Regulatory Responses to Post-1970 Chemical Disasters

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In the international chemical industry, two post-1970 accidents have had especially profound impacts on regulatory policy around the globe. The first occurred in Italy in 1976; the second in India just eight years later. Both of these major large-scale accidents brought public awareness to the issue of chemical safety in a way that both allowed and forced regulators to reform chemical regulatory policy on a local and international scale. In the years following these two disasters, the heightened public awareness of the risks associated with the chemical industry caused even small local accidents to become catalysts for major regulatory changes.

The Italian incident occurred on July 10, 1976 when a chemical reactor exploded at the ICMESA (Industrie Chemiche Meda Società Azionaria) plant outside the small town of Meda. The explosion released a massive toxic cloud of dioxin over the surrounding region, primarily affecting the nearby town of Seveso. As a result, most commentators refer to the accident as the “Seveso Disaster.” Within two weeks of the explosion, over 3,300 small animals had mysteriously died, 81,000 more were slaughtered for fear of contamination, and over 200 families had evacuated the region. Responding to the damage and dread left by the lethal cloud, the European community passed a series of directives drastically redesigning regional environmental policy (De Marchi et al 1996). The second event occurred in India on December 3, 1984, when the Union Carbide pesticide plant in Bhopal, the capital city of Madhya Pradesh, accidentally released a cloud of toxic gas into the community, killing over 3000 people and injuring 100,000 others overnight. The incident in Bhopal is widely regarded as the world’s worst industrial disaster and completely transformed chemical safety regulation in India and around the world (Mannan et al 2005).

These two disasters inspired and shaped many of the regulatory policies governing the chemical industry that remain in effect today. By examining the events leading up to the incidents and the policy responses to each accident, this report uses the history of these two disasters to draw out general patterns in governmental responses to chemical disasters. The report first briefly considers the various causes of the two disasters. Two final sections explore how the initial policies have evolved in the decades following these two incidents locally and further afield, with a focus on community-level redress and redevelopment, and modes of risk regulation. This paper suggests that the policy responses to industrial disasters happen in primarily three stages: short-term response, longer-term response, and then policy revision. The short-term response phase primarily focused on tangible community relief and stabilization, decontamination and assigning liability. In the longer-term response stage, policy-makers established new regulations seeking to remedy newly-identified problem areas in existing regulatory frameworks. In the third phase, authorities implemented, evaluated, and revised the new risk management policies, particularly as subsequent disasters expose other areas for improvement.
I. THE CAUSES OF CHEMICAL DISASTER

In the cases of Seveso and Bhopal, a combination of neglect and institutional practices by both the local authorities and the pertinent company increased the likelihood of a major industrial accident. The relevant contexts include: lack of proper safety measures at the factory in question; weak or even nonexistent enforcement of existing regulation by local authorities; lack of institutional transparency about the risks associated with chemical production; human error, often due to high employee turnover and inadequate training; and a collective action problem in regard to mobilization against dangerous practices within the chemical plants. In isolation, each of these factors had potentially hazardous implications; in combination, they converged to create unsafe working environments ripe for disaster.

Corporate Failure to Comply with Existing Safety Standards

In 1969, the ICMESA plant just south of Seveso began producing 2,4,5 trichlorophenol (TCP), a common ingredient in herbicides sprayed around the world. Recognizing the success of its TCP program, the company management rapidly expanded production of the chemical from a modest 6,361 kilograms in 1970 to over 142,000 kilograms in the first six months of 1976 alone (Reich 1991). The plant’s production process was predicated on the reaction of two TCP molecules, which generated dioxin, one of the world’s most toxic chemicals, as an inevitable byproduct. The amount of dioxin created in this process, moreover, was strongly correlated with heat; the higher the temperature of the TCP reaction, the more dioxin would occur. Thus the safe manufacture of trichlorophenol depended on close regulation of reaction temperatures (Reich 1991).

By 1976, the risks associated with TCP production were well documented. Between 1949 and 1975, at least thirteen cases of dioxin contamination from trichlorophenol production had been recorded in humans, with contaminated individuals showing severe skin diseases, liver damage, emphysema, hypertension, renal damage, depression, and memory and concentration failure (Reich 1991). Several of these contamination cases were directly related to industrial accidents stemming from TCP production at plants around the world including: Montesano (USA, 1949), BASF (Germany, 1953), Dow Chemical (USA, 1960), Phillips Duphar (The Netherlands, 1963), and Coalite Chemical Productions (UK, 1968). After these accidents, industrial engineers developed a much clearer understanding of the relationship between TCP production and dioxin, as well as various actions plans. Thus in 1971, in response to the accident at the Coalite plant, M.H. Milnes published a paper in the scientific journal *Nature* describing the exothermic reaction that caused the explosion and subsequent dioxin contamination.

In response to these chemical accidents and the following scientific investigations, firms around the world either ceased TCP production, developed alternative waste disposal methods, and/or constructed supplementary safety vessels intended to collect and cool any toxic material that may have been released if reactor valve ruptured (De Marchi et al 1996). ICMESA, however, did not significantly adjust factory practices. According to the Italian parliamentary investigation into the Seveso disaster, this inaction was not a matter of ignorance. Several technical directors at the ICMESA plant were aware of the Milnes paper and the technological developments to reduce the risk of exothermic reactions in TCP production (Reich 1991).
Despite knowledge of the risks associated with TCP production, the ICMESA plant in Meda initiated very few safety procedures. To cut costs, the factory used a substandard temperature gauge, had a manual cooling system, vented fumes directly into the atmosphere rather than a containment tank, and altered its production process in ways that increased the risk of dioxin production and likelihood of a dangerous exothermic reaction (Reich, 1991: 105). The July explosion was caused by a rupture in a safety disk on one chemical reactor as a result of a mistimed exothermic reaction and a failure to adequately calibrate the disk to withstand emergency situations (Marzortati and Fratter 2009). According to several scholars who have studied the Seveso accident, a minimal investment in a containment tank or supplementary safety vessel would have completely prevented or reduced the release of dioxin, and thereby entirely prevented or greatly minimized the effects of the Seveso disaster (De Marchi et al 1996; Reich 1991).

The Bhopal story was similarly characterized by poor safety procedures, inadequate equipment, and relentless attention to cost-cutting, all of which contributed to the massive explosion at the Union Carbide plant. In the 1970s, the Indian government recruited the US-based chemical manufacturer Union Carbide to build a subsidiary plant in Bhopal for the production of Sevin, a pesticide commonly used throughout Asia. In the early 1980s, widespread famine on the Indian subcontinent significantly reduced the demand for pesticides, leading the plant to cut back production by as much as 75%. Unable to sell the business, Union Carbide made plans to dismantle the facility gradually, continuing production on outdated machinery as long as possible (Broughton 2005).

A series of unsafe procedures led to the Bhopal explosion, which eventually triggered a deadly release of methyl isocyanate (MIC) into the air. A chemical intermediate for the production of common herbicides, methyl isocyanate is extremely volatile and highly toxic to humans. Acute exposure can have wide-ranging adverse health effects on respiratory and reproductive systems. Methyl isocyanate reacts violently with water in an exothermic reaction that creates massive amounts of carbon dioxide (EPA, “Methyl Isocyanate”).

On December 3, 1984, a faulty valve pumped a large amount of water into a Union Carbide MIC tank, causing an exothermic chain of reactions through a system with multiple flaws. The MIC-water reaction created an excessive amount of carbon dioxide, increasing the pressure within storage tanks. As the heat and pressure within the tank rose, the high levels of chloroform used as a solvent in MIC production, caused another concurrent exothermic reaction in the storage tank. The rapidly increasing pressure caused by these two reactions ruptured a disk, which in turn caused the opening of a downstream safety valve, which permitted a large amount of MIC in vapor and liquid form to be discharged to the atmosphere (Naschi 1987).

Environmental health scholar Edward Broughton describes the series of system failures that contributed to the massive leak:

...an operator at the plant noticed a small leak of methyl isocyanate (MIC) gas and increasing pressure inside a storage tank. The vent-gas scrubber, a safety device designed to neutralize toxic discharge from the MIC system, had been turned off three weeks prior. Apparently a faulty valve had allowed one ton of water for cleaning internal pipes to mix with forty tons of MIC. A 30 ton refrigeration unit that normally served as a safety component to cool the MIC storage tank had been drained of its coolant for use in another part of the plant. Pressure and heat from the vigorous exothermic reaction in the tank continued to build. The gas flare safety system was out of action and had been
for three months. At around 1:00 AM, December 3, loud rumbling reverberated around the plant as the safety valve gave way sending a plume of MIC gas into the early morning air (Broughton 2005, 2).

As Broughton and Naschi describe, there were several crucial components of the MIC production process that were either missing, turned off, or removed leading up to the explosion. Using old and improperly constructed systems greatly elevated the risk of a chemical accident. At several junctures leading up to the incident, Union Carbide could have replaced the faulty machinery or checked the equipment for compliance with safety standards, but inattention on the part of the company greatly increased the risks involved with the chemical production of Sevin, repeatedly putting both employees and the local population in danger.

Lack of Regulatory Framework/Failure of Local Authorities to Enforce Existing Regulations

According to the Parliamentary Committee of Inquiry investigation into the Seveso accident, in 1976 there were approximately 1,243 different laws, royal decrees, presidential decrees, and rules protecting some aspect of industrial health and safety in Italy. With regulatory authority at the time of the accident distributed across national, provincial and local jurisdictions as well as public corporations, it was difficult if not impossible to discern the legislation applicable to the Seveso case, much less the capacity of different governments to prevent and then respond to the accident. The disjointed nature of prevailing Italian industrial and safety regulation caused the Inquiry Committee to remark in its final report, that “our legislative system is fragmented, confused, complicated and above all, incomplete.” The Committee further concluded that there is “an enormous legislative gap regarding the prevention of the so-called major industrial hazards (Basso 2009, 110).”

The Parliamentary Inquiry Committee further determined that local authorities failed to adopt and enforce the pre-announced measures against ICMESA to limit high contamination levels in the years leading up to the accident. Local administrative authorities had “failed to enact an adequate and substantial protection of the public interest,” focusing only on “formal fulfillment of its obligations so as to exclude any responsibility (Marzorati and Fratter 2009, xxiii).” Motivated by a desire to facilitate economic growth and generate local jobs, the local authorities in Meda and Seveso granted wide authorizations to the ICMESA factory. These expansive permits “proved the incapacity of the public administration to combine legitimate ambition for industrial development of the company with the due safeguard of the well-being and of the environment of the towns of Meda and Seveso (Marzorati and Fratter 2009, xxiii).” Ultimately the Inquiry Committee determined that the local governments neglected their responsibilities to adequately regulate the factory in the best interests of the public, and this regulatory inaction seriously contributed to the severity of the accident.

In Bhopal, inadequate legislation, bureaucratic finger-pointing and administrative incapacity prevented local authorities from regulating and enforcing safety standards in the Union Carbide factory. Prior to the explosion, the Union Carbide factory was monitored under four national laws, the Factories Act of 1948, the Insecticides Act of 1968, the Water Prevention and Control of Pollution Act (“Water Act”) of 1974 and the Air Prevention and Control of Pollution Act (“Air Act”) of 1982 (Reinhold 1985). The Water Act was India’s pioneer legislation for managing industrial pollution and primarily contained provisions for the establishment of environmental administrative agencies at the state and national level. The act itself did not inspire much regulatory change other than the establishment of new bureaucratic agencies and many inherent flaws “rendered this legislation inefficient and mostly
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unenforceable (Abraham and Abraham 1991, 357).” Importantly, the Act empowered state governments to define and enforce standards to monitor water pollution. The Air Act of 1981 was passed as corresponding legislation to the Water Act and likewise empowered state governments to construct administrative bodies to regulate air pollution. Eventually, the multiple boards established under these two acts merged to become national and state-level Pollution Control Boards (Abraham and Abraham 1991). Unfortunately, according to environmental law historians, C.M. Abraham and Sushila Abraham:

Although the Water and Air Acts seem to provide the requisite law to tackle the water and air pollution problems of India, they were in fact neither readily enforceable nor effectively implemented. Both these Acts in their administration were found deficient in many areas, such as the consent administration system, structure of the Boards, setting of standards and in the procedural hurdles to judicial recourse (Abraham and Abraham 1991, 358).

Part of the ineffectiveness of the legislation was due to the fact that under Indian law, the “enforcement of worker safety, environmental and other rules [was] left largely to the state governments (Reinhold 1985),”, and do “not represent the best form of state regulation of hazardous industries. Most such inspection agencies are too grossly understaffed, too incompetent and often too corrupt to be able to play an adequate role in ensuring safety standards are not violated by managements.” (Times of India 1985, “Carbide’s Responsibility”)

This was certainly true in Madhya Pradesh, where, in 1984, the state’s department of labor employed just fifteen people to monitor over 8,000 plants. Inspectors in regional offices of the department often lacked typewriters, telephones, and personal transportation; the local Pollution Control Board had not received new instruments to measure pollution in several years (Reinhold 1985). In November 1985, eleven months after the Bhopal disaster, the government of Madhya Pradesh released a 16-page statement admitting that “its inspecting agencies were not competent enough to supervise the running and maintenance of the highly sophisticated Bhopal plant, which was designed in the US (Times of India 1985, “MP Squarely Blames Carbide”).” Seeking to absolve themselves of responsibility for oversight of safety regulations, the government claimed in the report that:

...no inspecting agency could be reasonably expected to possess the super-expertise to probe deep into the designing faults of defects in fabrication of the plant and machinery according to the original design and ensure their continuous proper maintenance, under any statutory or other provisions (Times of India 1985, “MP Squarely Blames Carbide”).

Without the institutional capacity to enforce local environmental and worker safety regulations, the Union Carbide plant went largely unchecked in its use of faulty equipment and dangerous production processes. This is not to say that the corporation had no inkling of impending danger. In 1982, executives from the Union Carbide headquarters in the United States commissioned an inspection of the Bhopal plant. The subsequent report identified numerous areas in which safety or procedural practices could be improved. According to the New York Times investigation into the accident, the report “strongly recommended, among other things, the installation of a larger system that would supplement or replace one of the plant’s main safety devices, a water spray designed to contain a chemical leak.” Unfortunately, employees at the plant claimed “that change was never made,” and “on Dec. 3, the spray was not high enough to reach the escaping gas” (Diamond 1985). In addition to an inadequate spray system the Times investigation concluded, two other crucial safety devices—a gas scrubber and a flare
tower designed to burn off escaping gases, were structurally unable to cope with a major accident, despite claims by Union Carbide spokesmen that the company “had taken all the action it considered necessary to respond effectively to the 1982 report (Diamond 1985).”

In the aftermath of the explosion, local journalists raised numerous additional questions about workplace safety. Several internal company reports indicated that the plant violated numerous safety operating procedures. None of these warnings, however, convinced plant managers to improve safety practices (Harzarika 1984; Meier 1985).

**Lack of Corporate Transparency**

Common to both accidents was a fundamental lack of transparency between the company and the local community. In both accidents, the companies deliberately did not fully disclose to their employees, the public, or local authorities the full extent of their operations with toxic chemicals. This lack of communication prevented the communities from receiving proper medical care after the accident occurred, escalating the impact of the crisis.

In Seveso, the local community remained largely unaware of what was actually produced at the ICMESA factory. Rather than herbicides, many residents of the nearby towns believed the plant produced perfumes (Marzorati and Fratter 2009). Even employees of the plant were not fully informed of the chemicals they handled. Despite the obvious adverse health effects experienced by workers in direct contact with trichlorophenol, the employees never received information about the probability of producing dioxin as a TCP byproduct nor dioxin’s high toxicity (Marzorati and Fratter 2009). Outside of the plant, no one—neither residents, nor political or health authorities—was aware of the potential magnitude of the hazards associated with the factory. As a result, the explosion was greeted first with incredulity and then alarm and dismay as information regarding the chemicals slowly emerged after the explosion (De Marchi et al 1996).

ICMESA disclosed information regarding the severity of the cloud’s toxins at an incredibly slow rate, causing many scholars and politicians to suspect malicious motives on the part of the factory (De Marchi et al 1996; Marzorati and Fratter 2009). The mayors of Meda and Seveso were notified the day after the incident that there had been an accident at the plant, but received only a minimal amount of technical details. On July 12, two days after the accident, ICMESA officials did contact the local public health authorities regarding the accident, but insisted that “the causes of the accident are still being examined.” Claiming that they were “unable to identify the substances carried away by the fumes and their precise effect,” the managers also “warned the neighboring families not to eat garden vegetables, even though the finished product is also used in herbicides.” This caution was misleading however, as the ICMESA technical director suspected that dioxin had been produced as early as July 11 (Marzorati and Fratter 2009, xix). Internally, dioxin contamination was confirmed on July 14. Nonetheless, the company waited until July 20 to release that information to local authorities and the general public, a full ten days after the original accident (De Marchi et al 1996).

In addition to withholding information about the potential risks associated with TCP from the public, factory management never educated employees about the hazards associated with their work. Cognizant of the need to wear protective clothing to avoid burns, and aware of colleagues who developed hand and body eczemas from breathing in the fumes, factory workers were conscious of some implicit danger associated with the production of trichlorophenol. However, in the months leading
up to the accident, new employees rarely received training for handling dangerous chemicals, and never received information about the possibility of producing dioxin and its noxiousness (Marzorati and Fratter 2009).

The company did not provide employees with any more information about the toxicity of their work in the direct aftermath of the accident. On Monday, July 12, just two days after the incident, the factory reopened and production resumed as usual, aside from the department normally engaged TCP production. When workers questioned company officials about the department closure, they were told no significant danger existed, though it would be advisable for employees to wash more frequently and thoroughly before returning home. Operations continued at the factory for five days before suspicious employees declared their intention to strike until the company specifically communicated to workers the present dangers (Reich 1991). Two days after the announcement of the strike, the mayor closed the factory for good, despite continuing assurances by the company that production could continue without harm to workers (Marzorati and Fratter 2009).

Without prior knowledge of the chemicals used in the ICMESA plant, the medical community was forced to wait five days after the first children showed signs of contamination to confirm the presence of dioxin in the chemical cloud. Only then could doctors provide the correct medical treatment and recommend mass evacuation (De Marchi et al 1996). In those five days, the community watched hundreds of small mammals die and rates of human exposure dramatically climbed, increasing the sense of local dread. If the public had received more timely details about the chemicals in use at the plant, the government and local medical centers could have acted much more quickly and decisively, reducing public fear and the physical and psychological impacts of the disaster.

Similar to ICMESA in the Seveso case, Union Carbide did not inform members of the surrounding communities about the types of gas involved in the manufacturing of Sevin, nor the potential dangers associated with those chemicals. This silence dramatically increased the overall damage of the accident as local hospitals did not know how best to treat those injured by the toxic cloud (Broughton 2005). Had the company communicated with local government officials about the use of methyl isocyanate, thousands of people could have dramatically reduced their symptoms. Instead, upon arrival at the hospital factory doctors insisted that the gas was not lethal, only mildly irritating to the eyes and lungs (Reinhold 1985). Prior knowledge of the public health risks associated with the chemicals in use at the Union Carbide factory would have drastically reduced the impact of the accident on the city’s surrounding slum population, as residents could have protected themselves from exposure by simply lying indoors on the ground and covering their faces with wet cloths (Shrivastava 1996). Insufficient public awareness of the risks and preventative measures caused more than 300,000 casualties.

**Human Error**

In both Seveso and Bhopal, disaster resulted partially from human error and inexperience. In both factories, employee negligence and lack of training increased the scale and impact of the accident. The ICMESA factory had high rates of employee turnover and limited training for new workers. Only workers certified to handle toxic gases attended a specialized training course in addition to basic training (Marzorati and Fratter 2009). With limited training, employees were more likely to make mistakes. In the Seveso case, the factory worker onsite during the exothermic reaction “failed to cool
down the reacting mass, due to the fact that this operation had not been carried out in the last three of four occasions in which the production cycle was interrupted before its conclusion, and that management had never given him instructions in this regard” (Marzorati and Fratter 2009, xxi).

Similarly, in Bhopal, understaffing required workers to manage many areas simultaneously with limited specific procedural and technical knowledge, particularly regarding crisis management. According to employees of the firm, the staff in the methyl isocyanate plant was halved in 1983 from twelve workers to six, prompting Kamal K. Pareek, a senior chemical engineer for the firm, to assert that “the plant cannot run safely with six people” (Diamond 1985). Understaffing, combined with general incompliance with the procedures outlined in the plant’s safety manuals, created a unsafe and unstable environment (Diamond 1985). Thus, when the disk ruptured, the onsite workers mistakenly added extra water to the storage tanks in an attempt control the reaction, ultimately dramatically increasing the scale of the disaster (Shrivastava 1996).

**Lack of Community Mobilization against Dangerous Industrial Procedures**

Despite an inherent knowledge of the risks associated with factory operating procedures, members of the communities surrounding both the ICMESA and Union Carbide plants were unable to mobilize an organized campaign against the local industrial hazards. Neither Meda nor Seveso had any prior tradition of activism by environmental or labor groups. Instead, the region was a “society that practically desired to eliminate any sort of conflictuality, where the work force, even if used in small craftsman workshops or in industries of the area, was willing to accept relations of ‘confidential dependency’ toward employers (Marzorati and Fratter 2009, xxiv).” This widespread desire to avoid conflict, along with an extensive trust in large-scale employers that provided crucial local jobs, prevented the citizens of Meda and Seveso from working together to demand safer working conditions both before and immediately after the accident (One exception was the sixty factory workers engaged in the strike following the disaster.). A lack of communal desire to protect the environment, insufficient information about the factory’s true operations, and depressed economic conditions in the region also militated against significant action on behalf of the factory workers (Marzorati and Fratter 2009).

Economic circumstances significantly impacted the ability of the local community to mobilize in Bhopal as well. The Union Carbide plant was surrounded by some of Bhopal’s biggest slums. Impoverished, uneducated and lacking access to basic services, the communities surrounding the plant were unable to form any sort of organized response to the hazards posed by the local pesticide plant (Shrivastra 1996).

The death, danger and destruction caused by these industrial disasters inspired major overhauls to both local and international environmental regulatory systems. Smaller and more localized than Bhopal, the incident in Seveso inspired regulatory revisions primarily within the European community through the so-called “Seveso Directives.” Alternatively, Bhopal inspired major changes throughout the world, with the most far-reaching policy responses occurring in India and the United States. Many of the reforms inspired by the disasters were reactive, focused on remedying the various institutional factors that contributed to the accident; others were preventative, intended to create new regulatory frameworks and institutions better equipped to regulate future industrial risk. While the two accidents stimulated several similar regulatory reforms, particularly with the development of Right-To-Know legislation and self-regulation within the chemical industry, there are significant differences in the structural components to the new regulatory frameworks. Following Seveso, the European Community
largely amended pre-existing legislation, while the Indian and American governments chose to establish completely new regulatory bodies and legislative procedures. The remainder of this paper analyzes the institutional and regulatory response to both disasters in steps. Starting with a discussion of the immediate government reactions to the crisis event, the paper concludes with an analysis of how the regulatory frameworks that emerged following the accidents have evolved over time. See below for a timeline of major events, policy responses, and regulatory change starting with the Seveso Accident in 1976 through the passage of the Seveso II Directive in 1996.

**II. REGULATORY RESPONSES TO THE DISASTERS: SHORT-TERM CRISIS MANAGEMENT**

**Seveso: July 1976-December 1976**

Local government officials initially reacted slowly to the ICMESA explosion. The delayed response was largely due to a fundamental lack of information about the incident. Factory officials notified the mayors of Meda and Seveso of the accident on July 11, more than twenty-four hours after the explosion. According to then-mayor of Seveso, Francesco Rocca, in this first meeting, “the description of the accident was brief, mainly of a technical nature;” officials also deliberately minimized...
the toxicity of the chemicals, emphasizing that “you can also find [trichlorophenol] at the grocer’s, since it is also used as an herbicide” (Marzorati and Fratter 2009, xviii). At this initial meeting, no mention was made of dioxin or its potential negative health effects. The firm simply advised officials to inform local populations about “a cloud of herbicide that causes harm to agriculture” (De Marchi et al 1996, 110). Local residents were warned not to eat homegrown vegetables the next day, but received no further information. No formal action would be taken by local government officials until the passage of “Ordinaza 43” by Rocca on July 15, which mandated the construction of fences and warning signs around the factory.

In these five “days of silence” between the initial explosion and the first official government response to the disaster, local communities increasingly started to panic as thousands of small animals mysteriously died and young children began exhibiting symptoms of dioxin poisoning. After thirteen children were hospitalized on July 16, pressure from factory workers and local families pushed the mayor to officially close the factory on July 18. It was around this time that news of the accident made its way into national newspapers, with the first televised reporting of the disaster coinciding with the shutdown of the factory (De Marchi et al 1996). Two days later, the presence of dioxin was finally confirmed in local soil samples. Directly following this announcement, local authorities arrested the Technical Director and Director of Production at ICMESA, and public health officials call for a meeting of the Regional Health Department.

While all this was happening in Italy a director of clinical research at the healthcare firm Roche Basel (the parent company to ICMESA), also investigated the potential impacts of the disaster on the local community. After the explosion, the director contacted experts at chemical firms that had previously experienced dioxin accidents, including Coalite (Great Britain), BASF (West Germany), Philips-Duphar (Holland), Chemie Linz (Austria) and Dow Chemicals (USA) (Roche 2006). All experts recommended evacuation of the local population, and following these recommendations, on July 22, the first 80 children were evacuated to a nearby holiday camp; local officials further ordered a census of all dead animals and the establishment of a dermatological clinic to monitor exposed persons (De Marchi et al 1996).

The Lombardy Regional Health Department met for the first time two days after the first evacuation, calling together medical experts, civil servants and scientists. At this meeting the department established the first evacuation zone, Zone A. In the next few days, the local armed forces evacuated 225 people from the region and fenced off the area. Over the next few weeks, Zone A was repeatedly expanded following new test results, eventually covering 108 hectares around the factory and causing 730 people to relocate into temporary housing outside the city. Four weeks after the explosion, the Health Department created a second contamination zone: Zone B. Residents of Zone B were not evacuated from this area, but were subject to strict rules on the consumption of food and water. Children under 12 and pregnant women were encouraged to avoid the affected area during the day. During this time, local health authorities also suspended abortion laws, permitting pregnant women to obtain therapeutic abortions for cases in which the birth would be traumatic to the mother (De Marchi et al 1996).

Looking to further understand the crisis, on July 28th the Regional Health Department established four expert committees to investigate different components of the accident, including: public health problems and potential protective health measures, sample collection and data interpretation, decontamination methods, and the causes of widespread animal death. One week later, the national government organized a separate technical-scientific commission reporting to the ministry.
of Health, nicknamed the “Commissione Cimmino,” after its chairman, to explore decontamination methods. The regional government then created a third board, the “Commissione Giovanardi” to implement the policies of the Cimmino Commission, in Lombardy. Together, these three boards would be responsible for decontamination and recovery efforts in the region for the next several years. Following the formation of these boards, local officials began discussing decontamination measures, including the construction of regional incinerator to burn contaminated items, ultimately defeated by local opposition to the plan. Major decontamination work did not begin until the new year (De Marchi et al 1996; Roche 2006).

**Bhopal: December 1984-March 1985**

In 1984, Union Carbide, an American company, had chemical plants scattered throughout the United States in addition to its holdings in India. With operations in both countries, the incident in Bhopal demanded regulatory responses from both governments and the Union Carbide Corporation (UCC). In the days, weeks and years directly following the disaster, responses developed along several fronts, including: decontamination efforts, commissioned investigations, medical assistance, international litigation and regulatory reform.

**India:**

Indian government officials received notice of the disaster in Bhopal much sooner than their Italian counterparts in Seveso. Local officials were informed directly following the explosion. Within twenty-four hours, officers from the Indian Central Bureau of Investigation (CBI) had taken control of the Union Carbide plant. Within two days, a scientific investigation team, led by the director of the national Council of Scientific and Industrial Research, Dr. Srinivasan Varadarajan, had been assembled to investigate the causes and health effects of the accident (D’Silva 2006). With the seizure of the plant, government officials sealed the plant, removing log books and other papers from the premises and prohibiting entry into the factory without express permission from Parliament. Local police officials also quickly detained five senior managers of the plant for questioning.

Following the explosion, the first step undertaken by the local government in Madhya Pradesh, was an examination of the plant and the surrounding property. Dr. Varadarajan first visited the site on December 5, where he was informed by plant managers of the substantial amounts of MIC remaining on the property (D’Silva 2006). Because of the unknown cause of the accident, neutralizing the potential risk of the stored MIC became priority number one for the government. It was decided the best way to dispose of the MIC was to convert it into pesticide, as the company did under normal operating procedures. Apprehensive about the neutralization process, thousands of Bhopal residents fled the city, causing the local government set up evacuation camps on the southern edge of the city for approximately 125,000 people (Stevens 1984, “Poison Disposal is agreed upon”). Only a fraction of the space was used however, with approximately 12,000 people seeking asylum in the camps. In addition to temporary housing, residents in the camps also received two free meals a day (Hazarika 1984, “Camps for Bhopal Evacuees to Close Today”). Neutralization, codenamed “Operation Faith,” began on December 16 and concluded three days later. During the process, the government undertook “extensive precautionary measures,” including the constant spraying of water onto the factory and surrounding streets (Times of India 1984, “Killer gas disposal off to successful start”). Following the successful neutralization of the remaining MIC, the Madhya Pradesh government closed the refugee camps on
December 20, providing each resident with a free supply of wheat and rice as they moved back into their original homes and small shops (Hazarika 1984, “Camps for Bhopal Evacuees to Close Today”).

In the United States, Union Carbide headquarters received news of the accident around 3:00 on the morning of December 3. A crisis management meeting was held by UCC executives a few hours later, and by that afternoon, who quickly convened a task force headed by UCC Chairman Warren Anderson and Ron Van Mynen, the corporate director of occupational health (D’Silva 2006, 100). Within twenty-four hours, the rest of the crisis team had been assembled, including: Mr. Warren Wommer, a former manager at the Bhopal plant, Dr. Sridhar Avasia, an authority on the effects of toxic gas on humans and Gordon Rutzen, a specialist in process design (Hazarika, Dec. 7 1984). The team was then immediately dispatched to Bhopal. Initially turned away from the plant, the Union Carbide team finally gained access to the factory on December 7. But in light of the large quantity of MIC remaining on the premises, all investigations into the causes of the accidents were delayed until all the MIC had been neutralized (D’Silva 2006, 94).

Eager to see the plant himself, Chairman Anderson arrived in Bhopal on December 7, traveling with two senior Union Carbide India officials. Immediately upon arrival, all three men were placed under house arrest, detained on charges of “negligence and corporate liability” (Hazarika, Dec. 7, 1984). Anderson was released on bail later that day and encouraged to leave the country as soon as possible, as Madhya Pradesh officials “[did] not consider his presence in the country desirable (Times of India, Dec. 8, 1984).” Anderson returned to the United States the next day.

After the neutralization of the remaining MIC, Union Carbide and the Indian government both launched a series of investigations into the cause of the accident. Union Carbide established two commissions to study the disaster, one composed of Union Carbide specialists and the second organized by the independent international consulting firm Arthur D. Little (ADL). In total, the Union Carbide Commission stayed in India for twenty four days, the first fifteen assisting with the neutralization of the MIC and the remaining nine collecting samples and examining conditions inside the plant. The commission then left India and flew to research labs in the United States to carry-out further analysis. The UCC findings were published on March 20, 1985 in a report entitled Bhopal Methyl Isocynate Incident Investigation Team Report. The ADL report largely corroborated the UCC report’s claims, but also suggested there were some inconsistencies in eye-witness testimonies of the explosion. Similarly, the government initially established two commissions to examine the plant, one organized by the Central Bureau of Investigation in conjunction with the Council of Scientific and Industrial Research (CSIR), and a second, one-man commission organized by the state government of Madhya Pradesh. The CSIR committee published the findings of their investigation in December 1985, a full nine months after the UCC commission. This report generally supported the conclusions published in the UCC report. The second commission faced many hurdles throughout its investigation and was shut down in December 1985, just prior to the beginning of its official hearings on the accident (D’Silva 2006).

While neutralization and investigation efforts commenced, the local medical community was hard at work treating the thousands of gas victims in the city. As patients streamed into the local hospitals directly following the disaster, hospital administrators called in volunteer nurses, doctors and medical students from the surrounding region to help treat those affected by the accident. The immediate public health response was largely directed by the staff of the Hamidia Hospital, but the Indian government was crucial in providing medicine and supplies to the medical teams in Bhopal. The international community also contributed emergency equipment to regional hospitals. In the days following the explosion, medical teams expanded into surrounding neighborhoods conducting door-to-
door examinations of local residents. Despite the magnitude of the explosion and the astounding number of people affected by the toxic gas, the immediate medical response to the disaster was largely considered a success (Boffey 1984, “Bhopal’s Doctors Given High Praise”). In subsequent weeks, the Indian Health Department continued house-to-house surveys to monitor and assess public health and morbidity. The Indian Council of Medical Research also began long-term studies into the toxicity effects of MIC exposure in children and pregnant women (Times of India 1985, “Gas Victims Under Care”).

In the midst of all of these other immediate responses to the disaster, the Indian people and government, with help from some American lawyers, embarked on what would become an extensive legal battle to recover financial compensation for gas victims. The first class-action lawsuit against Union Carbide was filed on December 7, 1984, a mere four days after the incident. Naming Indian citizens as plaintiffs, two American lawyers filed suit against the company for $15 billion in damages. This lawsuit was filed in US District Court in Charleston, West Virginia. (New York Times 1984, “Lawsuit filed in US Court”). Two days later, Madhya Pradesh Chief Minister, Mr. Arjan Singh announced that his government would formally file a compensation suit against Union Carbide in American courts (Times of India 1984, “M.P. Govt. Will Sue Firm”). Represented by other Washington lawyers, the government would file suit in the United States because “compensation will be higher in the United States than India,” filing suits in India would have been cost-prohibitive to gas victims, and the American doctrine of “strict liability” held companies responsible for damage under the law without proof of negligence (Stevens 1984, “U.S. Lawyers Are Arriving to Prepare Big Damage Suits”). By December 12, a third American firm had landed in Bhopal seeking plaintiffs. Swarmed with American lawyers with questionable motives, by the end of December, the Indian government had appealed to the public “not to enter into individual agreements with foreign lawyers for taking up their suits” (D’Silva 2006, 147).

By mid-January, 37 lawsuits on behalf of gas victims had been filed in US courts, with more than 2,000 additional cases filed in Madhya Pradesh alone. By the first week in February, the number of US cases had jumped to 145. Seeking to consolidate the litigation, on February 6, the Judicial Panel on Multi-District Litigation ruled that all of the Bhopal cases would be combined into one massive suit. Following this development and overwhelmed by the sheer volume of cases, on March 29, 1985 the Indian national government passed the Bhopal Gas Leak Disaster (Processing of Claims) Act, giving the central government with the exclusive right to represent all claimants engaged in lawsuits regarding the Bhopal plant and thereby eliminating thousands of extraneous lawsuits. The controversial act granted the central government the power to combine all litigation into one lawsuit: *Union of India v. Union Carbide Corporation*. The Union of India officially filed suit against Union Carbide in the State of New York on April 18, 1985, thereby officially starting the massive jurisdictional and legal battle that would rage in multiple courts on multiple continents in the years to come (D’Silva 2006; Abraham and Abraham 1991).

*United States:*

The December 3 gas leak also sent shockwaves through the American regulatory community, as concerned citizens, regulators and public officials began to wonder whether something like this massive accident could happen in their communities. Of primary concern was the Union Carbide chemical plant in Institute, West Virginia. Similar to the factory in Bhopal, this plant also produced large quantities of methyl isocyanate. Initially unsure about the cause of the explosion in Bhopal, Union Carbide headquarters ordered the temporary shutdown of the Institute plant on December 4 (Lueck 1984, “Company Halts Output At Similar Plant in US”). Following the closure of the plant, Union Carbide
officials and representatives from the Occupational Safety and Health Administration (OSHA) were called to testify in front of congressional subcommittees on the status of the Institute factory. During the hearings, both the head of OSHA, Robert Rowland, and UCC Chairman, Warren Anderson, attested to the safety measures and precautions of the plant, claiming that the Institute factory was a “safe plant,” and it would be highly unlikely for an explosion akin to Bhopal to happen in the United States (Shabecoff 1984, “Officials Tell a House Hearing That Plant in West Virginia is Safe”). Hardly reassured, subcommittee members recalled UCC officials for a second round of questioning upon announcement of the reopening of the factory in April 1985 (The Baltimore Sun 1985, “Carbide sets W.VA restart”). Government officials held a second round of hearings to protest the resumption of MIC production prior to the publication of the full investigation into the Bhopal incident.

The congressional hearings presented a political opportunity for discussion of larger regulatory issues. Leading the congressional inquiry into Union Carbide and the Institute plant were Rep. Stephen Solarz (D-NY) and Rep. Henry Waxman (D-CA), who both pushed for stricter regulation of the chemical industry in light of the disaster in Bhopal. During the hearings, Solarz pressed witnesses to explain President Reagan’s revocation of a Carter-administration executive order strengthening control over sales of banned or severely restricted substances abroad, and called for “affirmative action by our government to assure that [Bhopal] never happens again” (Shabecoff 1984, “Officials Tell a House Hearing That Plant in West Virginia is Safe”). Solarz went so far as to travel to Madhya Pradesh himself and announce his intention to introduce legislation requiring American companies abroad to operate under US safety and environmental regulations the week following the hearings (Times of India 1984, “Solarz on Safety Law”). Rep. Waxman questioned officials on employee and area residents’ knowledge of emergency procedures and expressed serious frustration with chemical emissions standards set by the EPA. At the conclusion of the first round of hearings, Rep. Waxman’s subcommittee ordered 86 major chemical companies to submit internal safety analyses for review. The results of the congressional survey were released in late March 1985, prompting Rep. Waxman to declare his intent to push for legislation requiring the EPA to set standards for over 200 unregulated toxic chemicals (Isikoff 1985, “Panel Says Toxic Leaks Widespread”).

The steps undertaken by these congressmen indicate the international emotional impact of disaster in Bhopal, but also how political figures can use disasters to inspire regulatory change. In several articles the hearings are described as: “a forum to discuss what the panel’s chairman, Rep. Stephen Solarz (D-NY), called several inconsistencies or apparent shortcomings in US policy concerning the export of hazardous substances” (Greenberger 1984, “Union Carbide Gas Leak in India Spurs Debate in Congress on Export Controls.”). The portrayal of the hearings as a “forum for discussion” is consistent with the exasperated tone of several public comments made by Representatives Solarz and Waxman regarding the regulation of toxic chemicals under the Reagan administration. For these elected officials, the disaster presented a unique political opportunity to critique the sitting administration and enact tighter safety regulation within the chemical industry.

Discussion of the Immediate Responses:

Examining the initial responses to the gas explosions in Seveso and Bhopal reveals some key differences and some striking similarities in the actions and concerns of local communities. One can identify several broad conclusions about short-term policy responses, discussed below.

Quick communication networks are vital to quick response.
In Seveso, reluctance on behalf of ICMESA to inform local authorities of the gas leak and the toxicity of the chemicals involved prevented local government and health officials from responding to the disaster in a quick and organized fashion. Delayed action and a lack of information caused widespread panic in the local community as large populations of animals died and children started developing dioxin poisoning symptoms. In Bhopal on the other hand, factory personnel notified local authorities of the accident within a few hours of the explosion, allowing for a much more direct, thorough and coordinated response. Bhopali residents were evacuated from contaminated areas in a matter of days, not weeks. However, even with information, it took both communities several months before major legislative action, decontamination efforts, and regulatory revision began. In both Seveso and Bhopal it would take about six months to move away from immediate response to long-term regulatory revision.

**Ignorance of industrial risks leads to public outcry, panic, and demands for information.**

One of the most powerful lessons learned from these disasters was the extent of widespread ignorance among the communities near industrial zones. In both accidents, local communities were completely unaware of the potential health risks involved with nearby chemical plants. Following the disaster, demands for more information and advance warnings for toxic chemical use drove substantial regulatory revisions, most notably “Need-to-Know” and “Right-to-Know” legislation.

**Consistent Policy Response: evacuate, evaluate, and form a committee**

In both cases, governmental response occurred in three identifiable steps: evacuation of local residents, evaluation of what caused the accident and the formation of a separate commission (or three) to direct and monitor continued governmental response. The commissions formed by local governments were composed a combination of industry experts, public health officials, and scientists. Interestingly, in both cases, the parent companies—Roche Group in Seveso, Union Carbide in Bhopal—also arranged for small teams to investigate the crises in their entirety, rather than simply concerning the factories where the accidents transpired.

**Location is everything: the closer the accident, the more drastic the response.**

In the policy responses to these disasters, regulatory response is concentrated geographically, with proximity vital to the level of regulatory concern. Regulatory response to the incident in Seveso occurred largely on a local scale, with response to the disaster clustered in Italy and nearby countries. The disaster had little impact outside of Europe. Additionally, the Union Carbide disaster prompted no immediate regulatory revisions in Europe (Tagliabue 1984, “Gas Leak Touches a Nerve in Europe, But Chemical Companies Deny Mishap Like That in India Could Happen Here”), but inspired major regulatory overhauls in India and the United States. Directly following the explosion, the political discourse within the United States tellingly focused much more on the safety and stability of Institute, WV plant rather than the factory in Bhopal. Concerns that American citizens could experience methyl isocynate poisoning from Union Carbide plants drove US political response much more than concern for the well-being of Indian citizens. The disaster in Bhopal was tragic, and no doubt would have prompted responses from the American public, but the fact that Union Carbide was an American company operating chemical plants in the US as well as India, was the primary driving factory for much of the attention and regulatory response of the American government.
Political figures use disaster to maximize ongoing political goals.

More so in reaction to the Bhopal disaster than Seveso, local political figures took advantage of the accident within the context of the greater political moment to critique standing regulations or to further political goals. The accident in Bhopal occurred three weeks before a major series of elections in Madhya Pradesh, in which the Chief Minister of the state, Mr. Arjan Singh, would be up for reelection. On December 7, Mr. Singh denied responsibility for the accident, but also claimed that the upcoming election was “irrelevant” to him in light of the recent disaster (Hazarika 1984, “India Police Seize Factory Records”). However, he was sharply criticized in local editorials for arresting Warren Anderson as an “election-gimmick” (Times of India 1984, “Inexcusable Bungle”). The elections on December 24, 1984 resulted in the reelection of Mr. Singh to his post as Chief Minister.

In the United States, the Bhopal disaster fell into a greater political discussion at the time regarding Right-to-Know legislation and American corporate responsibility (Hiltzik 1984, “India Disaster May Spark US Disclosure Laws”). In addition to the critiques made by Representatives Solarz and Waxman, the lawyers immediately pursuing lawsuits against Union Carbide “appear[ed] united on one front: that this is an opportunity to discourage what they describe as a practice by some American companies to foist products and practices on third world countries that, they say, would not be acceptable in the United States” (Stevens 1984, “US Lawyers are Arriving to Prepare Big Damage Suits). The lawyers originally involved in the Union Carbide cases intended to sue the corporation in part to inspire change within industry practices, as John Coale describes, “If you hit them in the pocketbook, they will change...If you don’t, they won’t change (Stevens 1984, “US Lawyers are Arriving to Prepare Big Damage Suits”).” On all fronts, political actors focused on channeling the Bhopal disaster into policy change.

III. LONG-TERM COMMUNITY RESPONSE


The long-term institutional response to the accident in Seveso happened on four main fronts: decontamination, monitoring and evaluation, litigation, and extended community recovery programs. Confusion and disagreement immediately following the accident prevented local authorities from enacting many of these extended-response programs until almost a year after the event.

Decontamination

Decontamination of the towns of Meda and Seveso occurred over several months and involved the extensive treatment and demolition of local buildings, soil, and plants. Following evacuation, there was substantial debate about how best to proceed with decontamination efforts. As early as September 1976, ICMESA and its partner company, Givaudan, were authorized by the regional government to head the decontamination process. Throughout the fall of 1976, ICMESA and Givaudan worked with the local government to settle on a decontamination plan. Originally, the Lombardy government had suggested the construction of a massive incinerator in the area to dispose of all contaminated earth, buildings and
materials. This was met with strong opposition from the community however, forcing the local authorities to instead package and remove the contaminated waste from the Seveso area (Roche 2006).

The removal and decontamination process began in January 1977, six months after the initial explosion (De Marchi et al 1996). Starting in Zone A, closest to the site of the accident, and slowly moving outward to Zone R, the local government in conjunction with ICMESA and Givaudan removed soil and contaminated garden plants from the evacuation zones, collected contaminated waste water, and scrubbed buildings with special soap. All of the waste from this process was collected into massive storage bins. Constructive workers demolished heavily contaminated buildings. By October, workers completed the decontamination of Zone A, permitting 511 families to return to their homes. One month later, sanitation efforts officially commenced in Zone B. Since Zone B was a heavily agricultural area, much of its extended decontamination process involved the removal of topsoil and subsequent planting of crops. To prevent contamination, local administrators ordered the destruction of the harvest planted in 1979 and heavily monitored successive crops for traces of dioxin. Decontamination efforts continued to move out away from the factory, until Zone R, the farthest from the site of the original accident, was completely cleared for agricultural use in November 1981 (De Marchi et al 1996, and Roche 2006). Overall, the cleaning and removal of contaminated materials took almost four and a half years.

Toxic waste disposal posed one of the most significant problems for ICMESA, Givaudan and local governments throughout the decontamination process. Prohibited from burning the contaminated earth, vegetation and debris, the Cimmino Commission built two immense underground storage basins in 1981 and 1982. Despite holding 245,000 cubic meters of toxic waste from the explosion, these containers proved insufficient for the disposal of the toxic residue from inside the factory. Unable to find a suitable means of incineration within Italy or Switzerland, ICMESA and local authorities turned to outside groups to manage the waste. Negotiations with other European states ultimately failed, as “no one want[ed] to dispose of the waste from Seveso (Roche 2006, 10).” In the spring of 1982 negotiations with the firm Mannesmann Italiana finally led to a disposal agreement on the “condition that the disposal of the site should be kept secret from Givaudan (Roche 2006, 10).” Five years after the accident, on July 20, 1982, Givaudan and ICMESA formally agree to the terms established by Mannesamann Italiana and the removal of the finally toxic residue commenced.

The secrecy condition of this agreement became problematic for both companies over the next year. In the winter of 1982, Mannesamann Italiana exported the toxic residue from Italy to an “unnamed, approved and supervised disposal site (Roche 2006, 10).” A month later, the French media exposed the transport of the barrels into St-Quentin, France, but then the trail of the barrels disappeared. Anxiety and speculation about the mystery location of the barrels ignited public demands for disclosure. Mobilized by public outcry, French authorities arrested representatives from Mannesamann Italiana and their subcontractors for refusing to reveal the whereabouts of the barrels. In May 1983, Roche Group, the parent company for ICMESA, finally recovered the barrels in an unused slaughterhouse outside a remote village in northern France. With emergency permission from the Swiss government, Roche agreed to dispose of the barrels at its facility in Basel, a process that took another two years. Following the disposal of the remaining residue and the demolition of the ICMESA factory, authorities finally declared decontamination of the Seveso site complete, putting an end to this phase of disaster response.
In 1976, the international scientific community viewed dioxin as largely a mystery. Limited data was available on the health consequences of exposure to the chemical, and consequently dread about the perceived toxicity of dioxin elevated the accident to “a disaster with severe psychological, social, and economic effects (De Marchi et al 1996, 106).” Aware of the potentially drastic repercussions of the accident on the health and stability of the local communities, the regional government in Lombardy established the Ufficio Speciale di Seveso (Seveso Special Office) in June 1977 to address five intervention areas: soil, water and vegetation contamination; medical aid and health monitoring programs; social and educational community assistance; public building recovery; and economic and industrial aid (Ramondetta and Respossi 1998; De Marchi et al 1996).

Interventions by this office took a variety of forms and extended over widely different periods of time. For example, scientists tracked dioxin contamination in local soil and vegetation samples for 17 months, and also initiated several epidemiological studies expected to run for up to twenty years (De Marchi et al 1996; Ramondetta and Respossi 1998). Extensive and thorough health monitoring programs systematically reached over 220,000 local residents under the Ufficio Speciale. Two months after these programs went into effect, scientific experts from around the world came together to form an International Steering Committee to independently assess toxicological and epidemiological consequences (Roche 2006). To date, the only significant health impact on the local community has been the original chloracne outbreak directly following exposure. Established scientists agree that the affected population has not experienced any long-term, negative health effects in the years following the explosion (Homberger et al 1979; De Marchi et al 1996).

In the years following the Seveso accident, public fears of dioxin dissipated as scientists further studied its impacts. Ironically, the human exposure to dioxin caused by the explosion has provided important information for the scientific and regulatory community. Due to its toxicity, scientists cannot ethically study the health impacts of dioxin in traditional experiments; therefore data taken from the epidemiological studies of the disaster help inform the industrial and scientific community about the nature of dioxin exposure. Additionally, as toxicologists and public health specialists completed more research on the health impacts of contamination, the local community was able to successfully reconstruct its social and economic institutions.

Litigation

Paradoxically, the weak regulatory framework prior to the Seveso disaster may have significantly contributed to the community’s strong recovery. Risk and disaster scholar Bruna De Marchi argues that in the absence of strong regulations and the failure of ICMESA to uphold existing safety precautions, there was no question about liability. Responsibility for the accident clearly fell to ICMESA and the company quickly assumed full financial liability. This greatly simplified and accelerated the recovery process, preventing complicated jurisdictional litigation. As De Marchi argues, “it was the unprecedented speed of compensation offers, along with the acceptance of blame and contribution to rehabilitation that made all the difference in the recovery of Seveso. Otherwise there could have been [the sort of] protracted litigation that occurs in so many such cases and which causes psychological and moral harm, ultimately inhibiting the process of recovery” (De Marchi et al 1996, 105).
Despite the company’s questionable behavior in reporting the accident and disposing of the barrels, ICMESA at least partially redeemed itself in its prompt and generous compensation efforts. ICMESA settled its first private claims amicably out of court as early as February 1977. In the subsequent years, ICMESA would settle many other private disputes as well public settlements with surrounding municipalities up until 1993. Originally the claims went solely to citizens who lived close to the plant, residents with clear evidence of physical health effects or serious contamination, but in 1991 citizens from remote contamination Zones B and R sued for psychological damages, opening the door for further civil litigation with the company. Overall, the company spent several billion lire in reparations to individuals and municipalities (Roche 2006 and De Marchi et al. 1996).

In addition to civil litigation and monetary settlements, the accident also prompted a criminal investigation into the responsibility of ICMESA and Givaudan employees. In September 1983, five former ICMESA/Givaudan employees were sentenced to prison for their involvement in the accident. All five appealed the conviction to the Court of Appeal in Milan (Roche 2006). The court absolved three employees of responsibility for the accident, but upheld the conviction of the Director of ICMESA and the Technical Director of Givaudan (De Marchi et al. 1996). Both of these men appealed to the Italian Supreme Court but their convictions were upheld, thereby reinforcing legal precedent for individual legal responsibility for corporate noncompliance with local regulation.

Extended Community Recovery Efforts

Another key component to the successful recovery of Seveso was the long-term community rehabilitation efforts of local community leaders. Fully aware of the potential social, cultural, and environmental impacts of the accident on the Seveso community, local government officials and community organizations sought to define and shape the meaning and memory of the accident within the community. In the years following the accident, “an underlying tension, characterized by a sense of expiation and above all a social need to remove the event remained in the air” (Marzorati and Fratter 2009, xvii). Resolving this tension has been an on-going process for over thirty years.

Community healing began with a cathartic removal. The deconstruction of the ICMESA factory in 1985 removed the largest physical reminder of the disaster; a few years later, the community constructed a sports center on the site (Marzorati and Fratter 2009). The remains of the ICMESA buildings were buried under two hills in a TCDD-contaminated area between Meda and Seveso. Landscapers transformed this area into a beautiful green space complete with a forest, gardens, and a “walk of memory” memorializing the disaster. Officially opened to the public on the twentieth anniversary of the accident, the park has been healing to the community and the local environment. Five years later, historical reexamination of the events inspired the “Bridge to Memory” project, which included the creation of a historical archive of the disaster and a renewed effort on behalf of the community to examine the events of the 1976 accident and learn from the events. The creation of the archives “have enabled the reconstruction of a period of history in the [Seveso] territory and contributed, starting from Seveso, to give a sense of epoch-making change during the second part of the twentieth century” (Marzorati and Fratter 2009, xxix). The communal reflection and reexamination of the accident inspired by the project, reaffirmed the identity of the communities affected by the incident, providing the community with “the power to anchor this experience and preserve the origin of our lives where we live, creating new energy” (Marzorati and Fratter 2009, xxix). Connecting the region’s past to its contemporary issues through the “Bridge to Memory” revitalized the community and transformed the narrative of Seveso from one of tragedy to one of energy and hope.
Bhopal: March 1985-Present

The long-term recovery of Bhopal took a very different path. Whereas Seveso is generally considered a success story in disaster recovery, from every angle recovery efforts in Bhopal continued to disappoint decades after the initial explosion. From the beginning, the crisis in Bhopal was largely used as a political tool by the ruling party to maintain power in the local government. Fragmented recovery efforts were often intended more to sway public opinion rather than truly rehabilitate the socioeconomic circumstances of the gas victims. Union Carbide further exacerbated the consequences of the disaster by actively abdicating responsibility for the explosion, withholding vital information from the public, and diverting attention and money away from recovery efforts through extensive legal disputes with the Indian Government.

Bhopal as a Medical and Ecological Crisis

Initially, Bhopal primarily posed a medical and ecological crisis (Shrivastava 1996). Following the explosion, the most immediate need was medical treatment. The Indian government dispatched doctors and supplies to the city, but not nearly enough to adequately treat the astounding number of victims. Already low on supplies and manpower, a fundamental lack of knowledge presented the most significant barrier to treatment. Unkempt medical records and poor communication between medical services combined with the absence of readily available information about the toxins to inhibit adequate treatment of patients. Doctors never received information from Union Carbide about the chemical, its toxicity, or additional chemicals potentially released with the explosion (Shrivastava 1996). Without this information, the medical community could only treat surface symptoms and struggled to differentiate between existing conditions and health problems attributed to MIC exposure.

As a part of the initial medical response, several Indian research organizations began epidemiological and medical surveillance studies. Similar to the medical response teams, these organizations struggled to find reliable health records, sorted through misinformation (and missing information) from the Union Carbide Company, and lost study participants due to relocation and displacement following the disaster. Additionally, the Indian government considered all government-sponsored research as confidential evidence in its case against Union Carbide and therefore did not publically release the information for many years after the accident (Shrivastava 1996 and Vivek 1990). This decision further prevented adequate medical attention for gas victims.

From an ecological standpoint, the chemical plant had been polluting the local environment for years prior to the accident (Vivek 1990). Chemicals from the plant continue to contaminate soil and groundwater despite discontinued operation at the factory. Following the closure of the plant, the company failed to clean up the industrial site completely. As a result, several toxic chemicals and heavy metals seeped into the city’s water supply (Broughton 2005). The Indian government did not implement a long-term decontamination plan outside of the initial neutralization process under “Operation Faith,” (Shrivastava 1987). Consequently, environmental conditions around the factory have continued to degrade unchecked in the decades following the disaster. In 1999, scientists from Greenpeace conducted an environmental survey of the factory and found “substantial and in some locations severe contamination of land and drinking water supplies of a level likely to have serious consequences for the health and survival of the local population,” (Brown 2009) yet it was not until 2006 that the state government finally initiated an action plan to restore safe drinking water to the area. In 2004, the state of Madhya Pradesh sued Dow Chemical, the new owner of Union Carbide, for damages resulting from...
the groundwater contamination by UCIL. The case was originally dismissed, then reinstated in 2008 at the US district court level. Four years later, the plaintiffs appealed the ruling in 2012, and in 2013 the US Circuit Court of appeals upheld the original ruling exonerating Dow Chemical and Union Carbide from any legal responsibility for environmental remediation and environmental-related personal injury claims. Almost three decades after the accident, liability for ecological damage remains disputed (the Union Carbide website denies that the company caused any environmental degradation at all in the first place), and plans to rehabilitate drinking water remain unfunded (Bhopal Information Center). For thirty years, the victims of the explosion have been drinking water with known carcinogens, and decontamination efforts do not seem to be going anywhere any time soon.

**Bhopal as a Political and Economic Event**

The accident in December 1984 occurred three weeks before major state and national elections and instantly became a leading political issue. As Bhopal scholar Paul Shrivastava writes, “While the government was greatly concerned about the welfare of the victims, it was equally concerned about retaining its legitimacy and preventing political fallout. Repeatedly these two concerns came into conflict.” (Shrivastava 1987, 95) Regulatory failure undoubtedly contributed to the explosion at the Union Carbide factory. Faced with that fact, the ruling party at the time strategically tried to assign as much blame as possible to the corporation, so as to paint the government as “morally representative of the victims’ interests.” (Shrivastava 1987, 97) To do this, the government established almost complete control over all information, data, and research compiled regarding the disaster, gradually releasing the results to influence certain events. (Shrivastava 1987) More than anything, the government used the information to portray Union Carbide as entirely responsible for the accident and unresponsive to the needs of the victims. With the assumption of all legal compensation claims under the Bhopal Gas Leak Disaster Act, the government asserted even more total control over the unfolding crisis narrative.

Additionally, specific recovery programs were often implemented as a political ploy. Following legal rulings, monetary compensation for damages resulting from the MIC gas could only go to people in “gas affected areas”—except there was no established medico-legal definition of the term. In 1991, the ruling party decided to award interim compensation to people living in “gas affected areas.” That same year, seven years after the original accident, local officials expanded the number of wards classified as “gas affected” in hopes of picking up additional votes. Significantly higher numbers of people received compensation and “as a result, the nature of the Bhopal crisis was profoundly changed. Victims were no longer defined by scientific standards of medico-legal documentation, but by political considerations. They became an economically advantaged category, instead of aggrieved and injured individuals.” (Shrivastava 1996, 139) In defining victims geographically rather than medically, the government also awarded damages to vast populations of migrants into affected wards, thereby compensating people who in actuality were not directly affected by the gas leak at all (Shrivastava 1996).

The closure of the Union Carbide plant eliminated a significant source of local employment and earning capacity for gas leak victims, causing the local economy in Bhopal to drastically decline. Following the accident, the government implemented a few unsuccessful economic development programs, including providing initial compensation for deceased family members, job-placement assistance, and job-training centers for non-strenuous and non-skilled trades (Shrivastava 1996 and Vivek 1990). Unfortunately most programs were underfunded or too limited in scope to make any lasting improvements. Economic repercussions from the event are still felt in Bhopal today.
In light of the government’s unsatisfactory recovery efforts, many independent social and
ingovernment organizations stepped up to provide aid and services to victims as well as actively
protest for sustained (and improved) government interventions (Shrivastava 1987 and Vivek 1990).
Most remarkable about the civil organizations in Bhopal is their persistence and perseverance. As early
as 1985, victims and activists demonstrated against insubstantial relief efforts. Twenty years later,
Bhopali protestors inspired the Indian Supreme Court to force Madhya Pradesh to supply fresh drinking
water to the citizens of Bhopal (Brown 2009). Unsatisfied with the government’s progress,
demonstrators marched again in 2009 to secure clean water. Despite three decades of disappointments
and the best efforts of Union Carbide to direct attention away from the incident, the people affected
by the gas leak in 1984 continue to fight for their rights and to hold those responsible accountable for their
actions.

_Bhopal as a Corporate and Legal Nightmare_

By far, the greatest obstacle to Bhopal’s recovery has been Union Carbide’s failure to assume
responsibility for the disaster. Immediately after the disaster, the corporation focused its efforts on
distancing itself from the accident. The main tactic was to shift the blame directly onto their subsidiary
company: Union Carbide India Limited. Union Carbide argued that since UCIL built, managed and
operated the plant, culpability for the accident belonged entirely to the Indian directors of the plant,
despite majority ownership (50.9%) belonging to the parent company (Browning 1993). Denying the
“speculation” that the tragedy was caused by management failures and faulty equipment, in 1986 Union
Carbide formally filed a court document concluding that: “the cause of the disaster was undeniably
sabotage (Browning 11).” In the ensuing legal battles for liability claims, Union Carbide built its defense
around this claim, despite zero arrests or criminal investigations into the unidentified ostensible
“disgruntled employee.” Evidence supporting this version of the events came from questionable
interviews with unnamed former workers many years after the incident, and failed to explain the other
simultaneous equipment failures that contributed to the scope of the accident (Shrivastava 1996). Yet,
three years after the event, sabotage remains the official explanation for the “unfortunate accident” in
Union Carbide publications; an official statement from Union Carbide Bhopal Information Center asserts:

_Shortly after the gas release, Union Carbide launched an aggressive effort to identify the cause.
 Engineering consulting firm, Arthur D. Little, Inc., conducted a thorough investigation. Its
 conclusion: The gas leak could only have been caused by deliberate sabotage. Someone
 purposely put water in the gas storage tank, and this caused a massive chemical reaction.
 (Union Carbide 2013, “Statements”)_

With this defense, Union Carbide refused to voluntarily assume legal liability for the accident, a decision
that spurred decades of complicated litigation, deferred compensation payments for victims of the
accident, and inhibited a smooth recovery process for the city.

The highly technical Bhopal-related compensation litigation involved enormous stakes. After the
Indian government assumed responsibility for all claims, the case wound its way through a series of
courts, crossing continents and jurisdictions for four years. The two main legal questions at hand were
over the amount of compensation owed by Union Carbide and the exoneration of the company from
any future liabilities. After a brief stint in New York District Court, the case was sent back to the Bhopal
District Court, where it eventually wound its way up to the Indian Supreme Court in 1989. At this point,
the Supreme Court negotiated a settlement requiring Union Carbide to pay $470 million in
compensation and securing immunity from further persecution (Abraham and Abraham 1991). This verdict was appealed again in 1991 and the court sustained the monetary damages, but removed Union Carbide’s legal immunity. Eight years after the initial accident, victims of the disaster finally received some, albeit small, compensation for their causalities (Shrivastava 1996). The 1991 Supreme Court decision also prohibited further personal injury suits resulting from this specific incident. However, claims regarding property damage due to contamination have still been heard in court up through the settlement of Sahu v. Union Carbide Corp. in US appellate court as recently as 2013 (Union Carbide 2013, “Chronology”).

Changes in ownership of the Bhopal factory and the original company further complicated matters. In 1994, Union Carbide sold its ownership of UCIL, thereby releasing itself from future liability. In 1998, the land leased by UCIL to build the factory was returned the state government in Madhya Pradesh, again shifting the legal liability for future litigation (Union Carbide 2013, “Chronology”). Additionally, in 2001, Union Carbide became an official subsidiary company of Dow Chemical, which again complicated the question of liability. In subsequent court cases and demonstrations, victims demanded damages from Dow Chemical, holding the chemical giant liable for the original pollution of its subsidiary (Union Carbide 2013, “History”). Union Carbide became a subsidiary to Dow Chemical, after “the Bhopal disaster slowly but steadily sapped the financial strength of Union Carbide and adversely affected its morale and productivity.” (Shirvastava 1996) In a sense, one can also see Union Carbide as a victim of the gas leak.

Recovery Processes in Comparative Perspective

Reviewing the long-term recovery efforts in response to the two disasters, sharp differences emerge between the cases of Seveso and Bhopal. Seveso is generally regarded a successful recovery from a major industrial crisis; Bhopal on the other hand, is not. This comparison suggests several broader implications for the handling of major industrial accidents.

Successful long-term recovery includes (or should include) four components:

1. **Plan for extensive decontamination of the industrial disaster site and surrounding community**

In Seveso, the responsible party and the local authorities collaborated on a long-term community decontamination program that removed, monitored and cleaned up materials around the area over a four and a half year period. Decontamination of the zones surrounding the plant was expensive and slow, but also prevented the same kind of extended exposure to the chemicals through the environment that occurred in Bhopal. By taking the time to fully decontaminate the community, the Seveso recovery efforts minimized extended health effects, and prevented future litigation, unlike the brief neutralization efforts by Union Carbide.

The degree of community involvement and honesty in public communication also proved crucial to the decontamination process. In Seveso, decisions to dispose of the waste by incinerator provoked massive community protests, and caused authorities to examine other solutions that were much more positively received by the community. Public involvement in the disposal process increased transparency and community ownership in the recovery process, both of which are important to rehabilitating disaster sites. Along with transparency, the decontamination process required honesty by government officials. The mysterious disappearance of the Seveso barrels and the failure for Union Carbide to
disclose information about chemicals released in the toxic cloud impeded the recovery process and built distrust, both things to avoid in the future.

2. *Comprehensive long-term monitoring and evaluation studies to assess public health and safety*

Extensive and organized studies of the victims and environment not only help inform medical practices, legal compensation claims, and policy in response to the disasters, but they also assist the scientific and industrial community in assessing the potential health consequences of toxic chemicals. Due to their toxicity, experimental research on the health effects of the chemicals released in these gas clouds cannot be done for ethical reasons. Therefore the only substantial information gathered on these compounds occurs as a result of accidents like these. In both incidents the scientific, medical and industrial communities were able to track the health of the environment and affected individuals to better understand how to improve the health response and future regulatory policy. In comparison to Bhopal, authorities in Seveso established much more thorough, organized and legitimate monitoring and evaluation processes, including an expert third party panel to assess the findings. Officials did not meticulously gather or review information in Bhopal, which further complicated the recovery process.

3. *Inevitable civil and criminal litigation*

Following both explosions, various constituencies rushed to assign responsibility for the accident and punish those found responsible. In both cases, this involved civil and criminal litigation. In Seveso and Bhopal, the state found the corporations primarily responsible for the disasters and demanded reparations—either through primarily out-of-court settlements (Seveso) or extensive legal battles and a court mandate (Bhopal). Once the private company had been established as responsible, authorities involved in both accidents brought criminal lawsuits against the directors of the corporations for criminal negligence and culpable homicide. In both cases, the companies were convicted of negligence and individuals were held legally responsible for corporate noncompliance (Roche 2006, Brown 2009, and Dodds Frank 2010).\(^1\)

4. *Community redevelopment and rehabilitation programs*

Disaster by its nature is inherently disruptive, generating death, injury, fear, job loss, damage to infrastructure and basic services, migration, and social upheaval. Seveso and Bhopal were no different and thus major components of their recovery processes were social and economic development programs. Additionally, for both Seveso and Bhopal, memorializing the disaster was helpful for the victims, although this has taken different forms. With the “Bridge to Memory” project, establishment of the Seveso Archives, and memorial walkway through the nearby woods, the residents of Seveso removed the physical remains of the factory, and built a new way to remember the story of the disaster. Bhopal has been less formal in its remembrance of the destruction. For some, the physical remnants of the factory serve as a sufficient memorial (Brown 2009), for others, the construction of a memorial statue in the city helped preserve the narrative of the events. In both cases, establishing a tribute to the disaster facilitated the overall recovery process.

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\(^1\) A June 2010 ruling convicted seven UCIL executives of criminal negligence, sentencing them each to two years in prison. Yet despite these convictions, widespread public support remains for the extradition and imprisonment of Warren Anderson, CEO of Union Carbide at the time of the accident. In 2002, a warrant was issued for Anderson’s arrest and appearance in Indian court, but extradition efforts have been unsuccessful to date.
Identifying responsibility is crucial to recovery.

According to Paul Shrivastava, in Bhopal, “the consequences of the accident stretched around the globe...and have continued to exert their effect month after month, year after year. Attempts to deal with the consequences have been marked not by sympathy and support, but by conflict and controversy (Shrivastava 1987, 63).” Seveso on the other hand, with its clear liable party, has been largely considered a successful, smooth recovery. Crucial to the difference in the two disaster stories is the clear identification of a responsible party and then cooperative reparation on behalf of that party. In Seveso, ICMESA, and its parent companies Givudan and Roche voluntarily assumed responsibility for the disaster fairly quickly after the explosion, leading to a simplified settling of injury claims and a quicker, more comprehensive and cohesive response to the disaster. In Bhopal on the other hand, the expensive and complex litigation necessary to establish Union Carbide as liable diverted attention and resources away from recovery efforts for the thousands of people affected by the gas leak. Identifying one clearly liable party streamlined the recovery process in Seveso, hastening a progressive recovery. Complications with liability in Bhopal dragged on for years, and consequently left decontamination efforts incomplete, limited resources available for social programs, delayed the distribution of monetary compensation, distracted both the government and the media from the suffering of victims, and prevented victims from receiving timely closure following the event. Thus, the clear identification of one responsible party encourages a faster and more efficient recovery from accidents.

Timing—everything takes longer than expected.

In responding to the crisis, recovery takes a long time. Compensation payments can take years, if not decades, after the accident itself. Repercussions for local economic and social stability are felt long after the event itself and loose ends of unfinished litigation drag on and on. In both Seveso and Bhopal, the municipalities continued to confront the process of recovery efforts twenty-five years after the original disaster.

The lingering and unfinished nature of these industrial crises also has significant consequences for the social and cultural attitudes toward the disaster. As time goes on, direct victims of the accident become frustrated and discouraged by the slow pace of recovery, while the attitudes of those not affected become increasing aggravated by the drawn-out proceedings. For them, “the disaster became a nuisance. It was a source of political conflicts and economic decline...they preferred to forget about the accident and move on with their lives (Shrivastava 1996, 133).” These conflicting attitudes amongst city residents further inhibit meaningful recovery as the unfinished business of the disaster drives residents apart. Responding to and recovering from an industrial disaster does not happen in a matter of weeks or months; it takes years and decades. This slow-moving process is echoed in the policy process as regulators write and revise legislation for years after the disaster in hope of preventing the same kind of devastation from happening again.

IV. Longer-Term Policy and Regulatory Response

The massive scale of the accidents in Seveso and Bhopal dramatically increased public awareness of the issues involved with chemical safety both locally and internationally, and caused regulatory authorities and government officials to overhaul chemical regulations on both a local and
international level. From the wreckage in Seveso came the Seveso Directives, a series of regulations and guidelines first established by the European Economic Community (EEC) in 1982 to better protect the environment and largely to equalize the regulatory burden on industry across European Community (EC) member states. The ashes of Bhopal likewise gave way to a major overhaul of chemical regulation, particularly in India and the United States. In India, new environmental regulation materialized from legislative action on behalf of the national parliament and judicial activism by the Indian high courts. In the United States, the Bhopal disaster and subsequent smaller accidents on American soil led to substantial regulatory revisions and an entire new regulatory body to analyze industrial safety, the Chemical Safety and Hazard Investigation Board. These accidents may have served as the major catalysts for policy change, but they did not occur in isolation. Rather, the disasters built upon on-going discussions about chemical safety and hazard management and served as the tipping point for brewing regulatory shifts.

**Regulatory Change in the European Community—The Seveso Directives**

Prior to the creation of the Seveso Directives, each EC member state had its own rules for managing industrial safety, which subjected industries to regulatory obligations of varying stringency (De Marchi et al 1996). To attract industrial development, states competed to reduce regulatory burdens, causing a general race-to-the-bottom in industrial safety rules. This was exacerbated on the municipal level, as competing jurisdictions imposed different regulations on industrial actors. Confusing, ineffective, and inconsistent regulations in Seveso contributed significantly to the causes of the disaster.

In the 1970s, a series of industrial accidents throughout European Community ignited urgent discussions about establishing a new EC-wide regulatory framework for industrial and environmental safety (De Marchi et al 1996). In the early 1970s, coordinated environmental protection efforts were introduced through Article 100 of the EEC Treaty. Article 100 granted the EEC authority to organize and synthesize environmental legislation only so much as the environmental issues affected competition and trade between member states. This Article was first used in an ecological context in 1972, when the EEC’s first Environmental Action Plan (EAP) declared that “economic expansion, which is not an end itself, must give priority to reducing the disparity in living and working conditions...special attention shall be placed on values and spiritual goods, as well as the protection of nature” (Pozzo 3). The most important objectives of this action plan included: the prevention, reduction and containment of environmental damage, the conservation of an ecological equilibrium, and the rational use of natural resources (Hey 2005). Within this new eco-friendly framework, several disasters occurred that furthered the green policy movement within the European Community. These accidents included explosions at chemical plants in the UK (Flixborough 1974), The Netherlands (Beek 1975), and Italy (Seveso 1976). Together, these events shaped the dialogue about ecological conservation and industrial safety throughout the 1970s, eventually resulting in the adoption of the Seveso Directive by the EEC in 1982 (De Marchi et al 1996).

The environmental protection and industrial safety measures included in the Directive sought to address the risk factors that contributed to the European accidents. By requiring baseline standards for all Member States, the Directive attempted to remedy the regulatory race-to-the-bottom that contributed to the accident in Seveso and equalize the administrative burden throughout the European Community (De Marchi et al 1996). These baseline regulations were outlined in Articles 3 and 4, which instruct Member States to ensure manufactures take all measures necessary to prevent major accidents through the identification of existing hazards, adoption of appropriate safety measures, and
informational training for employees on safety risks and procedures (EEC 1982). The new requirements standardized the regulatory climates in each country, while addressing other factors that contributed to the Seveso disaster, including inadequate employee training, outdated equipment and insufficient accident management planning. The Directive also introduced the watershed “need-to-know” principle to EC legislation, a conscious response to the lack of communication between industrialists and communities that exacerbated the accidents in both Seveso and Felixborough (De Marchi et al 1996; Pozzo 2009). This principle recognizes the need for communities and factory employees to understand the potential hazards and proper safety measures involved in local industrial production. Under the Directive, firms in EC Member States had to submit regular reports to the state government outlining the use of dangerous substances, safe operating procedures, and detailed emergency action plans (EEC 1982, Art. 5). Once provided with that information, Article 8 directed Member States to ensure that “persons liable to be affected by a major accident” were “informed in an appropriate manner of the safety measures and of the correct behavior to adopt in the event of an accident (EEC 1982, Art. 8).”

This provision gave the government the responsibility to determine the “need” of the community and the scope of the information provided to the general public. Additionally, Article 10 required firms to report accidents to the authorities immediately and provide them with as much information as possible as soon as it becomes available—a pointed response to the “days of silence” resulting from ICMESA’s reluctance to disclose details of the accident to local officials (EEC 1982, Art. 10).

Aware of the need to review and modify legislation, Article 16 of the Directive outlines an amendment procedure and Article 18 requires the EEC to compile reports on the impacts of the Directive on Member States and accident prevention. This prompt for ongoing review opened the door for a series of revisions over the next several decades in response to calls for standardization, noncompliance by member states, and subsequent chemical accidents.
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<td>Outdated and unsafe equipment; inadequate employee training programs</td>
<td><strong>Article 4:</strong> &quot;...all manufacturers are required to prove to the competent authority at any time...that they have identified existing major-accident hazards, adopted the appropriate safety measures, and provided the persons working on the site with information, training and equipment in order to ensure safety.”</td>
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<td>Inconsistent regulatory standards among EC member states</td>
<td><strong>Article 3:</strong> &quot;Member States shall adopt the provisions necessary to ensure that...the manufacturer is obliged to take all measures necessary to prevent major accidents and to limit their consequences for man and the environment.” <strong>Article 20:</strong> &quot;Member States shall take the measures necessary to comply with this Directive at the latest on 8 January 1984.”</td>
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<td>Confusing and conflicting regulations between levels of government</td>
<td><strong>Article 6:</strong> Member States “shall set up or appoint the competent authority of authorities who...are responsible for” inspecting, monitoring, and enforcing the new regulations among manufacturers</td>
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<td>Failure to identify toxic substance and risky chemical processes</td>
<td><strong>Annex I, II, III:</strong> List of hazardous substances and chemical processes</td>
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<td>Failure to communicate risks and accident safety measures to local authorities and surrounding community</td>
<td><strong>Article 5:</strong> &quot;Member States shall introduce the necessary measures to require the manufacture to notify the competent authorities if...one or more of the dangerous substances listed in Annex III are involved or it is recognized that they may be involved.” <strong>Article 8:</strong> &quot;Member States shall ensure that persons liable to be affected by a major accident...are informed in an appropriate manner of the safety measures and of the correct behavior to adopt in the event of an accident.”</td>
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<td>Failure to promptly notify local authorities of the accident</td>
<td><strong>Article 10:</strong> &quot;As soon as a major accident occurs, the manufacturer shall be required to inform the competent authorities specified in Article 7 immediately.”</td>
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Standardization

One of the primary issues facing the EEC in the years following the passage of the Seveso Directive was the implementation of the new regulations across Member States. Article 15 of the Seveso Directive created the Committee of Competent Authorities (CCA) to oversee the implementation of the Directive throughout the European Community, which included over 3,700 establishments by 1996 (Pozzo 2009). However, as early as 1987 the ECC Council passed an amendment to the Directive to clarify and standardize the threshold levels for substances subject to increased monitoring under the policy. The amendment required Member States to comply with the legislation within 18 months and then submit a report detailing the new provisions enacted for compliance (EEC 1987). Over time, the volume and variance of the reports submitted to the CCA for review led to another amendment to the Directive enacted in 1991. This amendment standardized reporting on the implementation of directives related to the environment in an attempt to make reports more complete and consistent, mandating that Member States report every three years on their compliance with a variety of environmental directives (EEC 1991; Pozzo 2009).

Subsequent Disasters

Within a year of the first amendment, the ECC passed a second amendment to the Directive in response to a series of storage tank explosions in the early 1980s, including the accident in Bhopal, the San Juanico gas explosion in Mexico City, and most significantly, the Sandoz warehouse fire and chemical spill in 1986 (De Marchi et al 1996; Pozzo 2009). The Sandoz accident was caused by a fire in an agrochemical storehouse in Basel, Switzerland, which caused the release of toxic chemicals into the air and into the Rhine River, ultimately killing massive populations of wildlife downstream. This amendment, passed in 1988, included new regulations for the storage of dangerous substances and required Member States regularly and actively inform the general public of potential hazards, safety measures, and accident procedures presented by local industrial firms (EEC 1988). The urban nature of the accidents in Bhopal and Mexico City prompted the Council of the European Community to issue a resolution in October 1989 calling for regulatory action on urban land-use (EC 1996). An amendment to 82/501/EEC in this regard was never enacted, but new standards for incorporating land-use planning did figure prominently into regulations under the “Seveso II” Directive.

Noncompliance and New Industrial Practices Spur “Seveso II” Directives

While standardization efforts and subsequent disasters prompted amendments to the original Directive, it was ultimately noncompliance by member states and new developments in environmental policy and risk management that eventually compelled the EEC Council to amend the entire law by passing the “Seveso II” Directive in 1996. The original Directive presumed full implementation by Member States by January 8, 1984. However, upon review, a 1988 report published by the ECC revealed that all but two Member States—France and Denmark—missed the deadline or failed to adequately implement the Directive’s standards. As outlined in the report, the EEC Commission had initiated numerous proceedings against Member States for failure to fulfill their obligations under the legislation. Implementation varied between nations, with most charges against states dropped following eventual compliance. In two cases, Spain in 1994 and Italy in 1997, the Commission was obliged to intervene regarding infringements of the Directive and related implementing legislation (Pozzo 2009). Following the substandard execution of the Directive, the EEC Council’s Fourth Environmental Action Plan “highlighted the need for more effective implementation of Directive 82/201/EEC and called for a
review of the Directive to include, if necessary, a possible widening of scope,” (EEC 1996) reflecting both the challenges of implementation and the shifting risk management framework of the late 1980s.

Drafted in 1987, the Fourth Environmental Action Plan reflected a major shift in how the EC saw the industry and the environment. The EAP observed that:

...the context has again changed. It is no longer seriously contested that environmental protection policy has a central part to play in the whole corpus of Community policies and that environmental protection needs to be taken into account as a fundamental factor when economic decisions are taken. Continuing — and in many cases growing — problems of environmental deterioration have convinced the Commission that the establishment of strict standards for environmental protection is no longer merely an option; it has become essential...High standards of environmental protection have thus become imperative—and an economic imperative at that (EAP 1987, 7).

The fourth EAP and subsequent fifth EAP called for stricter EEC policies that addressed the interconnectedness of environmental, industrial, and social concerns, both within state boarders and across them (EAP 1987; Hey 2005). Under this new framework that integrated environment, risk management and industrial practices, the EEC considered the original Seveso Directive insufficient, prompting leaders to propose new legislation to replace the first directive with “Seveso II.”

The “Seveso II” Directive Incorporates Lessons Learned and On-going Conversations

Enacted in 1996, Council Directive 96/82/EC outlined a series of new priorities for the management of European industrial risks and environmental policy. Rather than simply amending the original Seveso Directive, the Council chose to institute an entire new policy, providing for a total repeal of the original Directive within two years (Pozzo 2009; EC 1996, Art. 23). This new Directive articulated two basic goals: first, to prevent major accidents involving dangerous substances, and second, to limit the consequences of these accidents for man and the environment (EC 1996, Art. 1). In framing the new legislation, the Council drew heavily upon experiences with accidents throughout the preceding decade, citing conditions affecting the accidents in Bhopal, Mexico City and others reported to the European Commission, as justification for the changes in policy (EC 1996, recitals 4 & 15).

As discussed previously, the disaster in Bhopal resulted from an accidental chemical reaction that caused the production of the lethal methyl isocyanate, along with managerial failures that created the unsafe working conditions that led to the disaster. Reflecting an improved understanding of these risk factors in the post-Bhopal era, the new Directive expanded the scope of the legislation from specific types of industrial installations, to “establishments where dangerous substances are present,” thereby extending the jurisdiction of the Directives over a much broader range of industrial activities, including the storage of toxic chemicals and “the actual or anticipated presence of [dangerous] substances, or the presence of those which it is believed may be generated during the loss of control of an industrial chemical process (EC 1996, Art.2).” The new Directive also grew to encompass worker health and safety, recognizing that “the majority of [major accidents] are the result of managerial and/or organizational shortcomings (EC 1991, Recital 10),” and drafted subsequent regulations to ensure manufacturing firms “take all measures necessary to prevent major accidents and to limit their consequences for man and the environment (EC 1996, Art. 5).”
Reacting to the tragic death tolls in urban centers like Bhopal and Mexico City, the Seveso II Directives required member states to incorporate considerations of industrial geography and an approach to hazard analysis known as “the Domino Effect” into risk management strategies. The Domino Effect emphasizes that dense concentrations of establishments may increase the likelihood or potential consequences of an accident, and therefore under the new Directive, member states must incorporate proper land-use planning into risk management frameworks to maintain appropriate distances between industrial and residential areas and reduce the size of communities at risk (EC 1996, Art. 5 and 7).

Some aspects of Seveso II were not so much direct responses to learning from the chemical accidents around the world, but rather an extension of the broader, on-going conversations about the environment and risk management in Europe throughout the early 1990s. A pivotal element here was the expansion of information sharing and public participation in the formation of environmental and risk policies. Several provisions of Seveso II specify how and how quickly information should be distributed to different stakeholders (Pozzo 2009; EC 1996), building on the existing principle of “need-to-know” legislation. Additionally, the new Directive allowed for the general public to influence environmental policies. Under Article 13, Member States were required to allow for public comment on the planning for new establishments, modifications to existing establishments covered by the Directive, and developments around such existing establishments (EC 1996, Art. 13). This emphasis on increased public participation and a consensus-orientated approach to environmental policy had already been included in the EC’s Fifth Environmental Action Plan, and reflected a growing trend in EC policy (Pozzo 2009; Hey 2005).

Seveso II: Amended, Critiqued and Replaced with Seveso III

In the early 2000s three additional major chemical and industrial accidents rocked the European community, prompting a 2003 amendment to the new directives. Together, the cyanide spill in Baia, Romania (2000), the “fireworks accident” in Enschede, The Netherlands (2000), and the deadly explosion at a fertilizer plant in Toulouse, France (2001), motivated the European Parliament and the Council of the European Union (CEU) to once again extend the scope of the Seveso Directives (CEU 2003, Recitals 2-6). The under Article 1 of the amendment, the Directive now had authority over:

- (a) the exploitation (exploration, extraction and processing) and storage (if involving dangerous substances) of minerals, and
- (b) disposal facilities containing dangerous substances including tailing ponds or dams and waste land-fill sites (CEU 2003)

Despite further criticism, this 2003 amendment was the only major change to the legislation until the EC adopted the Seveso III Directive in 2012. In the years following the 2003 amendment, many critics of the Directive argued that the legislation did not do enough to satisfy its original goal of a harmonized European policy for industrial hazard management (Kirchsteiger 2005; Pey et al 2009). The Directive gave each Member State wide leeway to define and implement the provisions of the legislation, avoiding prescriptive guidelines or specific standards to follow. In the absence of clearly-defined methodology, and Europe-wide risk thresholds, Member States developed very different approaches for risk assessment (Kirchsteiger 2005; Pey et al 2009). With different approaches, Member States applied unequal regulatory burdens to industrial firms across borders, creating “countries/regions where practice for the implementation of Seveso II is less restrictive than elsewhere.” (Pey et al 2009, 58) Thus,
in proposing improvements to European industrial and environmental policy, critics called for the standardization of assessment methodology to harmonize implementation throughout Europe (Kirchsteiger 2005; Pey et al 2009). Responding to these critiques and the notion that the impact of accidents “can extend beyond national borders,” the Seveso III Directives are much more detailed than the previous iterations, outlining specific procedures for the risk assessment of dangerous substances (Art. 4), information exchanges (Art. 21), the incorporation of land-use planning (Art. 13), and the reporting of accidents, including near misses (Annex VI). Article 24 of the new Directive also allows the Commission to “develop guidance on safety distance and domino effects” if need be.

Similar to the previous Directives, “Seveso III” derives both its authority and its name from previous accidents. The recitals of the legislation cite decades of previous accidents and their consequences as inspiration for the new guidelines, justifying the evolving legislation as protection from another Seveso, Toulouse, or Enshede (CEU 2012). The Directive’s informal title, “Seveso III” serves as a constant reminder of what did happen forty years ago, and what could happen again if the EU fails to protect its citizens and its environment. Four decades after the original accident, it is clear the ICMESA explosion in Italy continues to shape European environmental and industrial policy. The new Directive will officially repeal and replace Seveso II on June 1, 2015.

Emerging Environmental and Process-Safety Law in India—Legal Repercussions of Bhopal

The accident in Bhopal had profound repercussions on the legal and regulatory systems throughout India and prompted major regulatory revisions over the course of the next twenty years. The explosion itself exposed major deficiencies in the existing regulatory framework for hazard and risk management and revealed the dramatic impact of chemical operations on the local environment. In the ensuing decades, India’s policy toward the environment and industrial risk was propelled forward by two types of regulatory revision: legislative action and judicial activism.

At its heart, the legislative response to Bhopal was primarily a process of revision, rather than creation, as the accident exposed massive deficiencies in the existing laws regarding industrial risk management and environmental protection. Unlike the European Community, Indian legislators strove to reexamine and amend existing statutes rather than create an entirely new regulatory framework. For both industrial risk management and environmental protection, changes made to the regulatory structure largely fell into ongoing discussions and regulatory trends. Yet, similar to the European response to Seveso and the US response to Bhopal, regulatory change was driven partially, if not primarily, by a similar accident shortly following the major accident, in this case, the Shiram Foods gas leak one year later in Delhi.

Prior to the 1984 explosion, industrial risk and workplace safety were governed by the Workmen’s Compensation Act of 1923 and the Factories Act of 1948. The 1923 Act recognized factory workers regularly exposed to hazards as a community at risk, and implicitly held employers liable for workplace accidents. The Factories Act of 1948 outlined acceptable workplace conditions, but solely focused on activities inside the factories—the health, welfare and safety of those working within the factory walls. These two acts presided over industrial risk without major amendments until 1976, when the law expanded worker protections to reflect the rapid influx of chemical companies into India throughout the 1970s and new types of workplace risk (Ramanthan 2004).
Directly following the Union Carbide accident, the primary legislative response focused on victim relief and compensation with the passage of the Bhopal Gas Leak Act in 1985, not policy revision. However, on December 4, 1985, almost exactly one year after the Bhopal disaster, another factory exploded in Delhi, spreading toxic oleum gas throughout the comparatively wealthy city. While not nearly as deadly as the explosion in Bhopal, the second accident heightened the sense of urgency among policy elites, making industrial risk management and environmental standards to a top legislative priority (Ramanathan 2004).

After the two accidents, the Indian Parliament passed the 1987 Amendments to the Factories Act, which directly addressed some of the major contributing factors to the explosions in Delhi and Bhopal, including establishing stronger risk regulations, enforcing stricter penalties for noncompliance, and increasing corporate transparency with local communities and administrators. Tackling the need for tighter regulations and better enforcement, Parliament added Section 41A to the Factories Act which authorized states to create Site Appraisal Committees to screen corporate hazard and risk management plans prior to construction. This same section makes factories responsible for the creation of an internal Safety Committee and outlines specific emergency standards and maximum threshold limits for chemical exposure (Labor Department, Government of Delhi). This set of amendments further established new disclosure laws requiring companies to communicate hazards and emergency action plans with local communities before accidents occurred, thereby including the local population in the greater community at risk (Ramanathan 2004; Mannan 221). The Public Liability Insurance Act of 1991 further acknowledged this concern for nearby communities by explicitly making the owner of a factory liable for the death or injury of people outside factory in case of an accident.

Similar to industrial risk management, emerging environmental policy in the years following Bhopal also largely emanated from amendments to existing legislation and an overall trend toward more ambitious frameworks for environmental protection. Throughout the 1970s and early 1980s, Indian officials implemented a variety of new environmental protection measures including the Water Act (1974), the Air Act (1981), and the passage of a constitutional amendment that established the “fundamental duty” of the Indian government and citizenry to protect and improve the natural world (Bowonder et al 1994). However, the events in Bhopal and at Shiram foods generated considerable concern among the general public and policy-makers, and thus a platform for a more extensive environmental policy to fall into place. Beginning in 1986, Parliament enacted several pieces of legislation to bolster environmental protections.

The first of these statutes, the Environmental Protection Act of 1986, extended the Indian government’s authority to cover the regulation of hazardous materials, such as the toxic methyl isocyanate involved in the Bhopal disaster. The act established regulations for the handling, storage and transport of hazardous substances, and required firms to disclose information on the substances to government officials. Under this act, anyone authorized by the government can inspect a factory handling potentially toxic materials. Following the results of an inspection, the government can completely shut down a facility that presents a serious risk to the local community. Additionally, the act allows citizens to petition the central government and report violations by corporations or local agencies. In a direct response to the controversies surrounding liability following the explosion, the Environmental Protection Act permits senior corporate managers to be held personally responsible for violations of the law (Mannan 2005; Bowonder et al 1994). In 1989, the government further clarified its authority over hazardous substances with the passage of Hazardous Waste rules, which specified what constitutes a hazardous waste and requires firms to properly dispose of them. With these rules, the
government intentionally aimed to alleviate future expensive conflicts with the disposal of waste, similar to “Operation Faith” following the explosion in Bhopal (Mannan 2005; Bowonder et al 1994).

The next big pieces of environmental legislation in response to Bhopal came as amendments to the Air Act. Under the original law, a firm had to request permission from the State Pollution Control Board to pollute, but once it received consent, the government was unable to rescind its permit. In 1987, the Air Amendment Act permitted the government to revoke an industry’s ability to operate and emit pollutants following a failure to uphold regulatory standards—a central issue in the Bhopal case. In 1992, the Indian government further revised its environmental policies with the passage of Environmental Protection Amendments that mandated regular environmental audits of industrial firms and charged industries with reducing their environmental impacts (Mannan 2005; Bowonder et al 1994).

Together these legislative initiatives have substantially strengthened environmental policy in the wake of the Bhopal disaster. While Bhopal and regulatory scholars may continue to identify existing gaps or deficiencies in the environmental framework (see Bowonder et al 1994; Ramanthan 2004; Mannan 2005), it is clear that the disaster in Bhopal and the Shiram Foods explosion in Delhi forever reshaped India’s industrial and environmental policy through the legislation that sought to address policy shortcomings identified by the accidents.

In the years following the accidents in Bhopal and Delhi, the Indian regulatory frameworks for industrial risk management and environmental protection were also substantially shaped through innovation and activism by the Indian High Courts. According to risk scholars, Bowonder, Kasperson and Kasperson, “prompted in part by the Bhopal catastrophe and the massive suffering it induced, the judicial arm of the Government has taken a long-term view that mandates the curtailing of human activity resulting in serious or irrevocable environmental damage (Bowonder et al 1994, 78).” With that long-term view, the High Court took a very active and progressive role in developing environmental and industrial law, demanding new standards for corporate liability, community risk, and action by government regulators.

The courts articulated this new judicial activism not so much through cases directly involving Union Carbide or the incident in Bhopal, but rather through lawsuits brought in response to the Shiram Foods explosion in Delhi. In a series of cases referred to as the M.C. Mehta cases, the court directed the national government to establish national standards on the location of industrial plants, outlawed hazardous industries from operating within the city of Delhi, and created the judicial notions of “absolute liability” and “enterprise liability” which make individual owners and companies liable for the damaged caused by negligence or malpractice within their factories (Abraham and Abraham 1991; Bowonder et al 1994; Ramanthan 2004). These cases in the decade following the Bhopal and Shiram foods disasters marked the peak of the accidents’ influence on the Indian Supreme Court.

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2 See M.C. Mehta v. Union of India (1986). In this case, the court ruled that industrial risk cannot be completely alleviated even by adequate and thorough safety procedures; therefore the best option for the elimination of risk is to locate plants outside urban areas. The court then called for a national policy to govern the location and relocation of industry away from dense urban areas.

3 See M.C. Mehta v. Union of India (1996). Building on the ruling from the 1986 M.C. Mehta case, the Indian Supreme Court issued an order on July 8, 1996 to “stop functioning and operating in the city of Delhi,” effective on November 30, of that year.

4 See M.C. Mehta v. Union of India (1987). In this judgment, the court ruled that corporations in India handling dangerous substances have an absolute responsibility to prevent hazards and that this liability was not subject to any standard common law defenses.
Amendments, Agencies and Self-Regulation: The American Response to Bhopal

The American regulatory response to Bhopal built upon 25 years of environmental progress first initiated by the publication of Rachel Carson’s book *Silent Spring*. Throughout the 1960s and 1970s the US framework for environmental protection and industrial regulation expanded tremendously through the passage of the Clean Air Act (1970), the Occupational Safety and Health Act (1970), and the Toxic Substances Control Act (1976.) The progression of these acts reflects an increasing public awareness of the risks associated with hazardous chemicals. In the late 1970s, environmental catastrophes like Love Canal and the Valley of the Drums, pushed federal hazard management to the top of the national agenda leading to the passage of the Comprehensive Environmental Response, Compensation and Liability Act (CERLCA), or Superfund, in 1980.

Despite increasing public anxiety about the risks posed by inadequate regulation of the chemical industry, the Regan Administration refrained from passing further legislation until the 1984 accident in Bhopal, followed closely by the 1985 gas leak at the Union Carbide plant in West Virginia. These events generated a spike in public concern about the regulation of industrial risk. Spurring cries for action by public figures and citizens alike, the Union Carbide disasters served as the catalyst for major environmental change over the next decade. Addressing the widespread public fear that a disaster similar to Bhopal could happen in the United States, lawmakers largely abandoned the early Reagan Administration’s hands-off approach to environmental and industrial safety regulation in favor of more comprehensive protections. The reshaping of American process safety and environmental policy after Bhopal was implemented through a series of reauthorizations and amendments of existing legislation, the creation of new administrative agencies, and emerging self-regulation by the chemical industry (Willey et al 2005).

Within the first few years after the Bhopal accident, the American government adopted a series of regulations and legislative frameworks that largely echoed the changes in Europe and India. Eleven months after the accident in Bhopal, the EPA released a list of 400 acutely toxic chemicals found throughout the country that could pose a serious health risk in the event of their accidental release into the atmosphere, similar to the lists of hazardous chemicals released by the EC and the Indian government (Stammer 1985 “EPA Unveils Plan on Chemical Accidents”). In 1986, President Reagan signed into law the Superfund Amendments and Reauthorization Act (SARA) and the related Emergency Planning and Community Right-to-Know Act (EPCRA). The Superfund Amendments required industrial plants that produced or used chemicals to make public any information on possible related threats to the surrounding communities. Similarly, under EPCRA owners or operators of industrial facilities had to prepare Material Safety Data Sheets (MSDS) for hazardous chemicals under new OSHA regulations. These MDSDs must be submitted to each state’s emergency planning committee, emergency response commission and the local fire department. Together, these acts solidified the principle of a community’s “right-to-know” about the day-to-day hazardous risks posed by nearby industry. Building on this principle, the EPA created its Toxic Release Inventory in 1987, which compiled mandatory annual data on chemical releases into the air, water, and land, by plants throughout the country (Willey et al 2005).

While EPCRA and SARA focused primarily on publicizing information on hazardous risks and establishing emergency plans, legislation passed under the 1990 Clean Air Act Amendments expanded the regulatory focus to chemical process safety, accident prevention, and the minimization of consequences following a disaster. Directly responding to the industrial risk factors that contributed to the Bhopal disaster and similar smaller explosions in the United States, the CAA Amendments established a uniform process safety standard to protect employees from accidental releases of
dangerous chemicals and required employers to create and implement accident prevention programs and risk management plans, including worst-case release scenarios. Under the CAA Amendments, the emerging framework for the management and prevention of industrial risk was primarily shared between OSHA and the EPA, with OSHA primarily overseeing onsite risk and the EPA regulating external risk to the greater public and the environment. This distribution of regulatory responsibility required significant coordination between the two agencies and sometimes resulted in conflicting regulations—what may be adequate for worker safety (OSHA) might be dangerous for the public (EPA), or vice versa.

The CAA Amendments also established a new independent agency, the Chemical Safety and Hazard Investigation Board (CSB). Modeled after the National Transportation Safety Board (NTSB), the CSB was created to investigate industrial accidents and issue safety recommendations to manufacturers, industry associations, and regulators. While the CSB has no formal authority to enforce its recommendations, the board does have the obligation to investigate all contributing factors to the accidents, anything from faulty machinery to faulty regulations. The independence of the CSB confers impartiality on the board’s investigation process, something industry leaders claimed was missing in the previous regulatory framework (Willey et al 2005; Joseph 2005; Free and Preston 2014).

Yet, despite the best of intentions with the CSB, the organization has struggled to prove effective in the years since its inception. The board initially got off to a rocky start as it failed to become operational until 1998, eight years after the Clean Air Act Amendments authorized its creation. This initial setback prevented the board from fully integrating into the emerging post-Bhopal process safety framework until long after the chemical industry and regulators had established the new system. Leadership failures, institutional incapacity, jurisdictional disputes, and high employee turnover have continued to plague the CSB since it finally opened its doors, constraining the organization’s ability to constructively impact and shape the chemical process industry.5

The explosion in Bhopal had a profound impact not only on American legislators, but also on the chemical industry itself. Responding to the accident, the two major American trade associations for chemical manufacturing significantly redesigned process safety internally within the chemical industry. The first major development was the creation of the Center for Chemical Process Safety (CCPS) in 1985. The CCPS was founded by the American Institute of Chemical Engineers (AIChE) to bring together manufacturers, government officials, academics, and other industry experts to study ways to improve process safety. Since 1985, the CCPS has published more than 100 guidebooks, manuals, and university curricula on how to safely manage, operate, and improve process safety in manufacturing plants, and has “evolved into a widely respected source of knowledge and expertise in the area (Hood 2004, A354).” Growing from seventeen original charter companies to over 100 member corporations today, the CCPS regularly hosts international conferences and has become internationally renowned for its work (Willey et al 2005; CCPS 2014). The second major industry initiative was launched in 1988 by the Chemical Manufacturers Association (CMA), now the American Chemistry Council (ACC). The ACC’s Responsible Care program remains the industry’s first attempt at self-regulation without sanctions. The ACC is one of the oldest and most prominent chemical manufacturing trade associations in the United States. Recognizing the need to reshape the image of the chemical industry following Bhopal and the series of other chemical accidents throughout the 1980s, the ACC (then CMA) brought Responsible Care to the US from Canada, where it had been in operation since 1984. Responsible Care outlines a series of guidelines that all ACC member companies are required to adopt. The “guiding principles” of the program define a series of broad objectives for management practices, environmental concerns and community

5 For more information about the CSB, see Free and Preston 2014.
interaction (King and Lenox 2000; Hood 2004). The ACC credits the program for dramatic reductions in workplace accidents, toxic releases and greenhouse gas emissions (ACC Fact Sheet). Over the years, the program has been criticized by some for its minimalist goals and lax enforcement, yet supporters of the initiative view Responsible Care as a model for ethical business practices and positive, rather than punitive, self-regulation (Hook 1996; King and Lenox 2000; Hood 2004).

V. The How and Why of Regulatory Revisions: Patterns in Crisis Response

As discussed in this report, the chemical disasters in Seveso and Bhopal have had powerful and lasting impacts on the regulation of risk not only in their own local communities, but around the world. These two disasters inspired and shaped many of enduring regulatory frameworks for chemical risk. Thus a close examination of policy responses to these accidents can inform future risk regulation frameworks, especially when policy-makers confront analogous crises. Several themes emerge from responses to chemical accidents – their role as catalysts for regulatory change; the significance of timing and the salience of subsequent accidents; and the importance of the affected population in shaping the extent of policy responses.

Accidents as Catalysts

Rather than isolated incidents that sent industrial risk management enlightenment down from the heavens, the accidents in Seveso and Bhopal served as important catalysts in on-going conversations about hazard management, environmental concerns, and chemical safety. For many years prior to the accidents, scientists, scholars and government officials had begun to focus their efforts on improving workplace safety and environmental protection, but often lacked the political capital or public will to raise the highly technical issues involved in industrial process safety to a level which would garner enough support to create substantial policy change. In the wake of the disasters however, heightened public attention to the issue of process safety, allowed (or in some cases, forced) lawmakers to respond to public demands for action. With public attention finally focused on these issues, long-time proponents of process safety finally were able to realize many of the changes they had long been hoping to institute.

Timing, Policy windows and “regulatory half-life”

Following the disasters, the increased public attention on process safety and hazard management created a policy “window” of opportunity for legislators to create changes before the issue lost public salience. The metaphor of regulatory half-life is helpful here. Over time, public attention spurred by a major accident tends to fade, corresponding with a decrease in political focus and regulatory revision. Directly after the accidents in Seveso and Bhopal, public awareness was hyper-focused on the disasters, fueled by extensive media coverage of the event and the initial response in the first few weeks and months following the accident. As governments and corporations began to determine causation and initiate long-term crisis management proceedings, public attention to the accident settled and policy-making processes generates substantial reforms related to industrial safety and risk management.

Yet, even with the sharp lens of public attention, policy revision was by no means a process that happened overnight. In both Seveso and Bhopal, the full policy response to the disaster happened over
years and decades, not weeks or months. The majority of legislation following Bhopal was implemented in India by 1987, but it took lawmakers six years to finalize the new regulatory frameworks under the Seveso Directives and the Clean Air Act Amendments. More than a decade passed after the accident in Bhopal before the Chemical Safety Board finally opened its doors. The length of these processes, with a sharp spike in activity soon after the accident followed by a long drawn out series of subsequent legislation, closely reflects the general curve of public attention to the accident. Using New York Times coverage as a proxy for public attention, a search for “Bhopal” and “accident” after November 1984 shows a very distinct curve with the Times publishing 52 articles within the first month of the accident alone, 92 articles over the course of the next year, 53 articles in 1986, 16 pieces in 1988, and then only 5 articles in 1991. By 1998, the same year the CSB became operational, the search yields only 1 result. As shown in the figure below, newspaper coverage around the world replicates this trend, indicating the widespread decline in public attention to the accident over time.6

This waning of attention is described well by risk scholar Usha Ramanth, who argues that “judicial tolerance of risk and hazard appears to have grown with the increasing temporal distance from the Bhopal Gas Disaster,” due to a “re-prioritization that has occurred which can in part be traced to a fading institutional memory (Ramanthan 2004, 4524).” As the distance from the disaster increases, politicians and the public the accident loses its sense of immediacy and destruction, and consequently people become more complacent with regulations as other debates and issues gain prominence. However, as the legislative history of the Seveso Directives powerfully suggests, subsequent and reoccurring accidents can refocus public attention, reopen policy windows and drive further policy change as gaps in enforcement or regulations are exposed.

6 Results for this chart were taken from a Proquest Congression Historical Newspapers database search for terms “Bhopal” and “accident” in three newspapers, The New York Times, The Times of India, and The Guardian (UK). The search was constrained to contain only articles, editorials, and letters to the editor published after November 1984, through December 31, 2002.
Location and Affected Population Matter in Regulatory Change

While the accidents in Seveso and Bhopal captivated public attention and inspired substantial regulatory change, two other factors, proximity and the affected population, greatly influenced the path of that change. Geographic proximity to the explosion greatly shapes how nations respond to the accident. While Seveso was a significant accident in Europe, the accident had little to no noticeable effect on chemical process safety in the United States or India. In fact, the Italian accident largely shaped only European environmental and hazardous risk policy, and even then primarily within countries under the jurisdiction of the European Commission. As the largest chemical disaster in history, the Bhopal case did influence industrial regulation around the world, but in significantly different ways.

Because the Bhopal disaster occurred in India and had direct ties to American business frameworks, the accident had much more significant influence than an isolated event in these two countries. Lawmakers in the US and India specifically cited the disaster and its potential to happen again as the primary drivers of policy change. Even years after the accident, Senator Joe Lieberman advocated for the creation of a US chemical safety board, to prevent “another tragedy, a Bhopal on American soil,” from happening (Lieberman, 1989). In contrast, European policymakers analyzed Bhopal within the context of other international accidents to identify global accident trends. When referring to the Bhopal disaster, the Seveso II Directive only evaluates the accident in conjunction with the San Juanico explosion in Mexico City, drawing out what the accidents together suggest about the nature of industrial safety and how best to address these concerns (EC 1996). For example, Recital 4 of the Directive cites the two disasters as justification for its land use planning provisions, explaining that the accidents “demonstrated the hazard which arises when dangerous sites and dwellings are close together (EC 1996, Recital 4).” The different ways these regions interpreted the significance of the Bhopal disaster implies that the influence of a single crisis event is constrained by proximity. For residents of the United States and India, the Bhopal disaster was geographically and mentally close to home. This closeness caused the event to become the focus of regulatory change in these two countries, whereas European distance from the accident caused European policymakers to analyze the event in the context of greater trends.

The Bhopal case also strongly demonstrates the impact of location and population on policy. As Union Carbide is an American company, it makes sense that the American media and policy elites paid more heed to the Bhopal explosion than their European counterparts in 1984 and late 1985. However, as demonstrated by the December 1984 Congressional Hearings, the major cause of concern for Americans after Bhopal was the possibility of a similar explosion happening in the United States. Less than a year later, that public fear was partially confirmed as two Union Carbide plants in West Virginia experienced toxic leaks within the same week in August 1985. Touring the plants after the incident, US government officials at the EPA and OSHA identified several weaknesses that could be prevalent nationally and called for an improved national strategy for chemical process safety (Franklin 1985, “Federal Officials Question Credibility of Carbide”). The accidents in West Virginia confirmed Americans’ anxiety about the possibility of explosions in their backyard, and together with the magnitude of the disaster in Bhopal, showed the American public and regulatory state that changes needed to be made at home.

In India, while the Bhopal disaster led to massive public concern. Only after the oleum gas leak at the Shiram Foods factory affected wealthy residents of Delhi did lawmakers and the Indian High Court began to dramatically reshape industrial risk regulations. As Bhopal scholar Usha Ramanthan argues:
...the enormity of the explosion in Bhopal “paralysed parts of the apparatus—and even as disinformation, lack of information and unpreparedness aggravated the direct damage done to the disaster—the oleum gas leak, with the relatively limited extent of injury and loss, allowed an immediacy to enter the discourse. Where Bhopal showed up the vulnerability of the industrial shantytown, the oleum gas leak raised the spectre of the denizens of Delhi living under perpetual threat posed by hazardous industry (Ramanthan 2004, 4522).

Almost a year to the day after Bhopal, the oleum gas leaked showed the country that industrial risk could harm anyone at any time and pushed the country toward definite action and policy revision. The most influential court cases for industrial risk management stem not from the accident in Bhopal, but from the Shiram Foods leak; not from the residents of Bhopal’s urban shantytowns, but the wealthy and well-connected elites of the nation’s capital. In charting the impacts of the Bhopal disaster, it seems that the Union Carbide accident alone did not spur massive regulatory change. In both the United States and India, subsequent accidents identified a potential pattern of risk and brought a sense of immediacy to regulatory revision as the dialogue about disaster shifted from “look what happened to them,” to “look what could happen to us.”

The “What” of Regulatory Revision: Commonalities of Policy Change after a Chemical Disaster

In the wake of a chemical disaster, all of the factors discussed above can create the space for substantial revision of risk management and industrial regulatory policy, the next important question concerns the choice of specific policy responses. The examples of Seveso and Bhopal indicate that these resulting policies tend to be both reactive and preventative in nature. Learning from the specific conditions that contributed to each accident, the new policies proscribe a recipe to prevent those conditions from reoccurring in another industrial plant. As discussed previously, the articles of the Seveso Directives, EPCRA, SARA and the amended Factories Act all contain precise provisions to address mistakes that led to the accident in question.

These crises also inspired governments to create and experiment with new administrative agencies to address newly-identified concerns about chemical process safety. These new agencies created opportunities for policy entrepreneurship, which officials often squandered. Responding to the disaster in Bhopal, the Indian government established the state Site Appraisal Committees to prevent the construction of hazardous facilities near important population areas. With careful scrutiny and review prior to the construction of new facilities, these committees had the potential to shift the focus of hazard management toward a cooperative and preemptive, rather than reactive, regulatory framework (Bowonder et al 1994). Similarly, the United States Congress established the Chemical Safety and Hazard Investigation Board in response to the disaster in Bhopal, but failed to let the board develop with the other emerging regulatory frameworks (i.e. industry self-regulation under Responsible Care, revised worker safety standards under OSHA and environmental protections under the EPA). This prevented the CSB from coordinating an innovative framework for accident prevention and management, a problem exacerbated by leadership failures and a reluctance to collaborate with industry. In response to crises, governments often turn to the creation of new administrative agencies, but even sensible institutional designs do not necessarily generate innovative policy solutions.

Lawmakers also began looking internationally to stabilize industrial burdens across national boundary lines. This policy orientation especially emerged in the Seveso case, where one of the primary
goals of the European legislation was to create a unified standard throughout Europe and prevent states from having a competitive advantage for industrial firms. In a more complicated example, the judicial proceedings to resolve jurisdictional disputes in the Union of India v. Union Carbide case established that an American parent company was accountable under Indian law for the actions of its Indian subsidiary. With this ruling, the courts established more consistency for industrial firms across international borders (De Marchi et al 1996; Chopra 1994)

Another hugely significant policy innovation resulting from these crises was the expansion of recognized communities at risk. Prior to the explosions in Seveso and Bhopal, governments around the world generally defined the communities “at-risk” in the event of an industrial accident as entirely contained within the factory walls. Only industrial workers, and typically only those regularly working with toxic substances, received information about the risks associated with their jobs. These two accidents inspired major outward shifts in the drawing of societal risk maps, as governments eventually expanded industrial risk management frameworks to include the greater public surrounding the factory as a potential community at risk.

The primary method of expanding the social reach of risk assessment, involved the mandated sharing of information among firms, governments and nearby residents. An important distinction exists however between the “need to know” framework developed under the Seveso Directives and a community’s “right to know” under American regulations. Under the Seveso Directives, firms must furnish information regarding their industrial risks and crisis management plans to local governments. These governments then determine what the surrounding communities need to know in the event of an industrial crisis. In contrast, it is the right of American citizens to have access to information about the risks to their communities. Under EPCRA, all information submitted to the government by firms, unless protected by a trade secret claim, is publically available and government funding is available to help disseminate that public information to local residents. Both frameworks represent a significant innovation in public safety and risk management in response to crisis and reflect a more general move by regulators to include greater public participation in environmental and safety regulations (De Marchi et al 1996). Similarly, amendments to the Factories Act required corporate disclosure of information regarding potential hazards and mandated companies disseminate detailed emergency plans to both workers employed in the factory and the general public living around the factory (Ramanthan 2004).

In his book When All Else Fails: Government as the Ultimate Risk Manager, David A. Moss argues that the United States underwent a fundamental shift in risk management frameworks after the 1960s, from a period he calls “Security for Workers” to one referred to as “Security for All” (Moss 2002). Moss argues that from the early 1900s to the 1960s, the American risk management framework focused primarily on labor and worker safety, but starting in the 1970s, the American government dramatically expanded its risk management policies across a host of industries and potential hazards to focus on protecting consumers and citizens. In general, the global expansion of communities at risk beyond factory walls following the crises in Seveso and Bhopal seems to support Moss’s periodization, suggesting that, like expanding environmental protections and increasing public participation in policy-making, the paradigm shift for at-risk communities following these disasters reflected an already emerging international shift in ideas about the regulation of risk. The accidents in Seveso and Bhopal in the 1976 and 1984 thus served as the global catalysts for brewing change in the regulation of industrial risk.
VI. How Safe Are We?: Regulating Near-Misses and the Future of Industrial Risk

Despite all the policy entrepreneurship and regulatory revisions following these disasters, the resulting regulatory frameworks contain shortcomings. Accidents still happen; and while each accident opens up another window for policy revision, we do not live in a world without risk. As regulatory frameworks strive to achieve the seemingly contradictory goals of facilitating industrial growth and protecting workers and the environment, it is well agreed upon that “safe” does not mean “zero-risk” (De Marchi et al 1996). This is true of any major industry, not solely chemicals. But what separates the regulation of risk in chemical and industrial safety from that of industries like transportation is the ability to track accidents that almost happened -- the near misses of planes that almost collide, or trains that nearly derail.

In the absence of major accidents, it is challenging to determine the state of chemical safety. A lack of major explosions does not by itself indicate low levels of risk. Experts in risk management continually refer to the issue of near-misses, or events that could have potentially devastating consequences if just a handful of conditions had been different at the time. CSB toxicologist Gerald Poje, characterized the problem well in 2004, when he said “I wish somebody had a good solid finger on the pulse of chemical safety, but we really don’t have that in the [United States] right now (Hood 2004).” By contrast, the black boxes required for aviation safety tracks everything that happens in an airplane’s control system. If something goes wrong, it is recorded, even if the mistake or malfunction did not cause the plane to crash. To better understand the current state of chemical process safety, and to prevent catastrophic accidents like Seveso and Bhopal from happening again, the industry must find a way to incentivize firms to track and report their near-misses. Together with regulators and lawmakers, industry leaders must continue to find a better way to regulate risk and to understand near misses. Policy-makers need more information on how best to define “near-misses” in industries like chemical processing, or manufacturing, how to frame effective reporting standards, and how to structure information provision in order to spot significant trends. As the world becomes more globalized, we need to establish world-wide information sharing systems for near-misses and the regulation of multinational risks. As our world becomes increasingly more complicated, so too do the challenges associated with risk regulation.
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