Socio-economic Impacts of Hazardous Waste

Environmental Information System (ENVIS)

Ministry of Environment, Forest & Climate Change, New Delhi

Compiled by ENVIS-NEERI

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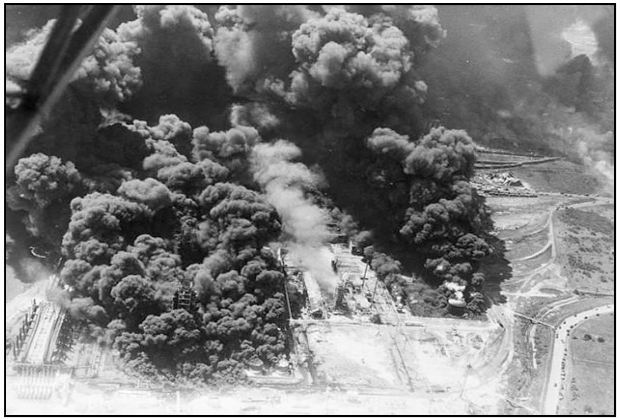
Sr. no	Incident	Date	Place	Description	Hazardous Material	Source
1	Arsenic-Contaminated Beer – England	1900	Manchester and Salford,	The epidemic occurred in the second half of 1900. It was centred on Manchester and Salford, but also affected Liverpool and other places. The true nature of the disease was not realised at first, as the victims were assumed to be suffering from alcohol-related complaints such as peripheral neuritis. Dr Kelynack of Manchester Royal Infirmary and William Kirkby of Owens College (i.e. the Victoria University, Manchester), published an account of the epidemic. Their book Arsenical Poisoning in Beer Drinkers dealt with the subject from the medical point of view, with full details of symptoms, treated under chap- ter headings and subheadings such as Manifestations in connection with the cutaneous system, Erythromelalgia, Nervous system, Motor impairment, Reflex disturbances, and so on, and also described some of the chemical tests made of the beers. The frontispiece was a photograph of a foot showing keratosis and erythema with pigmentation. 	Arsenic	http://www.breweryhistory.com/journal/archive/132/Death_in_a_beerglass.pdf

2	Texas City disaster	April 16,17, 1947		A fire discovered by stevedores preparing to resume loading of ammonium nitrate aboard the S. S. GRANDCAMP at Warehouse (Pier) "O", about 8 A. M., April 16, 1947, resulted in the first of two disastrous explosions at 9:12 A. M., April 16, 1947 which destroyed the entire dock area, numerous oil tanks, the Monsanto Chemical Company, numerous dwellings and business buildings. The second explosion resulted from a fire in ammonium nitrate aboard the S. S. HIGH FLYER which occurred some sixteen hours later at 1:10 A. M., April 17, 1947. Damage to property outside the dock area was widespread. Approximately 1000 residences and business buildings suffered either major structural damage or were totally destroyed. Practically every window exposed to the blast in the corporate limits was broken. Several plate glass windows as far away as Galveston (10 miles) were shattered. Flying steel fragments and portions of the cargo were found 13,000 feet distant. A great number of balls of sisal twine, many afire, were blown over the area like torches. Numerous oil tanks were penetrated by flying steel or were crushed by the blast wave which followed the explosions. Drill stems 30 feet long, 6 3/8 inches in diameter, weight 2700 pounds, part of the cargo of the S. S. GRANDCAMP were found buried 6 feet in the clay soil a distance of 13,000 feet from the point of the explosion. Only brief mention is made of the fire protection features such as automatic sprinkler systems and the fire department. The initial explosion disrupted the sprinkler systems and the water supply to them, destroying all of the fire equipment owned by Texas City and wiped out	Ammonium nitrate	http://www.local1259iaff.org/report.htm

				much of the personnel of the department who were endeavoring to extinguish the fire aboard the S. S. GRANDCAMP. The loss of life was high. All firemen and practically all spectators on their pier were killed as were many employees in the Monsanto Chemical Company and throughout the dock area. At this date, April 29, 1947, 433 bodies have been recovered and approximately 135 (many of whom were on the dock) are missing. Over 2000 suffered injuries in varying degrees, among whom were many school children injured by flying glass fragments and debris in school buildings located about 6000 feet distant. The loss of property excluding marine (which was not ascertainable) is estimated to be $35,000,000 to $40,000,000. Time for rebuilding the various docks, warehouses and the chemical plant is expected to take one to two years. 		

3	Minamata Disease –	1956	Japan	Minamata disease affects the nervous system and is caused by acute mercury poisoning. Symptoms include weakened muscles and impaired senses, and severe cases can result in madness, paralysis, coma and death. The syndrome was first recognized in 1956 in a small Japanese coastal city called Minamata. The source of the problem was the release of mercury-tainted waste into the sea by the Chisso Corporation, which went on between 1932 and 1968. The toxic chemical built up in sea creatures, which then poisoned the people who ate them. For years, cats were witnessed “dancing” in the street – though in reality, they were having convulsions before they went crazy and perished. Locals referred to the condition as “dancing cat fever.” But it wasn’t just animals that suffered. According to data from 2001, 2,265 people have been affected by the case, of which 1,784 died. As of 2004, the Chisso Corporation had shelled out $86 million to compensate victims.  	Mercury	https://en.wikipedia.org/wiki/Minamata_disease

4	Poison Grain Disaster – Iraq (1971)	1971	Iraq	In 1971, ingestion of toxic grain contaminated by a mercury-based fungicide led to over 6,500 people being sent to hospital and as many as 650 reported deaths in Iraq. The disaster was caused by grain imported from the US and Mexico that had been treated with the dangerous fungicide – which was meant to be planted, not eaten. Largely due to problems understanding the foreign-language labels of the grain, rural Iraqis ate it – with devastating effect. People who consumed the grain suffered a lack of sensation in the skin, bad physical coordination, loss of sight, and even brain damage. The World Health Organization was still investigating the incident as recently as 2002.  	Mercury	http://www.toxipedia.org/display/toxipedia/Mercury+Poisoning+in+Iraq+-+1971

5	Poisoned Wheat – Afghanistan (1974)	1974	Afghanistan	From 1974 to 1976, an outbreak of hepatic veno-occlusive disease (a liver disease) occurred in rural Afghanistan. This incident was caused by wheat – which was then used in flour to make bread – that had been contaminated with charmac seeds. The contamination led to around 1,600 deaths and afflicted up to 7,800 people in total. As recently as 2008, a similar case in the same country affected more than 100 people and killed 10. Charmac is a weed, and its seeds contain substances known as pyrrolizidine alkaloids, which are released by plants to protect themselves from being eaten. Ingestion can often have toxic effects – as the Afghanis experienced firsthand to their cost. 	Pyrrolizidine alkaloids	http://www.hindawi.com/journals/jt/2010/313280/

6	Toxic Oil Syndrome – Spain (1981)	1981	Spain	 In 1981, a disease known as “toxic oil syndrome” broke out in Spain that was caused by contaminated cooking oil. The consequences were serious, with the illness leading to the deaths of over 600 people. In response to the crisis, the Spanish government offered free olive oil in exchange for the hazardous oil. The contamination is believed to have occurred when low-cost industrial colza oil from France was imported into the country. The colza oil was then refined and sold by street vendors as olive oil. Symptoms of the disease resembled a lung infection that weakened immune systems and was accompanied by skin problems. The condition was resistant to antibiotics, and there are numerous conspiracy theories associated with the case – all of which has added to its notoriety.	Colza oil	http://www.euro.who.int/__data/assets/pdf_file/0005/98447/E84423.pdf

7	Polychlorinated Biphenyl Transformer Incident -- New Mexico	June 17, 1985	New Mexico State	On June 17, 1985, a transformer located in the basement of the New Mexico State Highway Department building in Santa Fe was found to have overheated and released an oily mist containing polychlorinated biphenyls (PCBs) and their pyrolysis by-products. The transformer contained 245 gallons of askarel, most of which was vented from the transformer. The askarel was tested for PCBs, and the result was interpreted as negative. Therefore, clean-up began under the assumption that PCBs were not present. By that afternoon, however, a laboratory identified PCBs in an askarel fluid sample from the site. By that time, the three-story building had been extensively contaminated, compounded in part by the clean-up efforts. Contamination occurred in several ways: (1) mist containing PCBs and pyrolysis by-products entered two rooms in the basement adjacent to the transformer vault and two rooms on the ground floor above the vault via vents and unsealed electrical conduits; (2) direct spread of mist and fumes occurred through three stairwells located in the building, none of which had fire doors; (3) air drafts created by open windows and exhaust fans spread fumes throughout the building; (4) foot traffic by employees and emergency-response teams extended the contamination; (5) the exhaust vent in the transformer room, located near the intake vents for the building's air-conditioning system, allowed further contamination through fumes drawn into the air-conditioning system. The askarel contained 87% polychlorinated biphenyl (PCB) (Aroclor 1260) and a mixture of tri- and tetra-chlorinated benzenes (13%). Air samples obtained within 14 hours after	PCB	http://www.cdc.gov/mmwr/preview/mmwrhtml/00000609.htm

				the incident showed PCB levels of 48 ug/m((3)) in the transformer vault and 20 ug/m((3)) in the room above the vault. Wipe samples of surfaces showed PCB levels ranging from 30 million ug/m((2)) for grossly contaminated surfaces to 4,700 ug/m((2)) for a desk top with no visible contamination. Additional air and surface samples were collected June 22-24. Analysis of these samples demonstrated potential pyrolysis products of PCBs and polychlorinated benzenes. The 2,3,7,8 isomer of tetrachloro dibenzo furan (TCDF) was identified in concentrations averaging 48 pg/m((3)) of air in the most heavily contaminated areas of the building. For wipe samples, levels ranged from 41,224 ng/m((2)) on grossly contaminated surfaces to 5 ng/m((2)) in areas with no visible contamination. The 2,3,7,8 isomer of tetrachlorodibenzo-p-dioxin (TCDD) was not detectable in air samples or on surface wipes (detection limit 0.5-5.0 pg/m((3)) for air samples and 180 ng/m((2)) for surface wipes). The highest levels of chlorinated benzenes were found on the second floor, where air levels of 168 mg/m((3)) and 3.9 mg/m((3)) were recorded for 1,2,4-trichlorobenzene and 1,2,3,4-tetrachlorobenzene, respectively. The Office of Epidemiology, New Mexico Health and Environment Department, conducted a study to determine whether exposure to fumes or oil at the transformer incident site had caused illness. Exposed persons were identified by highway department officials, by police and fire department attendance logs, and by self-reporting. A questionnaire was administered to exposed and unexposed employees and to emergency-response team members. Eighty		

				(79.2%) of the 101 persons with known exposure completed questionnaires. The most commonly observed symptoms were: nausea (27.5%), eye irritation (22.5%), sore throat (21.2%), nose irritation (18.8%), chest tightness (15.0%), and headache (15.0%). Symptoms were transient and usually resolved as soon as the person left the site. However, two people reported headaches persisting more than 1 day. Nine persons were evaluated at a local emergency room and then released. Analysis of symptom-prevalence data showed that, for individuals not wearing self-contained breathing apparatuses, the number of symptoms was correlated with time at the site ($r = 0.236$, $p = 0.039$) and time in the building ($r = 0.340$, $p = 0.035$). Fifty-six persons with known exposure submitted sera for PCB analysis, as did 20 controls (unexposed firefighters and highway department employees). Serum PCBs were calculated using Aroclor 1260 as the standard. All but four persons had levels below 10 parts per billion (ppb). The median for exposed persons was 4.1 ppb (range 1.2-41.8 ppb) compared to 2.4 ppb (range 0.9-8.0 ppb) for controls. The values observed in exposed persons were greater than in controls (p 0.002). Persons who entered the building had higher serum PCB levels than persons exposed to fumes outside (median: 4.8 ppb inside; 3.4 ppb outside; $p = 0.014$). Neither individual symptoms nor total numbers of symptoms were correlated positively with serum PCB level. The affected building has not been reopened. Reported by K Sherrell, RF Meyerhein, MS, Organics Section, Scientific Laboratory Div, SA Rogers, MES, WT		

				Slade, MES, C Oppenheimer, Occupational Health and Safety Bureau, D Fort, Environmental Improvement Div, HF Hull, MD, State Epidemiologist, New Mexico Health and Environment Dept; Div of Field Svcs, Epidemiology Program Office, Div of Surveillance, Hazard Evaluations, and Field Studies, National Institute for Occupational Safety and Health, CDC.		
8	New Delhi Mustard Oil Contamination – India (1998)	1998	New Delhi, India	This incident first came to light in New Delhi in 1998, when mustard oil (a popular cooking oil) was mixed with poisonous Argemone mexicana (Mexican poppy) seed oil. The effects were devastating, leading to an outbreak of the condition “epidemic dropsy,” which causes severe swelling, mainly of the legs. Other symptoms include breathing problems, diarrhea, nausea, headaches and glaucoma. As well as India, other countries that have experienced spates of epidemic dropsy are Madagascar, Fiji, South Africa, Mauritius and Nepal. With the exception of the South African case, all the epidemics were caused by A. mexicana-contaminated mustard oil. The 1998 New Delhi episode claimed 60 lives, and as many as 3,000 individuals spent time in hospital. In the years since, there have been further outbreaks of the disease in India, but the 1998 incident is still the most severe so far.	Argemone mexicana	http://nmji.in/archives/Volume-11/issue-5/editorials-2.pdf

9	Aflatoxin-Contaminated Maize – Kenya (2004)	May 2004	Kenya	A tragic incident took place in Kenya in May 2004 when maize grain was contaminated with alfatoxin. Aflatoxin is a seriously poisonous carcinogen that is produced by the fungus *Aspergillus flavus*. *A. flavus* occurs in the presence of high levels of moisture, and the contamination is thought to have occurred due to inadequate storage and drying procedures after heavy rains around harvest time. The case led to 317 incidences of liver failure, and 125 people died. A similar occurrence happened in 2010 that left no less than 2.3 million bags of grain unusable. Scientists have in fact developed a cheap, harmless and natural way to combat the problem. Using biocontrol technology, they introduce harmless strains of *A. flavus* into an infected field, and these out compete the dangerous strains. 	Aflatoxin	http://www.cdc.gov/nceh/hsb/chemicals/pdfs/mmwr5334p790.pdf

10	Chemical Fire in Apex, North Carolina	October 5-7, 2006	North Carolina	Explosions and fire at a hazardous waste facility forced the evacuation of approximately 16,000 residents from Apex, North Carolina, on October 5, 2006. The incident likely began in the oxidizer section of the EQ North Carolina waste facility, where chemicals such as pool chlorination tablets were stored. The fire was allowed to burn out and the facility was destroyed. 	Chlorination tablets	https://www.usfa.fema.gov/downloads/pdf/publications/tr_163.pdf
11	Milk Scandal – China (2008)	2008	China	The first reports of the deadly Chinese milk scandal broke on July 16, 2008 in the country's Gansu Province. Dramatically, 16 babies developed kidney stones after being fed powdered milk produced by state-owned dairy company the Sanlu Group. The cause was found to be the addition of melamine to milk and baby formula. Following an inquest, it was discovered that the Sanlu Group had ignored reports of ill babies in 2007 and only began carrying out tests the following year. According to health officers and media accounts, the company tried to cover up the scandal and suppress any negative publicity. Estimates have it that by November 2008, the	Melamine	https://en.wikipedia.org/wiki/2008_Chinese_milk_scandal

				contamination had affected up to 300,000 individuals, with 54,000 babies hospitalized and six dying due to kidney damage. It's thought that melamine was added to the milk to make it seem higher in protein. In the wake of the scandal and resulting court cases, prominent government officials were forced to resign. There were also two executions, and a suspended death sentence, two 15-year prison terms and three lifetime sentences were handed out as well. Alarmingly, officials were still confiscating melamine-tainted products as late as 2010 		

12	CAPECO oil refinery fire	23, 2009	Caribbean Petroleum Corporation (CAPECO) facility in Bayamón, Puerto Rico,	On the night of October 23, 2009, a large explosion occurred at the Caribbean Petroleum Corporation (CAPECO) facility in Bayamón, Puerto Rico, during offloading of gasoline from a tanker ship, the Cape Bruny, to the CAPECO tank farm onshore. A 5-million gallon aboveground storage tank (AST) overflowed into a secondary containment dike. The gasoline spray aerosolized, forming a large vapor cloud, which ignited after reaching an ignition source in the wastewater treatment (WWT) area of the facility. The blast and fire from multiple secondary explosions resulted in significant damage to 17 of the 48 petroleum storage tanks and other equipment onsite and in neighborhoods and businesses offsite. The fires burned for almost 60 hours. Petroleum products leaked into the soil, nearby wetlands and navigable waterways in the surrounding area. The blast created a pressure wave registering 2.9 on the Richter scale1 and damaging approximately 300 homes and businesses up to 1.25 miles from the site. In particular, the nearby Fort Buchanan military facility suffered over $5 million in damages; air and vehicle transportation was interrupted; and thousands of gallons of oil, fire suppression foam, and contaminated runoff were released to the environment. (Figures 9 and 10 show a map of communities neighboring the CAPECO facility and community damage.) CAPECO and the local fire department lacked the appropriate equipment or training to extinguish multiple tank fires, prolonging the environmental effects of the incident. The accident resulted in an emergency declaration for	Gasoline	http://www.csb.gov/file.aspx?DocumentId=714

				assistance from President Obama for the affected municipalities. 		
13	Deepwater Horizon oil spill	20-April-2010	Gulf of Mexico	The Deepwater Horizon oil spill is the largest marine oil spill in history, and was caused by an explosion on the Deepwater Horizon offshore oil platform about 50 miles southeast of the Mississippi River delta on April 20, 2010. Most of the 126 workers on the platform were safely evacuated, and a search and rescue operation began for 11 missing workers. The Deepwater Horizon sank in about 5,000 feet (1,500 m) of water on April 22, 2010. On April 23 the U.S. Coast Guard suspended the search for missing workers who are all presumed dead. After a series of failed efforts to plug the leak, BP said on July 15 that	Oil	https://en.wikipedia.org/wiki/Deepwater_Horizon_oil_spill

				it had capped the well, stopping the flow of oil into  the Gulf of Mexico for the first time in 86 days.		
14	Toxic Illegal Alcohol – India (2011)	2011	West Bengal, India	In 2011, a serious problem arose in West Bengal, India when toxic illegal alcohol led to the deaths of as many as 143 people. It's thought that the alcohol was corrupted by the addition of methanol, ammonium nitrate (a fertilizer), or both. Each of the two substances is toxic to humans, and effects can include heart and respiratory difficulties. Black market alcohol is a big problem in India, and toxic alcohol-related deaths are quite common. Even so, the breweries in West Bengal often operate without any interference from authorities and frequently bribe police. This contamination case at least led to 10 arrests. A man involved in the illegal alcohol trade told the BBC that a contaminated shipment was from	Methanol, ammonium nitrate (a fertilizer)	http://www.bbc.com/news/world-asia-india-16174531

				a very greedy man who had mixed the alcohol with water and then added pesticide for “flavor.” 		
15	Explosion at the fertilizer plant in West, Texas	April 17, 2013	West Fertilizer Company (WFC) West, Texas	On April 17, 2013, a fire and explosion occurred at the West Fertilizer Company (WFC), a fertilizer blending, retail, and distribution facility in West, Texas. The violent detonation fatally injured 12 emergency responders and three members of the public. Local hospitals treated more than 260 injured victims, many of whom required hospital admission. The blast completely destroyed the WFC facility and caused widespread damage to more than 150 offsite buildings. The WFC explosion is one of the most destructive incidents ever investigated by the U.S. Chemical Safety and Hazard Investigation Board (CSB) as measured by the loss of life among emergency responders and civilians; the many injuries sustained by people both inside and outside the facility fence line; and the extensive damage to	Ammonia	http://www.csb.gov/file.aspx?DocumentId=732

				residences, schools, and other structures. Following the explosion, WFC filed for bankruptcy. The explosion happened at about 7:51 pm central daylight time (CDT), approximately 20 minutes after the first signs of a fire were reported to the local 911 emergency response dispatch center. Several local volunteer fire departments responded to the facility, which had a stockpile of between 40 and 60 tons (80,000 to 120,000 pounds) fertilizer grade ammonium nitrate (FGAN), not counting additional FGAN not yet offloaded from a railcar. More than half of the structures damaged during the explosion were demolished to make way for reconstruction. The demolished buildings include an intermediate school (552 feet southwest of the facility), a high school (1,263 feet southeast), a two-story apartment complex with 22 units (450 feet west) where two members of the public were fatally injured, and a 145-bed nursing home (500 feet west) where many of the seriously injured civilians resided. A middle school (2,000 feet southwest) also sustained serious but reparable damage. Section 3 describes the incident and its consequences in detail. The CSB investigated the factors that contributed to the detonation of FGAN. Section 4 describes the properties of FGAN and posits three scenarios that could lead to its detonation under the conditions present during the WFC fire. CSB concluded that the construction of the bins and other building materials as well as the lack of an automatic sprinkler system plausibly contributed to the detonation. Section 6 describes inherently safer approaches to FGAN use and storage that reduce the risk of an FGAN		

				detonation. The total insurance-related losses from the explosion are estimated to be around $230 million and federal disaster assistance is estimated to exceed $16 million. WFC was only insured for $1 million, which fell far short of the incident's damage. Section 5 presents CSB's analysis of the policies and regulations that led to this as well as to the failure of the insurer to identify the risks posed by FGAN. A few years prior to the incident, WFC was dropped by one insurer for failing to address safety concerns identified in loss control surveys. The company that insured WFC at the time of the incident did not appear to have conducted its own safety inspections of the facility. CSB's analysis of the emergency response, found in Section 7, concludes that the West Volunteer Fire Department did not conduct pre-incident planning or response training at WFC, was likely unaware of the potential for FGAN detonation, did not take recommended incident response actions at the fire scene, and did not have appropriate training in hazardous materials response. CSB found several shortcomings in federal and state regulations and standards that could reduce the risk of another incident of this type. These include the Occupational Safety and Health Administration's Explosives and Blasting Agents and Process Safety Management standards, the Environmental Protection Agency's Risk Management Program and Emergency Planning and Community Right-to-Know Act, and training provided or certified by the Texas Commission on Fire Protection and the State Firefighters' and Fire Marshals' Association of Texas. CSB's complete analysis is presented in Section 8. The location of the		

				WFC relative to the surrounding community exacerbated the offsite consequences, leading CSB to assess whether other FGAN storage facilities could pose significant offsite risks. CSB's analysis shows that the risk to the public from a catastrophic incident exists at least within the state of Texas, if not more broadly. For example, 19 other Texas facilities storing more than 10,000 pounds of FGAN are located within 0.5 miles of a school, hospital, or nursing home, raising concerns that an incident with offsite consequences of this magnitude could happen again. Section 9 explores the connection between land use planning and offsite consequences.		