risk communicators / information officers.

Research suggests that conflict with the public can be reduced when agency staff demonstrates respect for citizens concerns. However, this is only one factor in the larger context of risk decision-making, and alone it cannot eliminate conflict with the public over risks.[20] This study found factors such as gender, age, education and personal beliefs about avoiding risk to have strong effects on perceived risk and risk acceptance. Therefore, government behavior can reduce but not stop conflict. However, it must be recognized that risk communication will not always reduce conflict and smooth risk management. Avoiding all conflict is not a realistic or even legitimate, goal for risk communication, since people do not all share common interests and values, so better understanding may not necessarily lead to consensus about controversial issues or to uniform behavior. The best-case scenario for risk communication (and indeed, risk management) is having fewer, but better conflicts.[45]

Many agency managers, corporate executives and academic experts feel that giving citizens more details about health effects and exposure routes would reduce their concerns.[20] This study suggests that this may not be the most appropriate avenue to pursue. Although people did notice the extra information about health effects and exposure routes, this did not affect their perception of the risk. Providing people with risk information is certainly important, but

it may not always reduce people's concerns. Both the agency process and science are important in shaping public responses to risk. Yet, officials who try to educate citizens on technical issues without also considering changes in how they deal with citizens in general may do themselves a disservice. They should swiftly inform citizens how they are dealing with a problem, and address public concerns.[20]

As government agencies and corporations struggle to reassure communities about risks that represent small threats to health and environment quality, much that determines the public response is beyond the risk manager's control: risk aversion, demographics, etcetera. But how risk managers interact with communities is very much in their control. Though this study found no significant influence of outrage and technical details on risk perception, it is not unlikely that these factors do (to a certain extent) play a role in people's risk perception. Assuming that outrage does play a part (as found in Sandman's study), it is preferable to avoid exacerbating outrage in the public's response to low-consequence hazards. This is because if an agency or company behaves satisfactorily otherwise, people tend to judge it as providing enough information as well, while if its behavior is improper or offensive, the information given is more likely to be thought less accurate and less detailed.

In conclusion, this study found no significant relation between outrage and risk perception (except for people's perception of the controllability of the risk), and between technical details and risk perception. Neither did the manipulations significantly affect people's risk acceptability. People's gender, age, education, previous familiarity with the risk, their natural tendency to avoid risks and whether or not they had children - all beyond the control or the agency or corporate communicator - appear to be much better predictors of people's risk perception and acceptability. This does not mean that these results conclusively determine that there is no relationship between the amount of technical (risk) detail and outrage provided in a risk message. However, it does show that the results indicate that, although these factors may be elements in models explaining risk perception (and acceptability), they may not be as powerful as often argued in risk perception literature. Further research is needed to confirm this. Future studies should also consider the possible cultural differences between study populations in terms of risk perception and perform a thoroughly examination of other potential factors influencing people's risk perception (such as previous familiarity with the risk and people's natural tendency to avoid risks).

When a company or government managing the risk, has elicited outrage among the public, these study results indicate that it might definitely be worthwhile considering to bring in a neutral party (e.g. a research institute as the RIVM) in to communicate the technical information about a risk, to the public. Risk information from a neutral source, is more readily accepted, and in a highly outraged situation, people might even become more alert to the amount of technical details provided to them, if it is a neutral party providing the risk information (with no direct role in managing the risk).

Finally, another interesting finding in this study was the effect the amount of technical detail had on people's perception of outrage (specified for people's gender). It appears that when women are given more technical details about the risk, it somehow calms them down in terms of outrage, while for men, the outrage seems fueled when given more technical details. Although this effect might not be easily transformed in an unequivocal, practical advice for risk communicators, the effect certainly deserves further investigations.

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Appendix 1: Invitation to participate

Dear …

For my final thesis at Universiteit Maastricht, I am conducting a study after the influence of communication on people's risk perception. In short, this means that participants of the study are asked to read four news paper articles and to fill in a questionnaire with multiple choice answers. The articles are about certain health risks as they are regularly featured in news papers. The questions are about what one might think of the situation as described in the specific article.

The university has suggested that I approach local community groups for participation in the study. The idea behind this, is that those groups can perhaps easily invoke a group of members in their "clubhouse"; all willing to participate in the study at the same time. I then come by with the stories and the questionnaires. Reading the articles and answering the questions will take about half an hour, after which I will collect the questionnaires.

Since I am born and raised in Limburg, I soon thought of the idea of approaching carnival groups and brass bands. I am looking for as many participants at the same time as possible, but of course, every participant is one, and therefore very welcome. Male or female does not matter, but they have to be at least 18 years of age.

For every completely filled-in questionnaire, Universiteit Maastricht will donate €5.00 on your group's joint account. Perhaps a good idea to lard the club funds before carnival starts?

Sincerely,
Debby Jochems

Appendix 2: Informed consent

Information concerning the study 'Risk in perspective'

Below we ask your consent with this form stating that you are voluntarily participating in the study. Please read the statement carefully and if you agree, sign this form with your name and signature.

We would appreciate you not telling the goal and procedures of this study to future participants. Hereby, we want to prevent future participants from filling in the questionnaire by a certain 'pattern of expectation', that could influence study results.

Informed consent

Study 'Risk in perspective'

I hereby declare that I am voluntarily entering the study 'Risk in perspective'.

I understand the purpose of the study, as orally explained to me in advance, and I give permission to use the questionnaire I will fill out for this purpose.

I know that I can end the experiment any time, without giving grounds for doing so. My name and details are then to be removed from the study files and to be destroyed.

Date (day/month/year): …… / …… / ……

Name: …… Signature: ……

Appendix 3: Story format first story

Story 1 : Possible assocation between power (transmission) lines and leukemia

Story[*]	
1,2	'Possible association between power lines and cancer' - from our correspondent -
3,4	'Association between power lines and cancer found' - from our correspondent -
All	LONDON - British scientist Richard Doll has announced that he has found evidence that children living near power lines have an increased risk of developing leukemia.
1,2	This is, according to the British paper The Sunday Times, the first proof that there is an association between power lines and cancer.
3,4	This is proof that people do get cancer when living near power lines, wrote the British paper The Sunday Times.
All	Leukemia may occur at any age and is a type of blood cancer.
2,4	This means that there is a tumor, caused by a certain type of cells in the blood: the white blood cells. With leukemia, these white blood cells multiply uncontrolled. This disrupts the normal composition of the blood.
All	There is a distinction between a slowly and a rapidly developing type of leukemia, the latter usually occurring in children.
3,4	This rapidly developing type has, especially with young children, very bad prospects.
2,4	The number of new cases of leukemia appears to be stable. In the Netherlands, every year, about 120 children between the ages of 0 and 14, develop leukemia, and about 30 children a year die of this disease. In the past few years, due to improved treatment possibilities, the mortality rate of acute leukemia among children has strongly decreased.
2,4	The presumed increased risk of cancer caused by power lines, is possibly caused by electrically charged particles spread in the air by power lines, Doll's co-worker, professor Blakemore told a reporter of The Sunday Times. These particles bind to air pollution. By breathing in this polluted air, the particles enter the bloodstream where they cause cancer.
1,2	Doll also expected adults, who live near power lines, to have an increased risk of cancer, but this appears not to be the case.
3,4	Doll also expects adults, who live near power lines, to have an increased risk of cancer, but he has not yet been able to proof this.
3,4	Despite previous appeals of concerned residents living near power pylons in the small Dutch town of Roterdalen, where in a very short time, three children

[*] 1,2 = low outrage version; 3,4 = high outrage version; 2,4 = high technical detail version

	were diagnosed with leukemia, authorities have always dismissed a possible association between the three childhood leukemia cases and the power lines in the town. The authorities refer to a Dutch study stating that at the most, once every ten years, one additional mortality case of leukemia occurs among a child living near a power pylon. “Those three incidental cases are no reason to get upset. Besides, it would be highly unlikely. Surely that one extra child would not just happen to die in our little town?”, states a laconic city councilor, Mr. Pastersen, in Roterdalen.
1,2	A few months ago, three children were diagnosed with leukemia in the small Dutch town of Roterdalen. At that time, concerned residents suspected an association between the cases and the power lines running through the city. Mr. Pastersen, city councilor of Roterdalen, issued an investigation. Recently the results of this study were made public. Mr. Pastersen: “For the Dutch situation, it is roughly estimated that, at the most once every ten years, an additional case of leukemia mortality will occur among a child living near a power pylon. Please take this number with a pinch of salt, but at least it gives you an idea of the magnitude of the effect we are talking about. Apart from that, those three children in our community fortunately seem to be responding to the chemotherapy.”
2,4	In the past, several studies have been performed, investigating the presumed association between power lines and cancer. In 1990, several British studies suggested that electromagnetic fields can damage human health. But after some more research, this association was found unlikely.
1,2	In the Netherlands, more and more power pylons are replaced by electricity cables buried deep in the ground.
All	Doll is the epidemiologist who, in the sixties, discovered the association between smoking and lung cancer. The present study is performed in association with the National Radiological Protection Board (NRPB), a British government agency studying the consequences of radiation on humans. Next week, Doll will present his conclusions more detailed. (ANP)

Appendix 4: Four versions of story 1

4a: low outrage and low technical detail

‘Possible association between power lines and cancer’

- from our correspondent –

LONDON - British scientist Richard Doll has announced that he has found evidence that children living near power lines have an increased risk of developing leukemia. This is, according to the British paper The Sunday Times, the first proof that there is an association between power lines and cancer.

Leukemia may occur at any age and is a type of blood cancer. There is a distinction between a slowly and a rapidly developing type of leukemia, the latter usually occurring in children.

Doll also expected adults, who live near power lines, to have an increased risk of cancer, but this appears not to be the case.

A few months ago, three children were diagnosed with leukemia in the small Dutch town of Roterdalen. At that time, concerned residents suspected an association between the cases and the power lines running through the city. Mr. Pastersen, city councilor of Roterdalen, issued an investigation. Recently the results of this study were made public. Mr. Pastersen: “For the Dutch situation, it is roughly estimated that, at the most once every ten years, an additional case of leukemia mortality will occur among a child living near a power pylon. Please take this number with a pinch of salt, but at least it gives you an idea of the magnitude of the effect we are talking about. Apart from that, those three children in our community fortunately seem to be responding to the chemotherapy.”

In the Netherlands, more and more power pylons are replaced by electricity cables buried deep in the ground.

Doll is the epidemiologist who, in the sixties, discovered the association between smoking and lung cancer. The present study is performed in association with the National Radiological Protection Board (NRPB), a British government agency studying the consequences of radiation on humans. Next week, Doll will present his conclusions more detailed. (ANP).

4b: Low outrage and high technical detail

‘Possible association between power lines and cancer’

- from our correspondent -

LONDON - British scientist Richard Doll has announced that he has found evidence that children living near power lines have an increased risk of developing leukemia. This is, according to the British paper The Sunday Times, the first proof that there is an as-sociation between power lines and cancer.

Leukemia may occur at any age and is a type of blood cancer. This means that there is a tumor, caused by a certain type of cells in the blood: the white blood cells. With leu-kemia, these white blood cells multiply un-controlled. This disrupts the normal composition of the blood. There is a distinction between a slowly and a rapidly developing type of leukemia, the latter usually occurring in children.

The number of new cases of leukemia appears to be stable. In the Netherlands, every year, about 120 children between the ages of 0 and 14, develop leukemia, and about 30 children a year die of this disease. In the past few years, due to improved treatment possibilities, the mortality rate of acute leukemia among children has strongly decreased.

The presumed increased risk of cancer caused by power lines, is possibly caused by electrically charged particles spread in the air by power lines, Doll’s co-worker, professor Blakemore told a reporter of The Sunday Times. These particles bind to air pollution. By breathing in this polluted air, the particles enter the bloodstream where they cause cancer. Doll also expected adults, who live near power lines, to have an increased risk of cancer, but this appears not to be the case.

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Recently the results of this study were made public. Mr. Pastersen: “For the Dutch si-tuation, it is roughly estimated that, at the most once every ten years, an additional case of leukemia mortality will occur among a child living near a power pylon. Please take this number with a pinch of salt, but at least it gives you an idea of the magnitude of the effect we are talking about. Apart from that, those three children in our community fortunately seem to be responding to the chemotherapy.”

In the past, several studies have been per-formed, investigating the presumed asso-ciation between power lines and cancer. In 1990, several British studies suggested that electromagnetic fields can damage human health. But after some more research, this association was found unlikely. In the Netherlands, more and more power pylons are replaced by electricity cables buried deep in the ground.

Doll is the epidemiologist who, in the sixties, discovered the association between smoking and lung cancer. The present study is performed in association with the National Radiological Protection Board (NRPB), a British government agency studying the consequences of radiation on humans. Next week, Doll will present his conclusions more detailed. (ANP)

4c: High outrage and low technical detail

‘Association between power lines and cancer found’

- from our correspondent -

LONDON - British scientist Richard Doll has announced that he has found evidence that children living near power lines have an increased risk of developing leukemia. This is proof that people do get cancer when living near power lines, wrote the British paper The Sunday Times.

Leukemia may occur at any age and is a type of blood cancer. There is a distinction between a slowly and a rapidly developing type of leukemia, the latter usually occurring in children. This rapidly developing type has, especially with young children, very bad prospects.

Doll also expects adults, who live near power lines, to have an increased risk of cancer, but he has not yet been able to proof this.

Despite previous appeals of concerned residents living near power pylons in the small Dutch town of Roterdalen, where in a very short time, three children were diagnosed with leukemia, authorities have always dismissed a possible association between the three childhood leukemia cases and the power lines in the town, stating that there is no reason to be worried. The authorities refer to a Dutch study stating that at the most, once every ten years, one additional mortality case of leukemia occurs among a child living near a power pylon. “Those three incidental cases are no reason to get upset. Besides, it would be highly unlikely. Surely that one extra child would not just happen to die in our little town?”, states a laconic city councilor, Mr. Pastersen, in Roterdalen.

Doll is the epidemiologist who, in the sixties, discovered the association between smoking and lung cancer. The present study is performed in association with the National Radiological Protection Board (NRPB), a British government agency studying the consequences of radiation on humans. Next week, Doll will present his conclusions more detailed. (ANP)

4d: High outrage and high technical detail

‘Association between power lines and cancer found’

- from our correspondent -

LONDON - British scientist Richard Doll has announced that he has found evidence that children living near power lines have an increased risk of developing leukemia. This is proof that people do get cancer when living near power lines, wrote the British paper The Sunday Times.

Leukemia may occur at any age and is a type of blood cancer. This means that there is a tumor, caused by a certain type of cells in the blood: the white blood cells. With leukemia, these white blood cells multiply uncontrolled. This disrupts the normal composition of the blood. There is a distinction between a slowly and a rapidly developing type of leukemia, the latter usually occurring in children. This rapidly developing type has, especially with young children, very bad prospects.

The number of new cases of leukemia appears to be stable. In the Netherlands, every year, about 120 children between the ages of 0 and 14, develop leukemia, and about 30 children a year die of this disease. In the past few years, due to improved treatment possibilities, the mortality rate of acute leukemia among children has strongly decreased.

The presumed increased risk of cancer caused by power lines, is possibly caused by electrically charged particles spread in the air by power lines, Doll’s co-worker, professor Blakemore told a reporter of The Sunday Times. These particles bind to air pollution. By breathing in this polluted air, the particles enter the bloodstream where they cause cancer. Doll also expects adults, who live near power lines, to have an increased risk of cancer, but he has not yet been able to proof this.

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leukemia, authorities have always dismissed a possible association between the three childhood leukemia cases and the power lines in the town, stating that there is no reason to be worried. The authorities refer to a Dutch study stating that at the most, once every ten years, one additional mortality case of leukemia occurs among a child living near a power pylon. “Those three incidental cases are no reason to get upset. Besides, it would be highly unlikely. Surely that one extra child would not just happen to die in our little town?”, states a laconic city councilor, Mr. Pastersen, in Roterdalen.

In the past, several studies have been performed, investigating the presumed association between power lines and cancer. In 1990, several British studies suggested that electromagnetic fields can damage human health. But after some more research, this association was found unlikely.

Doll is the epidemiologist who, in the sixties, discovered the association between smoking and lung cancer. The present study is performed in association with the National Radiological Protection Board (NRPB), a British government agency studying the consequences of radiation on humans. Next week, Doll will present his conclusions more detailed. (ANP)

Appendix 5: Story format second story

Story 2: Possibility of chemical substance in local gardens by leakage tank Chemilak

Story[*]	
1,2	'Lightning strike storage tank Chemilak: small amount of the released substance possibly entered surrounding residential gardens Marpelle'
3,4	'Lightning strike storage tank Chemilak: carcinogenic substance poured into surrounding residential gardens Marpelle'
All	During last night's thunderstorm, a lightning strike ruptured a chemical storage tank at Chemilak.
1,2	The perchloroethylene, (PERC), that was released, is considered a 'suspected human carcinogen' by the government. Although the leak was quickly sealed, it can not be ruled out that a small amount of the PERC possibly entered surrounding gardens of residents living near the company in Marpelle.
3,4	The perchloroethylene, (PERC), that was released, and is considered a carcinogen by the government, poured into surrounding gardens of residents living near the company in Marpelle.
All	MARPELLE (ANP) – According to Gerard Vangart, spokesperson for the city council of Marveld, under which jurisdiction Marpelle is, the lightning strike which caused a small hole in the storage tank, was "a very unusual event".
All	Chemilak manufactures and distributes a range of products, used by the car- and metal industries. According to Vangart, Chemilak meets all required standards.
1,2	"We will certainly want to take another look at the regulations. Perhaps the government should consider tougher standards for lightning protection."
3,4	"It looks like a fluke to me", Vangart said. "As far as I know, the city council has no plans to reexamine the regulations. You can't cover every conceivable event."
All	The lightning last night was accompanied by heavy rainfall. The rain may have washed part of the released PERC off the Chemilak premises. About twelve families live nearby; the nearest family lives 45 meters away from the tank.
1,2	Vangart said the city council is developing plans to test all gardens in the vicinity for PERC. "At this point I don't expect any of the gardens to be seriously contaminated, but we still want to test to be sure."
3,4	Vangart said the city council has no plans to test the gardens in the vicinity for PERC. "At this point I don't expect any of the gardens to be seriously contaminated. People who want to be absolutely sure, will have to contact a research laboratory and make their own arrangements."

[*] 1,2 = low outrage version; 3,4 = high outrage version; 2,4 = high technical detail version

2,4	Scientific research has linked long-term PERC exposure to liver cancer in mice. Although no evidence has been found concerning cancer in humans, the government considers PERC a 'suspected human carcinogen'.
2,4	According to Vangart, there are two ways local residents might be exposed to the released PERC. "This can take place by drinking water from the rain puddles or by direct skin contact with the puddles."
All	The city council advises residents to keep children and pets out of the puddles until they have had a chance to evaporate.
1,2	Ordered by the city council, shortly after the leak was sealed, rain- and soil-samples were taken from the Chemilak premises. Samples were also taken from twelve nearby lawns.
3,4	Ordered by the city council, shortly after the leak was sealed, some water samples from the puddles on the Chemilak premises were taken, but the results will not be back from the laboratory for at least some weeks.
1,2	Vangart added that he had been in contact with employees of Chemilak during the whole ordeal, and that they, together with the federal government had made arrangements to contact local residents later today.
3,4	Vangart added that there was no need to check local residents for symptoms caused by high levels of exposure, because "we are fairly confident that at the levels we think are present, no symptoms are likely". "Asking an expert to check with people", he said, "would be a senseless use of overtaxed agency resources and might just provoke hysterical responses in people who are not really at any risk".
1,2	"Even though we are fairly confident that at the levels we think are present, no symptoms are likely", he said, "checking with people is a way to make sure and at the same time answer any questions they might have".
1,2	"Shortly after I woke up, there was a person send by the city council at my door explaining what happened and what the cleanup crews were doing," said Monique Jaspers, resident of the afflicted neighborhood. Her neighbor, Mrs. Koster, lives closest to the storage tank of Chemilak. She said to be impressed by the promise of the city council to test her garden. "I am less worried now that I have talked to someone send by the city council", said Mrs. Koster.
3,4	"I have no idea what happened or what they are doing about it, and nobody from the council is taking the time to tell me," said Monique Jaspers, resident of the afflicted neighborhood. Her neighbor, Mrs. Koster, lives closest to the storage tank of Chemilak. She said to be furious about the fact that the city council is not willing to test her garden. "My whole family is worried and the city council does not seem to care. If this cancer substance is in my garden, it is only a matter of time before it will be in my home."

Appendix 6: Story format third story

Story 3 : DON in bread

Story[*]	
All	Wholesome bread?
All	Wheat in bread and cereals is the primary source of DON, a toxin produced by fungi. A recent study by the Dutch National Institute for Public Health and the Environment (RIVM) indicates that especially young children can exceed the tolerable daily intake, which can lead to a stagnation in growth.
3,4	However, a small inspection of the cereals in the grocery stores indicates that none of the "wheat-containing breakfast products" caution us for this extremely poisonous DON. Next to that, the bakers pretend not to know what is going on. It seems that they would rather have kept this information to themselves, fearing a decline in sales. During the baking process of bread, the fungus disappears, but the toxin remains. That is why you can take poison on the fact that Dutch children are taking in more DON than they should.
1,2	However, it is certainly not wise to eat less cereals. At this moment, current cultivation techniques are revised, and the Dutch Guild for Bakers are performing more stringent inspections on the flour they acquire.
All	THE HAGUE (ANP) – In June 1999, completely by accident, a large amount of the fungus toxin DON, in full Deoxynivalenol, was found in a wheat-containing breakfast product.
2,4	DON is a substance produced by the fungus Fusarium. In nature, this type of fungus lives in moderate regions and grows on several types of grain (wheat, corn, barley, oat and rye).
1,3	The type of fungus that produces this toxin in nature, grows on several types of grain.
All	Research showed that the 1999 breakfast product was made of cereals harvested in 1997 and 1998, at which period the fungus, due to rainy weather conditions flourished in Western Europe.
3,4	And there are more examples: at the beginning of last year, after investigating a number of Honig pasta products, researchers found that the batches of flour used in fabricating these products, also contained DON.
All	During the processing of cereals in bread and other food products, DON hardly breaks down. True; the fungus disappears, but the toxin does not.
1,2	At the beginning of last year, a number of Honig pasta products was found to be fabricated using batches of flour containing DON.
All	The amount of DON found in the Honig-flour exceeded the allowable European standard of 500 microgram per kilo grain with more than a factor 3.

[*] 1,2 = low outrage version; 1,3 = low technical detail version; 3,4 = high outrage version; 2,4 = high technical detail version

All	It was then decided that these products should temporarily be removed out of the stores, and consumers who had already bought the products were advised not to eat the specific product, but to send the wrapping back to the Honig factory in order to get a reimbursement for the money spend.
2,4	But it is not only bread and pasta; also cookies, cake and pastry are not free of this fungus toxin that, at acute poisoning, can cause indigestion (vomiting, blood in excrement), headaches and dizziness. Laboratory animals continuously exposed to low concentrations of DON, showed a delay in growth. When increasing the dose, there was a negative effect on the immune system, on the reproduction and on the unborn foetus. According to the Health Council of the Netherlands, there are, at this time, no direct links that indicate damage to human health caused by DON.
3,4	Despite this, more and more people, especially parents, are concerned about this poison in their food. “When I used to take my son to the child health center for his regularly check-ups, I was once told that I should feed him more bread, since he had not grown sufficiently. Certainly, that was bad advice?” states a concerned mother.
1,2	Especially the interest of research institutes for this age-old substance has increased in the passing years. Inquiry with a child health center tells us that some concerned parents have called, asking questions about feeding their children bread. “Thankfully, we have been able to put their minds at ease”, tells an employee of the center.
All	However if, after intensifying inspection on cereal storage and adaptation of cultivation techniques in order to limit the fungus’ growth, the standard is still exceeded; RIVM investigators still advise to keep feeding the risk group (toddles) cereals and bread. Although exceeding the standard is essentially unwanted, not every violation of this standard will in fact cause health damage. “Health damage caused by DON is probably negligible compared to the damage caused by avoiding a daily dose of cereals”, according to the RIVM.
2,4	The Health Council of the Netherlands recently confirmed this advice.

Appendix 7: Story format fourth story

Story 4: Health complaints caused by manure

Story[*]	
1,2	Manure silo nuisance to neighbors
3,4	Continuing stench thanks to neighbors
1,2	When mid '90s, business in the Dutch agricultural sector was going bad, farmer Maars from Ulka, a small village in the north of Groningen, decided to concentrate his business on the manure trade, in order to secure the existence of his family company. Since that time, the quality of living of the Brammers family is frequently disrupted.
3,4	Day and night, they are living in a terrible stench says the Brammers family from Ulka, a small village in the north of Groningen. A clean towel from the cupboard smells of manure, their children's friends will no longer come over to play, and health complaints are mounting. For years now, the family has been fighting, together with other neighbors, against the nuisance of farmer Maars.
All	LEEUWARDEN, 10 October 1996 – The Brammers are no Westerners, searching for some peace and quiet on the countryside of Groningen. On the contrary; they have lived in Ulka all their lives. "My father used to work for a farmer", states Mr. Brammers.
1,2	The Brammers and farmer Maars get along for years, but since Maars placed his manure silo a year ago, the quality of living for the Brammers is frequently disturbed.
3,4	He has nothing against farmers in general, but since neighbor Maars placed his manure silo a year ago, the Brammers are living "in a hell".
All	For about ten years, farmer Maars was earning some extra money by trading and spreading manure from farmers dealing with surplus elsewhere in the Netherlands.
1,2	When mid '90s, business went bad in the Dutch agricultural sector, he decided to have a second manure silo build on his land. This way he could trade more manure and secure the existence of his family company.
3,4	At the end of 1994, he had a second silo built on his land in order to expand this lucrative business.
All	Farmers elsewhere in the country, dealing with large surpluses of manure, can get rid of their manure at farmer Maars for a small fee. Trucks transport the manure from other parts of the country to Ulka, where it is stored in the silos. Maars then spreads this manure on his land between February and September.
1,2	The second silo was placed 150 meters away from the neighbor's house. Maars however states that "by no means" does it stink. "Well, what is stench? This is a rural area. Sure, it will smell from time to time, but a stench?"
3,4	To prevent nuisance near his own home, Maars placed the silo elsewhere on

[*] 1,2 = low outrage version; 3,4 = high outrage version; 2,4 = high technical detail version

	his land. The chosen location was over one kilometer from his own house, and 150 meters form his neighbor's house. Maars however states that "by no means" does it stink. "Well, what is stench? Sure, it will smell from time to time, but there is no stench."
1,2	The Brammers family and other neighbors clearly experience nuisance of the manure under certain whether conditions. Especially with a South-Western wind, the manure can be smelled in part of the neighborhood. "A number of local residents then develop somewhat vague complaints such as headaches, nose and throat irritations, a burning sensation of their eyes, and sleeping disorders", according to family doctor Lans from Ulka.
3,4	The Brammers family and 26 other neighbors have complained about it from the start. The manure is causing nauseating stench waves. "Next to that many local residents complain about headaches, nose and throat irritations, a burning sensations of their eyes, and sleeping disorders", according to family doctor Lans from Ulka.
2,4	All complaints possibly brought on by the stench. "Sensitivity of smell differs from person to person and the experience of nuisance depends on local conditions. The source also plays an important role in valuing smells. For example; the smell from a bakery is usually considered a pleasant one. But when the source spreads an unpleasant smell, as with manure, or when the smell is associated with physical complaints, smelling the certain smell becomes unpleasant and is considered a potential health threat. This can then lead to health complaints."
3,4	Mrs. Brammers: "There are days that, even with the windows and doors closed, we still get sick of the stench. The laundry can no longer dry outside, and towels smell of manure even after drying indoors." Especially with a South-Western wind, the manure can be smelled in part of the neighborhood, because under those weather conditions, the stench will even penetrate into bedrooms within a radius of 800 meters.
1,2	The town council was not able to take actions against the farmer, since the silo was placed farther away from the houses than the required distance of at least a hundred meters and the silo is covered according to regulations. The council does record the complaints.
3,4	The town council does not take actions against the farmer. Because the silo is placed farther away from the houses than the required distance of at least a hundred meters and the silo is covered according to regulations, the farm simply can not smell, according to the council. Complaints were recorded at most, but were usually discarded with the comment that a bit of a smell should be accepted at the countryside.
All	Last month, a court ordered in summary proceedings that there is a matter of nuisance. According to the court, Maars had unlawfully acted and was ordered to compensate the damages. Maars immediately lodged an appeal. "I do not want to cause nuisance", he stated to the court. "I am just trying to make a living. Next to that I am helping to resolve the manure problems in southern parts of the country."
1,2	"The nuisance is merely incidental", states the farmer.

3,4	The nuisance is merely incidental, he said. “Besides, the town council always tolerated the situation.”
All	According to the neighbors’ lawyer, the stench continues.
1,2	“The smell of manure remains a nuisance.”
3,4	“The stench of manure continues. We are not talking about a bit of a smell; no, we are talking about a continuing, very extremely, extraordinary disturbing stench.”
1,2	Recently, the neighbors met with farmer Maars. It was agreed upon that on days with “unfavorable” weather conditions, the farmer will limit his activities to using the old manure silo, which is located at more distance from his neighbors.
3,4	It irritates the neighbors that Maars is unwilling to meet with his neighbors. Word is that he would have told complainers that he was glad the silo was not placed near his own house. And does the laundry smell when dried outside? “Than you should have done a better job washing it”, he presumably would have told Mrs. Brammers. Furthermore, Maars said that his silo does not smell more than all 30 other silos in Ulka.
All	The appeal is set for December 15th, in the court of justice in Leeuwarden.

Appendix 8: Questionnaire

To help us shortly describe the participants in this study, we would like to ask you to answer the following questions.

1. Sex

☐ Male
☐ Female

2. Date of birth

……-……-19……

3. Do you have children?

☐ Yes
☐ No

4. What is your highest schooling?*

☐ Primary / elementary school.
☐ VGLO, LAVO.
☐ LBO.
☐ ULO, MULO, MAVO, 3-years of HBS, MBO.
☐ VHMO; contains 5-years of HBS, MMS, Gymnasium, Lyceum, Atheneum, HAVO.
☐ College / academy.
☐ University.

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* Abbreviations mentioned are specific types of education in the Netherlands.

Next are some statements about taking risks. Please indicate to what extent you agree or disagree with the following statement, by putting a circle around the option you prefer.
Please do not think too long before answering; usually your first impression is also the best one. This questionnaire will be handled strictly confidential.

5. Safety first.

Totally disagree						Totally agree
1	2	3	4	5	6	7

6. I do not take risks with my health.

Totally disagree						Totally agree
1	2	3	4	5	6	7

7. I prefer to avoid risks.

Totally disagree						Totally agree
1	2	3	4	5	6	7

8. I take risks regularly.

Totally disagree						Totally agree
1	2	3	4	5	6	7

9. I really dislike not knowing what is going to happen.

Totally disagree						Totally agree
1	2	3	4	5	6	7

10. I usually see risks as a challenge.

Totally disagree						Totally agree
1	2	3	4	5	6	7

11. I see myself as a:

Risk avoider						Risk seeker
1	2	3	4	5	6	7

12. The public has the right to demand zero pollution from industry.

Totally disagree						Totally agree
1	2	3	4	5	6	7

13. An industry that pollutes should not be allowed to stay open, no matter how little pollution it produces.

Totally disagree						Totally agree
1	2	3	4	5	6	7

14. If there was even the slightest amount of asbestos in my home, I would have it removed.

Totally disagree						Totally agree
1	2	3	4	5	6	7

15. I try to avoid all food additives and preservatives.

Totally disagree						Totally agree
1	2	3	4	5	6	7

→ *Specific version of the first story inserted.*

The following questions are about the newspaper article you have just read. Please answer these questions based on your impression of the situation described. **Imagine you and your children living near a power pylon**, and put a circle around the number best matching your impression of the situation.

For example:
Assume that after reading the story your impression was that the story was better than 'a little well written', but not as good as 'well written'. You could then put a circle around the figure five, for example.

0. How well written do you think the story is?

Bad written						Well written
1	2	3	4	(5)	6	7

16. Do you find the text used in the newspaper article comprehensible?

Not at all comprehensible						Very comprehensible
1	2	3	4	5	6	7

17. What is your impression of the seriousness of the situation described?

Not at all serious						Very serious
1	2	3	4	5	6	7

18. Do you find the scientific information clearly described?

Not at all clear						Very clear
1	2	3	4	5	6	7

19. How *accurate* is the information in the story about the possible health effects and the foundation of these effects?

Not at all accurate						Very accurate
1	2	3	4	5	6	7

20. How *detailed* is the information in the story about the possible health effects and the foundation of these effects?

Not at all detailed Very detailed

1 2 3 4 5 6 7

21. How detailed is the information in the story about the ways people might develop leukemia, caused by power lines?

Not at all detailed Very detailed

1 2 3 4 5 6 7

22. What do you think of the way Mr. Pastersen (town councilor of Roterdalen) dealt with the situation?

Not good at all Very well

1 2 3 4 5 6 7

23. Did Mr. Pastersen come across as trustworthy?

Not at all trustworthy Very trustworthy

1 2 3 4 5 6 7

24. Were the citizens of Roterdalen rightfully worried?

Not at all Absolutely

1 2 3 4 5 6 7

25. How much trust do you have in the town council's approach of the situation?

No trust at all A lot of trust

1 2 3 4 5 6 7

26. Do you think that information is being withhold?

Not at all Absolutely

1 2 3 4 5 6 7

27. How worried would you be, if you would be put in the same situation as described?

Not at all worried Very worried

1 2 3 4 5 6 7

28. How big would you say, the chance of children developing leukemia is, due to living near power lines?

Not big at all Very big

1 2 3 4 5 6 7

29. Were you already familiar with the possible association between leukemia and power lines, or did you first read about it today?

Never heard of Very familiar

1 2 3 4 5 6 7

30. Do you find the described risk scary?

Not at all scary Very scary

1 2 3 4 5 6 7

31. Do you find the described risk reasonable?

Not at all reasonable Very reasonable

1 2 3 4 5 6 7

32. Do you find the described risk acceptable for the community?

Not at all acceptable Totally acceptable

1 2 3 4 5 6 7

33. Do you find the described risk voluntary or is it a risk to which people are involuntarily exposed?

Not at all voluntary Totally voluntary

1 2 3 4 5 6 7

34. Do you think the risk is controllable?

Not at all controllable Very controllable

1 2 3 4 5 6 7

35. Do you think people are clearly in danger by the risk described?

Not at all clear Very clear

1 2 3 4 5 6 7

36. Based on what you just read: does Doll's study clearly ascertain an association between power lines and leukemia?

Not at all clear Very clear

1 2 3 4 5 6 7

37. Do you think that, at this moment, science gives clear answers to the questions brought on by the risk described?

Not at all clear Very clear

1 2 3 4 5 6 7

38. Do you think that, based on what you just read, the risk is thoroughly investigated by Doll (the researcher)?

Not at all thoroughly Very thoroughly

1 2 3 4 5 6 7

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39. Could you please indicate to what extent you would go through these emotions, if you and your children would be living next to a power pylon in Roterdalen?

Angry

Not at all Very

1 2 3 4 5 6 7

Helpless

Not at all Very

1 2 3 4 5 6 7

Frightened

Not at all Very

1 2 3 4 5 6 7

Alarmed

Not at all Very

1 2 3 4 5 6 7

Concerned

Not at all Very

1 2 3 4 5 6 7

Confused

Not at all Very

1 2 3 4 5 6 7

Annoyed

Not at all Very

1 2 3 4 5 6 7

Safe

Not at all Very

1 2 3 4 5 6 7

Carefree

Not at all Very

1 2 3 4 5 6 7

Relieved

Not at all Very

1 2 3 4 5 6 7

Indifferent

Not at all Very

1 2 3 4 5 6 7

Pleased

Not at all Very

1 2 3 4 5 6 7

40. Below are four possible reactions from people as they could have been given in an interview. Please indicate for each interview clipping how much you share the reaction described.

"Oh no, I am not at all worried about this risk. Please! If I had to worry about that…! I have much better things to do! Besides, chances of getting sick because of that, are so small."

Totally disagree Totally agree

1 2 3 4 5 6 7

"Hmm, well what should I say about that. Sure, chances are very small, but despite all that, I am not really comfortable with it."

Totally disagree Totally agree

1 2 3 4 5 6 7

"I don't like it, I mean… come on, this risk isn't just nothing? Frankly, I am quite scared; imagine that you would really end up being sick with something…."

Totally disagree Totally agree

1 2 3 4 5 6 7

"Yes, well I am very worried about this. We are talking about a very big risk, here. Seriously… I am greatly concerned about the effects this risk can cause."

Totally disagree Totally agree

1 2 3 4 5 6 7

→ *Specific version of the second story inserted.*

The following questions are about the newspaper article you have just read. Please answer these questions based on your impression of the situation described. **Imagine that you are living near the Chemilak storage tank, and you are not sure if the PERC did in fact enter your garden.** Put a circle around the number best matching your impression of the situation.

41. Do you find the text used in the newspaper article comprehensible?

Not at all comprehensible						Very comprehensible
1	2	3	4	5	6	7

42. What is your impression of the seriousness of the situation described?

Not at all serious						Very serious
1	2	3	4	5	6	7

43. Do you find the scientific information clearly described?

Not at all clear						Very clear
1	2	3	4	5	6	7

44. How *accurate* is the information in the story about the possible health effects and the foundation of these effects?

Not at all accurate						Very accurate
1	2	3	4	5	6	7

45. How *detailed* is the information in the story about the possible health effects and the foundation of these effects?

Not at all detailed						Very detailed
1	2	3	4	5	6	7

46. How detailed is the information in the story about the ways people might be exposed to the released PERC?

Not at all detailed						Very detailed
1	2	3	4	5	6	7

47. What do you think of the way Gerard Vangart (spokesperson for the town council) dealt with the situation?

Not good at all Very well

1 2 3 4 5 6 7

48. Did Gerard Vangart come across as trustworthy?

Not at all trustworthy Very trustworthy

1 2 3 4 5 6 7

49. Do you think the two interviewed neighbors appropriately dealt with the situation?

Not at all appropriately Very appropriately

1 2 3 4 5 6 7

50. How much trust do you have in the town council's approach of the situation?

No trust at all A lot of trust

1 2 3 4 5 6 7

51. Do you think that information is being withhold?

Not at all Absolutely

1 2 3 4 5 6 7

52. How worried would you be, if you would be put in the same situation as described?

Not at all worried Very worried

1 2 3 4 5 6 7

53. How big would you say, the chance of developing cancer is, due to exposure to the PERC that might have entered the gardens?

Not big at all Very big

1 2 3 4 5 6 7

54. Were you already familiar with the possible risk of lightning in a storage tank by which released chemicals could pour into nearby gardens, or did you first read about it today?

Never heard of Very familiar

1 2 3 4 5 6 7

55. Do you find the described risk scary?

Not at all scary Very scary

1 2 3 4 5 6 7

56. Do you find the described risk reasonable?

Not at all reasonable Very reasonable

1 2 3 4 5 6 7

57. Do you find the described risk acceptable for the community?

Not at all acceptable Totally acceptable

1 2 3 4 5 6 7

58. Do you find the described risk voluntary or is it a risk to which people are involuntary exposed?

Not at all voluntary Totally voluntary

1 2 3 4 5 6 7

59. Do you think the risk is controllable?

Not at all controllable Very controllable

1 2 3 4 5 6 7

60. Do you think people are clearly in danger by the risk described?

Not at all clear Very clear

1 2 3 4 5 6 7

61. Do you think that, based on what you just read, Chemilak should be closed down?

No at all Absolutely

1 2 3 4 5 6 7

62. Do you think that, at this moment, science gives clear answers to the questions brought on by the risk described?

Not at all clear Very clear

1 2 3 4 5 6 7

63. Do you think that, based on what you just read, the town council has thoroughly tackled the problem?

Not at all thoroughly Very thoroughly

1 2 3 4 5 6 7

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64. Could you please indicate to what extent you would go through these emotions, if you would be living in the vicinity of the stricken storage tank of Chemilak?

Angry

Not at all Very

1 2 3 4 5 6 7

Helpless

Not at all Very

1 2 3 4 5 6 7

Frightened

Not at all Very

1 2 3 4 5 6 7

Alarmed

Not at all Very

1 2 3 4 5 6 7

Concerned

Not at all 1 2 3 4 5 6 7 Very

Confused

Not at all 1 2 3 4 5 6 7 Very

Annoyed

Not at all 1 2 3 4 5 6 7 Very

Safe

Not at all 1 2 3 4 5 6 7 Very

Carefree

Not at all 1 2 3 4 5 6 7 Very

Relieved

Not at all 1 2 3 4 5 6 7 Very

Indifferent

Not at all 1 2 3 4 5 6 7 Very

Pleased

Not at all 1 2 3 4 5 6 7 Very

65. Below are four possible reactions from people as they could have been given in an interview. Please indicate for each interview clipping how much you share the reaction described.

"Oh no, I am not at all worried about this risk. Please! If I had to worry about that…! I have much better things to do! Besides, chances of getting sick because of that, are so small."

Totally disagree Totally agree

1 2 3 4 5 6 7

"Hmm, well what should I say about that. Sure, chances are very small, but despite all that, I am not really comfortable with it."

Totally disagree Totally agree

1 2 3 4 5 6 7

"I don't like it, I mean… come on, this risk isn't just nothing? Frankly, I am quite scared; imagine that you would really end up being sick with something…."

Totally disagree Totally agree

1 2 3 4 5 6 7

"Yes, well I am very worried about this. We are talking about a very big risk, here. Seriously… I am greatly concerned about the effects this risk can cause."

Totally disagree Totally agree

1 2 3 4 5 6 7

→ *Specific version of the third story inserted.*

The following questions are about the newspaper article you have just read. Please answer these questions based on you impression of the situation described. Imagine that you have just read the article in your newspaper this morning, during your breakfast. Put a circle around the number best matching your impression of the situation.

66. Do you find the text used in the newspaper article comprehensible?

Not at all comprehensible						Very comprehensible
1	2	3	4	5	6	7

67. What is your impression of the seriousness of the situation described?

Not at all serious						Very serious
1	2	3	4	5	6	7

68. Do you find the scientific information clearly described?

Not at all clear						Very clear
1	2	3	4	5	6	7

69. How *accurate* is the information in the story about the possible health effects and the foundation of these effects?

Not at all accurate						Very accurate
1	2	3	4	5	6	7

70. How *detailed* is the information in the story about the possible health effects and the foundation of these effects?

Not at all detailed						Very detailed
1	2	3	4	5	6	7

71. How detailed is the information in the story about the ways people might be exposed to the fungus toxin DON?

Not at all detailed						Very detailed
1	2	3	4	5	6	7

72. What do you think of the attitude of the bakers (as presented in this article)?

Not good at all Very well

1 2 3 4 5 6 7

73. Were the parents, mentioned in the article, rightfully worried?

Not at all Absolutely

1 2 3 4 5 6 7

74. How much trust do you have in the way Honig handled the situation?

No trust at all A lot of trust

1 2 3 4 5 6 7

75. How much trust do you have in the way the health center handled the situation (as presented in the article)?

No trust at all A lot of trust

1 2 3 4 5 6 7

76. Do you think that information is being withhold?

Not at all Absolutely

1 2 3 4 5 6 7

77. How worried are you about DON?

Not at all worried Very worried

1 2 3 4 5 6 7

78. How big would you say, the chance of growth delay in young children is, due to eating cereal products containing DON?

Not big at all Very big

1 2 3 4 5 6 7

79. Were you already familiar with the fact that this fungus toxin can be found in cereal products and that it may cause a delay in growth, or did you first read about it today?

Never heard of Very familiar

1 2 3 4 5 6 7

80. Do you find the described risk scary?

Not at all scary Very scary

1 2 3 4 5 6 7

81. Do you find the described risk reasonable?

Not at all reasonable Very reasonable

1 2 3 4 5 6 7

82. Do you find the described risk acceptable for the community?

Not at all acceptable Totally acceptable

1 2 3 4 5 6 7

83. Do you find the described risk voluntary or is it a risk to which people are involuntarily exposed?

Not at all voluntary Totally voluntary

1 2 3 4 5 6 7

84. Do you think the risk is controllable?

Not at all controllable Very controllable

1 2 3 4 5 6 7

85. Do you think children are clearly in danger by the risk described?

Not at all clear Very clear

1 2 3 4 5 6 7

86. Do you consider Dutch bread safe for consumption?

Not safe at all Very safe

1 2 3 4 5 6 7

87. Do you think that, based on what you just read, children should eat less bread?

Not at all Absolutely

1 2 3 4 5 6 7

88. Do you think that, at this moment, science gives clear answers to the questions brought on by the risk described?

Not at all clear Very clear

1 2 3 4 5 6 7

89. Do you think that, based on what you just read, the chance of exposure to DON is thoroughly tackled?

Not at all thoroughly Very thoroughly

1 2 3 4 5 6 7

---

90. Could you please indicate to what extent you would go through these emotions, if you read about DON in your own newspaper, just after you had given your child cereals for breakfast?

Angry

Not at all Very

1 2 3 4 5 6 7

Helpless

Not at all Very

1 2 3 4 5 6 7

Frightened

Not at all Very

1 2 3 4 5 6 7

Alarmed

Not at all Very

1 2 3 4 5 6 7

Concerned

Not at all Very

1 2 3 4 5 6 7

Confused

Not at all Very

1 2 3 4 5 6 7

Annoyed

Not at all Very

1 2 3 4 5 6 7

Safe

Not at all Very

1 2 3 4 5 6 7

Carefree

Not at all Very

1 2 3 4 5 6 7

Relieved

Not at all Very

1 2 3 4 5 6 7

Indifferent

Not at all Very

1 2 3 4 5 6 7

Pleased

Not at all Very

1 2 3 4 5 6 7

91. Below are four possible reactions from people as they could have been given in an interview. Please indicate for each interview clipping how much you share the reaction described.

"Oh no, I am not at all worried about this risk. Please! If I had to worry about that…! I have much better things to do! Besides, chances of getting sick because of that, are so small."

Totally disagree Totally agree

1 2 3 4 5 6 7

"Hmm, well what should I say about that. Sure, chances are very small, but despite all that, I am not really comfortable with it."

Totally disagree Totally agree

1 2 3 4 5 6 7

"I don't like it, I mean… come on, this risk isn't just nothing? Frankly, I am quite scared; imagine that you would really end up being sick with something…."

Totally disagree Totally agree

1 2 3 4 5 6 7

"Yes, well I am very worried about this. We are talking about a very big risk, here. Seriously… I am greatly concerned about the effects this risk can cause."

Totally disagree Totally agree

1 2 3 4 5 6 7

→*Specific version of the fourth story inserted.*

The following questions are about the newspaper article you have just read. Please answer these questions based on you impression of the situation described. **Imagine that you experience nuisance caused by the manure silo of farmer Maars.** Put a circle around the number best matching your impression of the situation.

92. Do you find the text used in the newspaper article comprehensible?

Not at all comprehensible						Very comprehensible
1	2	3	4	5	6	7

93. What is your impression of the seriousness of the situation described?

Not at all serious						Very serious
1	2	3	4	5	6	7

94. Do you find the scientific information clearly described?

Not at all clear						Very clear
1	2	3	4	5	6	7

95. How *accurate* is the information in the story about the possible health effects and the foundation of these effects?

Not at all accurate						Very accurate
1	2	3	4	5	6	7

96. How *detailed* is the information in the story about the possible health effects and the foundation of these effects?

Not at all detailed						Very detailed
1	2	3	4	5	6	7

97. How detailed is the information in the story about the ways people might experience odor nuisance, caused by the manure silo?

Not at all detailed						Very detailed
1	2	3	4	5	6	7

98. What do you think of the way farmer Maars deals with the situation?

Not good at all Very well

1 2 3 4 5 6 7

99. Did farmer Maars come across as trustworthy?

Not at all trustworthy Very trustworthy

1 2 3 4 5 6 7

100. Do you think that family Brammers appropriately dealt with the situation?

Not at all appropriately Very appropriately

1 2 3 4 5 6 7

101. How much trust do you have in the town council's approach of the situation?

No trust at all A lot of trust

1 2 3 4 5 6 7

102. Do you think that information is being withhold?

Not at all Absolutely

1 2 3 4 5 6 7

103. How worried would you be, if you would be put in the same situation as described?

Not at all worried Very worried

1 2 3 4 5 6 7

104. How big would you say, the chance of developing health problems is, due to the manure silo?

Not big at all Very big

1 2 3 4 5 6 7

105. Were you already familiar with the possible risk of developing health effects caused by odor nuisance, or did you first read about it today?

Never heard of Very familiar

1 2 3 4 5 6 7

106. Do you find the described risk scary?

Not at all scary Very scary

1 2 3 4 5 6 7

107. Do you find the described risk reasonable?

Not at all reasonable Very reasonable

1 2 3 4 5 6 7

108. Do you find the described risk acceptable for the community?

Not at all acceptable Totally acceptable

1 2 3 4 5 6 7

109. Do you find the described risk voluntary or is it a risk to which people are involuntarily exposed?

Not at all voluntary Totally voluntary

1 2 3 4 5 6 7

110. Do you think the risk is controllable?

Not at all controllable Very controllable

1 2 3 4 5 6 7

111. Do you think people are clearly in danger by the risk described?

Not at all clear Very clear

1 2 3 4 5 6 7

112. Do you think that, based on what you just read, the farmer should stop his activities?

No at all Absolutely

1 2 3 4 5 6 7

113. Do you think that, at this moment, science gives clear answers to the questions brought on by the risk described?

Not at all clear Very clear

1 2 3 4 5 6 7

114. Do you think that, based on what you just read, the problem is thoroughly tackled?

Not at all thoroughly Very thoroughly

1 2 3 4 5 6 7

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115. Could you please indicate to what extent you would go through these emotions, if
you would be living next to the manure silo and you would be experiencing nuisance from the odor released by the company?

Angry

Not at all Very

1 2 3 4 5 6 7

Helpless

Not at all Very

1 2 3 4 5 6 7

Frightened

Not at all Very

1 2 3 4 5 6 7

Alarmed

Not at all Very

1 2 3 4 5 6 7

Concerned

Not at all Very

1 2 3 4 5 6 7

Confused

Not at all Very

1 2 3 4 5 6 7

Annoyed

Not at all Very

1 2 3 4 5 6 7

Safe

Not at all Very

1 2 3 4 5 6 7

Carefree

Not at all Very

1 2 3 4 5 6 7

Relieved

Not at all Very

1 2 3 4 5 6 7

Indifferent

Not at all Very

1 2 3 4 5 6 7

Pleased

Not at all Very

1 2 3 4 5 6 7

116. Below are four possible reactions from people as they could have been given in an interview. Please indicate for each interview clipping how much you share the reaction described.

"Oh no, I am not at all worried about this risk. Please! If I had to worry about that…! I have much better things to do! Besides, chances of getting sick because of that, are so small."

Totally disagree Totally agree

1 2 3 4 5 6 7

"Hmm, well what should I say about that. Sure, chances are very small, but despite all that, I am not really comfortable with it."

Totally disagree Totally agree

1 2 3 4 5 6 7

"I don't like it, I mean… come on, this risk isn't just nothing? Frankly, I am quite scared; imagine that you would really end up being sick with something…."

Totally disagree Totally agree

1 2 3 4 5 6 7

"Yes, well I am very worried about this. We are talking about a very big risk, here. Seriously… I am greatly concerned about the effects this risk can cause."

Totally disagree Totally agree

Imagine you would personally have to deal with all four risks you just read the newspaper articles about. So, you would be living in Marpelle, near the Chemilak storage tank, and you are not yet sure if the released PERC entered your garden. You would be having two small children, and you just read about the fact that cereal products may contain a fungus toxin that can cause growth delay in children. Close by your house in Marpelle are power pylons. And you are experiencing odor nuisance caused by the manure silo of farmer Maars.

117. Will you please put a number (1 to 4) in front of the risks, indicating which risk you would be mostly worried about if all four risks were placed upon you at the same time. So, '1' for the risk you would be mostly worried about, '2' for the risk you would worry about next, '3' for the risk slightly less worrying (compared to the other risks), and '4' for the risk you would least worry about.

…. Possible association between power lines and leukemia.

…. Possible PERC in garden by leakage tank Chemilak.

…. DON in bread.

…. Health complaints due to the manure silo.

118. Imagine a scale from one to hundred. On the bottom of the scale (no. 1), place the risk you think is the smallest (out of the four). On the top of the scale (no. 100), place the risk you think is the largest.

Top	Scale no.: 100 Risk:……...
Bottom	Scale no.: 1 Risk:……...

119. Between the lowest and the highest ranking on the scale, the remaining two risks are placed. Please assign each of the two remaining risks on the scale from 2 to 99, to the number which you think, best indicates the magnitude of that risk, taking into account the two risks already placed on the scale in the previous question.

Top	
	Scale no.: …. Risk: ……...
	Scale no.: …. Risk: ……...
Bottom	