A COMPARISON OF RISKS FROM NEW JERSEY CHEMICAL FACILITIES AND THE BENEFITS OF RISK COMMUNICATION

by
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ABSTRACT

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The purpose of this study is to determine if the amount of toxic chemicals a facility stores on-site is a valid indicator for determining a facility's risk potential and need to communicate risk information to the public. This study analyzes New Jersey chemical facilities regulated under the CAA's Risk Management Plan (section 112(r)) and their toxic chemical releases and other risk factors to determine if there is a relationship between the amount of toxic chemicals stored on-site and the potential risk from a toxic release. The analysis of data suggests that no relationship exists; therefore, one could assume that all local communities are at risk and could benefit from risk communications programs.

A limited number of interviews were conducted with owner/operators of facilities not required to communicate risk information. The interviews suggest that these owner/operators do not communicate risk voluntarily. One of the main reasons is because they do not identify their facilities' as posing a risk to the surrounding communities.

APPROVAL PAGE

A Comparison of Risks From New Jersey Chemical Facilities' and the Benefits of Risk Communication

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This thesis is dedicated to David J. Rash

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CHAPTER 1

INTRODUCTION

In recent years, there has been an increased awareness of the dangers from accidental chemical releases. Because of this heightened awareness, the public has put pressure on the government to address these concerns. As a result, there has been an increase in the promulgation of federal and state laws addressing the risks of chemical releases to the public. The focus of this legislation to protect the public concentrates on risk management planning and risk communication. The Environmental Protection Agency (EPA) states in its "Risk Management Planning Fact Sheet" that the first steps toward accident prevention are the identification of hazards and the assessment of risks (USEPA OSWER 1996). Federal laws, such as the Superfund Amendment and Reauthorization Act (SARA) (42 U.S.C.9601 *et seq.* (1986)) and New Jersey's Toxic Catastrophe Prevention Act (TCPA)(N.J.S.A 13:1K-19 *et seq.* (1988)) require the identification of the risks of highly hazardous chemicals and the preparation of risk management plans to minimize those risks.

The Clean Air Act's Section 112(r) (42 U.S.C. 7401 *et seq.* (1990)) Risk Management Plan Rule (RMP Rule) goes a step further by requiring that certain facilities communicate risk information to the public. The summary of the RMP Rule found in the Federal Register states that EPA is required "to promulgate regulations to prevent accidental releases of regulated substances and reduce the severity of those releases that do occur." Additionally, the Rule states "the regulations will encourage sources to reduce the probability of accidental releases of substances that have the potential to cause immediate harm to public health and the environment and will stimulate the dialogue between industry and the public to improve accident prevention and emergency response practices." (61 FR 31668 (1996)).

In order to stimulate dialogue between industry and the public and improve accident prevention and emergency response practices, the Rule requires stationary sources (chemical facilities) to identify and assess their hazards and conduct certain activities to reduce those hazards. This information must then be distributed to state and local governments, the public, and all other stakeholders. (USEPA OSWER 1996). The RMP Rule, which came into effect in June of 1999, is directed specifically at facilities with more than a threshold quantity of a listed "regulated substance" in a single process. Specifically it targets those facilities posing a risk to the public from a catastrophic accident. The final list consists of 120 regulated substances, with threshold quantities for toxics ranging from 500 to 20,000 pounds (See Appendix A).

Questions arise about how to treat facilities that are not subject to the RMP Rule because they do not meet the threshold requirements. Previous research suggests that many facilities that store small amounts of hazardous chemicals on-site may have an increased potential for accidents due to a lack of resources and/or sophistication in handling hazardous materials. Research also suggests that these facilities may take steps to avoid falling under the RMP Rule, which may actually result in an increased exposure to the community from risks associated with releases other than catastrophic. For example, facilities may choose to reduce the amount of "regulated substances" on-site by having more frequent deliveries of these substances, thereby increasing the risk of spills during transport, yet effectively avoiding the necessity of complying with the RMP Rule. Transportation accidents may constitute up to 25 percent of chemical accidents as reported in a 1994 study done by the National Environmental Law Center (PIRG 1994, 4).

In an attempt to reduce risk of a catastrophic accident from facilities storing large amounts of toxic chemicals on-site, the Clean Air Act's RMP Rule may shift the risk to the roads, off-site storage and other media. Rather than decreasing risk, it is in effect allowing for the shifting of risk to other areas.

Risk communication for all facilities may help surrounding communities to reduce risk in all circumstances by educating the public on the risks and their possible exposure to them. Communicating risk information is not an easy task; many chemical facilities find it daunting. They avoid it or any other type of involvement with their local communities, unless they are required to do so under the law. Risk information must be adapted to the level of sophistication of the particular audience that is being addressed. A risk communications program must also be tailored to the needs and the resources of the chemical facility that is communicating this information. To frustrate matters further, the public may not be interested in receiving the risk information, which makes management question why they would want to make an effort to communicate risk information that is not wanted.

The RMP Rule focuses on potential risks from rare catastrophic accidents, rather than the total risk to local communities. A catastrophic accident or "extraordinarily hazardous accident risk", as defined in New Jersey's Toxic Catastrophe Prevention Act, is the potential for a release of an extraordinarily hazardous substance into the environment, which could produce a significant likelihood that persons exposed may suffer acute health effects resulting in death, or permanent disability (N.J.S.A 13:1K-21(a)). This study looks at risks from toxic chemical releases, other than rare catastrophic releases, that may affect local chemical facility communities. The purpose of this study is to determine if the amount of toxic chemicals a facility stores on-site is a valid indicator of a facility's broad risk potential and need to communicate risk information to the public. If there is no relationship between potential risk and the amount of chemicals stored on-site, then one can assume that these facilities, independent of the amount of toxic chemicals stored on-site, pose a risk to their local communities. Therefore, all of the facilities and their communities would benefit from some form of risk communication.

This study analyzes toxic release information from various New Jersey chemical facilities and various risk indicators identified by the author. The study includes a summary of interviews conducted with owner/operators to investigate the views and opinions of chemical facilities' management (not subject to the RMP rule) regarding risk communication and community involvement.

Chapter 2 will discuss the previous research regarding risks in chemical facilities handling smaller quantities of toxic chemicals, problems associated with risk communication, and the benefits of risk communication and community involvement. Chapter 3 will discuss the hypotheses upon which this study is based. Chapter 4 discusses the methodology used to address the hypotheses. It will discuss specifically how and why certain chemical facilities and their toxic release information are used in the study. Chapter 5 will discuss the results and an analysis of the data gathered.

The final chapter (Chapter 6) will summarize the above research and include recommendations for risk communication and community involvement. It is hoped that the recommendations will encourage facility management to identify risks and convey risk information to their local community, in the hope of decreasing these risks and providing benefits to their facilities as well.

CHAPTER 2

PREVIOUS FINDINGS

2.1 Risks to Public Health by Chemical Facilities

Most people are concerned about the risks from chemical exposure in their everyday lives. They are not, however prepared for or informed about the risks of toxic chemical releases from facilities in their own neighborhoods. In recent years laws and regulations designed to provide protection for the general public from toxic releases have been formulated. Many of those laws are directed at facilities with threshold amounts of chemicals on-site because of the increased threat of catastrophic releases from these sites. Indeed, many facilities storing lesser amounts of toxic chemicals on-site, with fewer resources available to manage chemicals, may have an increased potential for worst-case disasters (PIRG 1998, 3). Yet these facilities are not regulated under these laws. In addition to the threat of catastrophic accidents, local communities may be at risk due to toxic chemical releases from facilities that occur on a regular basis.

2.1.1 Regulatory Exclusions for Smaller Facilities

The development of laws and regulations in recent years, such as the Superfund Amendment and Reauthorization Act's Title III and the Clean Air Act's Section 112(r) Risk Management Plan Rule, was carried out to protect the public from chemical releases and exposure by requiring facilities to prepare plans to address emergency chemical exposure situations. As stated in Chapter 1, the CAA's RMP Rule requires stationary sources with more than a threshold quantity of a listed "regulated substance" in a single process to communicate risk information to stakeholders. These facilities are required to identify risks and to prepare plans to manage chemical releases and/or "worst-case scenarios". However, many facilities that do not meet threshold quantities for regulated substances do not fall under these laws and are not required to identify the risks of chemical releases from their facilities to the public.

2.1.2 Special Risks of Facilities with Less Experience Handling Hazardous Materials

The studies (PIRG 1998; Schaller, McNulty and Chinander 1998) discussed below have shown that chemical facilities storing small amounts of toxic chemicals on-site, may pose special risks to their local communities. In a 1998 study by PIRG, it was found that facilities lacking sophisticated spill prevention plans or adequate training may have an unusually high number of spills, but that the majority of those spills may not have the potential to create a danger to human health or the environment. PIRG examined the counties where accident potential and frequency of releases did not correlate. They found that those facilities with a low disaster potential, but high frequency of accidents, might store less hazardous chemicals but have ineffective accident prevention systems (PIRG 1998, 3).

In a study done by Schaller, McNulty and Chinander, that addresses the impact of hazardous substance regulations on small facilities, they interviewed a packager of regulated chemicals in New Jersey. They learned that management hired a consultant in an attempt to come into compliance with New Jersey regulations regarding hazardous chemicals. The process modifications implemented on the advice of the consultant actually resulted in the introduction of more hazardous chemicals, but below reportable threshold amounts. The management believed that these changes actually increased the overall risks to the community. (Schaller, McNulty and Chinander 1998, 186). This same study also found that several other companies reduced the inventories of certain chemicals in order to become exempt from the hazardous chemical regulations. The reduction of inventory in itself may be a positive step toward reducing risk; however, it may just be a shift in the risk to the local community. In fact, at these facilities the reduction in inventory required more frequent deliveries of hazardous chemicals, and/or increased use of off-site storage in public warehouses, which in turn transferred the risks to the highways and unregulated warehouses. This study also found that facilities received hazardous substances at slightly lower concentrations, which exempt them from the regulation, but did not reduce the total risks (Schaller, McNulty and Chinander 1998, 187).

2.2 Difficulties Communicating Risk Information

Catastrophic chemical accidents are rare, but that does not mean that the potential for accidents does not exist. The practice of building manufacturing facilities and residential areas next to each other creates a risk in many communities of which the citizens are totally unaware.

The RMP Rule is the only law that presently requires risk communication, however, it only requires it of those facilities that have a high risk potential for a catastrophic accident. This type of communication is too narrow and allows for the shifting of risk to other media. If communications provide information on all risks, this would increase the benefits of risk communication. The lack of knowledge regarding all risks prevents the public from taking the necessary steps to protect themselves by becoming educated about these risks.

Communicating risk is not an easy task. Chemical facilities may wish to avoid communicating risk because they believe it will arouse the public's concern and mistrust where there previously was none. Risk information given to the public must be directed to a wide range of citizens, with varied educational backgrounds, interests and belief systems. It is difficult to develop a communication program that builds trust within a diverse group of individuals. Chemical facility owners may also feel that a communications program is too costly or too much of a burden on their already fixed resources. And finally, studies (Rich, Conn and Owens 1993; Foster 1998) have shown that although many chemical facilities have tried to provide risk information to the public, the public is not always interested in the information.

2.2.1 Public Trust

Many chemical facilities have operated under the assumption that the less information the public has the better. They believe communicating with the public causes needless worry and panic; however, this is not usually the case. Late information or a perceived unwillingness to disclose information increases the incidence of distrust. The increase of distrust magnifies concerns and makes it difficult to establish a positive dialogue between a chemical facility and the public. (Forrest & Michaud 1995, 35). Establishing a dialogue early on can minimize concerns and mitigate accusations that the community is being "kept in the dark" (Forrest & Michaud 1995, 36).

A study done by McNulty, Schaller and Chinander found that management's concern of an adverse public reaction to reports of a "worst-case" chemical release is more acute in smaller rather than larger facilities. Larger facilities are more comfortable with the communities surrounding their facilities than smaller ones are. Although smaller facilities, such as propane dealers, tend to have contact throughout their communities through local customers and employees, they do not have the resources to address concerns regarding "worst-case" releases and other risk information (McNulty, Schaller and Chinander 1998, 196).

Chemical manufacturing trade organizations have conducted studies concerning the public's lack of trust. The Chemical Manufacturers Association (CMA)[1] and Decision Partners Inc. (DPI) conducted a study in 1997 to develop recommendations for effective communication strategies. As part of their study, they conducted interviews with 153 citizens from chemical facility communities across the United States and 45 "non-facility" community citizens. They found that one of the strongest beliefs was that industry is "profit motivated" and that they were driven to do the "right" thing by regulation, rather than by ethics (CMA 1997, 13). Polls of Louisiana voters conducted by the Louisiana Chemical Association in Baton Rouge, Louisiana, found that three-quarters of those polled do not believe that chemical companies tell the truth about their impact on the environment (Fairley 1998, 45).

The studies cited above indicate that the general public does not trust chemical companies regarding environmental issues. Therefore, an effort to reach out and communicate with the public might help, not hinder a chemical facility's relationship

[1] The Chemical Manufacturers Association has recently changed its name to the American Chemistry Council

with its neighbors. The 1997, CMA/DPI study discussed above found that a chemical facility's involvement with its local community appeared to be noticed and appreciated by the community. A facility's outreach efforts appeared to influence people's judgment of the industry. The study found that a chemical facility's community preferred direct, face-to-face dialogue, preferably in small groups. For example, they preferred such communication methods as tours, school programs and small industry presentations. The study suggests that chemical facility communities are not necessarily looking for expensive communication programs, but for a positive presence of the facility in the community, with the opportunity for one-on-one communication (CMA 1997, 5).

A study done in 2000 by Lillian Trettin and Catherine Musham proposes that strategies for risk communication should not focus on building public trust in institutions, but on establishing procedures to meet the public's needs for information and the mode of delivery of that information. They believe that although environmental risk communication is a difficult task, it can be made easier if the goal is to create a critically informed public, rather than to restore public trust in industry. The authors also stress that to be effective, risk communication must be interactive and it must aim for a partnership with the community (Trettin & Musham 2000, 424).

2.2.2 Meeting the Needs of the Local Community

The 1997 CMA/DPI and Trettin/Musham studies both suggest that the public does not require professionals to formally present risk information. The public wants an opportunity to discuss issues that are relevant to their community. The mode of delivery for risk communication can and should take many different forms, depending on the public's need. The most effective programs are the ones that satisfy the community's ability to make informed decisions (Trettin & Musham, 2000).

When assessing risk, experts focus on hazards, exposures, magnitude of consequences and probabilities, focusing on facts and statistics. However, a community may not be interested or sophisticated enough to understand this form of risk communication. Lay people assess risk in a less formal manner. In both cases, the perception of risk is as important as the actual risk that is identified by risk experts. Lay people may not even be aware of the particular influences on their assessment of risks and their judgments of the acceptability of those risks. (CMA 1996, 32).

Experts believe that the public pays too little attention to hazards, complaining about slight increases in risk, while participating in high-risk behavior themselves. The public believes that the experts ignore or dismiss their concerns about risk. The public's concerns are based on a much broader interpretation of risk than that of the experts. For example, experts might focus on the risk of a catastrophic accident, which can easily be defined as a "life-threatening" event, ignoring the everyday risks the public may face, that are not as distinct. The public, on the other hand, might become concerned about odors or visible emissions and their associated risks, which the experts might feel are not significant enough to warrant concern.

Some of these concerns are identified in a book authored by Hance, Chess and Sandman. These concerns are labeled "outrage" factors, and include risk factors such as whether the risk is: voluntary, natural, morally relevant or controlled by the individual. The authors emphasize that it is a mistake to dismiss these factors (Hance, Chess and Sandman 1990, 24-26). Responding to the needs of the community is one of the best ways to better community relations. A facility should specifically be aware of the small, day-to-day actions that are made in response to the local community (Hance, Chess and Sandman 1990, 38-39).

The mode of communicating risk information is as important as the risk information itself. Kamenstein (1996) conducted a case study of public meetings concerning the Lipari Superfund site located in Pitman, New Jersey. Scientists presented an abundance of information without considering the comprehension of the audience. The technical information made the community members feel ignorant and overwhelmed. Instead of participating in the discussion, they sat quietly, too embarrassed to ask naïve questions. (Kamenstein 1996, 460).

The above studies suggest that successful risk communication should meet the community's technical knowledge and level of sophistication. Depending on the community's needs, an opportunity for one-on-one contact to address their concerns, not a formal presentation by experts, may be the most appropriate type of communication.

2.2.3 Designing Risk Communication to the Facility's Resources

Risk communication programs should also be tailored to the resources of the chemical facility. According to a 1997 study by CMA and DPI, large chemical facilities that were preparing for the implementation of the RMP Rule planned to rely heavily on existing Community Advisory Panels (CAPs), Local Emergency Planning Committees (LEPCs), or trade organization materials. Media kits provided by the corporate parent were cited as the most valuable communication support tool. Risk communication videos, training and RMP newsletters were other resources on which they depended.

Smaller sites that were subject to the RMP Rule planned to depend heavily on their trade associations (CMA 1997, 17).

A study by McNulty, Schaller and Chinander concerning risk communication as required by the RMP Rule found that small facilities that operate independently do not have the expertise necessary to develop, package and deliver "worst-case" release reporting information. The cost of contracting this expertise was regarded as an excessive and unwarranted expense. Another reason smaller facilities were concerned with communicating risk, was that they did not have the resources to help address their community's negative reaction to "worst-case" scenario information if it should occur (McNulty, Schaller and Chinander 1998, 195).

A successful risk communication program can provide chemical facilities with many benefits. Although facilities may not be subject to the RMP rule, they still may want to share risk information with their communities. Unfortunately, these facilities' resources for risk communication may be limited or non-existent. Where possible, facilities can rely on trade organizations, CAPs or LEPCs for resources necessary for developing risk communications programs as other facilities have done.

2.2.4 Lack of Public Interest

A problem that many facilities face is the lack of public interest in risk communication. A few years after the Superfund Amendments and Reauthorization Act of 1986 (SARA) (42 U.S.C.9601 *et seq.* (1986)) was promulgated, a study was conducted by Rich, Conn and Owens to determine the effect of "indirect regulation" of the chemical industry by SARA. Under SARA, chemical facilities that may pose a risk to their local communities, due to the use of hazardous chemicals, are required to report toxic chemical release information to federal, state and local officials. This information is gathered by the federal government and reported in the Toxic Release Inventory (TRI) database. Facilities must report their releases of a toxic chemical if they fulfill four criteria:

1. They must be a manufacturing facility (primary SIC code in 20 -39[2]);
2. They must have the equivalent of 10 full-time workers;
3. They must either manufacture or process more than 25,000 lbs of the listed chemical or use more than 10,000 lbs during the year; and
4. The chemical must be on the TRI list of over 600 specific toxic chemicals or chemical categories. (RTK Network 2000)

The 1993 study by Rich, Conn and Owens interviewed Local Emergency Planning Commission (LEPC) members to determine their involvement in the communication of risk information required by SARA. They found that 53% of LEPCs received no requests for information from the public, and 88% had received fewer than 10 inquiries. Only 5 organizations claimed to have received 50 or more requests. One explanation of the lack of community interest was that many community members were not aware of LEPCs or their purpose. However, even when a community has experienced a risk of chemical exposure or problem with a local facility, once the problem is resolved, the public's interest wanes (Rich, Conn and Owens 1993, 20).

In the past 15 years, two major chemical accidents prompted the community around Institute, West Virginia, to demand that chemical facilities publicize "worst-

[2] The Standard Industrial Code is defined by the United States Department of Labor. Specifically, codes 20 through 39 represent Division D, the manufacturing industry. Mining, electrical power generators and RCRA treatment facilities are also included.

case" scenario information. One incident was an explosion at Rhône-Poulenc's pesticide plant that killed one worker, and the other was a chemical leak at Union Carbide's plant that hospitalized 145 people. A few years later, near that same location, local citizens could not be enticed to attend a meeting hosted by DuPont to discuss a practice evacuation of the surrounding community (Foster 1998, 52). In many cases, it is a challenge to get the public involved in meetings regarding risk information. Unless there is a recent serious incident or negative publicity regarding a facility, many people are not interested in taking the time to attend meetings hosted by chemical facilities.

Although many people are too busy to become involved with local facilities, there are those who are concerned. In 1998, the Environmental Defense Fund (EDF), an environmental non-profit organization, set up an environmental "scorecard" where anyone can enter a zip code and receive a variety of risk information about the surrounding community (<http://scorecard.org>). This webpage was designed to promote EDF's environmentalist agenda by identifying EDF's perceived risks to the public in their surrounding communities. This information includes chemicals used at various facilities, ranking of hazards, spill reporting, Superfund information, etc. Citizens are encouraged to contact chemical facilities directly with any questions or concerns that they may have regarding the facility's operations.

2.3 Benefits of Risk Communication

Lack of public trust, diverse communities, lack of resources and no public interest are all reasons that chemical facilities might want to shy away from risk communication.

If there is no problem with the local community, and if the facility believes that it is not a risk to the public then why should management make an effort to provide risk information to the public when the public is not actively seeking the information?

2.3.1 Problems Associated with a Lack of Risk Communication

During the course of everyday business, risk communication may not seem necessary to many facilities; however, it is in times of unusual circumstances that the benefits of having open communication with the public is a benefit. In their study, Santos, Covello and McCallum (1996) found that unless the law requires the facility to communicate with the public, risk communication will only take place in crisis situations. Crisis situations focus communications on environmental problems instead of environmental solutions. Poor communication impedes the ability of all stakeholders to forge effective partnerships (Santos, Covello & McCallum 1996, 65). Misinformation or false information that the public obtains from third party sources can greatly affect the perceptions of the public, which will exacerbate the crisis situation.

It is not just in crisis situations that risk communication may benefit a facility. If a chemical facility fails to acknowledge the concerns of the community and provide appropriate information, it can lead to community resistance and, in the extreme, to communication failures that can lead to an interference with business operations. For example, neighbors of a RCRA facility became concerned when they read in the newspaper about a pending public hearing for a "landfill". Protest from the citizens led to permitting problems for the facility. In reality, the facility was only applying for a permit to initiate post-closure activities. The misunderstanding was cleared up in a later newspaper report (Forrest and Michaud 1995, 35-36).

Public concern can be bothersome to clear up, but public perception can financially affect a facility, which can be seen in several recent court cases. Juries in the past have acknowledged "stigma claims" and one jury in particular awarded $6.7 million to neighbors of an Ohio Superfund site. (*DeSario et. al. vs. Industrial Excess Landfill, Case No. 89-570, Stark County Ohio Court of Common Pleas*). Although the neighbors' property had not been contaminated, they argued successfully that public perception of contamination had adversely affected property values (Forrest and Michaud 1995, 36).

In New Jersey, the Passaic Board of Chosen Freeholders passed a resolution in 1998 to establish a Neighborhood Hazard Prevention Advisory Committee (NHPAC) in order to promote participation by all of the stakeholders in the prevention of environmental and public health hazards. Although the NHPAC does not have the power to enforce any environmental statutes, it does have the authority to survey all or part of a facility on a monthly basis if it believes that there is an actual or potential environmental or public health hazard. If the facility's management refuses to allow the survey and the County Counsel agrees that there is a public health hazard, the County Counsel may request a warrant authorizing the survey. The reasons stated for this extreme reaction by the public and local government is lack of confidence in the New Jersey Department of Environmental Protection (NJDEP) and the chemical industry to protect the community from hazardous exposures (Resolution #40, County of Passaic, Board of Chosen Freeholders. 1998). As demonstrated by the above, the results of poor risk communication can range from small inconveniences to an increased burden on financial and personnel resources.

2.3.2 Benefits of Risk Communication and Public Outreach

The benefits of communicating risk far outweigh the potential problems associated with no or poor risk communication. One of the main beneficiaries of risk communication is the public. A study done by Santos, Covello and McCallum (1998) regarding the effects of SARA and risk reduction found that concern over the public's reaction to information about a facility's chemical use or pollution, motivates chemical facilities to lower their emissions and increase pollution prevention activities. This study also suggests that passive access to information on the part of the public may not be enough to motivate facilities to incorporate pollution prevention activities into their operations, proactive risk communication is needed to make a difference (Santos, Covello and McCallum 1994, 65). In other words, facilities that actively participate in risk communication or become involved with the public are more likely to participate in pollution prevention activities.

Benefits of risk communication are not limited to the public; there are many benefits to the facility as well. CMA identifies the many benefits of being proactive when it comes to communicating risk in their Benefits Method Research of 1996. For example, if a facility has good risk communication, it can communicate necessary information regarding certain situations and the perceived risks for the community. In addition, a facility has better control over the accuracy of the information that the community receives. If an incident does occur, it is easier to share information through an on-going dialogue than to defend and explain information released by other sources. And finally, timely release of information early on provides more time for dialogue – a key element in risk decisions. (CMA 1996, 62)

The same report also discusses the benefits of limited community outreach to a facility. Although it may not be apparent to the facility, citizens interpret actions and inactions of a facility. Chemical facilities and their employees that were involved in the community (*e.g.* sponsored local sports teams, participated in local fairs, etc.) were noticed and appreciated. The conduct of a facility within the community is a message in itself. CMA found that a facility's actions speak louder than its words (CMA 1996, 26).

Another benefit of public outreach is increased respect from local government officials. Facilities that engaged in public outreach as part of CMA's Responsible Care program in Louisiana received increased respect from local officials (Fairley 1998, 45). A positive relationship with government officials can be a valuable resource for many reasons, including the ability to obtain risk information and to implement better risk management practices at a facility.

Community involvement can also benefit a facility where an environmental problem is not the cause of poor community relations. BASF's Geismar, Louisiana facility had community relations problems that were based on the anger from a lockout of employees during union negotiations. Employees' billboards stating, "Welcome to Cancer Alley" publicized the "moniker" that still stigmatizes the area today. However, in a *Chemical Week* article a BASF spokesperson stated that the community had totally turned around in recent years, and public outreach is one of the reasons cited for this turn-around (Fairley 1998, 47).

If an incident occurs at a facility and risk communication has not been established, it is important that a facility take responsibility for its actions during the incident and in the future. Studies have indicated that attribution of responsibility for past environmental problems is important to the local communities. It not only helps them to understand what happened and why, but to evaluate the parties that were involved. They use this information to determine how they will respond to similar concerns in the future (Trettin and Musham 2000, 414).

In general, previous research has shown that chemical facilities that store small amounts of chemicals on-site, may not have adequate spill prevention plans in place, which may result in an increased risk to the public. Research also suggests that the steps some chemical facilities have taken to reduce the amount of toxic chemicals on-site may actually lead to an increase in risk to the public, rather than a decrease. These facilities are not subject to RMP, and therefore, not required to communicate risk information to the public. Communicating risk information has always been difficult. Overcoming public distrust and lack of interest are just a few of the problems that chemical facility management must face when communicating with the public. However, there are many benefits to risk communication and community involvement that benefit both the public and the chemical facility initiating the communications.

CHAPTER 3

STUDY HYPOTHESES

Under the RMP rule chemical facilities that store certain amounts of "regulated substances" on-site are seen as posing a risk to their communities and are required to communicate risk information to the public. However, a potentially catastrophic release of toxic chemicals is not limited to facilities that store large amounts of toxic chemicals. Chemical facilities that store small amounts of toxic chemicals on-site also have the potential for a catastrophic release. In addition, the public is at risk from toxic chemical releases that occur on a frequent basis from all chemical facilities. Chemical facilities that are not regulated under the RMP Rule are not required to inform their local communities of these potential risks. The purpose of this study is to determine if the amount of toxic chemicals a facility stores on-site is a valid indicator for determining a facility's risk potential and need to communicate risk information to the public.

Hypotheses:

This study will examine the validity of the following three hypotheses:

1. There is no relationship between the amount of toxic chemicals stored on-site and the amount of toxic chemicals released into the environment by New Jersey chemical facilities.
2. There is no relationship between the amount of toxic chemicals stored on-site and the potential risk due to toxic chemical releases to local communities surrounding New Jersey chemical facilities.

3. New Jersey chemical facilities that are not required by the RMP Rule to communicate risk information to the public, do not communicate risk information to the public, nor do they have any involvement with their communities.

Hypothesis 1 was designed to assess whether chemical facilities in New Jersey storing large amounts of toxic chemicals on-site had a significantly different amount of releases as compared to those storing lesser amounts. If there is no significant difference in the amounts of toxic chemicals released, then it can be assumed that facilities storing small amounts of chemicals on-site are just as likely to pose a threat from toxic chemical releases into the environment. This would suggest that the amount of toxic chemicals stored on-site is not the best indicator of whether a facility is a risk; all facilities pose a risk and therefore should be required to communicate risk information. In this case, the public would benefit from all facilities communicating risk information.

Hypothesis 2 was designed to assess whether chemical facilities in New Jersey storing large amounts of toxic chemicals on-site posed a significantly different level of risk to local communities as compared to those storing lesser amounts, based upon specific risk indicators. If there is no significant difference in the risk level, then it can be assumed that facilities storing small amounts of chemicals on-site are just as likely to pose a risk as facilities storing large amounts of chemicals on-site. As stated above, this would suggest that the amount of toxic chemicals stored on-site is not the best indicator of whether a facility should communicate risk information.

Hypothesis 3 was designed to determine if chemical facilities, not subject to the RMP rule, communicate risk information to the public and/or become involved with the community. A lack of community involvement and/or risk communication can increase the risk to the local communities in case of an emergency situation. This lack of information or familiarity with the facility can interfere with emergency response situations. If facilities are involved with their communities, this could be seen as an informal avenue to communicate risk information to the public or familiarize the community with the facility. If there is no community involvement, then it can be assumed, in most cases, there is little if any communication between the facilities and the communities, signifying a potential increased risk to the communities due to the lack of communication.

CHAPTER 4

METHODOLOGY

4.1 Overview

Under the CAA's Risk Management Plan (RMP) Rule, facilities that store certain amounts of "regulated substances" on-site are seen as posing a risk due to the threat of a catastrophic release to their communities and are required to communicate risk information to the public. Facilities that store lesser amounts of toxic chemicals on-site are not subject to this rule. The purpose of this study is to determine if the amount of toxic chemicals a facility stores on-site is a valid indicator for determining a facility's risk potential and need to communicate risk information to the public. This is accomplished by using toxic release information obtained from EPA. If no relationship exists, and it is found that both groups of facilities are an overall risk to the local communities, then on-site storage of chemicals is not a good indicator of risk and in this case risk communication would be beneficial to both groups. This study also includes a limited number of interviews with the management of New Jersey chemical facilities, not subject to the RMP rule, to determine if they voluntarily communicate risk information or become involved with the public. The interviews help to identify perceived problems communicating risk and potential solutions to those problems.

The literature search for background information was focused on environmental risk communication, communication problems due to the promulgation of the CAA's Risk Management Plan (RMP) Rule, and environmental risks in smaller chemical facilities. Trade organizations and special interest groups were contacted. The groups included the Chemical Manufacturers Association (CMA), the Public Interest Research Group (PIRG), the New Jersey Chemical Industry Council (NJCIC) and Rutgers' Center for Environmental Communication. An extensive amount of research has been published on environmental communication, specifically discussing the implementation of the RMP Rule requirements. Very little information regarding the environmental risks of small chemical facilities to their surrounding communities was found, although there was a limited amount of information concerning the problems of small chemical facilities communicating risk.

One aspect of this paper will be to analyze data in an attempt to identify a relationship between the amounts of toxic chemicals stored on-site and the amounts of toxic chemicals released into the environment by chemical facilities in New Jersey. Various toxic release information will be reviewed that may suggest a facility's potential health risk to the surrounding community due to toxic chemical releases. A comparison will be made between chemical facilities that store large amounts of toxic chemicals on-site to those that store lesser amounts. If no relationship is found, then one conclusion could be that chemical facilities pose a risk due to toxic chemical releases independent of the amount of toxic chemicals stored on-site. Therefore, one might assume that all of these facilities and their local communities would benefit from risk communication not just those storing large amounts of toxic chemicals and subject to the RMP Rule.

This study will also examine the relationship between the amount of toxic chemicals stored on-site and the potential health risks from these chemical facilities to their surrounding communities based on certain risk indicators. As stated above, if no relationship is found then one might conclude that chemical facilities pose a risk to their local communities, independent of the amount of toxic chemicals stored on-site.

Interviews were conducted with the owner/operators of chemical facilities that store small amounts of toxic chemicals on-site to determine if they voluntarily provide risk communication information or participate in community involvement programs with their local communities. As discussed previously, prior research suggests that these facilities do not voluntarily communicate risk information unless they are required to do so under the law. This study will verify these findings, and then investigate further why there is no risk communication and what the role of community involvement with these New Jersey facilities is.

4.2 Study Population

The focus of this study is on New Jersey chemical facilities that reported under the Superfund Amendments Reauthorization Act (SARA) in 1998. There are presently 793 chemical facilities located in New Jersey (ACC 2001, 1). In this study, chemical facilities are defined as beginning with the Standard Industrial Code (SIC) of "28", which is the classification for "Chemicals and Allied Products". This group includes facilities producing basic chemicals, and facilities manufacturing products by predominantly chemical processes (<http://www.osha.gov/cgi-bin/sic/sicser3>). Facilities regulated under SARA were chosen because they are required by law to communicate risk information to local officials; therefore facility management has some experience identifying and communicating risks. These facilities report toxic release information to the EPA, which is then reported in EPA's Toxic Release Inventory (TRI). Facilities that did not previously have experience identifying risk were not included because it would be very difficult to develop and compare information from these facilities quantitatively.

This study divides these facilities into two groups, those storing large amounts of toxic chemicals on-site and those that store lesser amounts. The RMP Rule threshold was used to distinguish between the two groups. The RMP Rule is directed at facilities with more than a threshold quantity of a listed "regulated substance" in a single process. The final list consists of 120 regulated substances, with threshold quantities for toxics ranging from 500 to 20,000 pounds. A list of these regulated substances can be found in Appendix A. Those facilities subject to the RMP rule will be referred to as "RMP facilities" throughout the paper. Those facilities that are not subject to the RMP Rule will be referred to as "non-RMP facilities". There were a total of 185 non-RMP facilities and 31 RMP facilities that met the criteria.

4.3 Study Area

This study focuses on the chemical manufacturing industry because they are one of the major industries that account for 79 percent of the total disaster potential among all industries as ranked by PIRG (PIRG 1998, 1). Specifically, the state of New Jersey was examined because of its relatively large number of chemical manufacturing facilities and the potential risk for a major chemical accident. New Jersey was ranked by PIRG as the 18th of 50 states that have the potential for worst-case disasters in a 1998 study of worst-case scenarios. In addition, New Jersey has a history of promulgating some of the most sophisticated laws regulating chemical manufacturing (*e.g.* New Jersey's Toxic Catastrophe Prevention Act) which require management to have a higher level of risk management knowledge, compared with those in other states. Finally, the government and its citizens largely support the chemical industry due to the fact that New Jersey employs nearly 20% of the state's manufacturing workforce, approximately 94,300 people. Many of the citizens are dependent on chemical industry jobs and the income it provides. In addition, the chemical manufacturing industry provides a production value of $29.2 billion to the state of New Jersey. These are very strong financial and political incentives, which encourage the public and chemical manufacturing industry to coexist, as compared to other states (ACC 2001,1). This suggests that chemical facilities and their surrounding communities have more incentive to have a positive relationship as compared to other states.

4.4 Toxic Releases

Hypothesis 1 states that there is no relationship between the amount of toxic chemicals stored on-site and the amount of toxic chemicals released into the environment by New Jersey chemical facilities. Previous research suggests that facilities storing small amounts of toxic chemicals on-site may have an increased potential for accidents due to a lack of resources and/or sophistication in handling hazardous materials (PIRG 1994, 3). The 1998 study by Schaller, McNulty and Chinander, discussed in Chapter 2, found that facilities storing small amounts of chemicals on-site shifted risk from the facility to the surrounding community. This research leads one to believe that facilities storing smaller amounts of chemicals on-site have a higher probability of releasing larger quantities of toxic chemicals into the environment than facilities storing larger amounts of chemicals. The RMP rule requires facilities storing large amounts of toxic chemicals on-site to communicate risk information to the public, implying that these facilities pose a greater risk to the public due to catastrophic accidents. This study will analyze the TRI information to determine which is the more likely scenario.

4.4.1 Defining Study Toxic Release Inventory (TRI) Data

To address Hypothesis 1, this study analyzes TRI information to compare the quantity of toxic releases from chemical facilities that store large and small amounts of toxic chemicals on-site to determine if there is a significant difference between these facilities. The TRI database has been used in the past by organizations such as the Environmental Defense Fund (EDF) and by researchers, such as Santos, Vincent and McCallum (1996) in studies analyzing risk information regarding chemical facilities. Identifying risk is a difficult task, especially when attempting a quantitative analysis. EDF used the amount of toxic chemicals released in many of their studies, demonstrating one method of quantitative analysis. This study will follow their lead by using the pounds of toxic chemicals released as one of the variables. Air emissions, discharges to land , and discharges to surface water are the only releases being considered in this study.

The most recent years of data available for this study were the years 1996-1998. The study was to be based on one year, for ease in making calculations. The first step in the analysis was to determine whether a single year should be used or whether an average of the facilities' annual releases would be a better indicator. Initially the releases in 1996, 1997, and 1998 were compared to get a history of the facilities' releases. This comparison is based on the total pounds of toxic chemicals released for each year.

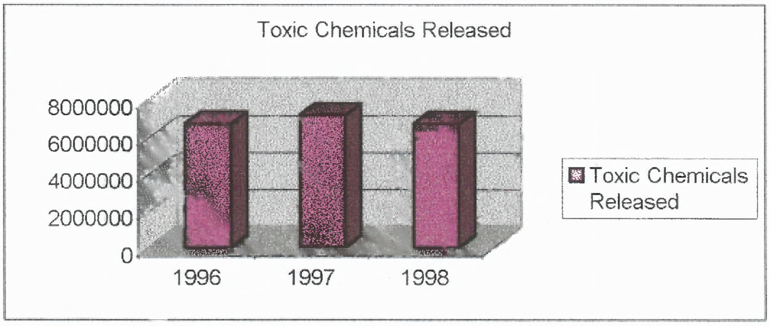

Figure 4.1 New Jersey Chemical Facilities Pounds of Toxic Releases 1996-1998

As shown in figure 4.1, it did not appear that the pounds of toxic chemicals released per year varied significantly. To verify that the releases per year were not significantly different, the average releases for each year were calculated and a two-tailed hypothesis test for the differences of means was used to determine if there was a significant difference between the means (Sternstein 1994, 95). The mean average pounds released per year for 1996, 1997 and 1998 were 310,000, 330,000 and 310,000 respectively. The standard deviation for 1996, 1997, 1998 were 215,000, 243,000 and 269,000 respectively. As expected, at 0.05 and 0.01 significance levels, there was no significant difference between the means.[3]

In order to get another perspective on the data, the chemical facilities were grouped by the range of releases per year shown in Figure 4.2. For example, there

[3] The critical difference at 0.05 confidence levels was ±43,000 lbs, between 1996 and 1997, ±49,000 lbs between 1997 and 1998 and ±47,000 between 1996 and 1998. The critical difference at 0.01 confidence level was ±57,000 lbs., ±65,000 lbs., ±62,000 lbs, respectively.

were 162 facilities in 1996, 165 facilities in 1997 and 166 facilities in 1998 releasing 0-10,000 pounds of toxic chemicals.

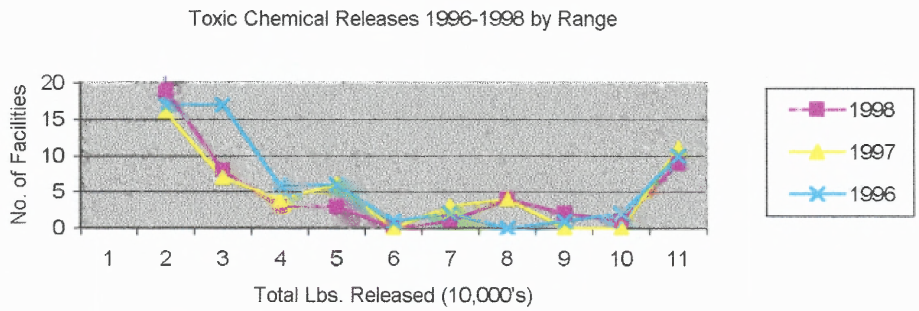

Figure 4.2 Toxic Chemical Releases Grouped by Range

In all three years, the majority of facilities (150) released less than 10,000 lbs. of toxic chemicals. Although this data was used in the statistical analysis, it was removed from the above chart, to improve the quality of the visual analysis only. The data representing facilities releasing over 20,000 lbs is depicted in Figure 4.2. The above analyses suggest that there is no significant difference in all three years; therefore, the study was based on the year 1998.[4]

4.4.2. Comparison of Average Pounds of 1998 Toxic Releases: RMP v. Non-RMP

The annual average amounts of toxic chemicals released from RMP and non-RMP facilities were compared. The mean average amount of toxic chemicals released for RMP and non-RMP facilities was calculated and used in a two-tailed hypothesis test for the differences of means to determine if there was a significant difference between the means. Specifically, it was used to determine if there was a significant difference

[4] The EPA uses the most recent year to approximate releases per year in the future until the actual data is available. Data from 1998 is the most recent year available at the time of this study.

difference between the average amount of toxic chemicals released into the environment and the amount of toxic chemicals stored on-site.

The types of releases (air emissions, discharge to land, discharge to surface water) were also identified and analyzed to determine the most common type of release and the affect on risk to the community.

4.5 Risk Index Value

Hypothesis 2 states there is no relationship between the amount of toxic chemicals stored on-site and the potential risk to local communities due to toxic chemical releases from surrounding New Jersey chemical facilities. Previous research suggests that facilities may unintentionally increase the risk of exposure to their communities in their efforts to decrease the amount of regulated chemicals on-site (Schaller, McNulty and Chinander 1998, 186). This study will compare a risk index value assigned to facilities storing large amounts of toxic chemicals on-site with those that store small amounts, in an effort to determine if there is a significant difference in risk between the two groups.

4.5.1. Development of Risk Index

Other researchers have used risk indices to rank various risks to local communities. For example, the Environmental Defense Fund (EDF) created a national database ranking various chemical facilities that they determined to be a risk to the public, using a risk index.

The formula for the risk index created for this study is as follows:

Risk Index Value= Toxicity and/or Carcinogenicity + (TEP)(Lbs. Released)
+Enforcement Action

Each indicator is considered of equal risk value. The risk index has a value of zero to three points, "0" meaning that there were no risk indicators found associated with the facility. A risk index score of "1" signified one risk indicator was found associated with that facility, "2" signified two risk indicators were found associated with that facility, etc. A maximum of three points could be assigned to the risk index. Risk can be interpreted in many different ways. By no means has this study included all of the factors that can affect risk to a community from chemical facilities. This study attempted to define risk using a limited number of indicators that cover a broad spectrum of areas associated with potential risk.

4.5.2. Risk Index Variable: Toxicity/Carcinogenicity

One of the risk indicators or risk index variables chosen for this study is the release of toxic or carcinogenic chemicals from these facilities. A release of chemicals that were considered carcinogenic or toxic would indicate a potential risk to the public.

This study does not limit the chemicals considered in this risk variable to those regulated chemicals listed under the RMP Rule; a more comprehensive list of chemicals was used. Chemicals that are considered toxic or carcinogenic, specifically those found in California's Proposition 65 List, are included as indicators of risk. Chemicals that were specifically chosen include: carcinogens, recognized developmental toxicants, and recognized reproductive toxicants (see Appendix B). If it was determined that any one of the Proposition 65 chemicals was released by any of the facilities, a value of "1" point was assigned to the facility as part of the "risk index". The risks associated with these facilities focus on the releases of carcinogens and/or toxicants into the atmosphere. The risks associated with storing Proposition 65 chemicals on-site were not included in this analysis.

4.5.3. Risk Index Variable: (Toxic Equivalency Potential)(Pounds Released)

As stated previously, EDF has created a national database ranking the chemical facilities in the order in which they are a threat to the public, the more threatening being the first facilities on the list. This study incorporates this risk analysis into the risk index as one of the variables. If a facility is found to be in the top 100 chemical facilities on this list, it was considered to be a risk to the surrounding communities. If a facility is located on the EDF ranking, it was assigned a value of "1" point as part of the "risk index".

Although it is recognized that EDF has a political agenda, its work in this area is still valuable. The EDF ranking of chemical facilities is used because it is a way to encompass the risks to human health as identified by various scientific authorities. This ranking system was developed in collaboration with scientists at the School of Public Health at the University of California at Berkeley. To determine the ranking, they extracted the most recent TRI reported number of pounds released to the air and water and multiplied each of the chemicals' released quantity by a chemical-specific Toxic Equivalency Potential (TEP). A TEP indicates the relative human health risk associated with a release of one pound of a chemical, compared to the risk posed by the release of a reference chemical. Detailed information regarding this ranking can be found on the EDF web page "How the Scorecard Identifies Health Hazards of Toxic Chemicals" (<http://scorecard.org>) and/or in Appendix C.

4.5.4. Risk Index Variable: Environmental Enforcement Action

The environmental enforcement history was also included as part of the risk index. This study in no way suggests that those facilities with an enforcement history are negligent in their operating procedures. The enforcement history is used only as an indicator, that in the past, the facility had a violation that was serious enough to have an enforcement action brought against them by EPA. This might suggest that, the facility management's knowledge or actions regarding environmental regulations in general were not as strong as they could have been. This lack of sophistication or *laissez faire* attitude concerning environmental regulations could affect their operating procedures in areas such as spill prevention and the management of hazardous chemicals. Because this study focuses on federal statutes and regulations, environmental actions solely brought against the facility by NJDEP were not included in this study; however, as a general rule, the NJDEP is usually involved in all EPA actions.

This study specifically reviewed the facilities' histories in the last 5 years. To determine the enforcement history of the facilities, data retrieved from EPA's DOCKET database were used. Each facility was researched in the EPA's DOCKET database to determine if they had any civil enforcement action brought against them by EPA between 1996 and 2000. Under the RMP Rule, the risk management plan must contain a 5-year history of releases/enforcement; therefore, this 5-year period was determined to be satisfactory for the purposes of this study as well. If a facility was found to have enforcement actions brought against them between 1996 and 2000 it was assigned a value of "1" point as part of the "risk index".

4.5.5. Risk Index and the Test for Independence

Initially, a test of independence was performed to compare the risk index values to determine if they were independent from the RMP status. To make this determination a X^2 - value of weighted squared differences was used to perform a test for independence. If the X^2 - value exceeds the set critical value, then there is sufficient evidence to reject the null hypothesis and claim that there is some relationship between the variables or methods of classification (Sternstein 1994, 166-67). If there is no relationship between the amount of toxic chemicals stored on-site (RMP v. non-RMP facilities) and the risk index score (0-3), one can conclude that the risk index is independent of whether the facility stored large or small amount of toxic chemicals on-site. Independence of these variables would demonstrate that the value of the risk index score has no dependence on the amount of toxic chemicals stored on-site. The risk index created for the purpose of this paper in no way encompass all of the risk factors that could be associated with specific facilities and/or locations that could influence the risk potential.

4.6 Chemical Facility Interview Process

Hypothesis 3 states that New Jersey chemical facilities not required by the RMP Rule to communicate risk information to the public do not communicate risk information to the public, nor do they have any involvement with their communities. Previous research suggests that chemical facility management does not want to communicate risk information for many reasons. For example, managers may be concerned about the public's reaction to risk information, they may feel that it is too expensive to implement a risk communications program, or they may feel that they are not a risk to their community. This study will interview a limited number of facility owner/operators, whose facilities are not subject to the RMP Rule, to determine not only if they communicate risk information and are involved with the community, but also why they are or are not. It will also examine the role of community involvement, if any, in managing the chemical facilities. The results of the interviews with facility owner/operators will be presented anecdotally, as have many other studies regarding risk communication, including those discussed in the "Previous Findings" chapter of this paper[5].

4.6.1. Study Population

Due to the large number of New Jersey chemical facilities and their diverse characteristics and populations, it was determined that a more in-depth interview process could be conducted if the focus was in one county. A representative county for the interview process would contain various sized chemical manufacturing facilities and residential areas. The determination was made by a review of TRI information relating to various New Jersey counties. Essex County was chosen because it is a very industrial area that contains a variety of small, medium and large chemical facilities. Although it is very industrial, it also has interspersed residential areas located within its borders. In addition, the chemical facilities have a mix of

[5] The study entitled "Impact of Hazardous Substances Regulations on Small Firms in Delaware and New Jersey" specifically uses an anecdotal presentation of the data collected.

RMP and non-RMP facilities. Most of the other counties were limited in the number of non-RMP facilities that were within their borders or the facilities were not located near residential areas. This criterion for a representative county was anticipated to provide the best results for the specific risk information needed. There were 21 facilities located in Essex County that met the criteria.

4.6.2. Survey Development

The questionnaire was designed to obtain the perspective of management regarding risk communication and community involvement. It was based in part on findings from the literature review, specifically the study regarding hazardous substance regulations and small firms by Schaller, McNulty and Chinander (1998). The questionnaire was purposely designed to be brief because the interview was to be conducted over the telephone. It was thought that a telephone interview would encourage a larger response rate. The data from these interviews is to be used anecdotally, therefore the interviewees were encouraged to not only answer the questions asked, but to elaborate on their views regarding risk communication and community involvement. Two questionnaires are located in Appendices D and E, the only difference being that one questionnaire has a cover letter that was included with the mailed questionnaires.

4.6.3. Interview Process

All information regarding facility names, contacts and telephone numbers were retrieved from the EPA TRI database. Of those facilities that were viable, someone from management was requested to answer questions regarding community involvement and risk communication. If they were willing, the person was interviewed immediately. If no contact could be made with the designated person after a two-week interval, a questionnaire was sent out with a cover letter discussing the purpose of the questionnaire. A follow-up reminder was sent in the mail to encourage additional responses. The information obtained from this survey is supplied in all cases by either the management or owners.

At the beginning of the interview, it was explained that only general information regarding chemical facilities was needed and that all answers would be kept strictly confidential. The first part of the questionnaire was designed to gather background information on the facilities.

Background information included whether they were a subsidiary of a larger company (Question 1). This would indicate that they would have access to outside influences that might encourage risk communication. If they were a subsidiary, this might also indicate that they had more resources available to them to implement a risk communication program. The number of employees for each facility and how many of them were management was also asked (Question 2). This information might be used to determine if the number of employees (facility size) had any correlation to the amount of toxic chemicals stored on-site.

The facility's involvement with trade organizations was also discussed. Certain trade organizations, encourage participation in programs that promote community involvement such as the Chemical Manufacturers Association (Question 3). Each facility was specifically asked if it was required to report under the RMP Rule. This was to verify that these facilities were not subject to RMP and therefore not required to communicate risk information to the public (Question 4).

It was also determined if they were subject to New Jersey's Toxic Catastrophe Prevention Act (TCPA), which has regulatory requirements regarding risk communication similar to the RMP Rule. If it was subject to the TCPA, it might be more sophisticated in identifying and creating risk management plans compared to those not subject to TCPA (Question 5). Although it was previously established that all of the facilities were subject to SARA and therefore required to have contact with their Local Emergency Planning Committee (LEPC) and other local government agencies, this information was verified. In addition, this question was used to screen the interviewees to determine if the person interviewed had knowledge of risk communication for his/her company and was the correct person to interview (Question 6).

The next group of questions concerned the actual risk communication and involvement with the community. A 5-year history was chosen because that is the time period used for the risk index enforcement history review discussed above; consistency in the time period under review was desired. When asking questions about risk communication and community involvement, various examples were volunteered so they would understand the breadth of the question. Questions regarding "risk communication" seemed to deter some people from expanding on their answers. Once examples, such as information booths and open houses, were given as examples of avenues to communicate risk information to the public, the interviewees seemed less intimidated by the questions (Questions 7-8a). These questions were designed not only to determine the level of community involvement and risk communication, but also to determine the perception of management in this regard.

Detailed questions regarding risk communication were part of the survey, but because only one of the facilities communicated risk information to the public, and that was on demand, these questions were not asked. The questionnaire also directly addressed the management's opinion of why they did not communicate risk (Question 8b). For this question specific answers were offered, representing the following ideas: (1) there is no risk; (2) lack of resources; and (3) concern about public relations. In most cases the management picked one topic and elaborated on their views regarding that specific topic. Questions regarding risk management ended the questionnaire (Questions 9-10).

CHAPTER 5

DATA ANALYSIS

5.1 Overview

The analysis of data is specifically designed to test a number of hypotheses regarding New Jersey chemical facilities and the risk they pose to their surrounding communities, due to the release of toxic chemicals into the atmosphere, regardless of the amount of toxic chemicals stored on-site. Various sources of data were used to test the hypotheses in this study. Sources of data analyzed included EPA's TRI and Enforcement DOCKET databases, EDF's Chemical Facility Ranking, and California's Proposition 65 list of carcinogenic and toxic chemicals. Additionally, a limited number of interviews were conducted with the owner/operators of various chemical facilities that were not subject to the RMP Rule, in other words, those facilities not storing large amounts of toxic chemicals on-site. These interviews were used to determine the management's perspective on risk communication and their facility's risk to the surrounding community.

5.2 RMP v. Non-RMP and Toxic Releases

Hypothesis 1 states that there is no relationship between the amount of toxic chemicals stored on-site and the amount of toxic chemicals released into the environment by New Jersey chemical facilities. To determine if this hypothesis is correct a comparison of the actual pounds of toxic chemicals released, in 1998 between RMP and non-RMP facilities was used to determine if any relationship existed between the two groupings.

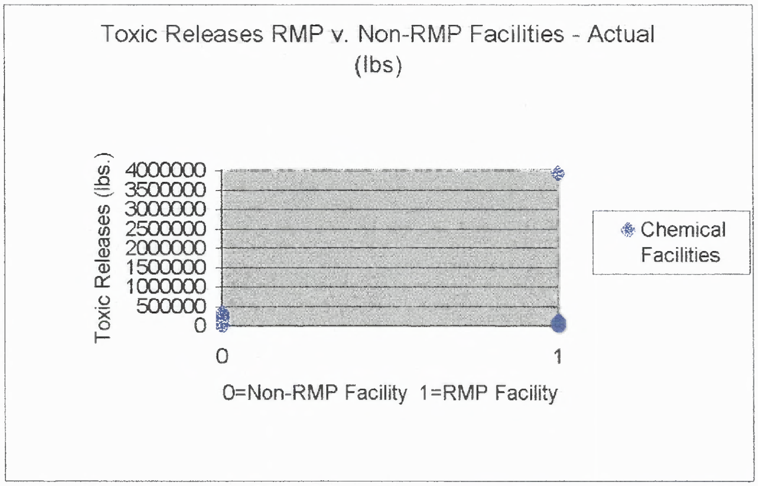

Figure 5.1a Actual Pounds of Toxic Chemical Releases: RMP v. Non-RMP Facilities (0-4,000,000 lbs)

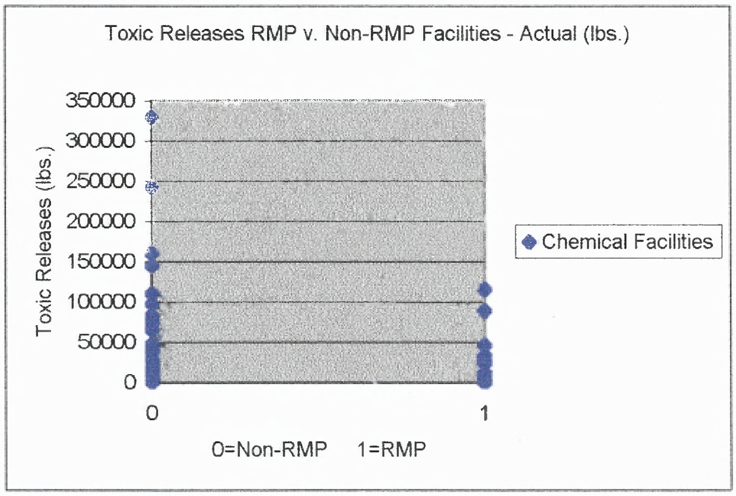

Figure 5.1b Actual Pounds of Toxic Chemical Releases: RMP v. Non-RMP Facilities (0-350,000 lbs.)

Figure 5.1a represents the data gathered. The visual analysis was difficult to interpret due to the wide range of releases, ranging from 0-4,000,000 lbs., with most of the facilities' releases under 500,000 lbs. On review of the data it was determined that only one RMP facility had over 350,000 lbs released, therefore, the chart was redesigned to focus on the facilities releasing under 350,000 lbs., those results are seen in Figure 5.1b[6].

The charts above show that both the RMP and non-RMP facilities seem to have a cluster of facilities with releases under 50,000 pounds and a scattering of facilities above that amount. To determine if the relationship was statistically significant, the annual average amount of toxic chemicals released from RMP and non-RMP facility was examined. A two-tailed hypothesis test was used to analyze the average amount of toxic chemicals released from each group. Although the average amounts of releases varied greatly, a comparison of the averages and standard deviations were expected to support the previous findings above. Specifically, the analysis was used to determine if there was a significant difference between the average releases between RMP and non-RMP facilities. This is a method of testing Hypothesis 1. The mean average amount of toxic chemicals released for RMP facilities was approximately 143,000 lbs., with the standard deviation equal to 703,000 lbs. The non-RMP facilities' mean average of toxic chemicals released was approximately 12,000 lbs., with the standard deviation equal to 37,000 lbs. At a significance level of 5%, the critical differences are 0±248,000 lbs., and at a significance level of 1% the critical differences are 0±326,000 lbs. The observed difference between the average means was 131,000 lbs., which falls between the critical differences and is therefore not considered a significant difference. As discussed previously, the data contains one facility that had releases of 4,000,000 pounds. When that 4,000,000 pounds is removed from the data the average chemicals released for RMP facilities' was

[6] Note that this scatter chart merges the data points making the separate 215 data points indistinguishable.

approximately 16,000 lbs, with the standard deviation equal to 26,000 lbs. Using the modified data, at a significance level of 5%, the critical differences are 0±11,000 lbs. and at a significance level of 1% the critical differences are 0±16,000 lbs. The observed difference between the average means was 4,000 lbs., which also falls between the critical differences and is therefore not considered a significant difference.

This analysis suggests that there is no relationship between the amount of toxic chemicals released into the atmosphere by chemical facilities and the amount of toxic chemicals stored on-site. The comparison of the annual average releases of RMP and non-RMP facilities, using the two-tailed hypothesis test, finds no significant difference between the average amount of toxic chemicals released for the RMP and non-RMP facilities. Because a facility may store large amounts of toxic chemicals on-site, one cannot conclude that they have a higher volume of toxic releases as compared to those facilities that store smaller amounts of chemicals.

An examination of the types of releases (air emissions, discharge to land, discharge to water) were analyzed with the following results:

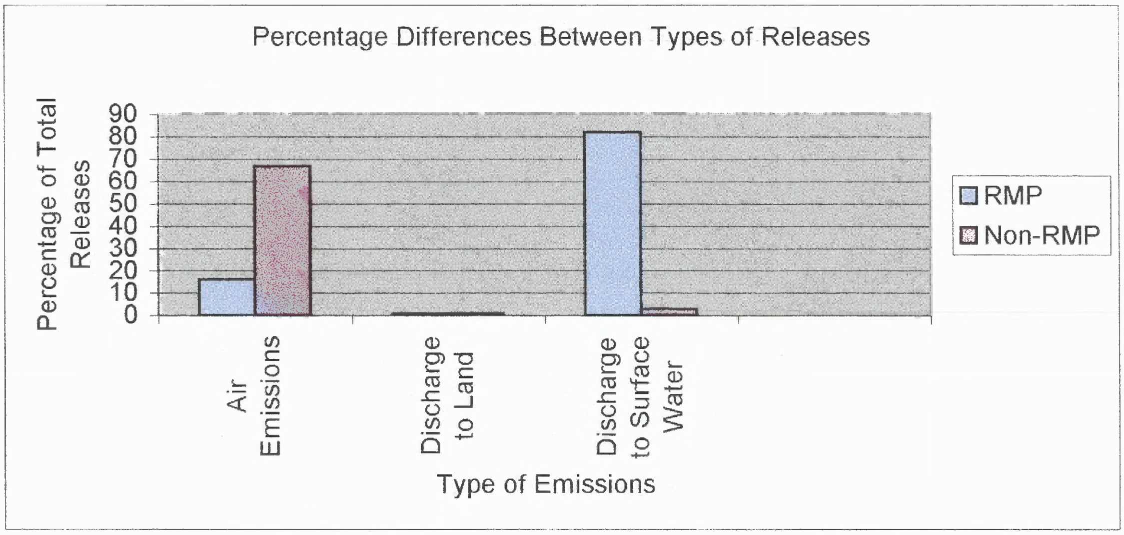

Figure 5.2 Percentage Differences in Types of Releases RMP v. Non-RMP

Note that 82% of the total releases for RMP facilities are to surface water; however all but 1% is from one facility. That facility reported their treatment facility's wastewater as discharge to surface water. If that facility is removed from the data, it is obvious that the largest percentage of the releases from both RMP and non-RMP facilities are air emissions. When considering risk issues, one must recognize that different types of releases pose different risks. For example, air emissions have a higher exposure rate and are more difficult to remediate. Discharges to land and water have a more limited exposure rate and are easier to remediate and control.

5.3 RMP v. Non-RMP Facilities and the Risk Index

Hypothesis 2 states that there is no relationship between the amount of toxic chemicals stored on-site and the potential risk due to toxic chemical releases to local communities surrounding New Jersey chemical facilities. To address this hypothesis an index of risk "indicators" was created to help identify potential risks from chemical facilities to local communities. The risk index was compared to the RMP status to determine if there was a relationship between the amounts of toxic chemicals a facility stores on-site and the risk index score.

5.3.1. Risk Index Variable: Toxicity/Carcinogenicity

One of the indicators was release by a facility of recognized toxicants or carcinogenic chemicals, as listed in California's Proposition 65, into the environment in 1998.

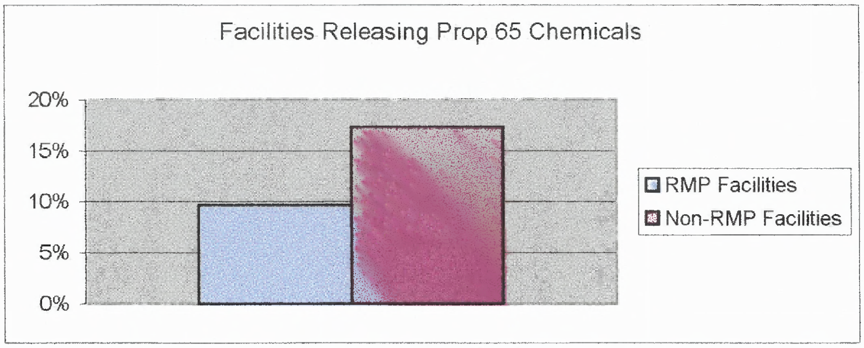

Figure 5.3 Percentage of RMP v. Non-RMP Facilities Releasing Prop 65 Chemicals

Figure 5.3 shows that in 1998, 18% of the non-RMP facilities and 10% of the RMP facilities released some Proposition 65 chemicals into the environment, establishing that there are more non-RMP facilities that released Proposition 65 chemicals than the RMP facilities. The total number of chemical facilities, in this study, releasing Proposition 65 chemicals is 16%. As an indicator independent of the risk index, this could indicate that the non-RMP facilities have a higher potential of risk to the public than RMP facilities due to the toxic and carcinogenic characteristics of the chemicals that they release into the atmosphere.

5.3.2. Risk Index Variable: (Toxic Equivalency Potential)(Pounds Released)

Another indicator of risk used was the fact that a chemical facility was named in EDF's top 100 list of facilities releasing toxic chemicals. A scatter chart was used to visually analyze the data in an attempt to find an obvious relationship between the EDF ranking and the RMP status. Figure 5.4 shows that both the non-RMP and the RMP facilities' were widely dispersed throughout the EDF ranking.

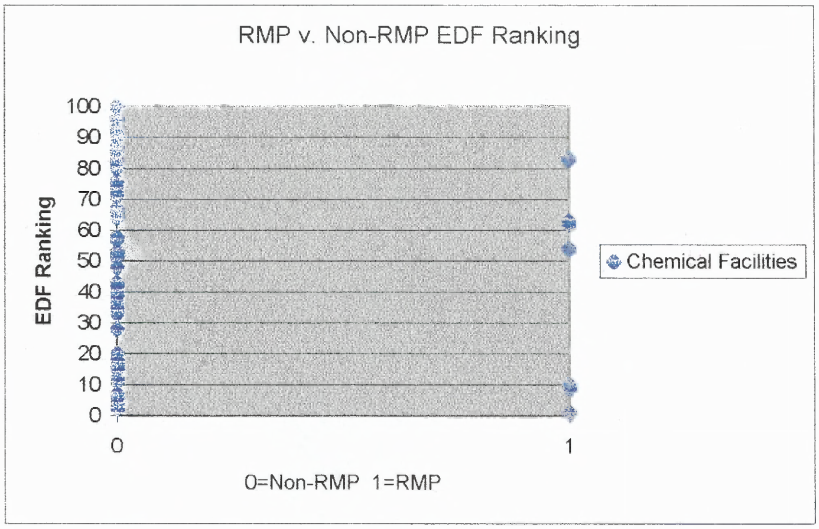

Figure 5.4 Scatter Chart of EDF Ranking v. RMP

5.3.3 Risk Index Variable: Environmental Enforcement Action

If EPA named a facility in an enforcement action, this was considered one of the risk indicators. The enforcement history reviewed for the facilities was limited to the time period between 1996 and the present.

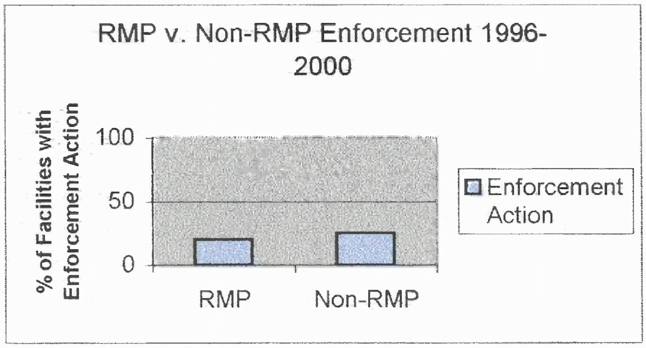

Figure 5.5 Enforcement Histories of RMP and Non-RMP Facilities

A summary of the data for the 5-year period, representing the percentage of facilities that have had civil legal action brought against them by the EPA is seen in Figure 5.5. This graph shows that there are 23% or 7 out of 31 RMP facilities as compared to 25% or 46 out of 185 non-RMP facilities that have had enforcement action brought against them. Initially it seems that there is no significant difference between the enforcement histories of the RMP versus non-RMP facilities. However, it is interesting to note that 46 non-RMP facilities had environmental actions brought against them. This large number of enforcement actions could be an indicator of risk to the surrounding community from non-RMP facilities. Environmental actions for all federal environmental statutes were included regardless of the type of violation because; this indicator only represents the past regulatory "culture" of the facility. Although an environmental enforcement action in a facility's past does not necessarily indicate that it is a danger to the public, it does signify that in the recent past it has operated in a manner that put the public health or environment at risk.

5.3.4. Analysis of Risk Index

Each of the above indicators was given an equal value of “1” point in determining the risk index value. A summary of the risk index values for the facilities is presented below.

Table 5.1 Risk Index Values for RMP v. Non-RMP Facilities

	RMP Facilities		Non-RMP Facilities	
Risk Index Value	No. of Facilities	% of Total Facilities	No. of Facilities	% of Total Facilities
0	8	25%	78	42%
1	17	55%	73	39%
2	6	19%	31	17%
3	0	0%	3	1%

The data show that approximately 80% of both RMP and non-RMP facilities have risk index values of “0” or “1”. A bar graph of the above information gives an even clearer depiction of the above data.

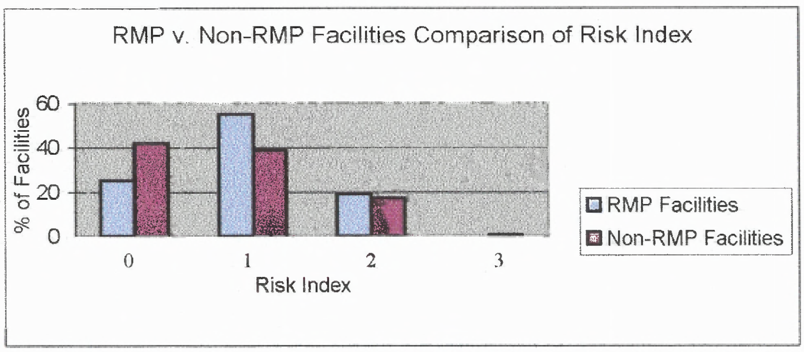

Figure 5.6 Comparison of Risk Index Value Between RMP v. Non-RMP Facilities

Figure 5.6 shows that 25% of the RMP facilities have a risk index value of 0, with twice the number of the facilities scoring a value of “1”. The non-RMP facilities have a relatively even distribution between the values of “0” and “1”. When looking at the risk index values of "1", "2", and "3", 74% of the RMP facilities had at least one risk variable associated with their facilities. The non-RMP facilities only had 57% of their facilities with at least one risk variable. This might suggest that RMP facilities pose more of risk to the surrounding communities than non-RMP facilities, based on the above risk index. However, when looking at all of the data, both RMP and non-RMP facilities have a relatively similar percentage of facilities with risk values. Further analysis was required.

A X^2- value of weighted squared differences was used to perform a test for independence to determine if the risk index values were truly independent of the amount of toxic chemicals stored on-site. Determining the mean of the actual values and comparing that data with the Poisson probability distribution calculated the expected risk values. The actual risk values and the calculated expected values are as follows:

Table 5.2 Risk Index Value Comparisons – Observed versus Expected Results

	Risk Index Values							
	0 Exp.	0 Obs.	1 Exp.	1 Obs.	2 Exp.	2 Obs.	3 Exp.	3 Obs.
RMP Facilities	12.3	8	12.9	17	5.3	6	.43	0
Non-RMP Facilities	73.7	78	77.1	73	31.7	31	2.5	3

Based on the above data, X^2 equals 3.9. The critical X^2- value at a significance level of 5% is 7.82 and at a significance level of 1% is 11.34. X^2 is equal to 3.9, which is less than 7.82 and 11.34, therefore, there is no evidence to reject the null hypothesis, and one can assume that there is no relationship between the variables. The fact that there is no evidence to suggest a relationship between the amount of toxic chemicals stored on-site (RMP v. Non-RMP facilities) and the risk index value (0-3) indicates that the risk index value is independent of whether a facility stores large or small amounts of toxic chemicals on-site.

5.4 Non-RMP Owner/Operator Interviews

Interviews of non-RMP facility owner/operators were conducted to address Hypothesis 3, which states that New Jersey chemical facilities not required by the RMP Rule to communicate risk information to the public, do not communicate risk information to the public nor do they have any involvement with their communities. The information gathered from these interviews is only a small sample of all non-RMP facilities, however, it provides an interesting representation of these facilities. The information gathered from the interview process could not be easily analyzed in the strict confines of a statistical analysis. In addition, the sample size was too small to benefit from a statistical review; therefore, this information is presented anecdotally, as mentioned earlier.

Twenty-one facilities in Essex County were contacted with the following results:

Table 5.3 Results of Telephone Survey

No. of Facilities	Results of Contact
4	Closed facility or conducting post-closure activities.
1	Not willing to participate.
1	Not valid – national pharmaceutical headquarters.
3	Questionnaire requested.
4	No return phone call, questionnaire sent.
8	Interviews completed.

As seen in the above table, only eight interviews were completed out of sixteen viable facilities. The rate of return may have been improved if a mutual business acquaintance or trade association contact could have introduced the author to the owner/operators to increase trust.

5.4.1. Chemical Facility Profiles

All information that was provided in the interview was strictly confidential and anonymous, however; the general characteristics of these facilities can be discussed. Six of the facilities had a management to employee ratio of approximately 1:4, with the remaining 2 facilities having a ratio of approximately 1:2.[7] Interviewees described management as any employee that was salaried. All but one of the facilities belonged to one or more trade organizations. The one facility that did not, had just recently worked its way out of bankruptcy. The involvement in trade organizations did not seem to influence a facility's decision to become involved with the community or to share risk information.

There were an equal number of independent facilities and facilities that were subsidiaries of parent corporations. Being a subsidiary to a large corporation with increased resources also did not seem to influence the facility's decision to become involved in the community or to set up a risk communications program. It was interesting to note that all of the subsidiaries stated that the parent corporation was in charge of risk communication, but when asked if the risk communication was directed

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[7] The ratio of salaried employees seems extremely high, but this can be due to the fact that most if not all chemists are salaried. Interviewees defined management as any salaried individual.

to the specific facility's local community, they stated that it was not. In addition, these same owner/operators thought that their parent companies were involved with the public, but not in their facilities' local communities.

To compare these specific facilities to the entire population of chemical facilities analyzed above, a table was created showing (1) range of the annual pounds of toxic chemicals released[8], (2) the risk index value, (3) each facility's use of Proposition 65 chemicals and (4) each facility's enforcement history.

Table 5.4 Summary of Chemical Facilities Risk Factors

Facility	Lbs. of Toxic Chemicals Released	Risk Index Value	Use of Prop. 65 Chemicals	EPA Enforcement History
A	0-5,000	1	No	No
B	0-5,000	1	No	Yes
C	25,000-30,000	1	No	No
D	25,000-30,000	1	No	No
E	0-5,000	1	No	Yes
F	0-5,000	2	No	Yes
G	0-5,000	0	No	No
H	5,001-10,000	2	Yes	No

The amount of toxic chemicals released from the facilities ranged from 0 to 29,000 lbs. in 1998, representing a wide range of releases. Most of the facilities had a risk index value of at least 1. Only one of the facilities used Proposition 65 chemicals. Finally, three out of eight of the facilities had civil enforcement action against them by EPA in the last five years.

[8] The range of toxic releases were used in this table, rather than the actual data, in order to protect the anonymity of the interviewees.

5.4.2. Chemical Facilities and Community Involvement

Most of the facility owner/operators interviewed stated that the facility was not formally involved with the community, however; of the privately owned facilities, two of the owners were involved with the local environmental board. One of these owners quit the environmental board because he was discouraged by the lack of the public's knowledge regarding the chemical industry and the hostility he received from the public. One manager stated that the previous owner and employees were involved with the community, but once the facility was sold to a non-local company the community involvement ceased. The new employees and management did not live in the local communities; therefore, they did not believe community involvement was necessary.

As stated previously, the subsidiaries of larger corporations knew that the parent corporation undertook community involvement activities, but not in their communities. One of the subsidiary facilities had open houses directed at recruiting employees and welcomed the public to this event. One facility owner/operator stated that they discussed community involvement, but they determined that it was not necessary. One owner stated that he did not want the community to know anything about his company. The owner specifically stated that, "The less they know the better." in regard to the public.

5.4.3. Chemical Facilities and Risk Communication

One of the subsidiary facilities (Facility H in Table 5.4) has a limited risk communication program in place. If that facility receives a written request from a community member for a tour of the facility, the site manager and safety manager will discuss the request, and if approved, will provide the requested tour. For all other requests regarding facility information, the site manager answers the calls or they direct the caller to view their website.

Out of the eight interviews, six of the owner/operators stated that they did not pose a risk to the local community; therefore, risk communication was not necessary. Some of the interviewees felt that no one in the community would attend any risk communication meetings. Other interviewees felt that none of the materials they handled could potentially impact the community, although all facilities are subject to SARA and handle chemicals designated as hazardous substances. And finally, the subsidiary facilities all felt that if there was a need for risk information to be distributed, the parent company would handle it for them.

Some of the interviewees seemed to interpret risk and make decisions about risk communication based on their own belief systems. One owner stated that he lived in the community, and if he thought he was putting his neighbors at risk, he would provide them with any necessary information. This owner also stated that risk was a factor of probability and that there is risk in all aspects of life. From his interview one could conclude that he did recognize that there was a risk from his facility, but he had determined that it was not a probable risk that would endanger anyone in his community. Two of the interviewees did not feel they were a risk because of the location of the facility, although it was noted that there were people in the area that would be exposed to a release.

5.4.4. Miscellaneous Comments from the Interviewees

All of the facilities' owner/operators wanted to discuss how risks related to the chemical industry have been decreased by new legislation, economic reasons and consumer demand. Recent changes to environmental laws have encouraged facilities to reduce the amount of toxic materials on-site, substitute less hazardous materials for those with heavy regulatory burdens attached, and update processes and equipment. Many of the facilities felt that they are under a very heavy regulatory burden in New Jersey, which will eventually force them to leave the state or quit the industry all together. Facility owner/operators also felt that the various government agencies regulating them were looking for revenues from fees, rather than solutions to operating problems. However, most of the interviewees mentioned an improvement in procedures at the New Jersey Department of Environmental Protection in the last couple of years. Economic benefits of pollution prevention encouraged many facilities to recycle or sell waste. One of the facilities stated that customers were demanding less toxic products and products with less regulatory burden attached. This demand forced some facilities to look for less toxic products to manufacture.

One facility owner made an interesting point in stating that the high population in New Jersey would eventually force many facilities out of business. Many facilities that were once surrounded by open areas or industrial parks are now surrounded by neighborhoods. These new community members then try to push the existing facilities out of business.

Another interviewee discussed his concern about facilities that were so small that they had a very limited regulatory burden. He knew of some facilities that he considered dangerous to the public because of the lack of government oversight they received. He stated that eventually these facilities are investigated, but he thought that the damage to the public health was already done by the time they were caught.

5.4.5. Results of Interviews and Risk Communication

Although there were only a limited number of interviews undertaken, the data confirm the hypothesis that New Jersey chemical facilities that are not required by the RMP Rule to communicate risk information to the public, do not communicate risk information to the public, and have no involvement with their communities. Previous research has shown how difficult and frustrating risk communication can be for facility management. As the above data shows, there are many reasons why the owners/operators do not initiate risk communication with the public. The interview data suggest that involvement with trade organizations does not seem to increase the amount of risk communication, even though risk communication is highly encouraged within these organizations. The data also show that although the parent companies participate in risk communication at the corporate level, there is no encouragement to have risk communication at the local levels, where it is needed.

Of those facilities that have sat on local environmental boards, at least one did not have a pleasant experience and dropped out. When this happens, it not only frustrates the chemical facility management, but it also cuts off an avenue through which environmental risk communication could be addressed. Finally, one of the main reasons that the facilities' owners/operators did not communicate risk information was that they did not identify the risks that their facilities posed to the surrounding communities.

CHAPTER 6

CONCLUSIONS AND RECOMMENDATIONS

6.1 Overview

Facilities that store large amounts of toxic chemicals on-site pose a risk to the public from catastrophic releases. These facilities are subject to the RMP Rule and are required to communicate risk information to the public. Those facilities not subject to the RMP Rule, may not pose the same risk of a catastrophic accident as those large facilities, but they do pose risks from releases of toxic chemicals into the environment that have a significant probability of affecting the public. Yet these facilities are not required to communicate risk information. The policy of requiring risk communication only for catastrophic releases is too narrow of an approach. This study looks at potential risks from toxic chemical releases, other than rare catastrophic releases, that may affect local chemical facilities' communities.

The RMP Rule is the only law that presently requires risk communication with the stakeholders. As stated above, this rule relies on the amount of toxic chemicals stored on-site to determine which facilities should communicate risk. The purpose of this study is to determine if the amount of toxic chemicals a facility stored on-site is also a valid indicator for determining a facility's risk potential, for other than catastrophic releases. This might better suggest when risk communication to the public is needed. The results of this study suggest that chemical facilities pose a risk to the local communities due to toxic chemical releases independent of the amount of toxic chemicals stored on-site. Therefore, on-site storage of toxic chemicals is not the only valid indicator of risk. Due to the presence of risk in all of the facilities, both with significant and little storage, one might conclude that these facilities and their local communities would benefit from risk communication.

Through interviews with a limited number of owner/operators this study also found that facilities did not communicate risk information voluntarily. The reasons for this lack of communication are discussed below, along with suggestions regarding risk communications programs for those facilities that are not subject to the RMP Rule.

6.2 Conclusions and General Recommendations

Facilities that store large amounts of toxic chemicals on-site are considered a risk due to the possibility of a catastrophic incident. One might also assume that these facilities have a higher incident of releases due to the high volume of toxic chemicals on-site. These releases could be considered a risk to the local communities as well. To the contrary, previous research suggests that chemical facilities that store small amounts of toxic chemicals on-site might have ineffective spill prevention systems that could increase risks to facilities' local communities. It also suggests that facility management might take measures that allow them to decrease the amount of toxic chemicals on-site, avoiding the RMP Rule, but in turn shifting the risk to other media.

In response to the previous research, Hypothesis 1 investigates whether there is a relationship between the amount of toxic chemicals stored on-site and the amount of toxic chemicals released into the environment by New Jersey chemical facilities. This study finds that in contrast to the previous research, there was no relationship between the amounts of toxic chemicals a facility stores on-site and the amount of toxic chemicals released into the environment.

This study also found that the majority of the releases to the environment are air releases. This is significant because air emissions are difficult to contain and often result in exposure of a significant population. Since air emissions, and catastrophic releases pose similar risks to the public, but of different magnitudes and duration, and the RMP facilities' communities benefit from risk communication, it stands to reason that non-RMP facilities' communities would also benefit, due to the potential risks and similar exposures.

A risk index was created to determine if there was a relationship between the amount of toxic chemicals stored on-site and the potential risk to local communities, due to toxic chemical releases. Risk index values did not suggest that there was an increased risk from facilities that stored small amounts of toxic chemicals on-site as compared to those storing large amounts. The risk variables considered were: (1) use of Proposition 65 chemicals; (2) the (TEP) toxic equivalency potential multiplied by the quantity released; and (3) environmental enforcement history. Although these risk factors are only a partial representation of risks that are associated with chemical facilities, these findings imply that potential risk is independent of the quantity of on-site storage of toxic chemicals.

The analyses suggests that the quantity of on-site storage of toxic chemicals is not a good indicator of risk. If that is the case, then what is a good indicator? If all facilities that store toxic chemicals on-site are a risk, then should all facilities communicate risk information? Risk communication could be required under SARA as part of the TRI reporting. However, previous research has shown that many smaller facilities do not have the resources for a risk communications program. Additionally, there are many other problems associated with risk communication such as public trust and lack of public interest. Risk analyses should be required under SARA as part of the TRI reporting; however, risk communications should not, due to the problems associated with it that are discussed below.

This study supported the findings of previous research, that chemical facilities do not communicate risk information voluntarily, supporting Hypothesis 3. Reasons found for not communicating risk information included lack of anticipated community interest and the preference to keep the community uninformed. The most common reason for no risk communication was that the interviewees did not recognize their facility as a risk to the public.

The first step toward risk communication must be the identification of risk. This includes identifying the stakeholder, or those communities that are at risk. If facility management does not recognize their risk potential, risk communication cannot be initiated. If simple, low cost, risk or hazard analyses were required under TRI reporting requirements, facility management would be forced to recognize the risks they pose to local communities. This information would be public record and available to all interested stakeholders. However, requiring a risk communications program under SARA is too much of a regulatory burden for many facilities. In addition, risk communications programs are very unique and to be successful, must meet the needs of the local communities.

Previous research discussed a wide range of benefits for the public, as well as for the facility, when risk information was shared with the public. When a risk communication program, or at the very least, community involvement is established, facility management identifies the risks and feels more responsible to decrease risks due to concern regarding the public's reaction. Facilities have fewer problems with the community during general operations and also during emergency situations because of open existing lines of communication.

The question is how to encourage facility owner/operators to voluntarily communicate risk information about their facilities once the risks have been identified. In this study it was found that the employees of individually owned facilities were more likely to be involved with the local community. These employees were more likely to live in the surrounding area; therefore, they had an interest in the local community. Community involvement is a good way to open lines of communication with the public, which in turn, can be used to discuss environmental concerns and the public's risk issues.

This study also found that subsidiaries of larger facilities felt that it was the responsibility of the corporate level management to handle risk information issues. This is only partially true, a large corporations' responsibility should be to encourage employees to become involved in community activities surrounding their facilities. Assuming that parent corporations are educated about the benefits of risk communication, and support community involvement for public relations purposes, they should encourage their subsidiaries to do the same by becoming involved in their local communities, through incentives to employees. These incentives could include paid time off of work for participation in community activities. During these community activities, facility employees could educate community members about the facility and learn about the public's concerns, in a non-threatening environment. Eventually, formal risk communication can be developed if needed, or facilities may learn that this type of communication meets their needs. Other recommendations to assist owner/operators in designing successful risk communications programs are discussed below.

The results of this research suggest that all facilities pose various risks to their local communities. Therefore, all risks should be addressed, not just catastrophic risks or those associated with certain media. Policies encouraging risk communication would be one way to decrease these risks. Educating the public on risk, all risks, not only the benefits to the public, but benefits to facilities as well.

In conclusion, chemical facilities, regardless of the amount of toxic chemicals stored on-site, pose a potential health risk to their local communities. The public and the government have both recognized these dangers and have implemented legislation in an attempt to prevent catastrophic chemical accidents from occurring. However, catastrophic incidents should not be the sole focus of legislators. Other risks to local communities from chemical facilities can pose a more "common" danger to the public than rare catastrophic accidents. Previous research has shown that communicating risk information to the public and/or community involvement can help to decrease risks to the public and also provide benefits to the chemical facilities themselves. As stated above, risk communications and community involvement programs do not have to be expensive or formal. The most important aspect of these programs is that they open the lines of communication between the public and the facility management. Once communication lines are open, facilities can be encouraged to identify the needs and concerns of the local community and take steps to address these concerns. This approach can encourage facility management to identify and address risks to the local community, decreasing the risk and providing benefits to them as well.

6.3 Recommendations for Owner/Operators

Research shows that there is no single message or delivery method that is ideal in all situations. Understanding the beliefs and the preferences of the community is the best way to ensure a successful communications program. Facility management should be informed that previous research suggests citizens want opportunities for dialogue. They want to be approached and to have the ability to access information on their own (CMA 1997, 32). For those community members that want to inform themselves, management can provide easy access to brochures about the company or set up a webpage.

When facility management is designing an effective program, the needs and interests of the people involved are the most important factors to be weighed. The activities themselves are less important than the way they are conducted. Management must be prepared to answer questions from the public in terms that are easy to comprehend. Facility owner/operators may also need to consider compromises on subjects important to the public. For example, management may consider changing hours of operations or keeping trucks carrying hazardous materials away from certain areas or neighborhoods. Such compromises are a good way of demonstrating "good faith" and a commitment to resolving concerns in a mutually beneficial way.

Communications programs must fit the needs of the community and focus on members' concerns. Steps to setting up communications programs should include the following.

1. Assess the community's concerns and issues that need to be addressed.
2. Identify the stakeholders involved and to whom the communications should be directed. Do not limit the dialogue to public officials.
3. Provide translators, if necessary, to make sure that all stakeholders are given an opportunity to participate in communications.
4. Reach out to all stakeholders and different community segments by publishing activities or meetings in local newspapers. (Forrest 1995, 36-37)

Facility representatives communicating with the public should discuss the products made at the facility and the benefits they provide to the public. Reaching out to trade organizations such as the CMA and NJCIC or federal and state government officials is also a good way to get support and background information to begin the process of building a community involvement or risk communication program.

6.4. Further Research

Risk communication and community involvement are extremely large areas of research, all of which can be the jumping off point for further investigation. This paper addresses a very focused area of study, but the results can be used to undertake further research in many areas.

- Exploring risks to local communities associated with releases to air versus water could be undertaken to determine if there is a relationship between increased potential risks versus the mode of release and community characteristics.

- Investigating the different chemicals released by each facility and determining the potential risks associated with each to the surrounding communities.

- Identifying community characteristics and the various chemical facility characteristics to determine how certain traits affect various risk factors.

- Investigating enforcement action in-depth to determine effects on communities and root causes of violations and their effect on the local communities.

- Interviewing a larger number of owner/operators, perhaps in other states to compare perceptions of risks to their local communities and risk communication. Interviews could be done through a trusted intermediary, such as a trade organization representative, to encourage trust and increase the response rate.

- Interviewing local community members to determine their perception of risk from surrounding chemical facilities and their perceptions and interest in risk communication.

Overall there are many different avenues one could take when investing risk communication. In the future, as chemical facilities and the population expand, risk communication will need to become more prevalent in chemical facilities so that the public can become more educated about risks, thereby reducing those risks and ensuring safer environments in which to live.

APPENDIX A

LIST OF REGULATED TOXIC SUBSTANCES AND THRESHOLD QUANTITIES FOR ACCIDENTAL RELEASE PREVENTION

40 CFR 68.130

This appendix lists the regulated toxic substances as defined under the Risk Management Plan Rule.

(6) Supporting data; that is, the petition must include sufficient information to scientifically support the request to modify the list. Such information shall include:

(i) A list of all support documents;

(ii) Documentation of literature searches conducted, including, but not limited to, identification of the database(s) searched, the search strategy, dates covered, and printed results;

(iii) Effects data (animal, human, and environmental test data) indicating the potential for death, injury, or serious adverse human and environmental impacts from acute exposure following an accidental release; printed copies of the data sources, in English, should be provided; and

(iv) Exposure data or previous accident history data, indicating the potential for serious adverse human health or environmental effects from an accidental release. These data may include, but are not limited to, physical and chemical properties of the substance, such as vapor pressure; modeling results, including data and assumptions used and model documentation; and historical accident data, citing data sources.

(h) Within 18 months of receipt of a petition, the Administrator shall publish in the FEDERAL REGISTER a notice either denying the petition or granting the petition and proposing a listing.

§68.125 Exemptions.

Agricultural nutrients. Ammonia used as an agricultural nutrient, when held by farmers, is exempt from all provisions of this part.

§68.130 List of substances.

(a) Regulated toxic and flammable substances under section 112(r) of the Clean Air Act are the substances listed in Tables 1, 2, 3, and 4. Threshold quantities for listed toxic and flammable substances are specified in the tables.

(b) The basis for placing toxic and flammable substances on the list of regulated substances are explained in the notes to the list.

TABLE 1 TO §68.130.—LIST OF REGULATED TOXIC SUBSTANCES AND THRESHOLD QUANTITIES FOR ACCIDENTAL RELEASE PREVENTION

[Alphabetical Order—77 Substances]

Chemical name	CAS No.	Threshold quantity (lbs)	Basis for listing
Acrolein [2-Propenal].	107–02–8	5,000	b
Acrylonitrile [2-Propenenitrile].	107–13–1	20,000	b
Acrylyl chloride [2-Propenoyl chloride].	814–68–6	5,000	b
Allyl alcohol [2-Propen-l-ol].	107–18–61	15,000	b
Allylamine [2-Propen-l-amine].	107–11–9	10,000	b
Ammonia (anhydrous).	7664–41–7	10,000	a, b
Ammonia (conc 20% or greater).	7664–41–7	20,000	a, b
Arsenous trichloride.	7784–34–1	15,000	b
Arsine	7784–42–1	1,000	b
Boron trichloride [Borane, trichloro-].	10294–34–5	5,000	b
Boron trifluoride [Borane, trifluoro-].	7637–07–2	5,000	b
Boron trifluoride compound with methyl ether (1:1) [Boron, trifluoro [oxybis [metane]]-, T-4-.	353–42–4	15,000	b
Bromine	7726–95–6	10,000	a, b
Carbon disulfide	75–15–0	20,000	b
Chlorine	7782–50–5	2,500	a, b
Chlorine dioxide [Chlorine oxide (ClO2)].	10049–04–4	1,000	c
Chloroform [Methane, trichloro-].	67–66–3	20,000	b
Chloromethyl ether [Methane, oxybis[chloro-].	542–88–1	1,000	b
Chloromethyl methyl ether [Methane, chloromethoxy-].	107–30–2	5,000	b
Crotonaldehyde [2-Butenal].	4170–30–3	20,000	b
Crotonaldehyde, (E)- [2-Butenal, (E)-].	123–73–9	20,000	b
Cyanogen chloride.	506–77–4	10,000	c
Cyclohexylamine [Cyclohexanamine].	108–91–8	15,000	b
Diborane	19287–45–7	2,500	b
Dimethyldichlorosilane [Silane, dichlorodimethyl-].	75–78–5	5,000	b
1,1-Dimethylhydrazine [Hydrazine, 1,1-dimethyl-].	57–14–7	15,000	b

TABLE 1 TO § 68.130.—LIST OF REGULATED TOXIC SUBSTANCES AND THRESHOLD QUANTITIES FOR ACCIDENTAL RELEASE PREVENTION—Continued

[Alphabetical Order—77 Substances]

Chemical name	CAS No.	Threshold quantity (lbs)	Basis for listing
Titanium tetrachloride [Titanium chloride (TiCl4) (T-4)-].	7550-45-0	2,500	b
Toluene 2,4-diisocyanate [Benzene, 2,4-diisocyanato-1-methyl-] [1].	584-84-9	10,000	a
Toluene 2,6-diisocyanate [Benzene, 1,3-diisocyanato-2-methyl-] [1].	91-08-7	10,000	a
Toluene diisocyanate (unspecified isomer) [Benzene, 1,3-diisocyanatomethyl-] [1].	26471-62-5	10,000	a
Trimethylchlorosilane [Silane, chlorotrimethyl-].	75-77-4	10,000	b
Vinyl acetate monomer [Acetic acid ethenyl ester].	108-05-4	15,000	b

[1] The mixture exemption in § 68.115(b)(1) does not apply to the substance.

NOTE: Basis for Listing:
a Mandated for listing by Congress.
b On EHS list, vapor pressure 10 mmHg or greater.
c Toxic gas.
d Toxicity of hydrogen chloride, potential to release hydrogen chloride, and history of accidents.
e Toxicity of sulfur trioxide and sulfuric acid, potential to release sulfur trioxide, and history of accidents.

TABLE 2 TO § 68.130.—LIST OF REGULATED TOXIC SUBSTANCES AND THRESHOLD QUANTITIES FOR ACCIDENTAL RELEASE PREVENTION

[CAS Number Order—77 Substances]

CAS No.	Chemical name	Threshold quantity (lbs)	Basis for listing
50-00-0	Formaldehyde (solution)	15,000	b
57-14-7	1,1-Dimethylhydrazine [Hydrazine, 1,1-dimethyl-]	15,000	b
60-34-4	Methyl hydrazine [Hydrazine, methyl-]	15,000	b
67-66-3	Chloroform [Methane, trichloro-]	20,000	b
74-87-3	Methyl chloride [Methane, chloro-]	10,000	a
74-90-8	Hydrocyanic acid	2,500	a, b
74-93-1	Methyl mercaptan [Methanethiol]	10,000	b
75-15-0	Carbon disulfide	20,000	b
75-21-8	Ethylene oxide [Oxirane]	10,000	a, b
75-44-5	Phosgene [Carbonic dichloride]	500	a, b
75-55-8	Propyleneimine [Aziridine, 2-methyl-]	10,000	b
75-56-9	Propylene oxide [Oxirane, methyl-]	10,000	b
75-74-1	Tetramethyllead [Plumbane, tetramethyl-]	10,000	b
75-77-4	Trimethylchlorosilane [Silane, chlorotrimethyl-]	10,000	b
75-78-5	Dimethyldichlorosilane [Silane, dichlorodimethyl-]	5,000	b
75-79-6	Methyltrichlorosilane [Silane, trichloromethyl-]	5,000	b
78-82-0	Isobutyronitrile [Propanenitrile, 2-methyl-]	20,000	b
79-21-0	Peracetic acid [Ethaneperoxoic acid]	10,000	b
79-22-1	Methyl chloroformate [Carbonochloridic acid, methylester]	5,000	b
91-08-7	Toluene 2,6-diisocyanate [Benzene, 1,3-diisocyanato-2-methyl-] [1]	10,000	a
106-89-8	Epichlorohydrin [Oxirane, (chloromethyl)-]	20,000	b
107-02-8	Acrolein [2-Propenal]	5,000	b
107-11-9	Allylamine [2-Propen-1-amine]	10,000	b
107-12-0	Propionitrile [Propanenitrile]	10,000	b
107-13-1	Acrylonitrile [2-Propenenitrile]	20,000	b
107-15-3	Ethylenediamine [1,2-Ethanediamine]	20,000	b
107-18-6	Allyl alcohol [2-Propen-1-ol]	15,000	b
107-30-2	Chloromethyl methyl ether [Methane, chloromethoxy-]	5,000	b
108-05-4	Vinyl acetate monomer [Acetic acid ethenyl ester]	15,000	b
108-23-6	Isopropyl chloroformate [Carbonochloridic acid, 1-methylethyl ester]	15,000	b
108-91-8	Cyclohexylamine [Cyclohexanamine]	15,000	b
109-61-5	Propyl chloroformate [Carbonochloridic acid, propylester]	15,000	b
110-00-9	Furan	5,000	b
110-89-4	Piperidine	15,000	b
123-73-9	Crotonaldehyde, (E)- [2-Butenal, (E)-]	20,000	b

TABLE 1 TO § 68.130.—LIST OF REGULATED TOXIC SUBSTANCES AND THRESHOLD QUANTITIES FOR ACCIDENTAL RELEASE PREVENTION—Continued

[Alphabetical Order—77 Substances]

Chemical name	CAS No.	Threshold quantity (lbs)	Basis for listing
Epichlorohydrin [Oxirane, (chloromethyl)-].	106–89–8	20,000	b
Ethylenediamine [1,2-Ethanediamine].	107–15–3	20,000	b
Ethyleneimine [Aziridine].	151–56–4	10,000	b
Ethylene oxide [Oxirane].	75–21–8	10,000	a, b
Fluorine	7782–41–4	1,000	b
Formaldehyde (solution).	50–00–0	15,000	b
Furan	110–00–9	5,000	b
Hydrazine	302–01–2	15,000	b
Hydrochloric acid (conc 37% or greater).	7647–01–0	15,000	d
Hydrocyanic acid	74–90–8	2,500	a, b
Hydrogen chloride (anhydrous) [Hydrochloric acid].	7647–01–0	5,000	a
Hydrogen fluoride/Hydrofluoric acid (conc 50% or greater) [Hydrofluoric acid].	7664–39–3	1,000	a, b
Hydrogen selenide.	7783–07–5	500	b
Hydrogen sulfide	7783–06–4	10,000	a, b
Iron, pentacarbonyl- [Iron carbonyl (Fe(CO)5), (TB-5-11)-].	13463–40–6	2,500	b
Isobutyronitrile [Propanenitrile, 2-methyl-].	78–82–0	20,000	b
Isopropyl chloroformate [Carbonochloridic acid, 1-methylethyl ester].	108–23–6	15,000	b
Methacrylonitrile [2-Propenenitrile, 2-methyl-].	126–98–7	10,000	b
Methyl chloride [Methane, chloro-].	74–87–3	10,000	a
Methyl chloroformate [Carbonochloridic acid, methylester].	79–22–1	5,000	b
Methyl hydrazine [Hydrazine, methyl-].	60–34–4	15,000	b
Methyl isocyanate [Methane, isocyanato-].	624–83–9	10,000	a, b

TABLE 1 TO § 68.130.—LIST OF REGULATED TOXIC SUBSTANCES AND THRESHOLD QUANTITIES FOR ACCIDENTAL RELEASE PREVENTION—Continued

[Alphabetical Order—77 Substances]

Chemical name	CAS No.	Threshold quantity (lbs)	Basis for listing
Methyl mercaptan [Methanethiol].	74–93–1	10,000	b
Methyl thiocyanate [Thiocyanic acid, methyl ester].	556–64–9	20,000	b
Methyltrichlorosilane [Silane, trichloromethyl-].	75–79–6	5,000	b
Nickel carbonyl	13463–39–3	1,000	b
Nitric acid (conc 80% or greater).	7697–37–2	15,000	b
Nitric oxide [Nitrogen oxide (NO)].	10102–43–9	10,000	b
Oleum (Fuming Sulfuric acid) [Sulfuric acid, mixture with sulfur trioxide] [1].	8014–95–7	10,000	e
Peracetic acid [Ethaneperoxoic acid].	79–21–0	10,000	b
Perchloromethylmercaptan [Methanesulfenyl chloride, trichloro-].	594–42–3	10,000	b
Phosgene [Carbonic dichloride].	75–44–5	500	a, b
Phosphine	7803–51–2	5,000	b
Phosphorus oxychloride [Phosphoryl chloride].	10025–87–3	5,000	b
Phosphorus trichloride [Phosphorous trichloride].	7719–12–2	15,000	b
Piperidine	110–89–4	15,000	b
Propionitrile [Propanenitrile].	107–12–0	10,000	b
Propyl chloroformate [Carbonochloridic acid, propylester].	109–61–5	15,000	b
Propyleneimine [Aziridine, 2-methyl-].	75–55–8	10,000	b
Propylene oxide [Oxirane, methyl-].	75–56–9	10,000	b
Sulfur dioxide (anhydrous).	7446–09–5	5,000	a, b
Sulfur tetrafluoride [Sulfur fluoride (SF4), (T-4)-].	7783–60–0	2,500	b
Sulfur trioxide	7446–11–9	10,000	a, b
Tetramethyllead [Plumbane, tetramethyl-].	75–74–1	10,000	b
Tetranitromethane [Methane, tetranitro-].	509–14–8	10,000	b

TABLE 2 TO §68.130.—LIST OF REGULATED TOXIC SUBSTANCES AND THRESHOLD QUANTITIES FOR ACCIDENTAL RELEASE PREVENTION—Continued

[CAS Number Order—77 Substances]

CAS No.	Chemical name	Threshold quantity (lbs)	Basis for listing
126–98–7	Methacrylonitrile [2-Propenenitrile, 2-methyl-]	10,000	b
151–56–4	Ethyleneimine [Aziridine]	10,000	b
302–01–2	Hydrazine	15,000	b
353–42–4	Boron trifluoride compound with methyl ether (1:1) [Boron, trifluoro[oxybis[methane]]-, T-4-.	15,000	b
506–77–4	Cyanogen chloride	10,000	c
509–14–8	Tetranitromethane [Methane, tetranitro-]	10,000	b
542–88–1	Chloromethyl ether [Methane, oxybis[chloro-]	1,000	b
556–64–9	Methyl thiocyanate [Thiocyanic acid, methyl ester]	20,000	b
584–84–9	Toluene 2,4-diisocyanate [Benzene, 2,4-diisocyanato-1-methyl-][1]	10,000	a
594–42–3	Perchloromethylmercaptan [Methanesulfenyl chloride, trichloro-]	10,000	b
624–83–9	Methyl isocyanate [Methane, isocyanato-]	10,000	a, b
814–68–6	Acrylyl chloride [2-Propenoyl chloride]	5,000	b
4170–30–3	Crotonaldehyde [2-Butenal]	20,000	b
7446–09–5	Sulfur dioxide (anhydrous)	5,000	a, b
7446–11–9	Sulfur trioxide	10,000	a, b
7550–45–0	Titanium tetrachloride [Titanium chloride (TiCl4) (T-4)-]	2,500	b
7637–07–2	Boron trifluoride [Borane, trifluoro-]	5,000	b
7647–01–0	Hydrochloric acid (conc 37% or greater)	15,000	d
7647–01–0	Hydrogen chloride (anhydrous) [Hydrochloric acid]	5,000	a
7664–39–3	Hydrogen fluoride/Hydrofluoric acid (conc 50% or greater) [Hydrofluoric acid]	1,000	a, b
7664–41–7	Ammonia (anhydrous)	10,000	a, b
7664–41–7	Ammonia (conc 20% or greater)	20,000	a, b
7697–37–2	Nitric acid (conc 80% or greater)	15,000	b
7719–12–2	Phosphorus trichloride [Phosphorous trichloride]	15,000	b
7726–95–6	Bromine	10,000	a, b
7782–41–4	Fluorine	1,000	b
7782–50–5	Chlorine	2,500	a, b
7783–06–4	Hydrogen sulfide	10,000	a, b
7783–07–5	Hydrogen selenide	500	b
7783–60–0	Sulfur tetrafluoride [Sulfur fluoride (SF4), (T-4)-]	2,500	b
7784–34–1	Arsenous trichloride	15,000	b
7784–42–1	Arsine	1,000	b
7803–51–2	Phosphine	5,000	b
8014–95–7	Oleum (Fuming Sulfuric acid) [Sulfuric acid, mixture with sulfur trioxide][1]	10,000	e
10025–87–3	Phosphorus oxychloride [Phosphoryl chloride]	5,000	b
10049–04–4	Chlorine dioxide [Chlorine oxide (ClO_2)]	1,000	c
10102–43–9	Nitric oxide [Nitrogen oxide (NO)]	10,000	b
10294–34–5	Boron trichloride [Borane, trichloro-]	5,000	b
13463–39–3	Nickel carbonyl	1,000	b
13463–40–6	Iron, pentacarbonyl- [Iron carbonyl ($Fe(CO)_5$), (TB-5-11)-]	2,500	b
19287–45–7	Diborane	2,500	b
26471–62–5	Toluene diisocyanate (unspecified isomer) [Benzene, 1,3-diisocyanatomethyl-][1].	10,000	a

[1] The mixture exemption in §68.115(b)(1) does not apply to the substance.

NOTE: Basis for Listing:

a Mandated for listing by Congress.
b On EHS list, vapor pressure 10 mmHg or greater.
c Toxic gas.
d Toxicity of hydrogen chloride, potential to release hydrogen chloride, and history of accidents.
e Toxicity of sulfur trioxide and sulfuric acid, potential to release sulfur trioxide, and history of accidents.

TABLE 3 TO §68.130.—LIST OF REGULATED FLAMMABLE SUBSTANCES AND THRESHOLD QUANTITIES FOR ACCIDENTAL RELEASE PREVENTION

[Alphabetical Order—63 Substances]

Chemical name	CAS No.	Threshold quantity (lbs)	Basis for listing
Acetaldehyde	75–07–0	10,000	g
Acetylene [Ethyne]	74–86–2	10,000	f
Bromotrifluorethylene [Ethene, bromotrifluoro-]	598–73–2	10,000	f
1,3-Butadiene	106–99–0	10,000	f
Butane	106–97–8	10,000	f
1-Butene	106–98–9	10,000	f
2-Butene	107–01–7	10,000	f
Butene	25167–67–3	10,000	f

TABLE 2 TO § 68.130.—LIST OF REGULATED TOXIC SUBSTANCES AND THRESHOLD QUANTITIES FOR ACCIDENTAL RELEASE PREVENTION—Continued

[CAS Number Order—77 Substances]

CAS No.	Chemical name	Threshold quantity (lbs)	Basis for listing
126-98-7	Methacrylonitrile [2-Propenenitrile, 2-methyl-]	10,000	b
151-56-4	Ethyleneimine [Aziridine]	10,000	b
302-01-2	Hydrazine	15,000	b
353-42-4	Boron trifluoride compound with methyl ether (1:1) [Boron, trifluoro[oxybis[methane]]-, T-4-.	15,000	b
506-77-4	Cyanogen chloride	10,000	c
509-14-8	Tetranitromethane [Methane, tetranitro-]	10,000	b
542-88-1	Chloromethyl ether [Methane, oxybis[chloro-]	1,000	b
556-64-9	Methyl thiocyanate [Thiocyanic acid, methyl ester]	20,000	b
584-84-9	Toluene 2,4-diisocyanate [Benzene, 2,4-diisocyanato-1-methyl-][1]	10,000	a
594-42-3	Perchloromethylmercaptan [Methanesulfenyl chloride, trichloro-]	10,000	b
624-83-9	Methyl isocyanate [Methane, isocyanato-]	10,000	a, b
814-68-6	Acrylyl chloride [2-Propenoyl chloride]	5,000	b
4170-30-3	Crotonaldehyde [2-Butenal]	20,000	b
7446-09-5	Sulfur dioxide (anhydrous)	5,000	a, b
7446-11-9	Sulfur trioxide	10,000	a, b
7550-45-0	Titanium tetrachloride [Titanium chloride (TiCl4) (T-4)-]	2,500	b
7637-07-2	Boron trifluoride [Borane, trifluoro-]	5,000	b
7647-01-0	Hydrochloric acid (conc 37% or greater)	15,000	d
7647-01-0	Hydrogen chloride (anhydrous) [Hydrochloric acid]	5,000	a
7664-39-3	Hydrogen fluoride/Hydrofluoric acid (conc 50% or greater) [Hydrofluoric acid]	1,000	a, b
7664-41-7	Ammonia (anhydrous)	10,000	a, b
7664-41-7	Ammonia (conc 20% or greater)	20,000	a, b
7697-37-2	Nitric acid (conc 80% or greater)	15,000	b
7719-12-2	Phosphorus trichloride [Phosphorous trichloride]	15,000	b
7726-95-6	Bromine	10,000	a, b
7782-41-4	Fluorine	1,000	b
7782-50-5	Chlorine	2,500	a, b
7783-06-4	Hydrogen sulfide	10,000	a, b
7783-07-5	Hydrogen selenide	500	b
7783-60-0	Sulfur tetrafluoride [Sulfur fluoride (SF4), (T-4)-]	2,500	b
7784-34-1	Arsenous trichloride	15,000	b
7784-42-1	Arsine	1,000	b
7803-51-2	Phosphine	5,000	b
8014-95-7	Oleum (Fuming Sulfuric acid) [Sulfuric acid, mixture with sulfur trioxide][1]	10,000	e
10025-87-3	Phosphorus oxychloride [Phosphoryl chloride]	5,000	b
10049-04-4	Chlorine dioxide [Chlorine oxide (ClO_2)]	1,000	c
10102-43-9	Nitric oxide [Nitrogen oxide (NO)]	10,000	b
10294-34-5	Boron trichloride [Borane, trichloro-]	5,000	b
13463-39-3	Nickel carbonyl	1,000	b
13463-40-6	Iron, pentacarbonyl- [Iron carbonyl ($Fe(CO)_5$), (TB-5-11)-]	2,500	b
19287-45-7	Diborane	2,500	b
26471-62-5	Toluene diisocyanate (unspecified isomer) [Benzene, 1,3-diisocyanatomethyl-][1].	10,000	a

[1] The mixture exemption in § 68.115(b)(1) does not apply to the substance.

NOTE: Basis for Listing:
a Mandated for listing by Congress.
b On EHS list, vapor pressure 10 mmHg or greater.
c Toxic gas.
d Toxicity of hydrogen chloride, potential to release hydrogen chloride, and history of accidents.
e Toxicity of sulfur trioxide and sulfuric acid, potential to release sulfur trioxide, and history of accidents.

TABLE 3 TO § 68.130.—LIST OF REGULATED FLAMMABLE SUBSTANCES AND THRESHOLD QUANTITIES FOR ACCIDENTAL RELEASE PREVENTION

[Alphabetical Order—63 Substances]

Chemical name	CAS No.	Threshold quantity (lbs)	Basis for listing
Acetaldehyde	75-07-0	10,000	g
Acetylene [Ethyne]	74-86-2	10,000	f
Bromotrifluorethylene [Ethene, bromotrifluoro-]	598-73-2	10,000	f
1,3-Butadiene	106-99-0	10,000	f
Butane	106-97-8	10,000	f
1-Butene	106-98-9	10,000	f
2-Butene	107-01-7	10,000	f
Butene	25167-67-3	10,000	f

TABLE 4 TO § 68.130.—LIST OF REGULATED FLAMMABLE SUBSTANCES AND THRESHOLD QUANTITIES FOR ACCIDENTAL RELEASE PREVENTION

[CAS Number Order—63 Substances]

CAS No.	Chemical name	CAS No.	Threshold quantity (lbs)	Basis for listing
60–29–7	Ethyl ether [Ethane, 1,1'-oxybis-]	60–29–7	10,000	g
74–82–8	Methane	74–82–8	10,000	f
74–84–0	Ethane	74–84–0	10,000	f
74–85–1	Ethylene [Ethene]	74–85–1	10,000	f
74–86–2	Acetylene [Ethyne]	74–86–2	10,000	f
74–89–5	Methylamine [Methanamine]	74–89–5	10,000	f
74–98–6	Propane	74–98–6	10,000	f
74–99–7	Propyne [1-Propyne]	74–99–7	10,000	f
75–00–3	Ethyl chloride [Ethane, chloro-]	75–00–3	10,000	f
75–01–4	Vinyl chloride [Ethene, chloro-]	75–01–4	10,000	a, f
75–02–5	Vinyl fluoride [Ethene, fluoro-]	75–02–5	10,000	f
75–04–7	Ethylamine [Ethanamine]	75–04–7	10,000	f
75–07–0	Acetaldehyde	75–07–0	10,000	g
75–08–1	Ethyl mercaptan [Ethanethiol]	75–08–1	10,000	g
75–19–4	Cyclopropane	75–19–4	10,000	f
75–28–5	Isobutane [Propane, 2-methyl]	75–28–5	10,000	f
75–29–6	Isopropyl chloride [Propane, 2-chloro-]	75–29–6	10,000	g
75–31–0	Isopropylamine [2-Propanamine]	75–31–0	10,000	g
75–35–4	Vinylidene chloride [Ethene, 1,1-dichloro-]	75–35–4	10,000	g
75–37–6	Difluoroethane [Ethane, 1,1-difluoro-]	75–37–6	10,000	f
75–38–7	Vinylidene fluoride [Ethene, 1,1-difluoro-]	75–38–7	10,000	f
75–50–3	Trimethylamine [Methanamine, N, N-dimethyl-]	75–50–3	10,000	f
75–76–3	Tetramethylsilane [Silane, tetramethyl-]	75–76–3	10,000	g
78–78–4	Isopentane [Butane, 2-methyl-]	78–78–4	10,000	g
78–79–5	Isoprene [1,3,-Butadiene, 2-methyl-]	78–79–5	10,000	g
79–38–9	Trifluorochloroethylene [Ethene, chlorotrifluoro-]	79–38–9	10,000	f
106–97–8	Butane	106–97–8	10,000	f
106–98–9	1-Butene	106–98–9	10,000	f
106–99–0	1,3-Butadiene	106–99–0	10,000	f
107–00–6	Ethyl acetylene [1-Butyne]	107–00–6	10,000	f
107–01–7	2-Butene	107–01–7	10,000	f
107–25–5	Vinyl methyl ether [Ethene, methoxy-]	107–25–5	10,000	f
107–31–3	Methyl formate [Formic acid, methyl ester]	107–31–3	10,000	g
109–66–0	Pentane	109–66–0	10,000	g
109–67–1	1-Pentene	109–67–1	10,000	g
109–92–2	Vinyl ethyl ether [Ethene, ethoxy-]	109–92–2	10,000	g
109–95–5	Ethyl nitrite [Nitrous acid, ethyl ester]	109–95–5	10,000	f
115–07–1	Propylene [1-Propene]	115–07–1	10,000	f
115–10–6	Methyl ether [Methane, oxybis-]	115–10–6	10,000	f
115–11–7	2-Methylpropene [1-Propene, 2-methyl-]	115–11–7	10,000	f
116–14–3	Tetrafluoroethylene [Ethene, tetrafluoro-]	116–14–3	10,000	f
124–40–3	Dimethylamine [Methanamine, N-methyl-]	124–40–3	10,000	f
460–19–5	Cyanogen [Ethanedinitrile]	460–19–5	10,000	f
463–49–0	Propadiene [1,2-Propadiene]	463–49–0	10,000	f
463–58–1	Carbon oxysulfide [Carbon oxide sulfide (COS)]	463–58–1	10,000	f
463–82–1	2,2-Dimethylpropane [Propane, 2,2-dimethyl-]	463–82–1	10,000	f
504–60–9	1,3-Pentadiene	504–60–9	10,000	f
557–98–2	2-Chloropropylene [1-Propene, 2-chloro-]	557–98–2	10,000	g
563–45–1	3-Methyl-1-butene	563–45–1	10,000	f
563–46–2	2-Methyl-1-butene	563–46–2	10,000	g
590–18–1	2-Butene-cis	590–18–1	10,000	f
590–21–6	1-Chloropropylene [1-Propene, 1-chloro-]	590–21–6	10,000	g
598–73–2	Bromotrifluorethylene [Ethene, bromotrifluoro-]	598–73–2	10,000	f
624–64–6	2-Butene-trans [2-Butene, (E)]	624–64–6	10,000	f
627–20–3	2-Pentene, (Z)-	627–20–3	10,000	g
646–04–8	2-Pentene, (E)-	646–04–8	10,000	g
689–97–4	Vinyl acetylene [1-Buten-3-yne]	689–97–4	10,000	f
1333–74–0	Hydrogen	1333–74–0	10,000	f
4109–96–0	Dichlorosilane [Silane, dichloro-]	4109–96–0	10,000	f
7791–21–1	Chlorine monoxide [Chlorine oxide]	7791–21–1	10,000	f
7803–62–5	Silane	7803–62–5	10,000	f
10025–78–2	Trichlorosilane [Silane,trichloro-]	10025–78–2	10,000	g
25167–67–3	Butene	25167–67–3	10,000	f

Note: Basis for Listing: a Mandated for listing by Congress. f Flammable gas. g Volatile flammable liquid.

[59 FR 4493, Jan. 31, 1994. Redesignated at 61 FR 31717, June 20, 1996, as amended at 62 FR 45132, Aug. 25, 1997; 63 FR 645, Jan. 6, 1998]

APPENDIX B

LIST OF RECOGNIZED TOXICANTS DEVELOPED UNDER CALIFORNIA'S PROPOSITION 65

This appendix lists recognized carcinogens, developmental toxicants and reproductive toxicants listed under California's Proposition 65.

Source: <http://www.scorecard.org/health-effects/gen/hazid.html/>

Carcinogens

DICHLOROMETHANE
1,2-DICHLOROPROPANE
TRICHLOROETHYLENE
CHLOROETHANE
CHLOROFORM
BENZENE
VINYL CHLORIDE
FORMALDEHYDE
TETRACHLOROETHYLENE
ETHYLENE OXIDE
PROPYLENE OXIDE
BENZYL CHLORIDE
LEAD COMPOUNDS
BIS(2-ETHYLHEXYL)PHTHALATE
NICKEL
1,3-BUTADIENE
LEAD
NICKEL COMPOUNDS
ETHYL ACRYLATE
N-METHYLOLACRYLAMIDE
CHLOROMETHYL METHYL ETHER
COBALT
ASBESTOS (FRIABLE)
CREOSOTES
HYDRAZINE
NITROBENZENE
EPICHLOROHYDRIN
ACRYLAMIDE
ACRYLONITRILE
ANILINE
ACETALDEHYDE
TOLUENE DIISOCYANATE (MIXED ISOMERS)
ALLYL CHLORIDE
1,2-DICHLOROETHANE
DIMETHYLCARBAMOYL CHLORIDE
O-PHENYLENEDIAMINE
O-ANISIDINE

P-CHLOROANILINE
DIMETHYL SULFATE
O-TOLUIDINE
DIGLYCIDYL RESORCINOL ETHER (DGRE)
C.I. DIRECT BLUE 218
5-NITRO-O-ANISIDINE
CADMIUM
CADMIUM COMPOUNDS

Developmental Toxicants

TOLUENE
BENZENE
CARBON DISULFIDE
LEAD COMPOUNDS
LEAD
ETHYLENE GLYCOL MONOMETHYL ETHER
CADMIUM

Reproductive Toxicants

BENZENE
CARBON DISULFIDE
ETHYLENE OXIDE
LEAD COMPOUNDS
LEAD
EPICHLOROHYDRIN
CYCLOHEXANOL
M-DINITROBENZENE
ETHYLENE GLYCOL MONOMETHYL ETHER
O-DINITROBENZENE
P-DINITROBENZENE
CADMIUM
THIOPHANATE-METHYL

APPENDIX C

ENVIRONMENTAL DEFENSE FUND RISK SCORING SYSTEM

This appendix includes the explanation of how the Environmental Defense Fund bases their risk scoring system on Toxic Equivalency Potentials.

This website uses a scoring system to help identify environmental releases of toxic chemicals that are likely to pose the greatest risk to human health. This system adjusts the amount of a chemical that is released (in pounds) using a weighting factor (a chemical's "toxic equivalency potential"), so that chemical releases can be compared on a common scale that takes into account differences in toxicity and exposure potential.

The risk scoring system was developed by Drs. Edgar Hertwich and William Pease, in collaboration with colleagues at the School of Public Health at the University of California at Berkeley. Similar scoring systems are used by Minnesota's Pollution Control Agency, major chemical manufacturers like ICI, and national environmental agencies in Europe.

WHAT ARE TOXIC EQUIVALENCY POTENTIALS?
Toxic Equivalency Potentials (TEPs) indicate the relative human health risk associated with a release of one pound of a chemical, compared to the risk posed by release of a reference chemical. Information about the toxicity of a chemical (how much of it is required to cause harm) and its exposure potential (how much of it people are exposed to) are used to make this comparison. TEPs are based on a screening-level risk assessment that estimates the cancer and/or noncancer health risks associated with the total dose of a chemical that people will receive if one pound of that chemical is released to air or water in a model environment.

A reference compound is used to create a common denominator for chemicals that may cause cancer or noncancer chronic health effects. In this risk scoring system, all releases of carcinogens are converted to pounds of benzene-equivalents; all releases of chemicals that cause noncancer health effects are converted to pounds of toluene-equivalents.

TEPs for different chemicals vary tremendously, with values ranging over many orders-of-magnitude. The chemicals with the highest TEPs exhibit extreme toxicity and have physical/chemical characteristics that result in very high exposure potential. For example, a chemical like aldrin is a potent carcinogen (very small doses can increase cancer risks significantly). When released into the environment, it end up in plant produce and meat that people eat, resulting in a relatively high cumulative dose. As a result, releasing one pound of aldrin to air poses a comparable level of cancer risk to releasing almost 7600 pounds of benzene.

HOW ARE RISK SCORES CALCULATED?
Risk scores are calculated for reported TRI releases to air or water by multiplying each chemicals' release quantity (in pounds) by the appropriate chemical-specific TEP. The resulting pounds of benzene-equivalents or toluene-equivalents are then summed to yield the

better indicator of the potential health risk posed by environmental releases than simply focusing on the total pounds of chemicals, because they take into account large differences in toxicity and exposure potential across chemicals.

THE LIMITS OF RISK SCORING USING TOXIC EQUIVALENCY POTENTIALS

TEPs are a tool for screening the potential human health impacts of environmental releases. TEPs are based on risk assessment values and environmental fate and exposure modeling that incorporate a number of [illegible] that must be made to deal with scientific uncertainties. Scoring systems based on other assumptions (or focused on other environmental health concerns like acute toxicity to humans or ecotoxicity) would produce different rankings.

TEPs have been developed to support risk scoring in the absence of the extensive local data that are required to conduct a comprehensive risk assessment of a specific facility's environmental releases. TEPs do not address all the toxicity, environmental fate and transport and exposure factors that will affect the level of human health risks posed by chemical releases. In some situations, exposure routes that are responsible for high risk scores may not be relevant for a specific site (e.g., if there is no local consumption of fish contaminated by a chemical is surface water). Each chemical's TEP explanation page identifies the most significant exposure routes contributing to a substance's risk scores.

TEP-weighted releases do not characterize the estimated increase in health risk associated with a chemical exposure, and they cannot be combined with information about an exposed population to predict the incidence of adverse effects.

MORE ON RISK SCORING AND TEPS

[illegible]

HOW CAN I GET A COMPLETE LIST OF RISK SCORES?

Toxic equivalence potentials are available in a [illegible], which contains chemical name, CAS number, and TEP values (for cancer and noncancer risks from air and water releases).

CSV files can be easily opened by most word processing, spreadsheet or database applications (just be sure to let your application know you're opening a text file that is in comma-separated value format).

APPENDIX D

SAMPLE COVER LETTER AND MAIL QUESTIONNAIRE TO FACILITY OWNER/OPERATORS

This appendix includes a sample of the cover letter and questionnaire sent to chemical facility owner/operators to gather data for this research.

SAMPLE LETTER

October 24, 2000

ADDRESS

Attn:

Re: New Jersey Institute of Technology Thesis Questionnaire

Dear Mr. Manager:

I am a graduate student at the New Jersey Institute of Technology preparing a thesis concerning smaller chemical facilities in New Jersey, with an emphasis on those facilities in Essex County. I am specifically interested in smaller facilities' level of community involvement and risk communication with the public. All information that is provided to me will be kept strictly confidential. The facilities responding to the questionnaire will be anonymous as I am interested in general information that will be presented anecdotally. If you would like a copy of my thesis upon completion, please check the box at the end of the questionnaire and I will be happy to provide one to you.

Thank you in advance for your anticipated cooperation. I have enclosed a self-addressed stamped envelope for you convenience.

Thank you,

Heather R. Dobbs

Chemical Owner/Operator Questionnaire

Facility Name____________________________________

Respondent's Name ______________________________

Job Title _______________________________________

Please answer the following questions to the best of your knowledge.

1. Are you a subsidiary of a larger facility? (please circle one) **YES or NO**

2. How many employees do you have? __________

2a. Of those, how many are managers? __________

3. Are you a member of any trade organization? (please circle one) **YES or NO**

3a. If so, which organizations? ____

4. Are you subject to the Clean Air Act Section 112(r) Risk Management Plan Rule? (please circle one) **YES or NO**

5. Are you subject to New Jersey's Toxic Catastrophe Prevention Act? (please circle one) **YES or NO**

6. Have you provided the Local Emergency Planning Committee (LEPC), fire department, police department risk information in the last 5 years? (please circle one) **YES or NO**

7. Have you had involvement with the community surrounding your facility in the last 5 years? (please circle one) **YES or NO**

   If so, what type of have you had (e.g. open house? participation at local functions? sponsorship of athletic clubs?) ______________________________
   ____
   ____

8. Have you provided any risk information or sponsored an event to discuss risk information with the surrounding community in the last 5 years (e.g. pamphlets, information booths, open house)? This does not have to be a formal event/communications plan. (please circle one) **YES or NO**

If your answer to 8 is yes, go to 8a. If no, go to 8b.

8a. If so, what type of risk information did you provide?

____

i. Initially, why did you start to provide risk communication information to the public?

____
____
____

ii. When did you start to provide risk communication information to the public ?

____

iii. On average, how often do you provide risk information per year?

____

iv. Have you received outside assistance in developing risk information? (e.g. trade associations, government agencies, consultant? parent company?) (please circle one) **YES or NO.** **Please Specify.** ______________________________

____

8b. If not, what reason do you have for not communicating risk information?

Please circle one of the below answers.

a. It is not necessary; there is no risk problem.
b. It is too costly to start a risk communication program; there is a lack of resources.
c. There is concern about how the public or special interest groups will respond to this information.
d. If other, please specify. ______________________________

____
____
____

9. Do you have any formal plan in place in case there is a release that may affect the community? (please circle one) **YES or NO**.
If yes, please explain.

____
____
____
____

10. Has your company made any changes in the last five years to reduce the amount of hazardous chemicals on-site or in your processes? If so, what changes have you made?

____

____

____

____

____

Comments on any of the above information:

____

____

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____

____

If you would like a copy of the completed thesis, please circle Yes or No.

Thank you for your participation in this survey. If you have any questions or further comments you may contact me, Heather Dobbs at (973) 540-8503.

APPENDIX E

SAMPLE PHONE QUESTIONNAIRE TO FACILITY OWNER/OPERATORS

This appendix includes a sample of the phone questionnaire used to interview chemical facility owner/operators.

October 11, 2000

Telephone Questionnaire to Chemical Facility Managers:

Introduction: Hello my name is Heather Dobbs and I am a graduate student at New Jersey Institute of Technology preparing a thesis about risk communication at smaller chemical facilities in Essex County. If possible I would like to ask someone at your facility a few questions regarding risk communication. If now is not a good time, I can mail the questionnaire to you so that you can complete it at your convenience. The questionnaire responses are labeled by number so that all information is kept anonymous and confidential. At the completion of my thesis I would be pleased to provide you with a copy of my thesis if you are interested in the results. Thank you for your assistance.

Facility Name ___________________

Interviewee______________________

Job Title ________________________

Please answer the following questions to the best of your knowledge.

1. Are you a subsidiary of a larger facility?

2. How many employees do you have? Of those, how many are managers?

3. Are you a member of any trade organization? If so, which organization?

4. Are you subject to the Clean Air Act Risk Management Plan Rule?

5. Are you subject to New Jersey's Toxic Catastrophe Prevention Act?

6. Have you had contact with the Local Emergency Planning Committee (LEPC), fire department, police department as far as providing risk information in the last 5 years?

7. Have you had any contact with the community surrounding your facility in the last 5 years? If so, what type of contact do you have? (Open house? Participation at local functions? etc.)

8. Have you provided any risk information to the surrounding community in the last 5 years (e.g. pamphlets, information booths, open house)? This does not have to be a formal plan. If yes, go to 7a. If no, go to 7b.

8a. If so, what type of risk information do you provide?

i. Initially, why did you start a risk communication program with the public?
ii. When did you start the risk communication program?
iii. How long has it been in existence?
iv. How often do you provide risk information per year?
v. Have you received outside assistance in implementing the program? (e.g. trade associations, government agencies, consultant?)

8b. If not, what reason do you have for not communicating risk information? Choose one of the below answers.

a. It is not necessary; there is no risk problem.
b. It is too costly to start a risk communication program; there is a lack of resources.
c. There is concern about how the public or special interest groups will respond to this information.
d. Other

9. Do you have any plan in place in case there is a release that may affect the community?

10. Has your company made any changes in the last five years to reduce the amount of hazardous chemicals on-site or in your processes? If so what changes have you made?

Comments on any of the above information:

Thank you for your participation in this survey. If you have any questions or further comments you may contact me at (973) 540-8503.

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