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Risk Communication For Water Reuse Projects

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ABSTRACT

This explorative research is conducted as part of a research about water recycling in general. The problem was that too little was known yet about risk communication, specific on water reuse projects. Therefore the research question is “*Which factors are important for communicating with stakeholders about the risks of water reuse?*” The research has got two parts: a literature review and a field research.

The literature review shows that there is a lot of information about risk communication, but very little specific for water reuse projects. The general information on risk communication can be very useful for water reuse projects; especially the approach that risk is a combination of hazard and outrage. A lot of outrage factors can be involved with water reuse, so risk communication should also focus on outrage mitigation and not just on the hazards of water recycling.

The conclusion from the field research is that it can be most important to convince a project manager of the need of risk communication. Risk communication in practice can be very different from what is described in the literature as good risk communication. None of the projects described in the field research had a very active risk communication plan. Future research could therefore focus on how to align the practice with the theories.

For a general conclusion about risk communication on water reuse projects, the field research is too constricted and future research is needed. Other water reuse projects can be very different from the projects in this research which might lead to different results.

Keywords:

Water, Reuse, Recycling, Risk, Communication, RECLAIM WATER, Aquifer recharge

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1 Introduction

Many places in the world face problems with drought. Also in Europe several countries face problems with securing sufficient water supplies. One of the possible solutions for these problems is water recycling. Water recycling involves the purification of waste water so it can be reused for different purposes such as irrigation or potable water production.

Waste water contains a variety of biological and chemical contaminants. To recycle water, these contaminants are removed by processes such as membrane filtration, reverse osmosis and UV treatment. Through this process, waste water can even be purified to the standards that apply for “normal” potable water. Water reuse can be direct or indirect. Direct water reuse means that the water that leaves the treatment plant will be used immediately. Indirect water reuse means that the water is “stored” for some time, for example by disposing it upstream in river or infiltrating it in an aquifer. In both situations, after a certain period the water is abstracted by a water treatment plant downstream the river, or by a well located in the infiltration area. Depending on its reuse purpose, the abstracted water can be further treated.

However this process involves certain risks. The purification might not be totally effective, or the treatment might not be effective for removing all contaminants. Furthermore issues related to public perception of water reuse can affect the sustainability of the project. A lack of public acceptance has already caused several projects in Australia, the Netherlands and the United States of America to fail (Hurlimann, 2007). So it is clearly important to inform the public and other stakeholders about the possible risks of water reuse. If the risks are not communicated properly the consequences for the project can be very significant. This underlines the importance of good risk communication.

The research reported here will focus on how to communicate with stakeholders about the risks of water reuse. The research was undertaken in two phases. The first part is an exploration of the existing literature; the second part is a field research amongst people involved with risk communication of water reuse projects. The final objective of the research was to identify which factors are important for communicating with stakeholders about the risks of water reuse.

To achieve this goal the following research question has been formulated:

Which factors are important for communicating with stakeholders about the risks of water reuse?

Three sub questions have been formulated to find an answer to the research question:

- What approaches to risk communication are available in the literature?
- How do water reuse projects communicate about risks?
- What are the major problems concerning risk communication for water reuse projects and what are the consequences of these problems?

The first question should generate an overview of what has been written already about risk communication both generally and in terms of water reuse and what the most important views on risk communication are. The second and the third question should give an insight in the way water reuse projects communicate about risks. The three questions together should give an overview of different aspects that are important for communicating about the risks of water reuse.

2 Methods

The literature review is an integral part of the research. Therefore this chapter which describes the research methods, precludes the literature review. In general there are three purposes to do a research: exploration, description and explanation. Exploratory studies are especially useful when the subject of the study is relatively new. The purposes of an explorative study are: *to satisfy the researchers curiosity and desire for better understanding, to test the feasibility of undertaking a more extensive study and to develop the methods to be employed in any subsequent study* (Babbie, 2001, pp. 92). The aim of a descriptive research is to give an accurate and precise description of a case or population. A descriptive study is often followed by an explanatory study. The purpose of an explanatory study is to give an answer to the question why things are as they are (Babbie, 2001).

This research will be explorative. Because of restrictions on time and funding a descriptive study was not possible and the data necessary for an explanatory study are not available yet.

The first sub question can be answered through a literature review. This is the most logical research method to find the different approaches to risk communication. The last two questions require some field research.

2.1 Literature review

A literature review has been carried out to answer the first sub question. In the literature review different types of sources were analysed: scientific articles, books, media publications and websites. In order to find literature which is relevant for the research, a searching method has been used. This started by searching very specific on the topic of risk communication for water reuse projects. After analysing the literature on this topic the search for literature became broader until literature on risk communication was analysed. On this topic many articles can be found. The returning of the same references in every article was seen as a sign that the literature review was quite complete.

The review provides an insight into what has been published about risk communication, risk communication on water reuse and it also gives examples of different types of risk communication strategies which were used on water reuse projects.

2.2 Field Research

Field research can be done in different ways. This is also the case for finding answers to the second and third research questions. Research methods can differ in access options (Table 1), vehicle options (Table 2) and Analysis options (Table 3).

Table 1: Access options (adjusted from Gillham, 2005)

Method	Explanation	Advantage	Disadvantage
Interview in person	The interviewee is visited, or will visit the interviewer to do the interview	Interviewee's might be willing to give more information, when asked face to face	Costs are high; takes a lot of time
Interview by telephone	The interviewer calls the interviewee and interviews from a distance	Relatively cheap; possibility to ask follow-up questions during the interview; Not bound by geographical distance	Non verbal elements are missing; Duration of interviews is limited
E-mail interview	A survey is being electronically send to the interviewee with the request to answer the questions	Not bound by geographical distance; Relatively cheap; Does not take much time for interviewer;	Interview has to be structured; E-mails can easily be ignored

An e-mail survey on risk management was also sent to the partners involved in the risk communication activities in the RECLAIM project. The results of this survey are also analysed in this document.

A set of interviews were held with people with responsibility for risk communication from three projects across two continents. A face-to-face interview would mean that either the interviewee or the interviewer would have to travel long distances to conduct the interview. This was not possible due to the constrictions on time and funding. An e-mail interview does not have that problem, but it does require a very structured interview. As a result it was chosen to conduct the interviews by telephone.

One of the advantages of interviewing by telephone is that interviews do not need to be very structured. This means that it is possible to choose which structure the interview will follow: unstructured, semi-structured or structured (Table 2). All the three types of structures have advantages and disadvantages as shown in Table 2.

A significant advantage of a structured interview is that the interviewer is sure that all topics to cover will be discussed. The unstructured interview has as an advantage that it is easy to ask follow-up questions to go more into details. For this interview, a structured interview is not required. Therefore a semi structured interview can offer the advantages of both techniques.

Table 2: Vehicle options (adjusted from Gillham, 2005)

Method	Explanation	Advantage	Disadvantage
Structured	A list of questions is prepared, these are the only questions to be asked	Quick to administer; Analysis is straight forward	Restricts coverage; Data are often superficial
Unstructured	No questions prepared, but topics which will be discussed	Useful as an exploratory technique; Minimum “inference” from the interviewer	Can be difficult to keep going; Requires lot of guidance from interviewer Can be very long
Semi structured	A combination of questions and unstructured interviewing	Balance between structure and openness; Analysis is facilitated by the level of structure	Skill/practice required to achieve adequate performance; Restricts methods of analysing

Three interviews have been conducted with different persons involved in risk communication on water reuse projects. These projects, which are taking part in the RECLAIM WATER project, are located in very different parts of the world and differ from each other in size, purpose, social circumstances and history. The projects were initially selected to participate in the section of the RECLAIM WATER project on risks. Therefore these projects were chosen for the field research. The interviewees were selected by the contact person of RECLAIM WATER on the project. They were asked to identify an individual who has either been directly involved in risk communication activities at their site or a person that should be able to provide relevant information on the risk communication strategy. Because of the distant locations of the projects, and the limitations on time and money, the interviews were conducted by telephone. The interviews were, with the permission of the interviewees, recorded with a Dictaphone. Anonymity of the respondents should enable them to speak more freely about the problems they might face and the way they communicate. As a consequence the interviewees and projects are referred to as Project A, B and C and Interviewee A, B and C. All interviews were held in May 2008.

To decide what the objectives of the interview had to be, a gap analysis has been undertaken. The information that had been gathered already by studying the literature and analysing an earlier held e-mail survey was compared with the information needed to produce a guidance document. Also the respondents of the email survey were anonymous. The result of this analysis showed that in order to find a sufficient answer to the research question, information from water reuse projects had to be obtained about the role of risk communication in their project. This way, not only information from the literature, but also from the practice could be used to find an answer to the research question. This is especially useful since very little has been published specifically on risk communication on water reuse projects.

2.2.1 Interview template

An interview template has been used for structuring conversations and to make sure all topics were discussed (Appendix 1). The template covers seven different topics:

- Personal information
- Risk assessment
- Risk management plan
- Risk communication plan
- Communicating with the public
- Opposition
- Experience

Since all the projects are already participating in the RECLAIM project, it was not necessary to ask general information about the project. This information could be obtained from earlier surveys. The first questions were asked to find out more about the role of the interviewee in the water reuse project and their background. Not only does the role of the interviewee influence the answers given, but it is also interesting to know what the background of the people that communicate with stakeholders is. The next subject is about risk assessment. Before you communicate about risks, you need to know what the risks are and who is exposed to these risks. The next part is about risk management. When communicating about risks to stakeholders, one should also tell what is being done to mitigate the risks and how they are managed. It is interesting to know whether for example an HACCP-study or an ISO 9001 system is being used. The other topics are more focussed on actual risk communication. For the research it is important to know what water reuse projects do at the moment to communicate about risks and whether they face any opposition against the project. The last questions are about experiences of the interviewee. What does he or she think is important for risk communication? Do people think risk communication is useful for their project?

2.2.2 Data analysis

Several different methods are available to analyse data from an interview (Table 3). Because of the small number of interviews and the different backgrounds of the projects, it is not possible to statistically analyse the data from the responses. Also it is not possible to make generalisations to other water reuse projects. Because of these restrictions, there is no need for a quantitative research. The advantage of this is that there is no need for closed questions and the interview can be relatively unstructured (Bell, 2005). The method used to analyse the data from the three interviews is content analysis. Content analysis is the study of recorded human communications. Content analysis is not per se designed for interview analysis. Interviews are an example of human communication and can therefore be analysed through content analysis. The units of observation are the interviews. The units of analysis are the water reuse projects and the interviewees (Babbie, 2001).

Not only the interviews held for this project, but also earlier interviews with people from the same water reuse projects have been analysed. These interviews were conducted by e-mail, also as a part of the RECLAIM WATER project. The topics of

these interviews were the history of the project and risk management/ risk communication. Also these interviews were analysed by content analysis.

To analyse the responses it was investigated how the projects ways of risk communication and risk management differed or fit with the methods described by literature. Also differences between the projects were analysed. The cause of these differences can help to find which factors are important to achieve good risk communication.

Table 3: Methods of analysis (adjusted from Gomm, 2004)

Method	Explanation	Advantage	Disadvantage
Statistical	Quantitative analysis of the results	Time efficient; Every researcher gets the same results from the analysis	Requires significant number of responses; Requires quantitative responses
Content/Thematic	Analysing which themes are central in the interviews	Gives good analysis of key points in a interview; No need for qualitative response	Not every researcher will conclude the same results form the data

3 Literature review of risk communication on water reuse projects

Risk is “*the possibility of an adverse outcome, and uncertainty over the occurrence, timing or magnitude of that adverse outcome*” (Covello and Merkhofer, 1994 in Powell, 1996 pp. 6). Almost every activity in our lives carries risks. This is also the case for the reuse of waste water. In the case of water reuse there are very different perceptions of risk. Some people, for example, associate water reuse with drinking water from the sewers and assume a great risk (Blog Toowoomba, 2007). Water companies on the other hand might for example state that the risk of drinking reused water is no bigger than drinking water which has not been reused. The question is: which factors are important for communicating the risks of water reuse to stakeholders. How can you make sure that people are informed and aware of the risks of water reuse, without making people assume that risks are high, because they are communicated?

First this review will look at the perception of risk, the development of communication strategies in general and the approaches to risk communication. Secondly it will have a closer look on articles written specifically on risk communication concerning water reuse followed by a case study on a water reuse project in Toowoomba, Australia.

In the literature there are two contexts within which risk communication is utilised. The first is risk communication as a part of calamity management. The objective of this use of risk communication is to warn people about a risk which is higher than normal, for example an incidental pollution of drinking water. The second use of risk communication is as a part of risk management. Here the purpose is to inform the stakeholders of which risks are associated with specific actions, why these actions are taken and what the possible consequences are. This document will focus on this second use of risk communication.

3.1 Risk perception

As described previously, not all people perceive risks in the same way. There are many factors that play a role in how people perceive risks. A statistically small risk can be perceived as very significant. Much research has been done and different aspects of risk perception have been studied. For establishing good risk communication, it is important to know how people perceive information about risks. Risk communication might also highly influence the perception of risk.

3.1.1 The source

People’s perception of risk is often not based on their own observations, but on information provided to them by others, for example from politicians, doctors, scientists, the media, friends, or family. An important factor that influences the perception of risk is whether the person who communicates the risk can be trusted. Or as Bennett and Calman formulate it: “*Who is telling me this, and can I trust them?*” (Bennett and Calman, 1999, pp. 4). So when communicating about risks, it is

important that people trust the source of information. If people do not trust the source, they will not be willing to believe the message.

There is a significant difference in the level of trust associated with certain groups. Lang *et. al.* (2001) showed that people find, for example, health professionals and consumer organisations much more trustworthy than government departments. Peters *et. al.* (1999) suggested that perceptions of trust and credibility are highly dependent on three principles: perceptions of knowledge and expertise; perceptions of openness and honesty; and perceptions of concern and care. When communicating about risks it is important that people trust the source of the information. If the source is not trusted by the stakeholder, risk communication can be counterproductive

3.1.2 Psychological elements

The identity of the person or organisation who communicates a risk has an important influence on the perception of risk. Another important factor is of course the nature of the risk. As described above, risk is not just a matter of hazard, but also what Covello and Sandman call “outrage”. This means that when people think about risk there are other factors often more important than the statistical chance that something happens. This model of Risk = Hazard + Outrage, is referred to in many articles (e.g. Powell, 1996; Sandman, 1999 and Beecher *et. al.*, 2005), often specified for a specific case. Table 4 gives examples of these outrage factors that influence the perception of risks. The outrage factors are often used to analyse risk perception of a certain subject. Lang *et. al.* (2001) use them to predict public concern over water quality issues.

Table 4: Outrage factors (Covello and Sandman, 2001, pp. 5-7)

Outrage factor	Explanation
Voluntariness	Risks from activities considered to be involuntary or imposed (e.g., exposure to chemicals or radiation from a waste or industrial facility) are judged to be greater, and are therefore less readily accepted, than risks from activities that are seen to be voluntary (e.g. smoking, sunbathing, or mountain climbing).
Controllability	Risks from activities viewed as 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 an automobile or riding a bicycle).
Familiarity	Risks from activities viewed as unfamiliar (such as from leaks of chemicals, or radiation from waste disposal sites) are judged to be greater than risks from activities viewed as familiar (such as household work).
Fairness	Risks from activities believed to be unfair or to involve unfair processes (e.g., inequities related to the location of industrial facilities or landfills) are judged to be greater than risks from fair activities (e.g., vaccinations).
Benefits	Risks from activities that seem to have unclear, questionable, or diffused personal or economic benefits (e.g., waste disposal facilities) are judged to be greater than risks from activities that have clear benefits (jobs; monetary benefits; automobile driving).
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 scattered or random in time and space (e.g., automobile accidents).
Understanding	Poorly understood risks (such as the health effects of long-term exposure to low doses of toxic chemicals or radiation) are judged to be greater than risks that are well understood or self-explanatory (such as pedestrian accidents or slipping on ice).
Uncertainty	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., actuarial risk data related to automobile accidents).
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 (e.g., poisonings).
Effects on children	Risks from activities that appear to put children specifically at risk (e.g., milk contaminated with radiation or toxic chemicals; pregnant women exposed to radiation or toxic chemicals) are judged to be greater than risks from activities that do not (e.g., workplace accidents).

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 or radiation) are judged to be greater than risks from activities that do not (e.g., skiing accidents).
Victim identity	Risks from activities that produce identifiable victims (e.g., a worker exposed to high levels of toxic chemicals or radiation; a child who falls down a well; a miner trapped in a mine) are judged to be greater than risks from activities that produce statistical victims (e.g., statistical profiles of automobile accident victims).
Dread	Risks from activities that evoke fear, terror, or anxiety (e.g., exposure to cancer-causing agents; AIDS) are judged to be greater than risks from activities that do not arouse such feelings or emotions (e.g., common colds and household accidents).
Trust	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 those that are trustworthy and credible (e.g., regulatory agencies that achieve high levels of compliance among regulated groups).
Media attention	Risks from activities that receive considerable media coverage (e.g., accidents and leaks at nuclear power plants) are judged to be greater than risks from activities that receive little (e.g., on-the-job accidents).
Accident history	Risks from activities with a history of major accidents or frequent minor accidents (e.g., leaks at waste disposal facilities) are judged to be greater than risks from those with little or no such history (e.g., recombinant DNA experimentation).
Reversibility	Risks from activities considered to have potentially irreversible adverse effects (e.g., birth defects from exposure to a toxic substance) are judged to be greater than risks from activities considered to have reversible adverse effects (e.g., sports injuries).
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).
Ethical/moral nature	Risks from activities believed to be ethically objectionable or morally wrong (e.g., foisting pollution on an economically distressed community) are judged to be greater than risks from ethically neutral activities (e.g., side effects of medication).
Human vs. natural 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" (e.g., exposure to geological radon or cosmic rays).

3.1.3 Media

The media play an important role in influencing individual perceptions of risk. Risks that attract a lot of attention are often over estimated and very common risks, which are not mentioned in the media, are under estimated. *The quality press and television news broadcasts are highly trusted* (Bennett and Calman, 1999, pp. 27). Therefore they have a significant influence on risk perception. For example after a widely broadcasted disaster, people tend to overrate the risks associated with the reported incident. Even fiction can influence the perception of risk. For example people tend to overestimate the risk of shark attacks after watching the movie Jaws (Slovic, 2000).

Not every risk is discussed in the media. According to Bennett and Calman (1999), there are certain aspects of a risk which make it interesting for the media. These media triggers are:

- Questions of blame
- Alleged secrets and attempted cover-ups
- Human interest through identifiable heroes, villains, dupes, etc.
- Links with existing high-profile issues or personalities
- Conflict
- Signal value: the story as a portent of further ills
- Many people exposed to the risk, even at low levels
- Strong visual impact
- Links to sex and/or crime

3.2 The four stages in the historical development of risk communication

In 1969 Chauncey Starr published an article in which he posed the question of what the balance should be between social benefit and technological risk. He tried to identify which risks are acceptable to the public. Communication is a part of this. According to Starr, communicating the benefits of taking risks encourages risk acceptance. This can be viewed as the first article about risk communication (Powell, 1996).

3.2.1 The first stage

Until the 1980's risk communication did not play a major role in policies. Covello and Sandman call this period the first stage in the evolutionary process of risk communication. The main philosophy behind risk communication during this period was that there is no need for it, or that it was even undesirable. Risk assessment was something to be left to the experts and not to the public. The public was considered too irrational and not intelligent enough to handle information about risks (Covello and Sandman, 2001).

3.2.2 The second stage

In the 1980's this starts to change. People became much more politically active, with significant public debate about nuclear energy and environmental protection. Citizens show a greater desire to be involved in policy making and express their personal

opinions (Peters *et. al.*, 1996). Also because of the ignorance of experts and policy makers in the first stage of risk communication, the call for more involvement of the public only became larger. Many citizen based environmental groups arose that pointed out the risks associated with governments' and companies' activities. It became important for policy and decision makers to inform people about risks; if they did not do it, others would (Covello and Sandman, 2001).

According to Powell (1996) this growing interest in public affairs and need for risk communication was driven by four factors: a requirement for government to inform the members of a participatory democracy, desires to overcome opposition to decisions, a desire to share power between government and public groups, and a desire to develop effective alternatives to direct regulatory control (U.S. National Research Council, 1989, in Powell, 1996).

Covello and Sandman characterise this as the second period of risk communication, with a focus on explaining risk data. The new approach is called the "Decide-Announce-Defend," or "DAD," approach in which experts try to explain to the public how and why they made a decision (Beecher *et. al.*, 2005). A new way had to be found to communicate often complicated data to the public. Techniques were developed to convince people that risks are small, especially if they are compared with other risks which are much bigger. The comparison of data becomes important. For example, flying 1000 miles in an airplane is as dangerous as eating 40 table spoons of peanut butter (Bennett and Calman, 1999).

3.2.3 The third stage

The increasing interest in risk communication at this time is also visible in the number of articles written on risk communication, especially since the 1990's (Gurabardhi *et. al.*, 2004). In 1988 the American Environmental Protection Agency published a brochure with seven cardinal rules of risk communication written by Covello and Allan. The leaflet argues that if people are affected by a decision, people have the right to participate in the decision making process. Furthermore listening to the public's specific concerns is one of the seven rules (Covello and Allan, 1988). According to Covello and Sandman, this brochure is a clear example of the third stage in risk communication. They state that when people are extremely outraged, an explanation of the data will have limited influence. The focus on outrage is typical for this third stage in which dialogue becomes very important. According to Sandman (1999) risk is a combination of hazard and outrage (Risk = Hazard + Outrage). Where in stage two the experts were communicating *to* the public, stage three is about communicating *with* the public.

3.2.4 The fourth stage

The fourth and last stage described by Sandman and Covello is where the public is treated as a full partner. There are many reasons why this stage would not be achieved. Many organisations are still in stage three or two, some even in stage one (Covello and Sandman, 2001).

Fischhoff (1995) analyses a very similar historical evolution of risk communication. However he does not define it as four clear steps, but as eight approaches to the public (Fischhoff, 1995 in Powell, 1996 pp. 5):

- All we have to do is get the numbers right;
- All we have to do is tell them the numbers;
- All we have to do is explain what we mean by the numbers;
- All we have to do is show them they've accepted similar risks in the past;
- All we have to do is show them that it's a good deal to them;
- All we have to do is treat them nice;
- All we have to do is make them partners; and,
- All of the above

The eight approaches of Fischhoff show that the public becomes more and more involved and taken more seriously.

3.3 Different approaches to risk communication

Many articles and books have been written on the communication of risk (e.g. Bennett and Calman, 1999; Lang *et. al.*, 2001; Powell, 1996). One can see a difference in the articles describing functions of risk communication, guidelines for the process of risk communication and those describing what form a risk communication message should have. The last two are closely related and do have some overlap. Sending out a message is also a part of a process.

3.3.1 The Function

The function of risk communication is informing stakeholders about a range of areas including: levels of health or environmental risks; the significance or meaning of health or environmental risks; and decisions, actions or policies aimed at managing or controlling health or environmental risks (Lang *et. al.*, 2001, pp. 318). Still there are many different directions possible within this function. Would a project manager for example want the public to know all the risks? And what end results are expected from a risk communication? Risk communication could be used to convince people that you are right for example. According to Renn and Levine in Lang *et. al.* (2001) risk communication could have the following functions:

- Enlightenment role (aiming to improve risk understanding among target groups).
- Right-to-know (designed to disclose information about hazards to those who may be exposed).
- Attitude modification role (to legitimise risk-related decisions, to improve the acceptance of a specific risk source, or to challenge such decisions and reject specific risk sources).
- Legitimate function (to explain and justify risk management routines with a view to enhancing the trust in the competence and fairness of the management process).
- Risk reduction role (to enhance public protection through information about individual risk reduction measures).
- Behavioural change role (to encourage protective behaviour or supportive actions towards the communicating agency).
- Emergency readiness role (to provide guidelines or behavioural advice for emergency situations).

- Public involvement role (aiming at educating decision-makers about public concerns and perceptions).
- Participation role (to assist in reconciling conflicts about risk related controversies).

Powell strongly emphasizes the different function of risk communication from risk management. According to his shorter definition, the function of risk communication is *policy decisions and public discussion based on the best information available, rather than a process for manipulation of public opinion* (Powell, 1996, pp. 9).

3.3.2 The Process

The process of risk communication concerns those steps which should be taken to accomplish effective risk communication. Perhaps the most famous risk communication process is the earlier mentioned brochure of the American Environmental Protection Agency (EPA). Many articles refer to this document (e.g. Khan and Gerrard, 2006, Powell, 1996). The EPA brochure describes seven cardinal rules to risk communication which are strongly based on taking the public seriously. The rules are:

- Accept and involve the public as a legitimate partner
- Plan carefully and evaluate your efforts
- Listen to the public's specific concerns
- Be honest, frank and open
- Coordinate and collaborate with other credible sources
- Meet the needs of the media
- Speak clearly and with compassion

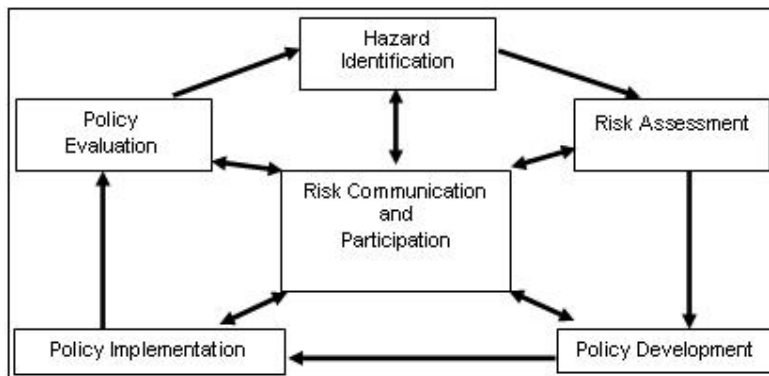
(Covello and Allan, 1988)

Sandman (1999) emphasises on the importance of outrage management. If outrage can be prevented or managed, hazard can be communicated. *The proper response to serious outrage is to mitigate the outrage* (Sandman, 1999, pp. 3). According to Sandman there are five guidelines to mitigate and prevent outrage:

- Stake out the middle, not the extreme. (do not exaggerate what you can offer)
- Acknowledge previous misbehaviour
- Acknowledge current problems
- Discuss achievements with humility
- Share control and be accountable

Lang *et. al.* (2001) look at risk communication guidelines from a very different perspective (although they also refer to the outrage factors of Covello and Sandman). The perspective of Lang *et. al.* (2001) is the role of risk communication in policy development. As illustrated in Figure 1, they see risk communication as a cyclic process and state that this is the general view. It is interesting to notice that Lang *et. al.* state that risk communication should be a part of all the steps in the process.

Figure 1 The risk management cycle (Lang *et. al.* ,2001)



3.3.3 The Message

How should the message to a stakeholder be formulated? What should definitely be said and what not? Slovic (2000) gives an example of a frequently used way of giving information about risks. The idea is not to give a number prescribing a risk, but rather to put it into perspective. When the goal is, for example, to communicate the risk of dying from a meteorite impact, one should not just give a specific percentage, but compare it with the chance of dying from, for example, a flood, or from smoking. Slovic (2000) argues that these comparisons give some of the information required for risk communication but that it should be completed with information about costs and benefits as well as an indication of the uncertainty in the assessments. Also Bennett and Calman (1999) pay attention to risk communication, or explanation, by comparisons. They argue that risk comparisons can be used to give a sense of perspective, but it should not be used to imply acceptability (Bennett and Calman, 1999). Powell's opinion about risk comparisons is even more negative. He states that risk comparisons should be avoided when they trivialize the concern in a risk message (Powell, 1996).

Covello *et. al.* (1993) have offered the following guidelines for communicating about risk:

- Be balanced and honest
- Focus on a specific issue
- Pay attention to what the audience already knows
- Be tailored to the specific needs of the audience
- Place the risk in appropriate context
- Contain (at least) the specific information needed to resolve the decisions that members of the audience face
- Be hierarchically organised so that people who only want answers can find them quickly, and people who want details can also find them
- Be respectful in tone and recognise that people have legitimate feelings as well as thoughts
- Be honest about the limits to scientific knowledge
- Consider and address the broader social dynamics in which risks are embedded
- Be subjected to careful empirical evaluation and iterative refinement

(Covello *et. al.*, 1993, in Powell, 1996, pp. 8)

A very short list of what should be in a risk message is given by Lang *et. al.*. These points focus more on the explanation of methods. According to this list a message should not just say that there is no evidence that x would cause y, but it should explain this. They give three guiding principles: acknowledge the initial plausibility of the link; explain what evidence would be expected if such a link existed; show that serious, well-conducted investigation has not found such evidence (Lang *et. al.*, 2001, pp. 329).

Sandman (1999) mentions a very controversial approach to risk communication. He argues that trying to convince the public that the risk is relatively small and the mitigation costs are high might be almost impossible when the public is already highly outraged. Instead, he stated, it might sometimes be useful to abandon control or even to take a more radical position than the public. Saying a lot of money will be spent, but the risks will be mitigated. Because it is often the public who are paying in the end, the public can decide whether they really want that or if it is perhaps not worth it. According to Sandman, often it will not make much difference to the company financially (Sandman, 1999).

3.4 Risk communication concerning water reuse

Although risk communication in general is well documented, very little has been published regarding risk communication on water reuse projects. More has been written about the perception of the risks of water reuse and communication in general about water reuse.

For example, Khan and Gerrard (2006) focus on how to promote water reuse projects and not on how to achieve successful communication about the risks involved with water reuse. Risk communication is a part of this promotion. Because of this perspective, the advice in this article borders on public relations.

However one interesting point raised in this article is that water reuse does not need to be a point of concern or controversy. According to them the “Windhoek-case” and other evidence show that a high level of awareness of the need for water together with other advantageous circumstances might encourage communities to become highly supportive of direct potable water reuse operations.

Like Bennett and Calman and many other authors, Khan and Gerrard also emphasise the importance of trust. To improve the trust of the public in water reuse projects the following conditions should be met:

- Dialog is sustained
- The community has independent sources of information
- The community can ask questions
- The community is involved early
- Information is available to everyone
- Behaviour is non coercive
- Everyone’s opinions matter
- Citizens have some level of control in the process

To be open is one of the key values of risk communication according to Khan and Gerrard (2005). Fundamental to successful risk communication is the willingness of all stakeholder groups to respect the views of others and for all concerns to be included in the decision making process. The article ends with ten messages to convince the public which goes beyond risk communication (Khan and Gerrard, 2005).

In contrast to the relative scarcity of publications on risk communication for water reuse, there are many about risk perception of water reuse. Examples of these are articles written by Baggett *et. al.* (2006), Hurlimann (2007) and Marks *et. al.* (2003). Just like the article of Khan and Gerrard, also the articles by Hurlimann and Marks *et. al.* have an Australian background. This is not very surprising: many parts of Australia have a shortage of drinking water and water reuse projects get a lot of, not always positive, attention.

Baggett *et. al.* look at how different stakeholder groups perceive risks and which group they would trust to protect their interests. According to their research, all groups see (public) health as the most important risk, except for the domestic costumer group who place it second to financial risk. Researchers, managers and regulators see insufficient public support as an important risk as well. Other regularly mentioned risks are pollution and a lack of control. The study further showed that the public trust academic researchers the highest to protect their interest. All the other stakeholders trust themselves more than others. The water suppliers and the public are the least trusted stakeholders.

Hurlimann (2007) mainly focuses on the perception of risk of water reuse in relation to the use of it. She finds that 33% of the population (of a small community 12 km north of Adelaide) thinks there is a risk involved with the use of recycled water. According to Hurlimann *the perceived risk associated with recycled water use increases as the purpose for which recycled water is used becomes increasingly personal*. For example toilet flushing and garden watering are seen as not risky whilst showering or the drinking of recycled water are seen as very risky. The highest concern for people is the safety of children and animals. An important factor for risk communication is the significant relation between trust in the Water Authority and the perception of risk. This means that the assumption, which was also frequently mentioned above by different authors, that trust is an important factor in risk communication, is also true for risk communication about water reuse.

The research of Marks (2003) looks at four cases where people can choose whether they want to use recycled water for different purposes, for example garden watering. Also in this research the safety of children is named as a concern for people using recycled water. Because the people in this research have got some freedom to decide for what they use recycled water, it also shows what people use it for. Recycled water is mostly used for automatic irrigation of the garden, but people are more reluctant to use it for more personal uses like washing their car or hand watering the garden. This might have other explanations than reluctance to use recycled water. People might for example always wash their car in an automatic car-wash. The most important reason for people to use the recycled water is the costs. Also water conservation is seen as a benefit (Marks *et. al.*, 2003).

3.5 Toowoomba: a case study

Toowoomba is a town in South East Queensland in Australia. Due to its geographical location, there is not much rain and drinking water is scarce. In the period 1998 till 2005 the rainfall was 30% below the long term average. As a result of this, in 2006 local reservoir level fell below 25% of its capacity. Several studies were conducted by the city council on how to deal with the water shortage. As a result of these studies, a project for the potable reuse of water was launched. Water reclaimed from a sewage plant would be added to drinking water supply sources. The city council of Toowoomba unanimously voted in favour of this plan (Verbeek, 2007).

Not all residents agreed with this decision. A group of citizens demanded a referendum on the subject (ABC news, 2008). The federal government decided that it will only fund the project, if a majority of the people of Toowoomba were in favour of the project. To achieve this, a campaign was organised by the town of Toowoomba. More than 160 public forums were held to inform the people, TV-commercials were broadcast and people had the possibility to taste reused water themselves (ABC news, 2006b).

Those who did not support the water reuse project also organised a campaign. Their central argument was that they did not want to become guinea pigs and that the water reuse project would have negative effects on the image of Toowoomba. An example of the No-campaign material is a brochure produced by Snow Manners and John Dowson called "Think before you agree to drink". This brochure focuses on the risks of water reuse. Several people call the No-campaign a scare campaign, used to frighten the people of Toowoomba about the risks of water reuse (ABC news, 2006a). An example of the fear that the image of Toowoomba will worsen and the risks of drinking recycled water is the slogan of a No-campaign website: *NO to putting POO in TOOwoomba's Water Supply for Drinking No Poowoomba Ever* (Blog Toowoomba, 2007).

On the 29th of July 2006 the referendum was held. The residents of Toowoomba could vote on the question: "Do you support the addition of purified recycled water to Toowoomba's water supply via Cooby Dam as proposed by the Water Futures Toowoomba Project?" Sixty percent of the public voted "No" in this referendum (Verberk, 2007).

Yet the vote against water reuse was not the end of the discussion about water reuse in Toowoomba. In 2007 the federal minister of industry, tourism and resources, Ian Macfarlane, argued that a water recycling plan had to be implemented. According to Macfarlane the attitudes to water recycling had changed and that people would now be in favour (ABC news, 2007c). A new referendum was announced, not just for Toowoomba, but for whole South East Queensland on 17th of March, 2007. Yet this referendum has never been held.

On the 28th of January, 2007, Queensland premier Peter Beattie announces that the referendum was cancelled and the plan to reuse water would continue. According to Beattie the "Armageddon situation" left him no choice (ABC news, 2007a). By the end of 2008 the people of Toowoomba will drink recycled water (ABC news, 2007b).

The Toowoomba case study shows many different kinds of risk communication, but it ends with the ignorance of the public and the cancellation of a referendum. What went wrong in Toowoomba? There are many lessons that can be learned from the Toowoomba case. These lessons do not describe what went wrong but how to make sure the same mistakes are not made again.

- Involve the community early - If water reuse is being seriously discussed it is time to involve the public. Do not use the DAD-approach.
- Keep outside interests at bay - Focus on the people affected by the water reuse and not on possible pioneer work. People do not want to be guinea pigs.
- Give serious consideration to all options - Do not let people choose whether they want to reuse water or not, but let people choose between all the options.
- Inform, do not coerce - When informing people about water reuse, one should not give the impression that a choice for water reuse is the only sensible one. People who do not agree will be offended and only harden their resolve.
- Explain relative risk - Put the risks of water reuse in perspective. Do not say the risks are zero because no human activity is without risks.
- Accept dissent - Acknowledge that it is not possible that everybody will agree with you. Accept that when you give people a choice, not everybody will make the same choice.
- Understand and accept the 'yuck factor' - Acknowledge that it is normal people are resistant to drink recycled water because of its history. People who have a problem with the 'yuck' factor do not lack intelligence, but associate recycled water with sewage. Focus on telling people the quality and not the history of the water is the important factor.
- Express costs in meaningful terms - Show that costs is also a factor in making a decision on whether or not using recycled water.
- Do not oversell technology - Be honest about what technology can and what it can not offer.
- Always remember the goal - The goal is not recycling water, but implementing the optimum sustainable water management strategy.

(Khan, 2006)

3.6 Conclusion

Although very little has been written on risk communication for water reuse projects, there is a lot of literature about the different aspects of risk communication and also about communication and risk perception of water reuse. These articles, books and web pages give a good overview on the important factors for the process of risk communication, the construction of a message about risks and also about the way people perceive risks in general and specific on water reuse projects. The historical development of risk communication shows that risk communication is fairly new and that the views on "good" risk communication have changed over time. The Toowoomba case study shows that many of the factors, which are according to the literature important for good risk communication, are indeed relevant for risk communication on water reuse projects. So the literature gives a good theoretical basis for finding an answer to the main question.

4 Field research

As described in Chapter 2, three interviews have been conducted with people linked to three different water reuse projects. Also earlier conducted e-mail interviews were analysed. The telephone interviews have been held on the 21st, 23rd and 24th of May, 2008. The email survey was conducted in May 2007. The telephone and e-mail interviews are both together analysed around five different topics. The e-mail survey was mostly used as background information about the different projects. The responses to the different topics will be described here. The responses will be analysed and compared with the literature to identify the information that will serve as a basis for the development of guidelines on risk communication.

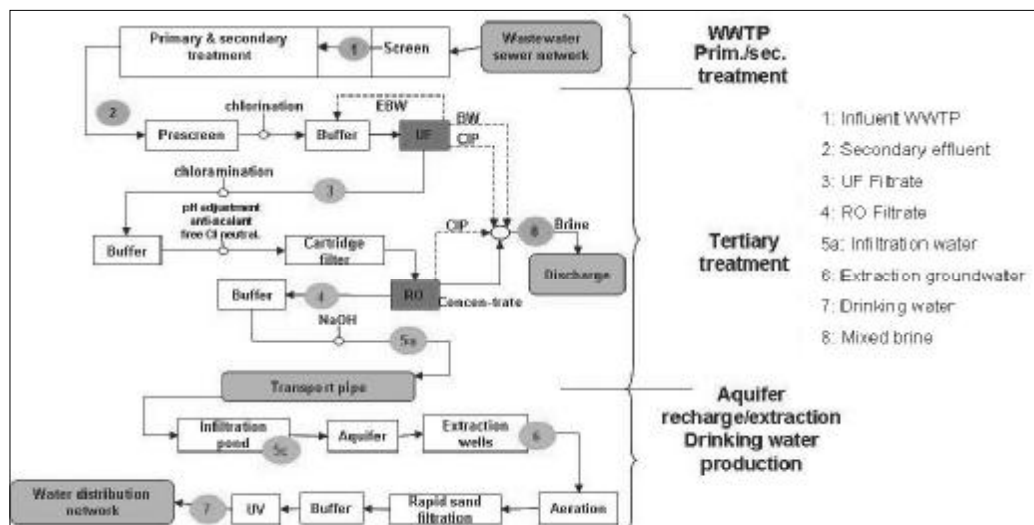
4.1 The projects

The aquifer recharge projects chosen for this series of interviews on risk perception and communication strategies differ significantly in terms of type of water used for recharge, level of treatment prior recharge and reuse purposes.

Project A is an aquifer recharge project which has been implemented more than ten years ago to reduce the extraction of natural groundwater for potable water production and hold back saline intrusion in the aquifer. Before the project started there were regular problems with potable water shortages, especially in the summer season when the water demand increased significantly due to a population growth associated with tourism. At this site, the wastewater used for recharge comes from a wastewater treatment plant operating full primary and secondary treatment. This effluent then undergoes tertiary treatment with UF and RO membranes. After recharge of the tertiary treated effluent, the abstracted water is further treated and reused for drinking water production (Figure 2).

The person who was questioned in both the telephone interview and in the e-mail survey is currently employed by the drinking water supply company and has been involved in this project since its early stages.

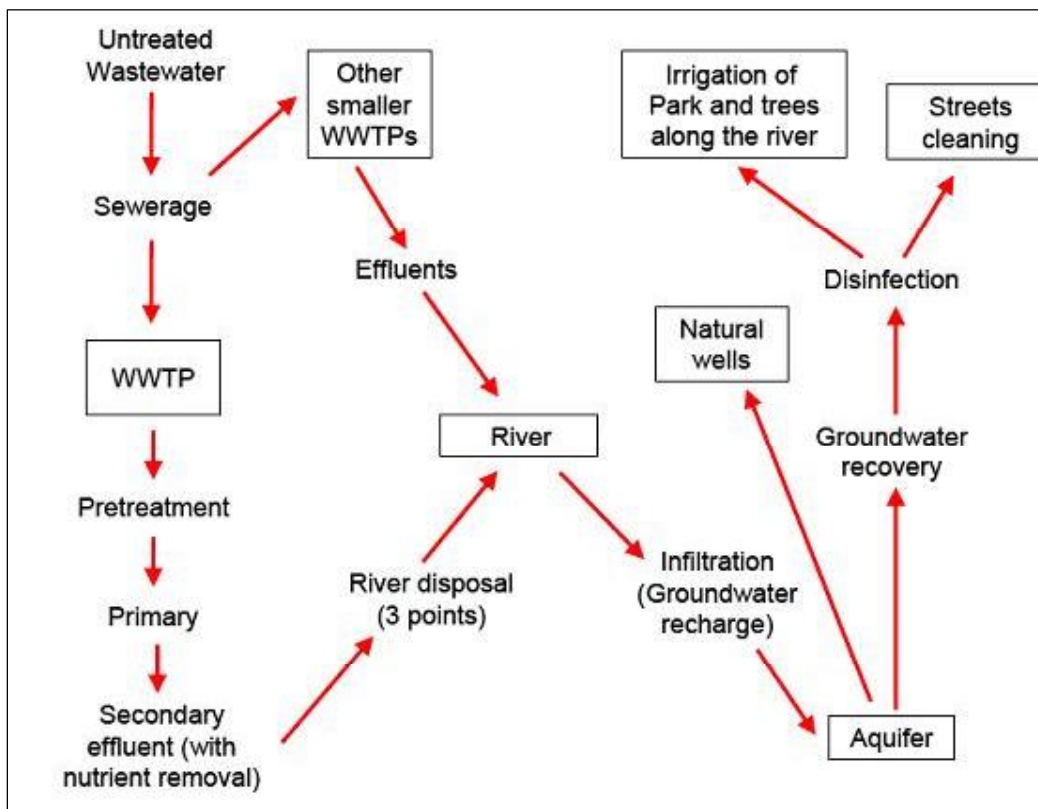
Figure 2: Process diagram of Project A



Project B is an aquifer recharge project where water is reused for irrigation of a public park and street cleansing. At his site secondary treated effluents are used for recharge through river bed filtration (Figure 3). This project has a background history of more than ten years but the actual water reuse only started few years ago to help overcome water scarcity issues linked to drought in the region.

The person who was interviewed by telephone about risk communication at this site is employed by the city council and is involved in the general coordination of the project. This person is not the one who was questioned in the e-mail survey.

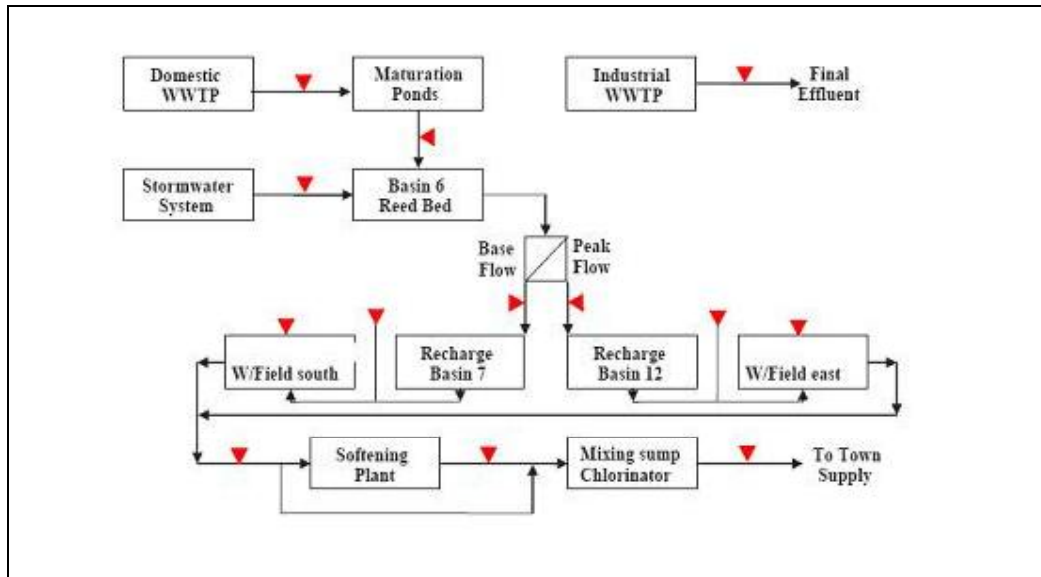
Figure 3: Process diagram of Project B



Finally project C uses aquifer recharge of secondary treated effluent and storm water for drinking water production (Figure 4). The use of wastewater and storm water for recharge at this site was implemented to tackle water scarcity but also to prevent salt water intrusion from the coast. Project C is the oldest project of the three with over twenty years of operation.

For that site, the interviewee is not directly involved in the project but has an advisory role on risk management. The e-mail survey was answered by someone else.

Figure 4: Process diagram of Project C



4.2 Risk assessment and Management

As illustrated in Chapter 3.3.2, assessing risks is the first step that water reuse projects should undertake to achieve successful risk management. One of the common methods used to assess risks associated with water recycling and reuse is to conduct a Hazard Analysis and Critical Control Points (HACCP) analysis. This procedure, originally developed to control the safety of food for astronauts (Mortimore and Wallace, 1998), is now commonly used to control the safety of food production and can also be applied to the production of (drinking) water. As illustrated by Mortimore and Wallace (1998), the HACCP method is based on seven principles:

1. Conduct a hazard analysis
2. Determine the Critical Control Points
3. Establish Critical Limits
4. Establish a system to monitor control of the CCP
5. Establish the corrective actions to be taken when monitoring indicates that a particular CCP is not under control
6. Establish procedures for verification to confirm that the HACCP System is working correctly
7. Establish documentation concerning all procedures and records appropriate to these principles and their application

Among the project previously described, Project A was the only one to fully have conducted an HACCP analysis to investigate the risks involved at their site and identify how these risks could be managed. However, as part of the RECLAIM project, project B and C also have started an HACCP study. The critical control points at these sites have been identified, but no critical limits have been established yet. Overall, none of the projects have identified which parties are exposed to the risks identified, but interviewee A and interviewee C, whose sites are used for drinking water production; assume that they would be the consumers of the water.

With regards to risk management, Project A and Project C are both in the process of developing a risk management plan. Project B has not developed a risk management plan. On project A the risks are managed by regularly checking the CCP's and a daily check of the membranes. If any problems that could affect the quality of the water occur, the production will stop. In a similar situation, Project C would switch to an alternative supply.

4.3 Risk communication

The aim of the interviews was to find out how water reuse projects communicate at the moment about risks. Therefore several specific questions on risk communication were asked.

Only project B has developed a risk communication plan. It was not possible to analyse this plan, therefore it is not clear why the communication plan is not part of a risk management plan. When asked about the current policy on risk communication, interviewee A argued that there is no reason for specific communication on the risks of water reuse as long as the water produced meets the general standards for potable water. However this site seems to have the most proactive communication with the public. Indeed, the site has been widely advertised in newspapers or through radio interviews. Furthermore, a public website provides general information on the project (*i.e.* description of the scheme). In addition, informative visits to the treatment plant and the infiltration area have been organised. In contrast, communication with the public is inexistent at site C, although according to numerous stakeholders, drinking water production is perceived as the situation presenting the highest risks in a water reuse project (Hurlimann, 2007). In the area of Project C, very few people are aware that they are drinking recycled water despite information about the project is definitely not kept a secret.

4.4 Opposition to reuse

To date, none of the projects have faced any significant opposition. In case of opposition to the reuse project, reaction from utilities in charge of Project A and Project B would be to publish articles that would show the quality of the water and demonstrate that it is actually safe. In such situation, Interviewee A also mentioned the possibility of not reacting at all which according to him/her can be the most effective approach. In such a situation, Interviewee C was the only one to recommend preventive intervention on the scheme itself by switching to the alternative water supply until new research proves the water is safe. It is interesting to notice that interviewees A and C both see the lack of public awareness of the project as a possible reason why there is no actual opposition to the project.

If there would be any opposition, the interviewees all expect different sources of opposition. Interviewee A thinks that a source of opposition might come only if new facts are presented. Interviewee B also would expect opposition to come from health authorities due to its location near a hospital. Interviewee C expects a different kind of opposition, not against the actual risk, but against the risk distribution. Certain groups might feel like they are exposed to more significant risks than other groups and protest against this distribution.

4.5 Personal experiences

A series of questions focused on the personal experiences of the interviewees on the project and on risk communication in general. All three interviewees have presented advices for successful risk communication. These advices are:

- Be open to the public; show everything that you do, so people do not suspect you of anything (Interviewee A).
- Always communicate when there is opposition. Not communicating can have significant consequences for the project (Interviewee C).
- Involve the public by for example organising workshops (Interviewee B).
- Be careful with communication with the press. Water reuse projects are complex and hard to explain, always ask to see what has been written before publication. (Interviewee A)

It is interesting to see that Respondent A sees openness as very important, but at the same time argues that not responding to opposition might be the best response. Interviewee C argues the opposite which is always to respond.

The interviewees were also asked whether they thought guidelines on risk communication might be useful for their project and what they expected guidelines to provide. Interviewee A and Interviewee C both do not think guidelines on risk communication could be of any use to the project. There is no opposition so they see no reason to start communicating about the risks. Interviewee B thinks that guidelines on risk communication could help to prepare meetings with the public. So the people for whom guidelines will be developed, will first have to be convinced that there is a need for risk communication.

5 Discussion and conclusion

The goal of this research is to find an answer to the research question: *Which factors are important for communicating with stakeholders about the risks of water reuse?* To find an answer to this question a literature review has been conducted as well as field research. First the answers to the three sub questions will be discussed followed by a general conclusion of the main questions and a discussion.

5.1 Sub question 1

What approaches to risk communication are available in the literature?

This section will discuss different approaches to the different parts of risk communication, as they are described in the literature. Also will be discussed which approaches can be used to specify a risk communication protocol for aquifer recharge projects. Little literature specific on risk communication for water reuse projects exists. Therefore most of the literature discussed here is about risk communication in general. The following subjects will be discussed: perception of water reuse risks, risk communication policies and messages about risk.

5.1.1 Risk perception

Quite a lot has been written on how people perceive the risks of different kinds of water reuse. These articles describe that drinking recycled water is perceived as riskier than for example showering or irrigation with recycled water (Hurlimann, 2007). The outrage factors of Covello and Sandman (2001) give more reasons which influence the perception of risk. Many of these outrage factors can be applied for water reuse, especially for reuse as drinking-water. A few examples are: people can not control the risks by themselves; people are not familiar with the concept of water reuse; their children are exposed to the risks and the risks of water reuse are difficult to understand. Also a lot of media attention tends to lead to a higher perception of risks.

Water reuse projects are likely to get a lot of media attention (Bennett and Calman, 1999). According to Lang *et. al.* (2001) it is quite easy to find water related scenarios with all the triggers accept links to sex. Although definitely not all triggers can be founding every water reuse projects, it is still quite likely that a water reuse project will get a lot of media attention.

At last trust is a very important factor. For a successful water reuse project, people need to trust the water company and the information they provide. Scientists are more trusted than the industry. This can be one of the reasons to call people from outside to investigate the risks.

5.1.2 Risk communication policies

The cyclic process of risk management can be helpful as a starting point of guidelines for water reuse projects (Lang *et. al.*, 2001). It clearly shows that risk communication is part of every step of the risk management cycle. It also shows that that risk management as well as risk communication are never completely finished.

For water reuse, also the seven Cardinal Rules from the EPA should be applied. These very basic guidelines are essential for any risk communication although they would need few little adaptations to be suitable for water reuse projects.

Also Sandman's rules for the mitigation of outrage are useful for water reuse projects. Outrage is an important factor in the perception of risk and a risk communication policy should focus on the mitigation of this outrage, so people's risk perception is more based on science.

5.1.3 Risk messages

A comparison of the risks of using recycled water can be useful to put the risks into perspective, but it should not be used to trivialise the concerns about risks or to imply acceptability. A comparison of reused water with "normal" drinking water might be useful, if accompanied by information about the costs and benefits of both alternatives.

The guidelines written by Covello and Alan (1988) should be applied for any communication about water reuse with stakeholders. Their focus on honesty and adapting to what the stakeholder already knows, and what it might want to know is very useful, also for water reuse projects.

If there is specific opposition to a certain risk the response described by Lang *et. al.* can be useful. The response states that the possible link between using recycled water and the risk should be acknowledged; describe what evidence would be expected if the link exists; and at last show that no such evidence can be found.

5.2 Sub question 2

How do water reuse projects communicate about risks?

In the literature risk communication is widely discussed. According to some authors it is so important that it should be a part of every step of the risk management cycle (Lang *et. al.*, 2001). Other authors give lists of rules and guidelines on how to communicate about risks, however the interviews showed that in practice risk communication does not always get the same attention as it should get (according to the literature). The interviewee's reason that, as long as there is no opposition, there is no need to communicate about risks, because they are sure the water is safe enough. According to two of the interviewees, the lack of opposition might be explained by the fact that people do not know that water is being reused. As long as there is no communication about the risks, there is no opposition and as long as there is no opposition there is no need for risk communication.

This perspective is not false, but it is important to look at the goal(s) of risk communication. If the goal is a successful reuse project, it might be true that there is no need for risk communication when there is no opposition. However, in the literature, there are many more functions of risk communication mentioned, for example the enlightenment role and the right to know role of risk communication (Renn and Levine in Lang *et. al.*, 2001). When looking at these functions of risk communication, there is a need for risk communication on water reuse projects no matter whether there is opposition or not.

This does not mean that there is no difference in risk communication between projects with no opposition and projects which face a lot of opposition. When people do not question your information, there is no need convince people about your information, and also trust is easier gained when there is no opposition. Contradicting the opposition requires different techniques than normal risk communication. Therefore it might be useful for the development of guidelines to give special attention on how to respond to opposition.

All the three projects have identified the Critical Control Points on the site. A full HACCP study can be very useful for communicating to the public. With this procedure it is possible to show to the public what the risks are, what the standards are and how the risks are mitigated. This procedure has some similarities with the guidelines given by Lang *et. al.* (2001) only in an HACCP the critical values are not tested once but on a regular basis.

None of the projects have officially identified which parties are exposed to the risks of water reuse, although for any effective risk communication strategy this is crucial. Parties exposed to risks are important stakeholders and people will want to know whether they are exposed to risks or not.

5.3 Sub question 3

What are the major problems concerning risk communication for water reuse projects and what are the consequences of these problems?

None of the three projects has faced any problems, mostly because they did not face any opposition. All interviewee's are well pleased with their current way of communicating or not communicating with stakeholders about risks.

The interviewees were also asked how they would react if problems occurred. The interviewees' possible responses to opposition against the project are: not responding at all; publishing articles which prove that the opposition is wrong and stopping the project to do new research. All these approaches are described in the literature, especially by Sandman (1999) and Covello and Sandman (2001). Not responding at all is a clear example of the first stage of risk communication and publishing articles to proof that you are right are an example of the second stage of risk communication. When you stop the project completely, the public is taken very serious. The question is whether the problem is outrage or hazard. The interviewee expects that if there is any opposition, it will be based on unfair distribution of the risks. This is a clear example of outrage. According to Sandman (1999) the response should be mitigation of outrage and not mitigation of hazard.

For general communication with the public, two of the interviewees have good experiences of open communication with the public through workshops, site visits and exhibitions about the project. Open communication is one of the cardinal rules described by the EPA (Covello and Allan, 1988). To show that there is nothing to hide makes the project more trustworthy and trust is one of the outrage factors.

Overall the interviewees do not show a lot of interest in guidelines on risk communication. Yet the way the projects communicate at the moment is very

different from guidelines in the literature. Not only the way in which the projects communicate, but also the reasons for communicating with stakeholders differs from the goals of risk communication given in the literature. Therefore it might be useful produce guidelines for risk communication on water reuse projects. It might improve the quality of risk communication on the projects.

5.4 Main Research question

Which factors are important for communicating with stakeholders about the risks of water reuse?

The assumption at the start of this research was that water reuse projects wanted guidelines on risk communication. However the field research shows that the projects' interest in risk communication can be very low. The lack of risk communication is even mentioned as an explanation of the success of the project. The circle reasoning is that there is no need for risk communication if there is no opposition there is no need for risk communication, and if there is no risk communication people will not oppose. However the literature review and the Toowoomba case study show that there are definitely reasons for communicating about risks even if there is no opposition. Therefore one of the most important factors to achieve good risk communication with stakeholders might be to convince the project managers that there is a need for risk communication. Not only because the project can benefit from risk communication, but also because stakeholders have a right to know to which risks they are exposed.

The literature gives a lot of guidelines to communicate about risks. Not only how to formulate a message about the risks of a project, but also on how to approach stakeholders and which role risk communication has in risk management. According to the literature the factors that are most important for good risk communication for water reuse projects prove to be: willingness to communicate about risks, understanding of people's perception of risks, listening to the stakeholders concern, honest and open communication and acceptance of stakeholders as serious partners in the project. The information in the literature is mostly not specific for risk communication on water reuse projects. A guidance document for these projects can therefore be very useful if projects want to develop a risk communication strategy.

Any future research could focus more on the stakeholders' side of risk communication. At the moment scientist are already in what they call the fourth stage of risk communication, while in practice people are often still in the first or second stage. Future research could focus on how to align the scientific theories with the practice on water reuse projects. The information seeking theory can be applied to find out which media could be used best for communicating about risks. Also the place of risk communication in normal stakeholder communication could be more explored.

5.5 Conclusions

The purpose of this research is explorative. This means that the research should improve understanding of the subject and test feasibility for future research. Feasibility for future research has been discussed above and the field research and literature improve understanding of the project. To formulate conclusions from a research more field research should be conducted. Only three projects have been

investigated. This number is too little and the projects differ too much to make any conclusions about risk communication for water reuse projects in general. This research can therefore mostly be used as guidance for future research and for people involved with risk communication on water reuse projects.

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APPENDICES

Interview Template

Section	Categories and questions
1	<p>Introduction</p>
	<ul style="list-style-type: none"> ▪ Nice to talk to you, my name is Douwe Yska from the Centre for Water Science at Cranfield University. ▪ This survey is being undertaken as a part of the RECLAIM project, sponsored by the European Commission. The project is about aquifer recharge and water reuse. I would like to talk with you about your knowledge of, and experiences with risk communication ▪ First I would like to state that your anonymity will be preserved and that the responses and information you provide during the interview will be treated confidentially. All records, responses and data, from this interview will be stored for one year and then destroyed. Electronic versions of the interview will be stored on a secure server once they have been validated and are only accessible to myself and my supervisor. For the purposes of reporting the work we will refer to Respondent 'a', 'b' etc. ▪ The interview will take around half an hour. ▪ Also, I would like to ask for your permission to record this interview with a Dictaphone as recording our conversation will improve the quality of response records and the summary report. ▪ Before I start, I would like to know if you are still willing to participate in this interview session and if you have any questions? ▪ The focus for this interview is the aquifer recharge scheme. Can you confirm that you have been involved in risk communication with regard to this scheme?
b	<p><i>-If YES, go to question 2, if NO, go question 1b</i></p> <p>What experience have you had on risk communication?</p>
c	<p>Can you tell me a bit about a project or scheme you have been working on?</p>
d	<p>Have any risk related activities been developed at this project or scheme?</p>
	<p><i>Decide whether the questionnaire fits or whether you go straight to question 8</i></p>

References

2	Personal information
	I will start by asking you some questions about your background.
a	What is your job function?
b	Who is your employer?
c	At which stage did you get personally involved in the project and in what capacity?
e	What is/was your function in the project?
3	Risk assessment
	The following questions will focus on risk assessment.
a	Has a risk assessment of the project been undertaken? <i>- If NO got to question 4</i>
b	Were or are you involved in the risk assessment process? <i>- If NO got to question 4</i>
c	When did this risk assessment take place?
d	Who conducted the risk assessment?
e	Can you give me a few examples of parties which were identified and to which risk they are exposed? <i>-If NO, go to question 4</i>
f	How were these parties identified?
g	Has there been any discussion with these parties about the risks they may be exposed to?
4	Risk management plan
	The following questions will be about risk management
a	Has a risk management plan been developed? <i>-If NO, got to question 5</i>
b	Were you involved in the development or implementation of this risk management plan? <i>-If NO, got to question 5</i>
d	When was this plan created?
e	By whom was this plan created?
5	Risk communication plan
	Now I would like to ask you a few questions about risk communication strategies
a	Has a risk communication plan or strategy been developed?
b	When was this strategy created?
c	By whom was this strategy created?
d	Can we have a copy of this risk communication strategy?

References

6	Communicating with the public
	The next few questions will be about communication with the public
a	Have you been involved with any communication with the public about the project? <i>-If NO, go to question 7</i>
b	Has there been any pro-active communication with the public about the project? <i>-If NO, go to question 7</i>
c	Can you give an example of pro-active communication?
d	Which media have been used to communicate with the public?
g	Were risks specifically mentioned, described or quantified during communication with the public?
7	Opposition
	The following questions will be about opposition to the project
a	Has there been any specific opposition to the project, by any stakeholder group? <i>[if several, ask to describe one for the purposes of the following questions]</i> <i>-If NO, go to i</i>
b	Who was it that opposed?
c	What form did the opposition take?
d	Did this opposition influence the project and if so, how?
e	Was there any direct response by the project to the opposition? <i>-If NO, go to i</i>
f	When did the project respond?
g	Who responded?
h	Which form was used to respond?
i	Do you see public or stakeholder opposition as a serious threat to the successful implementation of the project?
j	Can you give me an example of what type of opposition might cause the project to be abandoned?
k	How would you react if today an article was published in the media that states that the risk involved in the project are too high?
l	What do you think would be the consequences for the project?

References

8	Experience
	The last questions are about your personal experiences
a	Can you give an example of an effective communication route? [<i>Which technique, form of communication, etc.</i>]
b	Why do you think this was effective?
c	Can you give an example of a poor communication route?
d	Why do you think this was ineffective?
e	Is there anything about your previous risk communication activities that you would now do differently?
	<i>-If NO, go to g</i>
f	Why would you do this differently?
g	Do you think guidelines on risk communication can or could have helped your project?
h	What do you expect guidelines on risk communication to provide?
9	Ending interview
	Well, this is the end of this interview and I would like to thank you very much for your cooperation. Do you have anything to add to what we have discussed or do you have any questions? [<i>if so, answer and discuss these with the respondent</i>] Again, thank you very much for your time; I hope you enjoyed this interview as well...