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Introduction
A Pact with the Devil

The high-tech age has given us unprecedented benefits. Without industry, and the sophisticated technologies that it has brought with it, the world would still be living in pre-modern times. There would be no supersonic aircraft, no wonder drugs, no television or video, no skyscraper cities. The popular affluence that we now take for granted in the developed countries, give or take the entrenched problem of unemployment, could never otherwise have been attained. Without industry we would be denied the many and varied benefits of abundance. And humanity would have been spared the horrors of Chernobyl, Bhopal, Thalidomide, acid rain, pesticide poisoning, the health hazards posed by contaminated and adulterated food, the insidious danger of household drinking water tainted by toxic traces, and other unwanted features of life in the late twentieth century.

Poisoned soils, poisoned bodies, a poisoned future. The price of progress is rarely assessed in full. Industrial revolution was welcomed as the catalyst of social and political change, as well as the source of prosperity for many millions. But with it came an unforeseen danger. Under the assault of a rising tide of pollution the nature of this earth was to be changed completely. Now that polluting tide threatens to upset the delicate balance of our own biochemistry. Humanity faces the prospect of contamination overload – the high-tech holocaust.

The coming of industry has changed the character of our habitat for the worst. It reshaped our towns, pushed millions off the land to fill congested urban landscapes. These conurbations developed their own polluted climatic chemistry. A new breed of diseases emerged, diseases of the industrial age that were to be steadily exaggerated over the decades as industrialism trans-

formed the ecosystem. And this Faustian pact with technology brought also the more immediate threat of sudden, unexpected disaster. From Love Canal to Minamata, from Bonnybridge to Canonsburg, from India to the Ukraine, mankind has endured a growing catalogue of toxic accidents, catastrophic explosions and invisible visitations of deathly radiation. All of them are direct threats to our bodily well-being.

Typical of the scale of the problem is the predicament created by toxic wastes from commercial processes in the chemical, petroleum and metal industries. In the United States, for instance, thousands of dump-sites clogged with toxic organic chemicals, dangerous enough to wipe out entire city populations, present the US authorities with a monumental task of disposal. For decades the problem lay dormant, hidden away from an ill-informed citizenry . . . until 1978, when heavy rains pushed leaking drums of deadly substances out of the ground at Love Canal in Niagara Falls, New York. Hundreds of families were driven from their homes for ever. It was not to be the last such disaster in the United States: in 1983 Times Beach, Missouri was turned into a ghost town after the population was evacuated, victims of a massive spillage of toxic waste. And there will be more such cases in the future: since 1950 the US industrial complex has generated some six billion tonnes of toxic waste from chemical plants, refineries, smelters and other installations. Each year yields a further 250 million tonnes of hazardous garbage, with inadequate controls over where, and how, it is dumped.

The situation in the United States is mirrored throughout the world. In the summer of 1984, in the middle of Birmingham, the authorities uncovered a cache of illegally dumped dioxin that was sufficient to kill the entire population of the English West Midlands ten times over.

But toxic industrial waste is only one small part of the threat. The high-tech age has overtaken farming, food manufacturing, packaging, pharmaceuticals, materials, energy production and data processing. In almost every commercial sector the price of material advancement has been the creation of chemical compounds, products or processes that are toxic to man.

High Tech Holocaust charts the steadily growing danger to humanity. It suggests that we have perhaps no more than five years to make a choice in favour of a cleaner, safer world. Failure to make that choice could ensure that mankind is over-

taken by a fate more horrific than that of nuclear war, as the contamination of our bodies by a wide variety of toxic elements approaches lethal overload. It is a book written by a non-scientist alarmed at the mounting evidence that points to such a fate. That evidence has been gleaned from both the scientific literature and from everyday news, from the laboratory and from the experiences of ordinary, bewildered people.

Often the evidence is no more than circumstantial. Yet across the world there are thousands, even millions, of individuals who are suffering the consequences of man's decision to make a pact with a devil called industry. After the nuclear accident at Chernobyl, in the Ukraine, in the spring of 1986, we have yet another opportunity to gather circumstantial evidence about the effects of radioactivity on the human body. Only a habit of secrecy will prevent the full truth from ever being known. And not only about the tragedy at Chernobyl: a central feature of the escalating polluting threat to our health is the pattern of secrecy, complacency and lies that has prevented the flow of information to the general public, not only in the Soviet Union but in every country and in every industry where dangers exist.

That habit of secrecy and obfuscation is most apparent in the nuclear industry. But there are many other facets of that diabolical pact that have been similarly obscured from public scrutiny, ranging from chemicals in food to cancer-causing agents in plastic credit cards, from cling film to hair sprays, from pesticides to heavy metals, from acid rain to poisoned drinking water and effluent-choked river systems. But we are reaching a crossroads where the circumstantial evidence will, by its sheer weight, become incontrovertible proof that the world is facing an unsustainable toxic challenge. The high-tech holocaust will be all-embracing, all-pervasive. And time is running out.

1
The Price of Progress

Until 2 December 1984 few people in Institute, West Virginia, had ever heard of methyl isocyanate or the Indian town of Bhopal. Thereafter they would have a terrifying reason for never being able to forget either of these two names. Around midnight on that day clouds of gas leaked out from a Union Carbide chemical plant and fell upon residents of the surrounding shanty town. As injured people crowded into a nearby hospital the company's medical officer, a Mr L. L. Loya, told doctors: 'The gas is non-poisonous. There is nothing to do except ask the patients to put wet towels over their eyes.' Mr Loya was wrong.[1]

The death count in the Bhopal disaster was put at more than two thousand; another two hundred and fifty thousand were injured, condemned to suffer a lingering disease that would kill many thousands more over the years to follow. Nine months later another Union Carbide plant in Institute, six thousand miles away in the United States, leaked an equally toxic gas into the neighbourhood after malfunction in a storage tank. The plant manager, Mr H. J. Karawan, held back from informing local emergency services of the accident because of information flashed to his staff by a sophisticated computerised monitoring system: 'At that time we did not believe the emergency would affect the community because the cloud was hovering over the plant.' The computers – and Mr Karawan – were wrong.[2]

Luck, and a few dollars, intervened to save lives in Institute. About one hundred and forty people were reported injured, few seriously. At least, this was the verdict of doctors at the nearby medical centre. Yet the gas involved in the leak was aldicarb oxime, a powerful constituent of pesticide. It is classified by Union Carbide as among the most toxic of all chemicals, along-

side methyl isocyanate, the killer of Bhopal. In testimony to a Congressional Committee in 1983 the company admitted that chemicals in this category can cause cancer, birth defects, genetic damage and irreversible disorders of the nervous system.

Only time can tell what are the real effects of concentrated exposure to aldicarb oxime on the scale seen in Institute in August of 1985. In the meantime, local residents can be thankful that failsafe mechanisms at the Institute plant were in proper working order. The inhabitants of Bhopal were not so lucky. Six months before their catastrophe the vital refrigeration unit meant to keep the gas cool was turned off as part of a cost reduction programme. The saving produced by this step was about $50 a day. This sum represents an infinitesimally small fraction of the profits made each year by the world's chemical industry.

Affluent Effluent

But industry is not a recent invention. As soon as men and women could think rationally they were also searching for ways to conquer Nature. Metal-working was an everyday activity in prehistoric times. Woven textiles were being produced in the Indus Valley of the Indian sub-continent five thousand years ago. The economic value of dyes, ores, crops has been fully understood since before that time. Humans as a species are naturally curious, uncontrollably inclined towards the making of things that can take us beyond what Nature intended. Only now is this talent turning violently back on us to defeat Nature itself.

Planet Earth is being slowly poisoned by the effluent of affluence. The smokestacks, discharge pipes and slurry tanks of a million and one manufacturing plants, power stations and industrial premises across the world have poured out toxic substances for two hundred years; they continue to do so. Other industries have created products that contaminate our insides through the foods or liquids that we ingest or the medications we take; they continue to do so. The creation of new technologies, contrary to expectations that they would lead to a cleaner and safer habitat, has merely added to our ability to generate yet more poisons.

Until very recently the world's atmosphere, and our bodies, could cope with this rising tide of effluent. Now we have passed

the danger level. In practically every area of toxic pollution mankind has reached cross-over point, beyond which the natural balance of the earth's chemistry becomes seriously distorted. Sulphur dioxide, for instance, has for millennia been generated by the natural processes of the oceans, forests and volcanoes. Since the beginning of the 1970s the volume of sulphur dioxide produced by man has overtaken these processes, outdoing Nature and taking global SO_2 emissions to such levels that our soils and water supplies are being contaminated by hazardous acidic and metallic substances. The same point of cross-over has been reached in other areas of toxic threat. Our talent for industry has become a self-destructive pursuit.

Seen as individual processes, most industrial activities may appear as necessary and relatively innocent ways to create wealth. Indeed, for many centuries much of the world was engaged in simple manufacturing that posed no real threat to the surrounding community except, in some cases, to those directly employed. Man was certainly aware of the hazards that accompanied the quest for material goods. In the fifth century before Christ the Greek physician Hippocrates was writing of the effects of the working environment on human health; he described cases of lead colic in miners and other occupational diseases.

In the Europe of the Middle Ages a number of learned studies underlined the risks of working with toxic substances. In 1472, twenty years before Columbus discovered the New World, Ulrich Ellenbog in Augsburg had completed a tract on the adverse effects of carbon monoxide, nitric acid vapours, lead, mercury and other metals then in common use. A classic work on diseases in mining was published by Georg Bauer in 1556. It would not be out of place on a twentieth-century bookshelf: it contains graphic details of the silicosis, tuberculosis, lung cancer and other serious illnesses found among Bohemian silver-miners. Nor was this concern limited only to occupational diseases. As early as the 1290s England's King Edward I had decreed that coal should not be burnt while Parliament was sitting because of the acrid smoke that filled the London air.

Perhaps the most prescient observation was that made in the sixteenth century by a Swiss-born physician with a taste for alchemy and the somewhat ornate name of Theophrastus Bombastus von Hohenheim: 'All substances are poisonous . . . there is none which is not a poison. The right dose differentiates

a poison and a remedy.' Even four hundred years ago, with the industrial revolution still many generations away, there was an inkling of the dangers to come.

But even the most penetrating Renaissance mind could not have foreseen the all-engulfing transformation of the pattern of global chemistry that would be wrought by the industrial age. The primitive industrial infrastructure of medieval times was spread thinly across a predominantly agricultural landscape. There was not as yet any critical mass of polluting industrial endeavour to match the scale of the German Ruhr, the English Midlands, the congested industrial belt of the north-east United States or the densely packed urban zones of the north Italian plains, south-eastern Brazil or the Japanese island of Honshu. But when, in the 1750s, industrial revolution did trigger off an escalating search for the secrets of manufacturing and an unending boom in factory-building, the warning signs of eventual toxic holocaust quickly became visible for those prepared to see.

Again, the most disturbing evidence came from studies of diseases associated with particular jobs. The eminent English doctor Sir Percival Pott made a pioneering study in the 1770s of scrotal cancer amongst chimney sweeps. The phrase 'mad as a hatter', to be given immortal personification in Lewis Carroll's *Alice in Wonderland*, was born of the early recognition that mercury used in making felt hats invaded the body chemistry of the hat-maker and caused irreparable damage to the nervous system. And the first convincing reports linking defective childbirth to an industrial chemical were produced in the nineteenth century after investigation into the toxic effects of lead. As a result, women were banned from working in many manufacturing activities involving heavy use of this metal.

By the 1880s considerable work with laboratory animals had already been carried out by analysts like K. L. Lehmann in Wurzburg, who tested the toxicity of more than thirty gases and vapours in widespread industrial use. But the conclusions that were reached in all these research projects were seen as important only in relation to the workplace. Thus by the start of the twentieth century there was ample evidence that industry was the enemy of health, though few were ready to agree that the risk went further than the factory gates. They were days of environmental innocence; even the arrival of the motor car, unveiled in 1886, had been greeted as just one more techno-

logical toy for the eccentric rich. As with every other facet of the factory era, the potential hazards of the combustion engine for the world at large were never considered.

The Quiet Killer

In some other areas, however, there was concern from the beginning about the wider long-term dangers. There was a rapidly growing awareness, for instance, of the impact of industry on the quality of the air, particularly in countries like Britain where industrial expansion had already taken dramatic hold by the end of the eighteenth century. In emulation of King Edward's initiative seven centuries ago, the British parliament in 1819 appointed a select committee to inquire 'how far it may be practicable to compel Persons using Steam Engines and Furnaces in their different works to erect them in a Manner less prejudicial to public Health and public Comfort.' Thereafter, the issue of polluted air was never to be out of the headlines. Unfortunately, that same unwholesome air was never to be out of the lungs of the millions of people who poured into Britain's industrial towns in search of work. For though parliamentary speeches and crusading newspaper articles highlighted the problem of contaminated air, it was nearly one hundred and fifty years before that problem was tackled through the law.

There is a disturbing lesson to be learnt from those first faltering attempts at curbing the excesses of industry. They failed because politicians and businessmen wanted them to fail and because science was slow to supply iron-clad proof of the risks to human health. This is precisely the case with the escalating toxic adulteration of the world in the late twentieth century. Thus the anti-smoke campaign which dominated British politics in the 1840s was a microcosm of the broad-based environmental debate that emerged in the highly industrialised world during the early 1980s.

That 1840s campaign was to last until the 1890s before it petered out with nothing accomplished. Not for another hundred years, until the Clean Air Act of 1956, did Britain legislate to outlaw smoke from its major cities. And by then a host of other far more toxic substances were beginning to invade our body chemistry. By the 1980s those substances, the helpmates of a new breed of high-tech industrial processes, were threatening an unwitting citizenry with nothing less than toxic overload. Will we have to wait until 2056 before official steps are taken to

avert the holocaust? If that is so those steps will almost certainly be too late; they may be more than half a century too late.

The British experience with smoke in the early years of industry is therefore an instructive case study; it illustrates how suspect industrial activities can escape prohibition even though they are known to be hazardous. In practically every instance the burden of proof is on those raising the objection, whether they be customers, local residents or employees. And since the objectors are invariably non-specialists they operate from a position of considerable disadvantage. One such pressure group was the Manchester Association for the Prevention of Smoke, created in 1842 and chaired by a Rochdale vicar. They could just as well have tried to extinguish the sun. Smoke was the badge of industry and empire; it would not be prevented.

Thus, the citizen of the early industrial age had no more success than his modern-day counterpart in winning protection from the ravages of progress. The impact of the revolutionary steam engine had been far-reaching for good reason and bad. Textile workers were impelled by commercial pressures to abandon their cottage workshops powered by water wheels and were crowded into immense mills built around steam-driven machinery. The towns they now inhabited bulged with the sudden influx from the countryside. Sanitary arrangements were rudimentary: water had often to be bought from unscrupulous suppliers at profiteering prices. The squalid terraced alleys were riddled with disease. And above them all hung a thick pall of unhealthy smoke. From time to time a combination of climatic influences would drive the dense clouds downwards to choke both the streets and the people who stumbled through them. The larger the town the thicker and filthier was the fog.

The long delay before clean air laws took over is explained by the lack of any firm scientific evidence that smoke was harmful to humans. Most objections were linked not to health worries but to the nuisance factor. One Member of Parliament told the House of Commons in 1843 that a brewery in London's Tottenham Court Road was obliged to change to cleaner anthracite coal after complaints from genteel households in nearby Bloomsbury: 'The gentlefolks in the squares compelled us to do it . . . they said it made so much smoke in the drawing rooms and injured the furniture.'[3]

One causal element in this escalating spiral of harmful pollution was as relevant then as it is now. The thick smoke that

belched from the smokestacks and funnels of nineteenth-century Britain was the consequence not of wealth-creation but of waste. An endless stream of specialised witnesses agreed that smoke was merely coal dust that had escaped combustion because of inefficient manufacturing practices. A massively unhealthy contribution was also made by Britain's equally inefficient household grates; in 1880 in London alone there were some 3,580,000 fireplaces. Smoke represented wasted solid fuel, just as so many toxic dangers today – whether radioactive or chemically hazardous – result from the residues and waste by-products of industrial or energy-producing processes.

A belief that this realisation would prompt profit-minded Victorian entrepreneurs to overhaul their manufacturing systems so as to eliminate wasteful fuel consumption, and coincidentally to reduce their emissions of smoke, proved unduly optimistic. Hardheaded mill-owners and factory managers did nothing of the sort. And not only in Britain; smoke remained a major toxic component of everyday life throughout the industrialising world for many decades. Indeed, the nineteenth-century battle for safe air was only the opening chapter in what has become a long and unrewarding saga. In time, coal-generated smoke was to be overtaken by atmospheric lead and sulphur dioxide as the principal causes of poisoned air. Meanwhile, in developing regions of the world today, where smokestack industries are being constructed at an ever-increasing rate, old-style smoke is enjoying a second lease of life.

Significantly, the lack of firm remedial action by nineteenth-century industrialists and politicians to cut down on dangerous pollution was not the result of any ignorance about the hazards to public health. The facts and figures about smoke and human life had already featured in protest literature as early as 1880, without having any real effect on official thinking. The book *London Fogs*, written by the Honourable R. Russell (son of Lord John Russell) and published in the late 1880s, was to be a major source of evidence in the battle against smoke over the years that followed. Russell encapsulated the unarticulated fears of many thousands of city dwellers who had survived (many thousands did not) the choking, filthy blankets of wet dust that fell over their streets at regular intervals. 'It is hard to believe,' he wrote, 'that so harmless-looking and quiet a thing could do such mischief.'

But Russell also put his finger on a vital factor, something

that is equally central to the issue of high-tech hazard today. He noticed that disasters which are small in scale but which occur in one place as a single event – such as the tragedy that killed seven space shuttle astronauts in early 1986 – capture public feeling in a way that never applies to much larger catastrophes spread over a lengthy period and dispersed geographically. One thousand times as many people are killed, for instance, on the roads of a medium-sized European country in a typical year, yet there is never the merest sign of national mourning. The same was true of the fog-afflicted society of Russell's day. As he put it, 'a London fog performed its work slowly, made no unseemly disturbance and took care not to demand its hecatombs very suddenly and dramatically.'

Yet hecatombs there were: the week-long London fog of December 1873 is thought to have claimed at least five hundred lives through respiratory failure alone. In all, the death rate in the city for the week was seven hundred above normal. The fog that fell on London in late January 1880 was worse still. In the three weeks up to St Valentine's Day there were 2,994 additional deaths; about two thousand of them were attributed to the fog. In fact, the fatality rate was equivalent to that of a serious cholera epidemic. But while cholera and other such outbreaks had led social reformers like Edwin Chadwick to press, with great success, for radical steps to improve public sanitation, the hazards of smoke created little more than a shrugging of the nation's shoulders. A leader in *The Times* at the height of the 1873 visitation dwelt upon the tragic effects on herds of cattle being kept at an agricultural show in the London suburb of Islington: 'Perhaps these poor beasts may be considered to have been the chief sufferers.'

Efforts to translate Russell's terrible statistics into legal controls over smoke emissions came to nothing. The government's opposition to tough new laws was led by the Prime Minister himself, the third Marquis of Salisbury. Yet another succession of draft laws aimed at smoke abatement – more than ten in all – were presented to parliament by Lord Stratheden and Campbell between 1884 and his death in 1893. All of them were shot down by Lord Salisbury and his supporters. Meanwhile, the death rate from respiratory failure caused by polluted air continued to climb. In 1887 there were ninety-three serious fogs in London; in 1890 there were 156. During a particularly heavy fog in December 1886 the mortality rate was lifted by forty in one

thousand, equal to the death rate during the most serious cholera epidemic in recent British history.

Russell's book was the last thorough attempt by a Briton to assess the cost of polluted air until the 1950s, seventy years later, when a series of equally lethal 'pea-souper' smogs engulfed the capital. According to a subsequent Royal Commission report the killer fog of December 1952 claimed roughly four thousand lives. (Coincidentally, the first casualty was an Aberdeen Angus bull brought to London for the annual Smithfield Show, though this time the leader columns of *The Times* avoided comment.)

The 1952 fatality rate was no worse than in Rollo Russell's day, but this time the political consensus was right. Further analysis of the records for earlier years also revealed, moreover, that many thousands more fog-related deaths were hidden away in the dense tables of Britain's public health statistics. The revelations spurred the British government into drastic action, nearly three-quarters of a century after the publication of Russell's *London Fogs*; the Clean Air Act was the result. In the intervening seven decades countless thousands must have succumbed to the lung-destroying legacy of millions of chimneys, both domestic and industrial.

The failure, all those years ago, to act against a self-evident hazard could not be ascribed to a lack of the appropriate technology. Quite the contrary; fuel technologists in the 1880s certainly knew that the pollution was caused by incomplete combustion of bituminous coal and that smokeless fuels burnt in closed or well-designed grates would help reduce household emissions. Comparable changes could also be introduced into factories and on the railways. But the countervailing pressures were considerable. The producers of bituminous coal – in those days a private enterprise – were a very powerful lobby; the major coal owners were Members of Parliament. Many of them were friends of Lord Salisbury as well.

Another major obstacle to clean air laws was the cost to ordinary people. And the coal producers who supplied them with their fuel would never offer to help meet that cost. Hence the prospects for replacing millions of inefficient, open-hearth domestic grates were nil. Indeed, those same polluting grates were by now a national institution endowed with an unwarranted romantic quality. The scientific journal *Nature*, in a special smoke abatement issue in 1882, quoted approvingly the