

# Timetable for Catastrophe-I

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The recent conflicts and controversies over the proposed chemical hub in East Midnapur of West Bengal have aroused widespread interest and diverse opinions, misinformation and disinformation are daily making their appearances in the electronic and printed media and it is imperative to endeavor to make out what are going to be there and their likely impacts on the economy and on man & environment albeit there lies the problem of paucity of information and government's secrecy about the details of the whole plan. It appears from a government note of 18th May, 2007 circulated to political parties, which is incomplete and internally inconsistent, that petro-refinery and petrochemical industries would be the key stone of the chemical hub from which besides the usual fuels like gasoline, kerosene, furnace oil, LPG, wax, carbon, asphalt etc., plastics, synthetic polymers, pesticides, drugs, adhesives, synthetic rubbers etc. will be produced. For this, elementary chemical commonsense deduces that some other necessary plants like caustic soda, chlorine, sulfuric acid etc. will also be needed. Without details and the usual Environmental Impact Assessment one can at best try to make some enlightened guess works by the experiences from some other areas of the world from a chemical and environmental background.

## **THE HYDROCARBON ECONOMY**

Before entering into the subject proper it is necessary at least to mention the immediate background of the petrochemical industries and the rise of the gigantic multinational companies (MNCs), mostly of US. After the victory of the Allied Forces in WW II with USA as its leader, the world saw the emergence and dominance of US Capitalism over an wide area of the world and great advances in S & T, and the control of US on the oil fields of vast areas of the underdeveloped world and petroleum became the dominant source of energy and a host of important industrial chemical products. Advances in technological and industrial activities have become so much important that the present day economy has become almost synonymous with "hydrocarbon economy". Chemical industries under the patronage and ownership of big capital gradually got transformed into the gigantic multinational corporations of today.

## **HAVOC OF DDT & OTHER PETROCHEMICALS**

They made mighty progress with production of diverse chemicals in huge tonnages, which began to be used indiscriminately as pesticides, drugs, plastics, various polymers that are collectively branded as petrochemicals. But what actually those newer synthetic chemicals were and what their effects were on man and environment, was unknown even in science. But the industries, the public and the government applied them in millions of tons. The actions and fates of the newer xenobiotic (unfamiliar to life, non-biodegradable, and toxic to all forms of life) chemicals were previously, unknown; analytical methods for their identifications and measurements in different segments of the environment and in different organs of the living systems did not develop till the 1960s. But effects of such newer synthetics on man & environment began to be revealed in unexpected ways, in unexpected places that caused concerns among the scientific community, then gradually among the public at large. The industries, the government in the developed countries remained indifferent. An American science journalist Ms Rachael Carson collected information from the published papers and published her simple looking but powerful book "Silent Spring" in 1962 that showed convincingly what the innocent looking DDT (and similar petro-chemicals) with no apparent bad effects on

humans and testing animals, had done on Man & Environment. DDT, whose insecticidal properties were discovered in 1939 by Paul Muller of the Ciba-Geigy Company of Switzerland was widely applied in WW II to protect the health of the Allied Army on various war fronts and was an important factor in the Allied victory, was rewarded with the award of the Nobel Prize in 1948. After the Great Environmental Revolution of the 1960s which occurred mostly in USA and Western Europe by the intellectuals, scientific workers and students mainly and the adverse effects of such chemicals were further proved and established. DDT and some other Organo-chlorine pesticides, which belong to the "dirty dozen" of Stockholm Convention of 1981, became banned. (1972)

In the initial euphoria of triumph and quick profit the big companies produced a wide variety of synthetic organic chemicals in huge quantities. They are now many millions in number, 75,000 to 100,000 of them are in the market. The toxic effluents mainly from petro-plants, were in liquid form, and were dumped into rivers, lakes, seas, without caring to look into their consequences on soil, water, ecosystems, fishes, aquatic, avian and other forms life. The American Great Lakes Michigan, Huron, Erie, many rivers, forests were all poisoned as shockingly discovered later with developed technologies and better scientific understandings. Many unknown scientific phenomena like bio-accumulation, bio-magnification, non-biodegradability, bio-methylation etc. were discovered. All these culminated in the great international Stockholm conference of 1972 whence "environment" entered into every nook and corner of human thoughts and activities. Many damages were already done and then began the work of redemption and remediation, which even now has remained mostly elusive.

The thalidomide baby case of the early 1960s scared humanity when it was found that a mild sedative drug thalidomide had caused the births of over 5000 ghastly deformed and defective children in Germany alone, with lesser numbers in some other European States. The USA escaped because thalidomide did not reach US markets. Dioxin is a very toxic petro-product that usually is a contaminant of many other petrochemicals or produced from the incineration of many such compounds including some plastics and contained in Agent Orange extensively used in Vietnam War as defoliant. Polychlorobiphenyls (PCBs, which may be hundreds in numbers) much used for decades in electric industries, cause enormous harm to man and environment. Huge quantities of PCBs now lie on the sediments in the bed of the Hudson River in New York. Science and American Government are helpless in its detoxification till now. Chlorofluorocarbons (CFCs) or Freons apparently harmless to man and other living systems, was found in the early 1970s to migrate into the upper atmosphere and consistently depletes the protective ozone layer. Man with his enormous scientific and technical power so far remains mostly ignorant about the workings of the xenobiotic chemicals on man & environment. Most have not even been tested as yet.

### **TOXIC PETROCHEMICAL WASTES**

After the Love Canal episode (late 1970s) in which 20,000 tonnes of deadly toxic chemical wastes sealed in drums left buried by past chemical companies in the 1940s and 1950s, began to leak and pollute the soil and ground water in an area in Niagara falls, where subsequently a township sprang up. People were variously affected: increased cancers, defective childbirths were among many. Such irresponsible behaviors of chemical companies had an enormous political impact as a result of which the US Superfund Act 1980 was created to protect people, families, communities and others from heavily contaminated toxic waste sites that had been abandoned. The official name of the law is Comprehensive Environmental Response, Compensation and Liability Act. (CERCLA). Of the 1359 Superfund sites detected up to 1998, only 509 could be cleared up with an expenditure of 15 billion US\$ raised from the erring companies, the government and the public. For the rest another 25 billion dollars would be required, if

no further big waste disposal sites are discovered. It has also been estimated that something like 30,000 more smaller Love Canal like "Time Bombs" are ticking in USA, not all of which have been discovered as yet. The Great Lakes are yet to recover. It is not unnatural to be concerned about the waste disposals from the upcoming petrochemical plants in the Haldia area of West Bengal.

### **PEACEFUL COEXISTANCE WITH NATURE**

It is to be noted that there are similarities between the dangers and harmful effects between nuclear and toxic chemical wastes. Both are long lived, highly toxic and their safe disposals or containment remains unsolved problems in science, as radioactivity in nuclear wastes. Before 1950 there were only some 20 environmental laws in USA. Between 1950 and 1995 another 100 more such laws had to be enacted. Still the solutions to the problems are not achieved. Gradually it is being realized that production of such xenobiotic, non-biodegradable toxic chemicals is inadmissible, at least in huge quantities, because they are beyond the detoxifying power of Nature and non-recyclable in the bio-geo-chemical cycle, which Mother Nature has created to maintain life on earth. Nature constantly synthesizes billions of bio-molecules, and degrades them smoothly back into simpler innocent smaller molecules to place them in the Nature's "Closing Circle", whereby nature makes readily available life's all essential building block elements for plants, animals and other organisms. Barry Commoner's ("The Closing Circle, 1971") 3rd law of ecology (nature knows best) stresses that Nature's major way of maintenance and preservation of the cycle of life on earth can't be subverted, disturbed. Commoner believed that the Petrochemical Industries are toxically invading the biosphere and they are "inherently inimical to environmental quality." Hence massive production and use of xenobiotic non-biodegradable chemicals is not admissible. Similarly, by the way, it may be mentioned that under a particular configuration of the universe our Solar System evolved and life could appear in a nearby planet, the Earth in our case, in an arrangement where energy would be released from gargantuan nuclear reactions in a nearby star, the Sun in our case, and the emitted energy therefrom would be trapped by chloroplasts of green plants far away on the Earth, through the process of photosynthesis to make available the necessary energy for living systems through food chains. This arrangement cannot be disturbed and man must follow a commandment: "Thou shall not cause massive nuclear reactions on Earth." It thus follows that massive N-power generation is inadmissible. Likewise : "The Biogeochemical Cycle must not be tampered or poisoned beyond the limit of Nature's remediation power." Hence massive production of Petrochemicals is inadmissible.

### **EMERGENCE OF GREEN CHEMISTRY**

In response to the Love Canal disaster the Superfund Act 1980 was enacted. Other incidents in other countries, particularly the Bhopal MIC gas disaster of 1984 put the final nail into the coffin of the earlier Black and Red Chemistry which now seems to be a stray misadventure, exactly not of science, but its misuse by industry which is now being rectified with the development of Green Chemistry, which is being enthroned as the chemistry of the 21st century. To find a way out of the problems arising out of the petrochemical and other industries while ensuring a better standard of life for man on this planet, the US Pollution Prevention Act 1990 was enacted on the basis of which the American Environment Protection Agency and the American Chemical Society has formulated 12 cardinal principles of Green Chemistry which aims, among others at.:

- The maximum amounts of reagents are converted to useful product (atom economy)
- Production of waste is minimized through reaction design
- Non-hazardous raw materials and products are used and produced wherever possible.
- Processes are designed to be inherently safe
- Greater consideration is given to using renewable feed stocks

- Processes are designed to be energy efficient.

The aim is to solve the pollution problems at source. The principles and associated terminology are becoming widely accepted as a universal code of practice as the Green Chemistry Movements spread out of the USA into Europe, Australia and Asia. Green Chemistry is destined to restore the earlier respect and love for chemistry in its rising days in the 1st half of the 20th century when it helped man with better food, medicines, building materials, colors, dresses and so on. Consistent with the principles of Green Chemistry, now coming Bio-refineries to replace the extant petrochemical refineries. Bio-refineries, which may be on small scale also, will use biomass, agricultural products and their wastes, using principles and methods established in the chemical sciences. These can produce all things (all organic chemicals including the fuels) as are producible from the petro-refineries of the present, but will cause no pollution and other hazards and will not enhance green house effect by using carbon fixed through photosynthesis in the remote past.

West Bengal is a densely populated small state with much of its territories in Purulia, Bankura, Birbhum etc. are non-fertile with meager water resources. Since every country, every region cannot, does not produce all things they need and that is why the institutions of Trade & Commerce have evolved, West Bengal need not have petrochemical plants, which have been and being set up in other places having more favorable situations. West Bengal may specialize in agriculture, animal husbandry, dairy, fishery and dispersed eco-friendly pro-people industries, may be by also using bio-refineries. In such a development paradigm, as have been elegantly developed in Schumacher's "Small is Beautiful : A Study of Economics as if People Mattered", which in a way was also envisioned by Rabindra Nath some 85 years ago in his "Robbery of the Soil" (1922). Bengal's marxist Chief Minister may read or reread that along with studying the developmental histories of some countries like Switzerland, Denmark, Iowa State of USA, New Zealand, and others where "dirty" industries have little space.

#### **WHERE REMEDY IS UNAVAILABLE PREVENTION IS WISEST**

Apparently nuclear and petrochemical industrial plants look very different, but in their essence, particularly in their effects on man and environment and mode of operations, there exists much commonness. Both are sophisticated, capital intensive, high-tech, fully automated, remote controlled plants and both are accident prone and full of hazards from raw material extraction, transport, storage and operations. Detoxifying or safe containing of toxic wastes are impossible or extremely difficult and accidents are "Normal" in both (vide: *Normal Accidents : Living with High-Risk Technologies* by Charles Perrow, Princeton, 1999). The term 'Normal' is used as a synonym for "inevitable accidents" and it is applied to "enterprises that have catastrophic potential, the ability to take the lives of hundreds of people in one blow, or to shorten or cripple the lives of thousands or millions more".

#### **PETROCHEMICAL PLANTS**

#### **VIS-A-VIS NUCLEAR REACTORS**

Both the types of plants are highly accident prone. While the Chernobyl nuclear reactor accident killed 31 people, affecting many people with fatal radiation, which it is estimated will cause 2300 more cancer deaths. The Bhopal Union Carbide MIC gas disaster took toll of 2,500-10,000 lives and injured at least 200,000 people, many of whom died subsequently. The wastes from both are difficult, if not impossible, to contain safely or detoxify. The effects of nuclear radiations and toxic xenobiotic petrochemicals on living systems are similar, although the mechanisms of actions are different. Some xenobiotics are radiomimetic chemicals. Somewhat better known is the effects on human systems, where both cause cancers, defective childbirths, genetic mutations and various other diseases. Under normal routine running conditions, which need reactor re-

charging, leaks, shutdowns, maintenance, waste disposals, etc. regular low-level radiation and toxic chemical pollution routinely come out of nuclear reactors and petrochemical reactors that affect the surroundings. A comparison of the half-lives of some radioactive isotopes (which are of more concern) and synthetic xenobiotic chemicals, merit consideration : Strontium-90 : 28 yrs; Iodine-131 : 8.1 days; Cesium-137 : 30 yrs; Plutonium-239 : 24,400 yrs; DDT : 25 yrs; Dioxin, PCBs, Persistent organochlorines all almost infinite. Although these emission of radiation leaks are denied by promoters and patrons of N-Power but have been aptly disclosed by Ernest Sternglass in his "Secret Fallout : Low-Level Radiation From Hiroshima to Three-Mile Island" (McGraw-Hill, 1981). Similar low-level pollution routinely emanates from petrochemical plants, where it is evidently more, because of the need for working with much more material flows of gaseous and liquid reactants and products and their temperatures, pressures and flow rates need constant monitoring and delicate balancing. Records of petrochemical plants as presented by the companies, are fairly clean compared to nuclear reactors. The reason for this is that most incidents are concealed, not disclosed, nor even much investigated. Still whatever could not be hidden is simply staggering. A few examples will illustrate this.

#### **NORMAL ACCIDENTS**

In a nylon plant (Nypro works) in Flixborough, England, where caprolactum was being produced from cyclohexane oxidation, an explosion occurred (1974) with a force equivalent to 15-45 tonnes of TNT in which 28 people were killed and 36 persons injured. This is the most fearsome "vapor cloud explosion" that frequently occurs in petrochemical plants. These occur in the open air. An explosive gas forms a bubble, which may drift for several minutes before igniting. In an Illinois accident in 1972, two rail road cars involved in a "bumping" operation and in a collision the two cars coupled together with too much force that released 118,000 pounds of LPG. Since the cars were rolling, the gas spread as it leaked out. The bubble covered about 5 acres when it exploded. No deaths, 230 people injured and property damage was \$ 10.8 million (1972 dollars). Two years later in Illinois another rail car accident released isobutane. The cloud was one-half by three quarters of a mile in size before it exploded eight to ten minutes after the accident. The "yield" was estimated to be between 200 and 400 tons of TNT, ten times that of Flixborough accident. There were 7 deaths and 356 injuries; property damage was \$ 21.7 million. A tank valve failure in a New Jersey refinery created a cloud that extended to a highway just 200 feet away, where a car probably provided the ignition source. An accident in cyclohexane plant in Florida in 1971 produced a cloud that was 2,000 feet long, 1,200 feet wide and 100 feet high, but it found no ignition source and dissipated.

In Nov. 1979 a 106-car freight train derailed at Mississauga, Ontario. The goods train contained a variety of different substances, including one with a 90 - tonne load of liquid chlorine. In all, 24 freight cars derailed. Eleven contained liquefied propane. Within a few minutes, fires broke out and one propane car exploded. Another behaved like a rocket and was propelled 750 meters from the site. Some 70 tonnes of liquid chlorine gas were sent skyward by burning propane from other freight cars. Within 24-hours nearly a quarter million people had to be evacuated from an area of 120 sq.km. It may be noted that our LPG is mostly propane + butane in liquid forms and their and others' movements on rails and roads have become a common sight nowadays. The government and the public are not in any way prepared to tackle accident disasters.

"Accidents in which large quantities of dangerous chemicals are released into the environment are almost inevitable in the modern world. Toxic chemicals are produced in such large volumes today that it would be a surprise if such accidents were never to occur", writes Environmental Encyclopedia (Eds : Cunningham et al., 1999, Jaico print).

One of the most infamous accidents of this kind occurred at Seveso, Italy, a town near Milan on July 10, 1976. The Swiss manufacturing firm of Hoffman - La Roche operated a plant at Seveso for the production of hexachlorophene, a widely used disinfectant. One of the raw materials used in this process was 2,4,5-trichlorophenol (2,4,5-TCP). At one point in the operation, a reactor vessel containing TCP exploded, releasing the chemical into the atmosphere. A cloud 100 to 160 ft. high escaped through the safety valve and then drifted downwind. It eventually covered an area about 2,300 ft wide and 1.2 miles long. Although TCP, a minor skin irritant was not of so much concern, but an impurity in it, a side product of the reaction, called dioxin (name of a family of very toxic compounds) some 3 to 16 kg of which was estimated to be present in the escaped vapors, were of the greatest concern. Although no human death was reported, only some increased miscarriage and deformed childbirths were confirmed later, but damage to plants and animal lives in the exposed area was severe. Thousands of farm animals died and had to be destroyed.

The Seveso disaster is important in the concerned international parlance. But what is more important is to understand the attitude and mindset of the multinational companies. "The drug firm, Hoffinan-La Roche, in Switzerland was well aware of the danger of dioxin contamination in their plant in Seveso, Italy and indeed plant officials were instructed to readily reimburse their neighbours for dead farm animals that continued to appear. Knowing that dioxin was a by-product of the pesticide the plant produced, they would not allow production to take place in clean little Switzerland, where their headquarters were, but instead had it produced in dirty northern Italy. When the chemical reactor exploded one weekend when no one was attending it, the safety device protected the plant by allowing the poison to blow up into the air through a stack, from where it drifted into the neighbouring community. Plant officials avoided a panic by simply not informing the community (Charles Perrow : Normal Accidents). The readers must be, recalling that tragic fateful night of Dec 3, 1984 when Bhopal's MIC gas disaster took place by which babies sleeping in mothers' breasts, passengers in trains at Bhopal railway station, brides and bridegrooms in marriage parties died in hundreds and thousands. A chemical hub in South Bengal bears all these portents.

#### **TOXIC IRELAND**

Before the 1950s Ireland with its lovely lush countryside had no chemical industries worth the name and electricity just began to reach Irish countryside in late 1950s. At that time the Government chalked out a plan to open Ireland's agricultural economy to foreign capital. Ireland's Industrial Development Agency's (IDA) strategy was to entice foreign investment by offering generous government grants and subsidies, tax free exports and a host of other economic concessions and benefits, even ready-built factories. The result was a rapid influx in the 1960s of chemical, petrochemical, pharmaceutical and electronic industries into Ireland. From the 1960s U.S. multinationals arrived in Ireland at the rate of one every twelve weeks. Of the 360 multinationals in the early 1980s, 140 were chemical or pharmaceutical companies. By 1980, the chemical and pharmaceutical industry was employing 14,000 workers with export almost 20 percent of the country's GNP, 80 percent of which came from US companies. Big and reputed companies started their industrial operations. One such company, the Merck-Sharpe & Dohme Corporation set up a 35 million pound manufacturing plant at Ballydine in 1972. The company promised 450 jobs in a country of 3.5 millions, where 15 percent was unemployed and promised to ensure stringent air pollution controls for the 35 bulk chemicals used in drug manufactures. But explosions, at least three, occurred and neighboring residents complained of respiratory problems. In 1980 animals began to die, cattle miscarried, twin births and defective childbirths increased, milk production dropped, and digestion and breathing problems became

evident. A yellowish dust settled on pastures, and increased heavy metal concentration was discovered on vegetables. Despite all these the company consistently denied all these emissions of pollutants. Some official investigations were undertaken, but reports not disclosed.

In 1981 two more explosions, more cattle deaths. An asbestos company came in 1975 and polluted the environment. People protested when attempts were made to dump asbestos such that those become a health hazard. The government's IDA spent about 10,000 pounds in newspaper advertisements to convince people that asbestos was safe. In 1980 the company pulled out leaving the asbestos dump as a permanent source of health hazard.

In 1977 IDA estimated that 20,000 tons of toxic wastes were generated each year, which contained lead, mercury, chrome, asbestos, phenols, cyanides, arsenic, acids, solvents and low-level radioactive wastes. IIRS (Institute for Industrial Research and Standards) estimation was generation of 37,000 tonnes of toxic waste per annum and admitted not knowing where it is disposed each year. Some toxic wastes were clandestinely dumped at remote or unknown tip heads by some 50 or more waste disposal contractors who did not disclose the nature of their cargoes. Some rivers were poisoned, fish kills escalated, people's sufferings increased. The majority of toxic wastes were dumped on factory grounds, which were subsequently sold and unwittingly redeveloped. Most multinationals stayed in Ireland for the first few years of cost cuts, then closed up and moved out when the cost/benefit ratio readjusted, leaving a toxic Ireland to mend for herself. Meanwhile their temporary residence drained off financing and employment from native industry (*The Multinational Monitor*, June 1984; *Toxic Ireland* (1982) and *Making Their Merck on Ireland* (1983) by ASH (Association for Safety and Health, a citizens' environmental group). □ *[To be concluded]*