CONSEQUENCES OF CBRN INCIDENTS

Pavel CASTULIK

CB 050 Military Chemistry, Toxicology and Protection Against High Toxic Agents
Masaryk University, Faculty of Nature Sciences
Spring 2011

Cargo Trains Crush /Poland 05:30 hrs, Nov 09, 2010

"You cannot escape the responsibility of tomorrow by evading it today."

Abram Lincoln

Conventional Explosive Events

HazMat and CBR events

HAZMAT Limited Scale Event

BHOPAL MEMENTO

THURSDAY 2 DECEMBER 2004

Bhopal 20 years on: polluted wa chronic illness and little compens

THE FAILURE of the Indian government and an American corporation to tackle the after-effects of one of the worst industrial accidents in history has left a legacy of continuing pollution and inadequate medical care for survivors, according to a report released on Monday.

Days before the 20th anniversary of the Bhopal disaster in India a study has shown that survivors are still desperately in need of medical treatment and have not been properly compensated.

On the night of 2 December 1984, poisonous methyl isocyanate (MIC) gas leaked from the Union Carbide pesticide factory in Bhopal. Thousands were killed immediately. Thousands more were to die from the effects of that night in the months and years that followed.

Now, Amnesty International has claimed that neither the Indian government nor Union Carbide have done enough to provide proper redress for the victims or to clean up the site.

"The disaster shocked the world and raised fundamental questions about corporate and government responsibility for industrial accidents that devastate human life and local envi-

BY JUSTIN HUGGLER in Delhi

"Yet 20 years on, the survivors still await just compensation, adequate medical assistance and treatment, and comprehensive economic and social rehabilitation. The plant site has still not been cleaned up so toxic wastes still pollute the environment and contaminate water that surrounding communities rely on. And, astonishingly, no one has been held to account for the leak and its appalling consequences."

Survivors are marking the 20th anniversary this week by demanding the site is cleaned up and victims given proper compensation. Amnesty found the site of the factory is still severely contaminated, and is poisoning ground water supplies. The report details the case of Hasina Bee, a survivor of the disaster who still lives near the factory site, has been drinking the water from the hand-pump near her house for 18 years.

"When you look at the water, you can see a thin layer of oil on it," she said. "All the pots in my house have become discoloured...green-yellow. We have to travel at least two kilo-

Many lost their sight after the chemical leak in 1984 and the suffering continues, with pollution and toxic waste still in the region. Much of the comp sation for those injured has yet to be paid

my health is so bad that it prevents me from carrying the water I need from there."

The report confirms survivors' claims that far more died in the immediate aftermath of 2,000 claimed by the Madhya Pradesh state government. Amnesty's found that 7,000 died in the immediate aftermath, and 15,000 more have died of related diseases

100,000 people still suffer from chronic or debilitating illnesses. "The company decided to store quantities of the 'ultra-hazardous' MIC in Bhopal in bulk, and did not equip the plant

capacity," the report says.

"UCC transferred technology that was not proven and entailed operational risks. It did not apply the same standards of safety in design or operations

the USA. Unlike in the U the company failed to set up comprehensive emergency or system in Bhopal to local communities about le

Union Carbide has

Chernobyl's Nuclear Power Plant Catastrophe

- 26 April 1986 at 1:23 a.m. the Nuclear reactor No. 4 was destroyed by two explosions
- Steam explosion and following fire of graphite, disseminate aprox, 5% of radiation material during 10 days
- Serious contamination of 200,000 km^2 with Cs-135

Industrial Scale HAZMAT Event

Kurdistan-Halabja-use of Yperit and Tabun

Exposure of Skin with Yperit

Terrorism

- Terrorism is psychological warfare.
- Thus, the strategy in terms, of preparation and planning rehearsed by the authorities must focus on the psychosocial dimension.

Aims of Terrorism

- Create widespread fear, anxiety and panic
- Generate a communal and individual sense of helplessness, vulnerability and hopelessness
- Demonstrate the incompetence and/or inability of the authorities to afford security and protection against such opponents
- Provoke the authorities into errors or overreactions which will disaffect the general public or specific influential bodies
- Generally, terrorist incidents cause a higher level of psychopathology than is occasioned by natural disasters.

9/11 - 2001

INPUTS:
AIR TICKETS

OUTCOMES: !!!????

9/11 - 2001

- The terrorist attacks of 2001 increased the awareness of the vulnerabilities to asymmetric attacks with conventional, CBRN, environmental and cyber means.
- Lack of preparedness for non-conventional events is triggering an invitation for CBRNE incidents

Ultra-Right Extremisms-Arson Attack

The two-year-old girl Natalka who suffered burns to 80 percent of the body in an arson attack on her Romany family's house

Three Molotov Cocktails
€ 5

22, 20 and 20 year prison sentences; medical costs and compensation € 680,000

Risk of CBR(N)

- It is impossible to eliminate the risk of chemical or biological terrorism and thus
- A complete removal of CBR vulnerability is probably impossible
- Orientation for mass casualties impacts
- Enormous psychological impact-unknown effects, fear, panic
- Preparedness is significantly costly with unpredictable effects
- Consequence operations are lengthy and costly
- Restoration of public trust and confidence is very vulnerable

Why CBRN Dragon is still sleeping?

- The ease of using conventional weapons so far outweighs the potential benefits of using a more challenging, unconventional method CBR.
- The public's response to highly visible acts of property destruction may provide a disincentive for CBR agent usage.
- C/B agent development requires greater time and financial investment than development of conventional explosives, and it demands a higher degree of training.
- Groups may not be able or willing to invest such a high proportion of resources in unconventional weapons given the relative ease of obtaining and using conventional weapons.

How long CBRN Dragon would be sleeping?

- Transitional possibility is the use of CBR in conjunction with conventional weapons.
- Recent advances in dual-use technology may reduce the technological barriers for terrorist groups who wish to engage in CBRN-related attacks.
- These dual-use technologies provide prospective terrorists with equipment that can be obtained by theft or purchase.

Mass Murder of Industrial Scale

Know-How is there

THE PREPARATORY MANUAL OF CHEMICAL WARFARE AGENTS

A LABORATORY MANUAL

2) After each procedure, all glassware and non-electric equipment should be soaked in a bleach solution before removing from the clean box, and/or before rinsing and storing. Any electrical equipment that may be contaminated (even if suspected), such as hot plates and stirring equipment should be carefully wiped down with a rag soaked in bleach, followed by wiping down with hot water. 3) The desired mustard gas product should be stored in amber bottles, preferably non-breakable containers, and stored in a cool dry place away from sunlight. The bottles should also be placed inside an airtight sealed plastic bag, such as a "ziplock" bag. 4) Storage of any blister agent should be in airtight cabinets, drawers, or the like, and said storage spaces should be equipped with chemical agent detection monitors to alert of any potential leakage.
Use caution when handling chlorine gas, which is toxic, and very irritating. Ethylene gas is highly flammable, so extinguish all flames before using.

Procedure: Into a suitable flask, place 250 milliliters of methylene chloride, followed by 45 grams of powdered sulfur. Then assemble the left apparatus in figure 039. Thereafter, rapidly bubble 50 grams of dry chlorine gas into the methylene chloride/sulfur mixture while stirring the methylene chloride/sulfur mixture, and maintaining its temperature at room temperature. The addition of the chlorine should not take longer then 6 hours. After the addition of the chlorine, reflux the reaction mixture at 60 Celsius for 30 minutes. Thereafter, quickly allow the reaction mixture to cool to room temperature, and then quickly add in 5 grams of charcoal. Then, assemble the apparatus in the right illustration of figure 039, and then start the nitrogen purge. Then bring the reaction mixture back to reflux at 60 Celsius. Thereafter, rapidly bubble 49 grams of dry ethylene gas into the reaction mixture while rapidly stirring the reaction mixture and maintaining its temperature at 60 Celsius. The addition of the ethylene gas should take no longer then 3 hours. After the addition of the ethylene gas, continue to reflux the reaction mixture at 60 Celsius for 30 minutes. Thereafter, remove the heat source, and allow the reaction mixture to cool to room temperature. Then filter the reaction mixture to remove any insoluble materials, and then place the filtered reaction mixture into a rotary evaporator or vacuum distillation apparatus, and remove the methylene chloride under vacuum. When all the methylene chloride has been removed, remove the remaining residue, and place into clean vacuum distillation apparatus, and fractionally distill the mustard gas at 98 Celsius under a vacuum of 10 millimeters of mercury to obtain a refined mustard gas product of 85 to 98% purity. Further purification is technically not needed for use in military operations, but can be achieved through a second vacuum distillation.

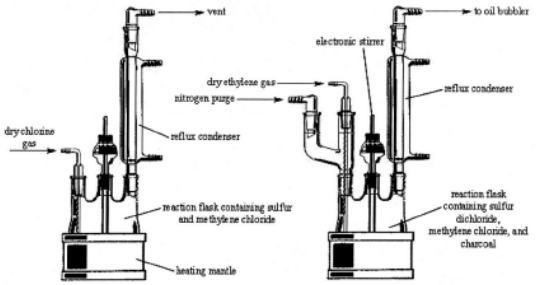


Figure 039. Left illustration: reaction of sulfur with chlorine. Right illustration: ethylene gas addition.

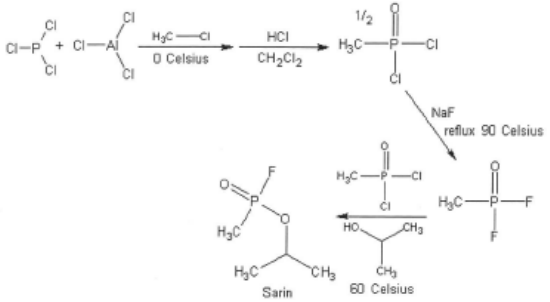
Procedure 3-001C: Preparation of Mustard gas (sodium sulfide process)

Summary: Mustard gas can be prepared in a two step process starting with the formation of bis(hydroxyethl)sulfide. This hydroxyethyl sulfide intermediate is easily prepared my reacting water solutions of sodium sulfide and ethylene chlorohydrin. The resulting hydroxyethyl sulfide intermediate is then converted into mustard gas by the addition of concentrated hydrochloric acid. Upon the addition of the hydrochloric acid, the mustard gas will separate as a viscous oil. The mustard gas is then removed using a seperatory funnel, and then fractionally distilled under vacuum to obtain a refined mustard gas product with an average purity of 95%.

Allow most of the ether to drain into the receiver flask. After which, remove the receiver flask from the apparatus, and then remove any water by placing the mixture into a seperatory funnel, and draining off the bottom water layer. After any water has been removed, place the ether mixture into a clean rotary evaporator, and distill-off the isopropyl ether under mild vacuum. When all the ether has been removed, take out the remaining residue, and place into a clean vacuum distillation apparatus. Then vacuum distill the sarin at 56 Celsius under a vacuum of 16 millimeters of mercury to obtain a purified sarin product, well suitable for use in chemical warfare cocktails. **Note: instead of distilling-off the isopropyl ether, the ether mixture may be used in chemical warfare operations, and is actually preferred as a method of storing, preserving, and protecting the sarin from decomposition. Mixtures of sarin with ether, or methylene chloride can be effectively used to disseminate the sarin in wartime operations. Mixtures of sarin in a solvent such as methylene chloride or ether may persist up to two or three times longer then straight sarin in wartime operations.**

Procedure 04-001C: Preparation of Sarin (modified sodium fluoride process)

Summary: Sarin can be made using a modified process where by sodium fluoride is the fluorinating agent rather then the dangerous to handle hydrofluoric acid. The first step is the preparation of the already discussed methyl phosphonic dichloride. The second step is the preparation of the difluoride, which is accomplished by refluxing sodium fluoride with half of the methyl phosphonic dichloride. The resulting difluoride is then mixed with the other half of methyl phosphonic dichloride, and then treated with isopropyl alcohol. The sarin can then be purified using the usual methods.



Reaction equation (by-products omitted)

Materials:	1. 10 grams of phosphorus trichloride	6. 3.1 grams of sodium fluoride
	2. 9.7 grams of anhydrous aluminum chloride	7. 4 grams of anhydrous isopropyl alcohol
	3. 11 grams of methyl chloride	8. 30 grams of dry silica gel
	4. 246 milliliters of methylene chloride	9. 200+ milliliters of isopropyl ether
	5. 18.4 milliliters of 35 to 37% hydrochloric acid	10. 100 milliliters of toluene

Hazards:

Do not attempt in anyway to prepare sarin using the following procedure unless proper safety precautions are taken. 1) Perform all operations in a clean box, which is treated with a nitrogen atmosphere, and in which is completely sealed

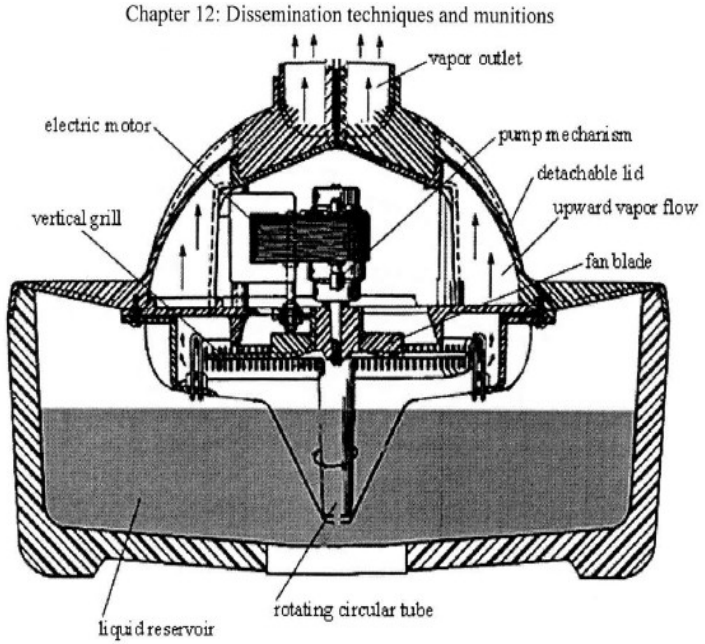


Figure 058. A standard humidifier—similar, but much smaller then a vehicle mounted device. The electric motor functions in two parts: 1) moving the centrifugal pump, and turning the fan blades. The centrifugal pump forces liquid up into the housing where by it makes contact with the fan blade. The force of the fan blade throws the liquid against a vertical grill thereby forcing the liquid into a greater surface area. The rotational action of the fan blade then proceeds to spray the high surfaced liquid into fine mists. Suction created by the electric motor draws air into the housing, whereby it mixes with the fine mists of liquid. The mixing of the fine mists of liquid with the air, produces a uniform vapor, which exits the device at the upper outlet vents. This vapor flow is directed upwards by the simple rotational direction of the fan blades. For information on the general function of humidifiers (not for chemical warfare dissemination), see serial number 187,695 April 16th, 1962 by Paal Myklebust, Baraboo, assigned to Hankscraft Company,

Bacillus anthracis

- One notable incident involved the release of anthrax *(Bacillus anthracis)* spores in 1979 in Sverdlovsk in the former Soviet Union. In that event, 96 people were hospitalized, 68 of whom died.
- That the incident was in fact caused by inhalation anthrax from an accidental spore release from a biological weapons facility.

Amerithrax

Bacillus anthracis-Amerithrax

- The dominant CBRN-related terrorist incident was the 2001 anthrax attack in the United States. Although the attack caused a relatively small burden of illness and **death—22 infections and 5 deaths**
- It created significant political, economic, and social disruption
- In the wake of the attack, as many as two million Americans might have taken antibiotics unnecessarily—a public health issue in and of itself.
- Additionally, the U.S. Government spent in excess **of $3 billion in** direct costs to the **U.S. Postal Service**, as well as more than **$24 million for the cleanup of the Hart Senate Office Building**.
- Contamination of Postal branch at US Embassy in Vienna through diplomatic mail sent from Washington DC.
- The so-called Amerithrax attack highlighted significant shortfalls and challenges in the Federal biodefense response to an attack on the homeland—many of which remain unresolved 5 years later.

SARS

- Greater public health significance was the 2002 outbreak of Severe Acute Respiratory Syndrome, a virus related to the common cold.
- First appearing in China and initially misdiagnosed as influenza or severe pneumonia—pointing out how newly emerging diseases can easily be allowed to “break out” from their initial cases—the virus ultimately resulted in 774 deaths worldwide and
- Caused economic losses estimated at $80 billion to $100 billion

Radiological Event-Three Mile Island

- In 1979, the US experienced its most serious radiological incident with the reactor accident at Three Mile Island in Pennsylvania.
- A failure in the non-nuclear part of the powerplant led to inadequate cooling and the melting of nuclear fuel pellets.
- The cleanup of the damaged reactor, however, took nearly 12 years and cost almost a billion dollars.

Radiological Event- Chernobyl

- In 1986 thirty-one people died in the Chernobyl accident and its immediate aftermath. Most of the immediate casualties were suffered by firefighters.
- Estimates of the delayed health effects vary, but by 2002, 4,000 cases of thyroid cancer had been reported in exposed children.
- The cleanup costs at Chernobyl are estimated at $1 billion.
- The aggregate damage from the catastrophe to the country has been estimated at $235 billion (calculated for a 30-year recovery period).

- Psychology and CBRN

EFFECTS OF CBR AGENTS ON MENTAL STATUS

- Whether from a biological or chemical agent attack, many people, exposed or not, who seek treatment in emergency rooms will exhibit tension, tachycardia, increased respiratory rate, tremors, and other nonspecific signs and symptoms that could result from the agent or from anxiety associated with the incident.
- Persistent long-term neuropsychiatric effects of acute intoxication with this class of pesticides include drowsiness, memory impairment, depression, fatigue, and increased irritability, and the symptoms last weeks to years after the exposure.
- Blister agents (nitrogen or sulfur mustards), another class of chemical weapons, can produce delirium and psychological distress resulting from highly disfiguring lesions that cover the skin, including genitalia, and from long-lasting oligospermia.
- Anthrax spores can produce rapidly progressive meningitis. Depression, irritability, and headaches occur in persons with brucellosis, and nearly all fatalities from this infection involve either the endocardium or the central nervous system.

PSYCHOLOGICAL IMPACT

- A chemical, biological or radiological attack is psychological warfare, whether that attack is real or a cleverly designed hoax and whether it is initiated by a lone sociopath, by a group of domestic or foreign terrorists, or by a nation.
- Such incident will produce psychological impairment at the individual and community levels and may generate numbers of casualties that overwhelm local medical resources.

PSYCHOLOGICAL IMPACT

- After the first missile attack on Israel by Iraq during the Persian Gulf war, nearly 40% of the civilians in the immediate vicinity of the attack had breathing difficulties, tremors, sweating, anxiety, and labile mood; subsequent attacks produced fewer symptoms.
- In a World War I incident, of 281 soldiers admitted to a referral center field hospital, 90 were true gas casualties and the rest were victims of "gas mania".
- Of the 5,510 persons who sought medical treatment from the 1995 sarin attack in Tokyo, 12 died, 17 were critically injured, 1,370 had mild to moderate injuries, and the other 4,000 had no or minimal injuries (worried well).

Psychological Impacts and Effects

- People who are exposed to a traumatic event often experience severe emotional shock and may suffer devastating, long-term, psychological consequences.
- In order to manage successfully psychological impacts of CBRN events the Consequence Management training is needed to address the Psychological Impacts & Effects of a Weapon of Mass Destruction incident on care providers, response elements, and incident victims.
- The training should be focus on methods for recognizing, minimizing, managing, and treating the severe psychological stresses associated with a WMD incident

The Art to be Calm

Panic

- WMD terrorist attacks are frightening – bringing fear and anxiety to the public and first response communities. 'Coping with fear under fire' is one of the most acute problems you must face as a First Responder called to a Weapons of Mass Destruction (WMD) terrorist attack.
- You will be asked to calm the public and assist fallen responders, while silently dealing with your own fears.
- How will victims from different cultural and ethnic groups react to a WMD incident and how will I respond?
- This will entail knowing the signs of panic within different contexts and with victims of different cultural and ethnic groups.

Challenges

- In the event of an WMD attack, how can public panic/fear be lessened?
- How can the public be persuaded to take appropriate action and to avoid inappropriate actions?
- Who among responders and the public are at higher risk of adverse psychological effects and how can such effects be prevented or mitigated?
- What are the likely psychosocial impacts of WMD and how can they be prevented or mitigated?

Preparedness of Responders

- The medical community will be greatly impacted by a WMD attack and must be prepared. To reduce the impact of WMD attacks, a clinically trained psychologist should be a part of the response team.
- Medical professionals and responders must be trained to deal with blame and the scapegoat syndrome.
- If they know to expect it, they are better prepared to deal with it.

- CBRN and Economic Impact

Costs caused by the impact of CBRN incidents

- **First response**

- Rescue of injured and threatened people
- Evacuation
- Registration of contamination
- Blocking the spread of dangerous CBRN materials
- Immediate decontamination
- Measures to cordon off the contaminated area

Costs caused by the impact of CBRN incidents

- **Recovery, reconstruction, restoration**

- Health care for injured people
- Costs for the deceased (medical forensics, funerals, life insurances)
- Pensions, etc for disabled people
- Cleaning up measures and thorough decontamination
- Reconstruction of buildings
- Resettlement and relocation
- Restoration of infrastructure: transport system, public services (water supply, electricity, telephone network)
- Gathering of infected animals
- Clearance of contaminated cadavers and plants
- Waste management (most importantly disposal of CBRN substances)

Costs caused by the impact of CBRN incidents

- **Indirect damage costs**

- Loss of earnings caused by loss of consumer confidence
- Loss of earnings caused by (preventive) culling
- Loss of earnings caused by decline in tourism
- Loss of earnings resulting from injuries/sicknesses or death of employees
- Loss of earnings because of state of emergency (regional and international)
- Economic impact of temporary infrastructure breakdown:
- Transportation system, public services (water supply, electricity, telephone network)

Costs caused by the impact of CBRN incidents

- Macroeconomic costs
- Consequential costs from loss of income (multiplier effects)
- Loss of investor confidence/propensity to save

Costs for countermeasures against CBRN incidents

- **Prevention**

- Stockpiling of antibiotics, diagnostics, vaccines and, management thereof
- Establishment and management of monitoring networks
- Establishment of new research facilities and programmes
- Biosecurity review

- **Preparedness:**

- risk assessment
- situation awareness
- security personnel
- training of qualified persons and threatened populations
- governmental authorities and private organisations for situation
- observation and assessment

- **Physical protection for the warehouses containing CBRN materials**:

- portal monitors
- import and export control
- security barriers, fences, video observation

Costs for countermeasures against CBRN incidents

Protection

Protection for the critical infrastructures and the general public against threats arising from CBRN terrorism/criminality/accidents:

- access control
- portal monitors
- protection against intrusion: security barriers, fences, video
- observation

Human security

- risk assessment
- situation awareness
- governmental authorities and private organizations for situation
- portal monitors
- import and export control
- security barriers, fences, video observation
- access control
- protection against intrusion: security barriers, fences, video observation
- security personnel
- training of qualified staff and endangered populations
- governmental authorities and private organizations for the control of certain security standard

Costs for countermeasures against CBRN incidents

- **Preparedness**

- Equipment
- Operation procedures
- Training of qualified persons and endangered populations
- Governmental authorities and private organizations for situation
- Observation
- First response capabilities and capacities

Palomares accident of 1966 in Spain

- On 17 January 1966, a B52-bomber collided with a KC-135 aircraft while refueling at a height of 9,000 metres, with both aircrafts crashing on Spanish terrain.
- Three of the four hydrogen bombs fell on the inhabited area of Palomares, the fourth fell into the sea.
- The high-explosive burster charges detonated and radioactive plutonium was dispersed across several hectares of agricultural land. Within three months more than 1,500 tons of radioactive contaminated soil was disposed of.

- **Recovery, reconstruction, restoration**

- Clean-up costs per hectare after Palomares accident: 33.6 million US$

Nuclear bomb attacks on Hiroshima and Nagasaki in 1945

Casualties	Hiroshima	Nagasaki
People killed directly	45,000	31,000
Death by cancer	31,881 in both	cities
Total number of injured people	72,200	25,000
Total number of killed people	140,000	70,000

Casualties of Chernobyl and Bhopal Disasters

Loses	Chernobyl NPP 1986	Bhopal Union Carbide 1984
People killed	47	5,000 – 17,500
Dead liquidators	300-20,000	
Cancer deaths	50,000 – 75,000	
Thyroid cancer	> 4,000	
People injured		200,000

Costs of Chernobyl and Bhopal Disasters

Item	Chernobyl	Bhopal
Recovery, Reconstruction, Restoration	17,5 billion US$	0,510 billion US$
Indirect damage costs	235,5 billion US$	3 billion US$
Containment of residual radioactivity	1 – 16 billion US$	

Cost of Amerithrax 2001

- Preventive costs 2 million US$ to get information on the perpetrator(s)
- Costs for decontamination 90.3million US$
- Total number of killed people 5
- Total number of injured people 22

- MEDIA and CBRN

Media

- A certainty in the wake of a major CBRN attack will be the extensive and rapid deployment of media personnel
- Dramatic terrorist events raise viewing and sales figures; the media at the same time provide an opportunity for terrorists to publicise their cause and provide a “justification” for their deeds, however apparently barbarous.
- Civil contingency planning must involve the media as allies not only because their presence is inevitable but, more constructively, because the media are experts in mass communication.

Misinformation

- Addressing Sources of Misinformation
  Planners will also have to address sources of misinformation, disinformation, and propaganda attacks by individuals and groups who thrive on government conspiracy theories, urban legends myths, and sensationalism.

?Media Alliance for CBRN Terror?

- The media attention given to civilian deaths may induce a terrorist to prefer an agent with high fatalities over agents that inflict a high number of casualties, but low fatalities, if they believed that this would garner more media attention.
- Terrorists may believe that such media coverage of terror events may further recognition of their cause or increase the impact of their actions
- Model in covering disease (no)epidemics by media

Partnering with the Media

- A key factor in developing an effective public awareness campaign is a close partnership between media and government.
- Will the media be willing to work with the government?
- The media is more likely to show body bags and disaster sites than progress being made.
- How can agencies and responders work with the media to encourage more positive messages and visuals in a WMD attack?
- In general, the news cycle is extremely fast, almost real-time.
- Yet, getting accurate information about a WMD attack can take time; will the media be able to communicate accurate information to the public?

Partnering with the Media

- The active involvement of media representatives at the strategic planning stage is likely to achieve a number of dividends, including:
- A reduced level of sensationalist reporting
- A lower risk of retraumatising survivors (through the gratuitous repetition of graphic and gruesome imagery etc)
- The prompt and wide dissemination of accurate information (e.g, about what has happened, what is happening, and what will happen; how to get help and where)
- An emphasis on resilience and coping rather than on psychopathology and helplessness

- Colombian Guerillas

Victims

Hostage Collar Bomb

Childe Parcel Bomb

Casualties in Colombia

- Each12 hours one person is the victim of antipersonal mine
- It represents 64% of military personnel
- 34 % of civilians and 50% of them are children
- 89% victims are young people and adults in productive age

Number of Victims 1995-2005

	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004	2005	Total
Gerrilas	0	0	11	0	0	0	6	3	2	9	3	34
Civilians	34	39	46	38	27	69	141	306	245	239	215	1.399
Sin Infor	0	0	0	0	0	1	1	0	1	2	4	9
Military	97	76	32	19	26	64	141	319	476	613	577	2. 440
Total	**131**	**115**	**89**	**57**	**53**	**134**	**289**	**628**	**724**	**863**	**799**	**3.882**

Victims

School of Engineers
„Military Victims“

School of Engineers in Bogotá

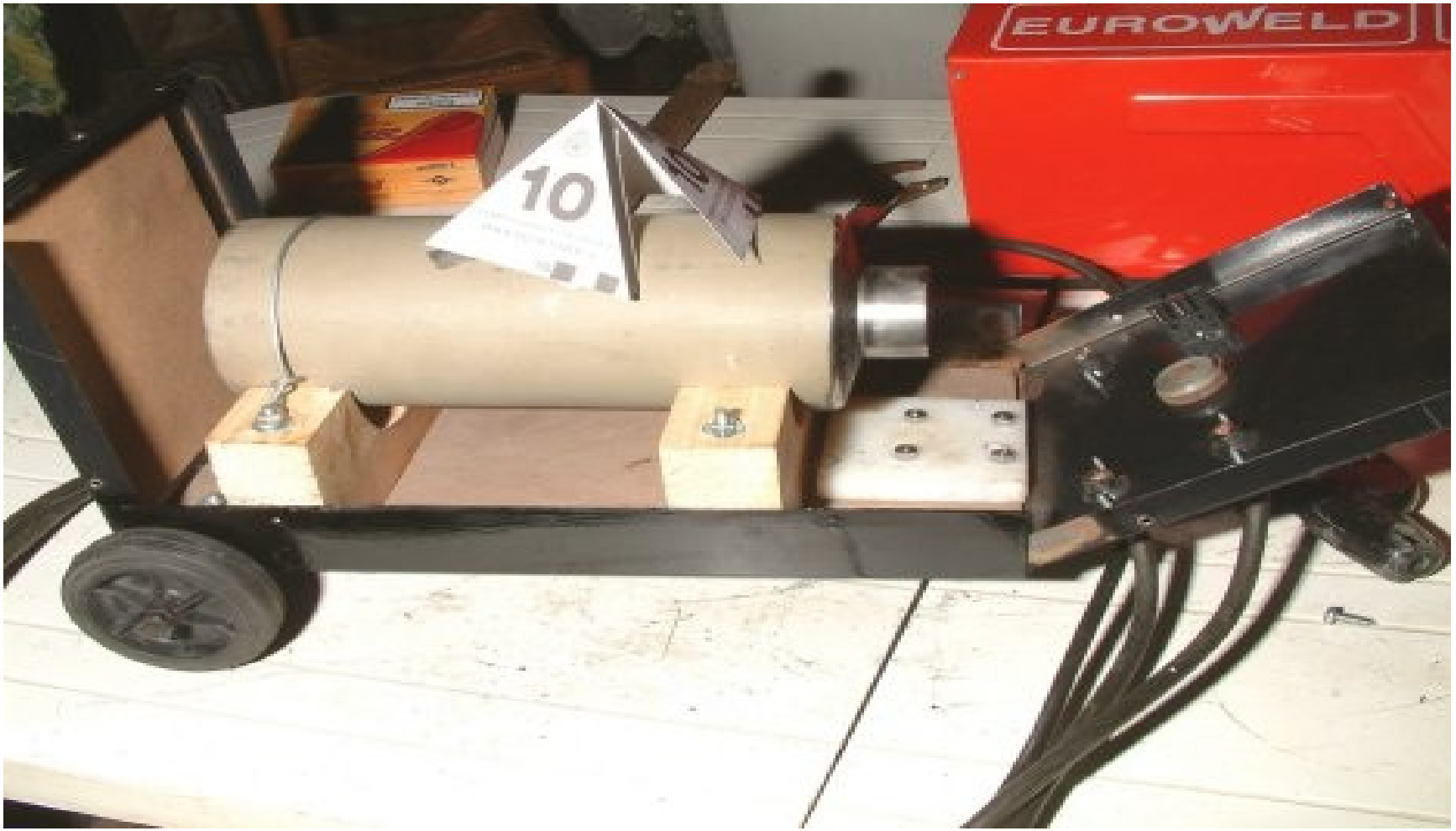
Cost

- Production and installation of 1 mine costs cca. 2 $
- Search and disposal of 1 mine costs cca. 2000 $
- Medical treatment and rehabilitation of 1 victim costs cca. 100,000 $

Anti-vehicle Mine and Chinese Hat

Chemical Binary Hand Grenade

„Welding“ generator as Mercury Bomb



Attack of Oil Pipelines continue for 30 years

Destruction of Electricity Towers

Rehearsal Quarries

1. What are the common characteristics and differences between conventional/natural and CBRN events?
2. What are the key factors in prevention and preparedness against CBRN events?

pcastulik@yahoo.co.uk