CHAPTER-5

FOOD BIOTERRORISM

PUBLIC PERCEPTION AND IMPACT ON STAKEHOLDERS

5.1 World Economy and Society

Food bio terrorism, while rare, is not new to the United States or other countries. Many years ago, the followers of the Guru Shree Rajneesh infected 10 salad bars in Dalles, Oregon with the potentially deadly salmonella pathogen, which was one of few occurrences in the US. In that incident, it was reported that about 750 residents were sickened and no one was killed from the exposure. The objective was to just prevent these people from voting in the local elections. But, it can be replicated in a large scale at any time anywhere. The confirmation of such fears on the heels of the Anthrax attack on the country (despite over $100 million spent by the FDA in 2002 alone) on measures to safeguard the US food supply against bio-terrorist attacks, (Welcome Newsline, 2002) only demonstrated the fitness of this method as a terrorist weapon for political objectives. Several cases of food sabotage on small scale have occurred in the US since.

"I, for the life of me, cannot understand why the terrorists have not attacked our food supply, because it is so easy to do," said Mr. Thompson, ex Agriculture Secretary of the US government.[63] Prof. Larry Wein, Stanford University, who studies terrorist attacks that could kill more than 100,000 people found that out of the items of daily use, milk was particularly vulnerable to an attack. He mentioned that if someone were to put just 10 grams of botulinum toxin into a milk tanker, it could have devastating effects.

A Kansas farmer said- "They could poison our feed stuff, water - I hate to even talk about it, we don't want to educate the terrorists".[64] Conventional use of weapons is being replaced by newer techniques on virtually every day basis, maybe because the forces dealing with them have become adept at handling such attacks. This has resulted in the terrorists finding new ways to keep the cinder burning. Timothy McVey used a combination of nitrogen fertilizer and diesel

fuel to create a bomb to blow-up the Alfred P. Murrah Federal Building in Oklahoma City, OK, US.[65]

Hans Morgenthau highlighted some of the elements of state power, which included; geography, population, military might, economic strength and also food resource.[66]

Recently the US FDA detained nearly 850 shipments of grains, fish, vegetables, nuts, spice, oils and assorted imported foods for issues ranging from filth, unsafe food colouring and contamination with pesticides to salmonella. Yet, despite the huge efforts put into the fight as well as resources at their disposal, Mike Doyle, Director of the University of Georgia's Center for Food Safety, still considers the FDA of the USA as not having “enough resources or control over this situation presently." [67] Consequently, there are fears that the USA is still vulnerable to harm from abroad, where rules and regulations governing food production are often more lax than they are in the USA. This suggests the huge cost of safeguarding the domestic population from threats of food poisoning from abroad, which has increased exponentially due to the globalisation. Contaminated food sickens 1 of 4 Americans annually, or about 76 million illnesses and 5,000 deaths, according to government data released by the US government recently. The food supply is especially vulnerable to an attack because of the broad range of biological and chemical agents that can be used according to the US FDA. The agency said *salmonella*, *E. coli* 0157:H7, and Ricin pose a significant threat because they can be disseminated easily to food. Anthrax and botulism are considered the most deadly.[68]

"We have concluded that there is a high likelihood, over the course of a year, that a significant number of people will be affected by an act of food terrorism or by an incident of unintentional food contamination that results in serious food borne illness. The relative centralization of food production in the US and the global distribution of food products give food a unique susceptibility," the FDA said.[69]

The USDA provides information on different programs available for farmers during an emergency or disaster 2014[70] Disaster Program Information Brochure. The USDA's Farm Service Agency Disaster Assistance site provides assistance to

farmers and other rural residents after natural disasters. This site also includes information for farmers who have losses resulting from crop or livestock disease or pest infestation. USDA also offers a Disaster Resource Center that includes a searchable database. The Risk Management Agency of the USDA provides information on a variety of issues that concern agriculture producers.

In Kenya in 1952, the Mau Mau used African Bush milk (a plant toxin) to poison steers of the Kikuyu tribe (carus, 1999; Chalk 2003).

In 1974, the "Revolutionary Command", a Palestinian group, claimed to have contaminated grapefruit exported from Israel to Italy. In 1998 again, Israeli grapefruit exports were threatened. In these cases the primary goal appeared to be economic disruption (Cameron et al. 2001).

In 1981 an eco-terrorist group, "Dark Harvest" threatened placing anthrax contaminated soil in places throughout the UK to highlight the ecological dangers of chemical and germ warfare.

In a study in Nigeria it was found that the threat of food terrorism in Nigeria no doubt is more real than imagined. The development of a genuine Nigerian variant of counter-terrorism strategies cannot be over emphasised. It was concluded that rising globalisation has accentuated this problem and it is incumbent on the nations to join hands to tackle this menace. The country, out of sheer necessity however, needs to align with other countries especially the US, and international bodies to form a uniform response to the threat posed by food terrorists.[71]

Recently, there have been cases of food poisoning and contamination emanating from imported food around the world, especially from countries that are grappling with food safety problems. In late January, 2008, the case of the frozen dumplings which were contaminated with a highly toxic organophosphate pesticide, *methamidophos*, was reported in Japan.(BBC News, 2008) The Chinese dumplings which were laced with pesticide made at least 10 Japanese people ill. Japan's health minister believed that they were poisoned on purpose.[72] Similarly, the case of the contaminated Chinese wheat gluten that poisoned cats and dogs in the United States also led to massive pet food recall. [73]

There was a nerve gas attack on the Japanese subway system and anthrax scare to the US law makers in the aftermath of the 2001 Trade centre attacks. These attacks may be limited in their impacts but the after effects may be huge. According to Gurr and Cole (2000:65)[74], tonnes of chemicals and biological agents would be required to effectively contaminate a municipal water supply system given the dilution that would occur in the water reservoir or the storage system.

In the contemporary international politics, the issue of food resources and strategic resource management are beginning to play vital roles in world politics and diplomacy as Osuntokun (2009:1) pointed out in his statement at the 64th session of the United Nations' General Assembly.[75] This is not to suggest that food was not used as a political tool in time past. (Messer, et al, 1998:3)[76] A nation that is sufficient in vital resources such as food production would be able to play international politics from a position of strength and to its advantage, as it is not dependent on its very basic need on anyone else. This underscores the significance of food as an element of strength and power in world politics as well as a weapon of asymmetric warfare in contemporary times. Agriculture and food processing remain critical to the socio- economic existence and the political stability of any country.

Tucker's collection of fifteen possible cases of chemical and biological weapons is very comprehensive in this context. He found that out of these fifteen, in twelve cases the groups never reached the stage of production activity. In the three cases where they were used, mass casualties did not result. According to Tucker, (2000a:264), the biological agents may be slow acting, thereby allowing the terrorists to escape detection, but, these do not attract media attention that the terrorists often desire. [77]

According to Foxell 2001:113-14, the disruption of the food supply system is likely to result in significant economic losses rather than mass casualties.[78]

In a special report in 2003, the WHO warned of a possible contamination of food supplies by terrorist groups employing chemical or biological agents and advised countries to strengthen their surveillance systems to avoid death or the contracting of serious illnesses like cancer.[79] Food supplies are especially vulnerable

to an attack because of the broad range of biological and chemical agents that can be used as well as their easy accessibility without suspicion. However, this is predicated on the terrorist's belief that killing or harming the largest number of people could prove the simplest and most powerful way to make a political statement.[80] This may also be the case worldwide, but, the difference is that the food standards in the other nations may not be as strict or the agencies may not be in a position to detect such acts. However, the fact remains that such threat exists.

There have been numerous instances concerning food safety issues in the past few decades all across the globe. Some of these have been listed in the table below.

Table-4

Personal and economic impact of food safety incidents[81]

Year	**Country**	**Food**	**Agent**	**Economic Cost**	**Human impact**	**Source**
1981	Spain	Cooking Oil	Chemical	-	20,000 injured 800 fatal	WHO (1983)
1985	USA	Watermelon	Aldicarb	-	1373 cases	Green *et al.* (1987)
1985	USA	Milk	*S. typhimurium*	-	1,70,000 cases	Ryan *et al.* (1997)
1989	Chile	Grapes	Alleged contamination with cyanide	$ 100 million	-	Root- Bernstein (1991)
c. 1999	UK	Beef	Prions	$ 7 billion	120 deaths by 2001	Nestle (2003)
1991	China	Clams	Hepatitis A	-	3,00,000 cases	Halliday *et al.* (1991)
1994	USA	Liquid Ice cream	*S. enteritidis*	-	2,24,000 cases in 41 states	Hennesey *et al.* (1996)
1996	USA	Apple juice	E. Coli 0157:H7	$ 14 million	1 dead, 70 hospitalised	Nestle (2003)
1996	USA	Guatemalan raspberries	Cyclospora cayentanensis	-	1465 cases	Herwaldt *et al.* (1997)
1998	USA	Frankfurters / Luncheon meat	Listeria	$50-70 million	35 cases	Carus (1999); Centres for Disease Control and Prevention (1999); (FSIS available at www.fsis.usda.gov)

The advancement in science and technology no doubt has improved global food production in the face of the ever increasing world population. Some of the discoveries have also had their negative effects on the human population. The

breakthroughs in the area of biotechnology especially in the use of molecular biology to create crop plants known as genetically modified (GM) crops for human and animal consumption in recent times have come under very serious controversies. Environmentalists and Public health groups have raised alarm on the dangers associated with the use of genetically modified crops on the environment, human and animal health. (Whitman, 2008:1) Though these crops are modified in the laboratory to enhance desired traits such as increased resistance to herbicides or improved nutritional content, experts believe that their negative effects on the environment and on humans far more outweigh the positive outcomes.

Recent studies about the effects of genetically-modified corn pollen on monarch butterfly caterpillar have raised further concerns on the health implications of genetic engineering.(Nature,199:214) These concerns were not unconnected with the potential human health impact: allergens, transfer of antibiotic resistance markers, and some other unknown effects.(Human Genome Information Project, 2007)[82] Similarly, the potential environmental impact include the unintended transfer of trans-genes through cross-pollination, sundry unknown effects on other organisms such as soil microbes, loss of flora and fauna biodiversity (Human Genome Information Project, 2007)[83]

The technology for production of biological agents is developing and some countries are involved in proliferating these, in spite of being banned by the international treaties. Chemical and biological weapons, also known as the weapons of mass destruction, have generated even greater concerns. The policy makers all around are seized of the concerns but the possibility of small scale attacks cannot be ruled out as it would have a tremendous psychological impact on the urban populace. The Al Qaeda terrorists hijacked commercial airliners to fly into the World Trade Centre and the Pentagon, using airplane as a form of kinetic weapon against pointed targets. Terrorists may have many other methods to create alarm in the hearts and minds of the population. The country's leaders and emergency managers must also address the potential for terrorists to employ weapons of mass destruction (WMD). Technological advances or development of newer mixtures in future can assist the terrorists as also the law enforcers.

5.2 Indian Economy and Society

In India, the burden of food-borne disease is not known. Most food-borne diseases go unreported and only a miniscule are reported by the media or the victims, usually those with high morbidity and/or occurring in urban areas.

The Integrated Disease Surveillance Programme (IDSP) network was launched in India in the year 2004. Aggregated analysis of IDSP data shows that the food-borne disease outbreaks across the country and the acute diarrhoeal diseases (ADD) constitute nearly half of all reported outbreaks for the period 2011-16.[84] This has been summarised in the table and the graph given below-

Table- 5

YEAR	ADD	FOOD POISONING	OUTBREAKS
2011	532	305	1675
2012	467	255	1584
2013	576	370	1964
2014	344	306	1562
2015	450	328	1935
2016	709	395	2679

Source: *Foodborne Diseases and Food Safety in India*, March 2017, Monthly newsletter for National Centre for Disease Control, Directorate General of Health Services, Government of India

Although use of biological weapons and its variants has not been weapons of mass destruction in the past in India, their lethal potential certainly exists. There are other reasons like severe reprisals by the state, which have hitherto prevented use of such weapons by the terrorist organisations. In India, religious tensions between the Muslims and Hindus have existed for many decades often resulting in communal violence. Due to diversity of language, religions, traditions and multi-ethnicity

possibility of conflict and unrest always exist. In terms of casualties due to conventional terrorist activities, India has been one of the most battered nations in the world. Among the most obvious responses include provision of greater security to the probable physical and individual targets, better detection and prevention, political will, precise intelligence network, civil co-operation, clear cut policies of negotiation with the extremists, cutting off financial sources of funding of these group, strict implementation of laws, diplomatic efforts and international co-operation. India's intelligence agencies have mounted a number of sophisticated and clandestine operations that have detected and defeated terrorist groups (Raufer 2000:49).[85] Notwithstanding these successes, terrorists have found newer ways to inflict casualties on the security forces and general public.

Poisons and pathogenic micro-organisms are among the natural health hazards which the humankind is forced to co-exist with. Slowly, over the centuries, we have become adaptable to such threats. But, due to the mutation of agricultural products and advancements in bio-technology the threat has increased. Genetically modified food and Recombinant technology are also changing the food habits of people around the globe. Unfortunately, deliberate food and water contamination remains the easiest way to distribute biological, chemical or even physical agents for the purpose of terrorism. The major concern of any government all over the world is to protect its inhabitants and provide them with healthy environment and safe food & water supplies.[86] With the pollution levels growing in India, the responsibility of the government towards its citizens increases.

Within the domestic food distribution chain itself, the inefficient food defence and safety measures allow for the proliferation of unmonitored food outlets such as road side eateries, snack shops, bar and open air canteens, exposing them as easy medium for food contamination or poisoning by terrorists. Similarly, the circulation of fake and adulterated pharmaceutical products by some syndicates has not only jeopardized the life of patients, but has also demonstrated the intractability of the phenomenon. At the international entry points, both land and sea, though there are many security measures in place to ensure that imported food material conformed to international standards, however, most of these measures are often circumvented by

the unscrupulous business cartels in connivance with the very officials in charge of those stations, thus, enhancing the possibility of terrorist infiltration of food supply chain and related industry of the country. Consequently, deliberate contamination of the nation's food supply is a real possibility. The unchecked proliferation of bottled and sachet water, unorthodox drug manufacturing and peddling in the developing countries demonstrate the unfettered manner with which such centres could spring up without detection. The economic and psychological implications of an attack and its scale on the food supply within our huge country are frightening. Moreover, there are hardly any quality control measures in place to detect and control such activities.

Terrorists using a biological weapon to introduce a disease to one or more agricultural product(s) or the vulnerability of draught animals, as carriers of diseases, could economically devastate a large segment of the nation. It could destabilize the economy, undermine political support for the country's leaders, weaken confidence in the government, and create social turmoil.[87] The capabilities of the municipal authorities are pathetic to say the least, especially in context of water treatment and sewage disposal, in the major parts of our country. Further, a closely related threat is that posed by imported food and food materials most of which does not have to undergo strict quality control checks. Adulteration of fruit juices by addition of water or stones in rice are now giving way to deadly pesticides and DNA altering carcinogens.

In a survey done a few years back, India was one of the worst violators of the food consumed.

Table- 6 [88]

Sl. No.	Name of Country	Percentage of Violations
1	India	11.1%
2	China	9.9%
3	Mexico	7.5%
4	France	5.5%
5	USA	5.4%
6	Vietnam	4.7%
7	Brazil	4.1%
8	Dominican Republic	3.8%
9	Turkey	3.7%

10	Spain	3.2%

Source: Food Violation Ranking by global food source monitoring company, Food survey, November 2014

At any point someone, somewhere along the food chain is trying to get rich at the expense of common man by altering or substituting the original with the fake food items. The terrorist element could easily pick on this and make hay. Out of approximately 50,000 samples tested by FSSAI in 2015, almost 8500 failed the laboratory tests. Random sampling shows that 5 to 7% of the eggs across India are contaminated with the deadly bacteria, *Salmonella*. The bread, commonly used for breakfast in our country is laced with 25 different chemicals. This includes fumigants, mud, dust, insects and fungus. It can lead to serious liver and kidney damage. Wheat and maize are coated with mycotoxins, which is harmful and can result in jaundice and gastrointestinal bleeding. Fruits are being ripened with the assistance of chemicals and coloured with copper sulphates; vegetables are being injected with hormone oxytoxins to make them look fresh; fish is contaminated with ammonia and formaldehyde to preserve them further and the farm animals with antibiotics to make them go faster; that is the situation in our country at present. Most companies do not even conduct a due diligence of their items being placed in the shelves for sale. The controversy of Maggi noodles has virtually opened the Pandora box. It appears that anyone can enter and alter the food chain to land a severe blow to the humans in any part of the country or may simultaneously attack various parts in the country.

FSSAI has put the fraud rate at approximately 11% of all food produced in India. Questions are also often raised at to the trueness of testing process. Almost 40% of the vacancies of the laboratories are lying vacant at any point of time. What adds to the confusion is that food safety is a state subject as per the provisions of the Indian Constitution.

The rise of many diseases in India from gastrointestinal, neurological, gynaecological, multi-organ failure and even cancer may be attributed to the consumption of adulterated food. This is the situation in normal times and one can easily imagine the plight of the common man when concerted terror strikes. As

early as 1989 it was observed that the Indians consumed half a milligram of Dichloro Diphenyl Trichloroethane (DDT) and Benzene Hexachloride (BHC); and a little bit of Malathion and Endosulfan. This may seem to be very less, but, it was almost 40 times the average consumed by the Americans and the Europeans. It was equal to the danger mark set by the World Health Organisation (WHO) standards.[89] There is little evidence to suggest that the things have improved since then.

The table below shows the inflow of the Foreign Direct Investment into India in the various years from the year 2012-2013 to 2016-17. The increased interest of foreign nations and multinationals in India is reflected in the increased FDI inflows including those from various multilateral organisations. E.g. International Finance Corporation, the investment arm of the World Bank Group, is planning to invest about US$ 6 billion through 2022 in several sustainable and renewable energy programmes in India. In FY 2016-17 infrastructures got US$ 3.49 billion as against US$ 2.98 billion in FY 2015-16. Huge investment is being made by Indian railways in the Bullet train project from Ahmedabad to Mumbai, which will be completed in 2022. Country wise and the sector wise inflows exhibit the potential of the country and the attractiveness it holds for the investors in future. Agriculture, animal husbandry, floriculture, horticulture and other related industries have been brought under the 100% direct investment route of FDI, thereby attracting investment to improve the conditions of the farmers. It also opens up these sectors to added vulnerability.

Table-7

FOREIGN DIRECT INVESTMENT FLOWS TO INDIA COUNTRY-WISE AND INDUSTRY-WISE[90]

Source/Industry	2012-13	2013-14	2014-15	2015-16	2016-17 P
Total FDI	**18,286**	**16,054**	**24,748**	**36,068**	**36,317**
Country-wise Inflows					
Mauritius	8,059	3,695	5,878	7,452	13,383
Singapore	1,605	4,415	5,137	12,479	6,529
Japan	1,340	1,795	2,019	1,818	4,237
Netherlands	1,700	1,157	2,154	2,330	3,234
U.S.A.	478	617	1,981	4,124	2,138
United Kingdom	1,022	111	1,891	842	1,301
Germany	467	650	942	927	845
U.A.E.	173	239	327	961	645
Switzerland	268	356	292	195	502
France	547	229	347	392	487
South Korea	224	189	138	241	466
Italy	63	185	167	279	364
Cyprus	415	546	737	488	282
Spain	348	181	401	141	213
British Virgin Islands	3	0	30	203	212
China	148	121	505	461	198
Belgium	33	66	47	57	172
Others	1,394	1,501	1,754	2,677	1,109
Sector-wise Inflows					
Manufacturing	6,528	6,381	9,613	8,439	11,972
Communication Services	92	1,256	1,075	2,638	5,876
Financial Services	2,760	1,026	3,075	3,547	3,732
Retail & Wholesale Trade Business Services	551	1,139	2,551	3,998	2,771
Computer Services Miscellaneous Services	643	521	680	3,031	2,684
Electricity and other Energy Generation, Distribution &	247	934	2,154	4,319	1,937
Transmission	552	941	586	1,022	1,816
Construction	1,653	1,284	1,284	1,364	1,722
Transport	1,319	1,276	1,640	4,141	1,564
Restaurants and Hotels	213	311	482	1,363	891
Education	3,129	361	686	889	430
Research & Development	150	107	131	394	205
Mining	69	24	129	596	141
Real Estate Activities	197	201	202	112	105
Trading	140	0	228	0	0
Others	43	292	232	215	470

P: Provisional.

Note: Includes FDI through SIA/FIPB and RBI routes only.

India is expected to be the third largest consumer economy as its consumption is expected to US$ 3 trillion by 2025, owing to shift in consumer behaviour and expenditure pattern, according to a Boston Consulting Group report. It will surpass the USA to become the second largest economy in terms of purchasing power parity (PPP) by the year 2040, according to a report by PricewaterhouseCoopers.

This has irked our neighbours especially China and Pakistan. As is known that in spite of the UN Security Council declaring certain elements as proclaimed terrorists, China has, on one pretext or the other tried to stymie the international efforts. Pakistan itself has tried unassiduously to destabilise India in the past. We also had to suffer from the low intensity conflict due to continuous support of the lumpen elements in Pakistan. Due to the peculiar geographical conditions, India has to be on continuous alert from terrorist and other such elements. People from Afghanistan, Sri Lanka, Myanmar, Bangladesh, Nepal, erstwhile Tibet and even some African countries have flocked into India and have been given refuge in our country. The fact cannot be denied that unwanted elements may infiltrate into our country in the garb of being a refugee. Some of these may have sympathies with the international terrorist organisations and may even be acting as sleeper cells. It is a fact which we have to live along with.

Thus, there are numerous reasons why the terrorist activities in one form or the other are likely to continue in India in the future-

- Existing differences between haves and have-nots, which are widening by the day thereby causing disgruntlement among various sections of the society
- No single universal definition and co-ordinated action/ plan by various countries
- Political and ideological differences exiting around the globe
- Globalisation and modernisation
- Religious fanaticism
- Poverty and Unemployment

- Publicity value attached to the dissident movements.

5.3 Perspectives of various countries

Knowingly and unknowingly contamination of food with various hazards, the world population is suffering from number of short term, long term illnesses or death. Almost 60 to 70% of the illnesses now prevailing in the society are due to food, water, air borne microbial infections and intoxications, toxicities due to heavy metal, pesticide residues, veterinary drug and other chemical residues. The infections are causing sporadic, epidemic and pandemic outbreaks throughout the world. Currently more than 50,000 types of chemical agents are produced and used in industrialized countries. There can be many new combinations also which can be developed and utilised for the purpose. Many of these are causing severe toxicities and casualties leading to gastroenteritis, congenital malformations, asthma, cancer, stunted growth and neurological & behavioural disorders.

Table-8

Food Supply Chain: Potential Sources of Food Safety Hazards

Agricultural Input	Farming	Storage/ Transport	Processing	Retailing	Consumer
Use of banned or Restricted Pesticides Seed borne and Animal Borne Diseases Improper Waste Water Management Industrial pollution (heavy metals)	Contaminated water and soils Improper Pesticide application Improper animal health practice	Improper storage, Drying and pest Control Poor waste management Industrial pollution Unhygienic Handling and Transport Use of prohibited Chemical as	Use of banned substances/ food additives Cross-Contamination Poor waste Management Industrial pollution (heavy metals) Contaminated water	Improper storage Unhygienic transport Improper handling and packaging	Unsafe raw material/ water Cross-contamination Improper storage Poor sanitation

preservatives

5.31 US perspective on food bio-terrorism

On 8th October 2001, the Office of the Homeland Security was established.[91] An internal US Department of Agriculture (USDA) Homeland Security Council was established. Its responsibilities include-

- Establishing policy
- Coordinating security issues
- Monitoring progress against objectives
- Appointing representatives to other committees
- Developing information and research with other agencies

The Protection of the Food Supply and Agricultural Protection Sub Council has specific responsibilities which include border surveillance, threat against agricultural produce, food processing, storage & distribution and food safety activities including inspections. Food Security Action Team has been established to co-ordinate and facilitate all activities relating to bio-security, food bio-terrorism and emergency preparedness within FSIS. Food Emergency Response Network has been established in 2002 to co-ordinate among laboratories. Consumer complaints are monitored and analysed to formulate response strategies. The US Public Health and Bioterrorism Preparedness and Response Act of 2002 addresses the national health preparedness for bioterrorism and other public health emergencies. Any factory, warehouse or importers must register with the US Food and Drug Administration (FDA). Through this, the traceability of the product has been ensured. Imports of agricultural produce are also being monitored in order to protect the food supply chain of the USA.

5.32 EU perspective on food bio-terrorism

As the European Union (EU) has been impacted by diseases like the Foot and Mouth disease and the Swine fever, European Commission calls on its member

states to ensure that the protective measures for human food, animal food, drinking water and surface water are sufficient to meet the safety requirements.

The EU Communication (European Commission, 2003) which addresses the fight against bio-terrorism states with regard to food supply that-

The Community has a broad body of legislation which covers primarily production of agricultural products and production of processed food. There is therefore, no need to establish new systems, but, rather to adjust the current mechanisms in order to improve their functioning, taking into account the threat of bioterrorism.

The EU has established body of legislations for animal and plant safety. The Directive 92/66/EEC introduces community measures. The EU Commission has developed a draft regulation to control LPAI and HPAI. There are proposals to renew the old control measures and issue new directives.

5.33 UK perspective on food bio-terrorism

The Civil Contingencies Secretariat[92] was established in 2001. Its objective is to build resilience at every level, national, regional and local- to detect, prevent and if necessary handle the disruptive challenges. These could range from the outbreaks of animal or human disease, to terrorist attacks. The UK government has been spending more than 50 million GBP every year to strengthen the resilience measures within its country. The Animal Health Act, 2002 and The Avian Influenza and Newcastle Disease (England and Wales) Order 2003 empowers the authorities to take appropriate measures to prevent and deal with such casualties.

5.34 Australian perspective on food bio-terrorism

Successful partnerships have been forged between the Department of Agriculture in Australia and industry organisations (The Grainguard, Hortguard, Stockguard and Beeguard initiatives) (Delane 2001). These have provided a cost effective approach to addressing known and anticipated invaders and effective

precautionary measures for enabling rapid response to rare and unexpected events of a disease outbreak or incursion.[93]

5.35 New Zealand perspective on food bio-terrorism

The New Zealand Biosecurity Act, 2003 is perhaps the most comprehensive of all as it unifies all pest management legislations into a single, comprehensive law; it creates a central authority to deal with harmful organisms and together with subsequent legislation, covers biological threats to agriculture, horticulture and forestry as well as country's unique biota (Bright 1998, Parliamentary Commissioner for the Environment 2000).[94]

5.36 WHO perspective on food safety issues

The WHO Five keys to safer food serve as the basis for educational programmes to train food handlers and educate the consumers. They are especially important in preventing food borne illness. The Five keys are as follows.

- Keep food surfaces clean. Wash all utensils, plates, platters, and cutlery as soon as used.
- Separate raw food from cooked food.
- Cook food thoroughly, to the appropriate temperature.
- Keep food at safe temperatures, both for serving and storage.
- Use safe water and raw materials.

World Health Organisation (WHO) has developed guidelines on preventing terrorist threats to food to assist Member States.[95] It has issued a handbook on "Terrorist Threats to Food" in May 2008. The objective of this handbook is to prepare the member nations to develop tools and also to support them against such threats. The 55th World Health Assembly adopted resolution WHA 55.16 which expressed serious concern about threats civilian populations by deliberate use of biological, chemical or radiological materials. WHO has initiated Global Food

borne Infections Network (GFN) with many countries to detect, control and prevent food borne and other enteric infections from farm to dining table. The main objectives of the network is to strengthen and enhance the capacities of national and regional laboratories in the surveillance of Salmonella, the other major food borne pathogens and antimicrobial resistance in Salmonella and Campylobacter from humans, food and animals through the programme activities(FAO/WHO, 2010).

5.37 Indian perspective on food bio terrorism

There are a host of agencies involved in the whole process but the security provided by the various agencies in negligible. The farmers are not even aware of the symptoms of any bio terrorist attacks and how to deal with these, similarly the handlers/ store keepers, the final sellers and consumers are also equally or if not more ignorant. The contamination therefore, need not be forceful and may be subtle enough to avoid detection. It may be short term or may have a long term impact. The effects may be localised or may spread over a large area or may have a delayed impact due to which the contagion spreads.

Tactics which may be adopted by the terrorists to harm the food chain, by contaminating or infiltrating can broadly be given as-

- The agricultural farms or agricultural produce at the farm level
- Transportation and logistics/ supply chain at any point
- Storage facilities
- Distribution channels
- At the final consumption stage

However, it presupposes that the extremist elements involved in the process of spreading these spurious elements are fully aware of the impact, consequences, quantity to be used, etc. The element of intent is central to the probability of use. Vulnerability does not necessarily mean that the threat is real. Many countries are vulnerable to such actions but the threat level more or less depends on the preparedness of that country and awareness among its citizens. Although globalisation has increased these threats due to increased imports and exports, but,

better preparedness by the concerned agencies, etc can certainly reduce or mitigate the impact.

NDMA integrates the global targets into the national efforts and seeks to strengthen significantly India's mitigation potential by focussing on multiple hazards and their likely cascading effects. The disaster preparedness or plan can succeed only when all the stakeholders/ agencies are identified and their expertise is made use of. They must also have the capability to use their knowledge and skills and institutionalise them. Seamless co-ordination and co-operation is a sine qua non for success of these plans. National Policy on Disaster Management, 2009 underlines the need for a strategic approach to capacity development and active participation of all stakeholders for it to be successful.

Any over emphasis on a police or military counter-terrorism operation can be counter- productive. It may also lessen attention to broader disaster preparedness and mitigation programmes. So, the planning process and preparedness has to be comprehensive and all inclusive. Broadly, the emergency management process being followed can be categorised into following four categories-

- *Mitigation*- When the governments and the various agencies do a risk assessment and try to prepare to brace with such acts. Steps are also taken by the society at large to reduce the risks.
- *Preparedness*- In this a response plan is developed in consultation with the experts and all stakeholders. The objective is to be fully prepared when any such event occurs. This will result in identifying the human and technical resources, their training and up-gradation required.
- *Response mechanism*- Each constituent of the plan has its tasks earmarked and in case of any situation emerging, take appropriate action. It also acts to reduce the secondary damage and assists in the recovery process.
- *Recovery*- In the eventuality of untoward event, take appropriate actions so as to enable the society to recover and restore itself.

Effective emergency management programmes are very difficult to design due to various reasons in our country. The main issue being that the administrative authorities, media and the politicians would not gain mileage in our country by

preparing rather than in distributing relief after the event has occurred. Secondly, when the disaster preparedness is done, the constituents are prepared for the worst, which may stretch the already limited resources. Also, resources may not be willingly made available beforehand. Thirdly, amendments in laws may have to be made in certain laws which fall within the State list. Fourthly, the diversity of our country and its cultures can increase the degree of difficulty for the agencies to prepare themselves to handle such emergencies. The effectiveness of the emergency management plan is difficult to quantify, but, the costs are more apparent. It becomes more apparent in cases where there is no historical data available for a particular type of disaster. These plans have to be rehearsed at regular intervals to keep the dealing agencies in a state of readiness. Difficulty also arises in case the area impacted is restricted. Hence, it is an uphill task to make a centralised Emergency Response plan.

In the private sector too, the Security practices often require significant investments within the firm and across the supply chain but they do not show any immediate tangible returns. Higher investments in securing the firms' processes and products do not necessarily make the food products safer if the supply chain partners exhibit higher risks. However, a risk that is realized can potentially bankrupt the firm. Security and safety preparedness therefore needs to be examined and plans prepared to deal with such emergencies.

India has been growing at a tremendous pace for the past many years and has become one of the fastest growing economies of the world. The urbanisation has also increased correspondingly. Due to increasing globalisation, the public has started demanding more and more and there is varied demand for greater variety of food and clothing. Awareness about the quality of food and water has been continuously increasing among the countrymen. The withdrawal of Maggi noodles had gained limelight recently. Improved monitoring by the different government agencies has also raised demand for safe food.[96] There exists a possibility of the sabotage of the food chain and the drinking water supply system. This may be used to intimidate or terrorize civilian populations.[97] Recently, in an audio clip ISIS urged its cadres to carry out lone wolf attacks on the Kumbh and the Kerala fests. In an article published in the Times of India, one Abdul Rashid has exhorted the radicalised Indian muslims

to launch attacks by driving trucks through devotees or by poisoning food.[98] Although the National Investigation Agency (NIA) had termed it as an act of desperation, but, the authorities need to be on high alert as the next Kumbh mela is due to be held in Allahabad in 2019. Thrissur Pooram is held every year and is next due in April 2018.

Governmental and non-government agencies may also be a target of such disruptive attacks. Government agencies include Civil Supplies departments, Water and Public Health agencies, etc and the Private organisations include the commercial acts of the Corporations and the NGO's and Trusts caring for the under privileged and poor in our country. Drinking water supplies and manufacture & distribution of food products are very vulnerable as they are quite low on priority of the security agencies and are easily accessible. Although globalisation & complex production and delivery systems for foods & medicines have increased vulnerability, the diversity of sourcing has also reduced the likelihood of their being contaminated. Water which has no alternative creates a more serious problem and increases the potential for panic and hysteria.

In the preparation of plans, the various Government departments like civil administration, police, civil defence, homeguards, health department; suppliers of food and water like the municipal authorities, Jal Board involved in the distribution of drinking water and private manufacturers of products for Mid day meal scheme, etc should be involved. Special expertise will be needed for plans to prevent, detect and respond to deliberate contamination. These will also include educating the consumers through advertising, publicity and dissemination of information through other relevant means. Improved vigil will reduce intentional and accidental vulnerability manifold.

During such outbreaks or incidents, proper dissemination of information should be done to educate the public and the media. This will prevent panic and hysteria among the population. Withholding information during this process can lead to loss of public confidence in the government agencies.

Proper identification systems for deviations result in establishing a robust quality control mechanism. These can be either manual or technological. Separate

mechanisms cannot be developed for each food safety issue. However, when the public health surveillance system is strengthened that itself will take care of such contaminations and its after effects. Whenever there is any outbreak of disease or systemic deviances the public health authorities should be capable of quick and effective responses. This will be possible only when there is a good monitoring mechanism and adequate level of preparedness on part of the public health authorities. Training must be imparted to the law enforcement authorities also so they are capable of collecting specimens and conducting scientific investigations.

Safeguarding food supplies and ingredients from mischief is a more difficult process as the raw materials are often sourced from far off areas. Similarly the end products are distributed widely, often to foreign countries. There are adequate opportunities at the pre-farm stage and in slaughter houses in case of meat products, which need closer look. The challenge is considerable and can only be achieved by educating and involving the producers of the raw material. Street food vendors, workers in the restaurants/hotels and in community kitchens are most appropriate detectors. Within the food system itself, certain products like cooking oil are easier to contaminate than others. All such items need to be categorised properly.

Some of the reported cases of food borne outbreaks of bacteria in the past two decades have been given in the table below. These can be analysed and can prove useful in formulating action plans at the local levels.

Table-9 [99]

Reported Food borne outbreaks due to bacteria in India during 1980-2016

Place	Incidences	Number Of person affected	Microorganism	Food
Party	3	98	*Salmonella Paratyphi A Var Durazoo; S.aureus; V. parahaemolyticus*	Veg food Coconut balls Fish and meat sandwiches
Mess	1	76	*E. coli serotype* 020	Dinner
Home	2	5	*Salmonella enterica* serovar Weltevreden	Stale rice

			(S. Weltevreden) *Salmonella bornum*	Chicken
Feast	2	303	*Yersinia enterocolitica* *Salmonella weltevreden and Vibrio fluvialis*	Butter milk Mutton- ghogni
Religious Ceremony	2	164	*Vibrio fluviatilis* *Shigella sonnei*	Bread and vegetable curry Food item not identified
Military establishment	2	78+43	*Salmonella enteritidis* Non typhoidal Salmonella sp	Frozen food Potato bitter gourd vegetable contaminated by rodents
Marriage Party	2	800	*Vibrio vulnificus* *Shigella sonnei*	Fish Food item not identified
School	2	135	*E coli* *Staph aureus*	Soyabean milk Bhalla
Hostel	2	184	*Salmonella weltevreden* *Salmonella weltevreden*	Fish Food item not identified
Educational Institution	1	150	*Salmonella enteritidis*	Kheer
Hospital	10	10	*Salmonella wein*	Poultry products
Slum area	1	103	*Salmonella typhi*	Yogurt and sweets
Tea Garden	1	72	Salmonella weltevreden	Contaminated drinking water
Funeral Reception	1	44	Vibrio parahaemolyticus	Food item not identified

Besides, the risks of food borne and waterborne diseases have also increased tremendously due to the contamination and widespread pollution within the country. Some studies have found that the risk is greater in case of poor and low middle income families due to their living standards, hygiene and environment in which they live. In India such diseases are not even reported many times.

Early detection is essential for success of any good system as it reduces the likelihood or magnitude of the tragedy. Early detection and corrective action will

only reduce the magnitude of the negative impact and help the victims recover early. Cent per cent protection and providing security to each and every source is not possible even in the most developed countries. Systems and technological gadgets have to be used to complement human efforts. These systems should also be checked for their effectiveness and robustness frequently. Also, given the potential use of various agents being so vast, it is not possible to monitor each and every product. Adopting adequate precautions and upgrading public health standards is imperative. E.g. Drinking water is being drawn from rivers or dams as raw water; it is being treated at a government facility and then despatched for use by the consumer. In this process numerous people may have access at any of these interim stages. Systems will thus, have to be developed at all the stages. Available resources need to be allocated on the basis of threat assessment and vulnerability of a particular geographical area. Technology has advanced enough to develop and implement systems for detection of deliberate contamination. The human element involved in the whole process should be kept uppermost in this planning and implementation process.

There have been illnesses associated with widespread water borne microorganisms and with drinking water & food contaminated with toxic chemicals, in India. As of 1st April 2010 about 9% of habitations face water quality issues due to chemical contamination. Out of the 1,44,064 remaining quality-affected habitations, arsenic contamination is reported in 6,548 habitations of 8 States, fluoride contamination in 26,131 habitations of 19 States, salinity, both in inland and coastal areas, in 28,398 habitations of 15 States, iron contamination in 79,955 habitations of 21 States and nitrate contamination is reported in 3,032 habitations of 12 States. These contaminations are either natural or associated with over-exploitation of groundwater. Many more sources report bacteriological contamination, especially during rainy season due to poor sanitation, poor organisation, management and hygiene leading to water borne diseases impacting on maternal and child morbidity and mortality. The main issues in dealing with water quality are related to: weak legislation and enforcement of water quality standards and testing protocols, exploitation of sources contaminated due to deteriorating groundwater levels, poor

Operation & Maintenance, weak provider accountability with respect to quality of water provided and lack of awareness amongst rural citizens about the importance of safe water and poor environmental and domestic hygiene. [100]

Water sources all across the globe are highly insecure and therefore vulnerable to deliberate contamination and sabotage. They can be sabotaged at any of the following points

- Raw Water main supply
- Treatment Plants
- Piped mass distribution systems
- Water tanks
- Local distribution systems

The affect of pathogens may manifest after a long gestation period. Introduction of monitoring mechanisms in water delivery systems and food manufacturing as an integral part of the quality control systems will greatly improve public confidence. Identifiers can help put the deviations back on track. Rapid follow up should be ensured thereafter immediately. Individual consumers also have a significant role to play in this process. There should be systems to conduct tracing of the contaminated items, their isolation and recall. Public awareness needs to be raised in this context. In case of water there can be no recall but there should be systems to disseminate information on a huge scale so as to prevent the impact from stretching further. However, neither the trace back of problems nor the trace forward of contaminated products is always simple, as shown by the Belgian dioxin crises. [101]

"Scientific evidence has shown that contamination of food is a serious issue in India as unchecked microbial activity and the use of pesticides and antibiotics seriously compromise food safety, while consumption of junk food and other chemically-laced foods adds to the problem," said Chandra Bhushan, Deputy Director General, CSE, in a statement. Pointing out that in 2013, about 10 per cent of deaths in India of children below 5 years were due to diarrhoea, Bhushan said the exact burden of all food-borne illnesses in India has still not been estimated. According to CSE researchers, largely unregulated pesticide use and management in

India was one reason for food contamination, leading to long-term health effects, such as endocrine disruption, birth defects and cancer. “Pesticides have even been found in packaged food products, such as soft drinks, bottled water and in human tissues in India”, they said.

Another threat is from indiscriminate use of antibiotics for non-therapeutic reasons. “The problem of drug resistance linked with this practice, further makes the food-borne illness difficult to treat. Most bacteria that cause food-borne illnesses, such as *E coli*, *salmonella* and *campylobacter*, are already found to be multi-drug resistant,” CSE said, calling for a ban on antibiotics for growth promotion and mass disease prevention, as in several European countries.

In some countries there have been outbreaks of diseases in animals. Such events have stretched the public health system besides causing panic and loss of economic activities. As a consequence, economy has suffered. Thus, there is likelihood of these services being poisoned by the terrorist and unwanted elements in India also. Particularly sensitive places like hospitals, marriage halls, public functions by a political party or religious institutions, security barracks or residential premises, bottled water processing plants, schools or colleges, huge residential or commercial complexes, malls or shopping complexes frequented by public on holidays, etc. are highly vulnerable. A university level knowledge is sufficient to produce many agents which can be harmful for human use. Therefore, government and commercial organisations must identify and ensure that all such drugs, chemicals, pesticides and insecticides items have restricted use and are prevented from unauthorised diversion. Laboratories for testing such chemicals and micro-organisms must be well equipped in order to quickly identify the contaminants so that preventive measures can be taken for future and proper treatment can be given to the effected persons. In vivo and in vitro assays are useful in detecting contamination and immunoassay screening tests for certain bacteria and viruses can be used in response to specific threats.

A wide variety of medicines, consumer eatables and other products are widely used by the people in their daily life. These include cosmetic items which can harm the human skin and body. In a well developed market economy, contamination of

one product is not likely to cause widespread disease outbreaks. It is also highly improbable that the terrorist organisations will contaminate similar items of all brands. This is most likely to be done by one commercial organisation against the other. However, in case of any such event occurring loss of public confidence and economic losses are the most likely events. Laws and processes need to be established as many consumers are also using the e-commerce and online buying & selling of daily use goods. This is likely to grow further in future. Traditional foods and medicines are also vulnerable and often same level of safety standards are not used for them as are used for other consumables. Toxic plants may be used as a replacement of traditional drugs and medicines.[102]

Mechanisms must be developed and suited to the local needs based on the guidelines given by the international and other specialised agencies. These must be well rehearsed and publicised for the education of the common populace. But, this also has a flip side as it can encourage hoax calls and panic calls which can rapidly overwhelm the emergency response systems. A balanced approach needs to be followed in this process. Total elimination of the risk of inadvertent or intentional contamination is impossible to achieve, hence, it should not be aimed at. The objective must always be to identify, restrict, regulate and eliminate such threats. Safety systems should incorporate mechanisms to do so. There should be proper system of investigation and trial in these cases. This will deter any such future misadventure. Consumers and final users have a very important role to play in the whole process. They act as the eyes and ears of any good governance system. This can be done only when they are well educated and are made aware of the adverse impacts of these acts. Moreover, any efforts made by the dealing agencies to prevent such contamination should complement and not replace other activities and plans to deal with such unscrupulous elements.

Adequate care has to be taken for the security of animal feeds. The use of pesticides and chemicals on farms needs to be strongly regulated. Excessive use may disturb or destroy the food chain itself. Remnants left on the food items will have serious and adverse impacts on human body as many vegetables and fruits are consumed directly by humans. Besides, it can also spoil the land use patterns for a

long time thereby making it useless for agricultural production. Large number of incidents of inadvertent contamination with pathogenic micro-organisms during the production of meat, fish, poultry and milk products are clear indicators that such items are easy to manipulate and are highly vulnerable to contamination.

There are risks of the use of the genetically modified organisms also which may reflect after a long gestation period or may not reflect at all. Although the genes being transferred occur naturally in other species, there are unidentified consequences to altering the natural state of an organism through foreign gene expression. Such alterations can change the organism's metabolism, growth rate and response to external environmental factors. Potential health risks to humans including the possibility of exposure to new allergens in genetically modified foods, and the transfer of antibiotic resistant genes to gut flora.

Horizontal gene transfer of pesticide, herbicide or anti-biotic resistance to other organisms would not only put humans to risk, but, would also cause ecological imbalances. The possibility of horizontal gene transfer between genetically modified organisms (including foods) and other organisms cannot be denied, however, this risk is considered to be quite low. The shocking consequences of vertical gene transfer between genetically modified organisms and their wild type counterparts have been highlighted by studying transgenic fish released into wild populations of the same species.[103] In a study it was found that the enhanced mating advantages of the genetically modified fish led to a reduction in their viability of their offspring. Thus, when a new transgene is introduced into a wild fish population, it propagates and may eventually threaten the vitality of both the wild type and the genetically modified organisms. It may also have severe consequences on human being if consumed, although the effects have not been researched till now.

The debates over genetically modified foods centre mainly on doubts concerning the potential adverse effects of genetically modified foods on human health. The concerns among the consumers can be attributed to various sources-

- The difficulty of scientific community in explaining to the public about the biological techniques involved in the process
- Anxiety about the improper dissemination of genetically modified foods

- The ethical principles inbuilt in traditional food processing
- The uncertainties with regard to the competence of evaluation of the genetically modified foods [104]

Major health risks potentially associated with genetically modified foods are-

1. Toxicity
2. Allergenicity
3. Genetic hazards

These arise from three potential sources-

1. The inserted gene and their expressed proteins per se
2. Secondary or pleiotropic effects of the products of gene expression
3. Possible disruption of the natural genes in the manipulated organisms.

Food safety management programmes need to set up and defined in minute details. There are issues of funding, approvals, sighting/location, technology, manpower, etc. which restrict the usage of such items at a large scale. But, these are guidelines on which the protective measures may be based. Steps which need urgent attention of the government may be summed up as follows-

- Developing clear cut and unambiguous laws
- Clear guidelines and regulations needed
- Developing institutional and human resources to implement and monitor these laws
- Setting up of latest equipped laboratories
- Delegating certain tests to the accredited private laboratories
- Training of personnel
- Viable opportunities to scientifically equipped personnel to assist in the implementation of these laws
- Increasing awareness among the consumers, food producers, suppliers of water and the officials of various departments involved
- Building capacity of the judiciary to handle such cases
- Co-ordination among various departments

- Educating the farmers is also essential as they use pesticides and insecticides on agricultural produce

From the above mentioned details it is amply clear that as far as the preparedness for disaster situations is concerned, the government and its associated agencies have to take huge steps to ensure food security and safety. The process of preparedness can be summed up in the following table-

Table 10

DISASTER PREPAREDNESS FRAMEWORK[105]

Vulnerability assessment	Planning	Institutional Framework
Information Systems	Resource Base	Warning Systems
Resource Mechanisms	Public Education and Training	Rehearsals

The importance of proper planning can be depicted in the form of diagrams below-

PLAN WITHOUT PROPER RESOURCES

PLAN WITH APPROPRIATE RESOURCES

FOLLOW ON ASSETS TO SUPPORT AND RESPONSE TO CONSEQUENCES ON LIVES AND PROPERTY

The top 3 steps in the above diagram represent the Crisis management and the bottom 3 represent Consequence management.

Source: United States office of Antiterrorism Assistance

Hence, proper assessment, planning, rehearsal and implementation in times of need is extremely important.