PVC: TOXIC WASTE IN DISGUISE

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[Note: we loaded this 1992 PVC factsheet on the site because the realitites of PVC production and use have not changed – in fact even more PVC is now globally produced.]

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Factsheet 1

PVC (polyvinyl chloride) - often referred to simply as 'vinyl' - is one of the most versatile of the plastic materials which now pervade modern society. It is also the most dangerous.

PVC is used in a broad range of applications, so startlingly diverse that it becomes difficult to speak of it as being a single material: PVC is used in packaging such as mineral water bottles, tubs, boxes and cling film.

It is used for consumer articles such as credit cards, records, and toys; in construction, for window frames, doors, walls, panelling, pipes and gutters; around the home in flooring, wallpaper, Venetian blinds, and shower curtains; in the office for furniture, binders, folders, pens...; it is used in the automotive industry, especially as underseal; in hospitals for medical disposables; as cable and wire insulation; for imitation leather; for garden furniture... It has become an integral part of our lives!

Why then does this plastic give rise to greater environmental concern than any other plastic? The answer is that a seemingly harmless piece of PVC pipe or soft PVC toy is the product of a highly dangerous and toxic industry, because the manufacture of PVC is linked to the production of chlorine to a degree unmatched by any other material.

Chlorine, originally considered a waste byproduct from caustic soda production, is a highly reactive chemical that must be combined with other materials. Chlorine compounds are found in nature - the obvious example is sodium chloride, or common salt. But chlorine manufactured by the chlor-alkali process is quite different.

This chlorine gas is highly reactive; it must therefore be combined with organic compounds (material containing carbon), and creates organochlorines, which are so rare in natural systems that living organisms cannot cope with them when they enter the ecosystem.

Yet in only a few decades, the modern chemical industry has distributed millions of tonnes of organochlorines per year into our environment. The whole process represents an environmental catastrophe on the largest possible scale. Some organochlorines associated with environmental and human health scandals are familiar names: PCBs - found to stop the reproductive ability of wildlife - were banned in the late 1970's, although most of the millions of tons produced are still circulating in the environment; products such as halons and CFCs will continue to destroy the ozone layer into the next century even with an immediate ban on their production; pesticides such as DDT and lindane are still being produced. Some of the chemical industry's worst chemical disasters, such as Seveso and Love Canal have involved organochlorines.

They are universally recognised as so dangerous that they are slowly being phased out and banned from production and use.

In 1990 the German Council of Experts for Environmental Issues, a government think-tank, stated: '...Chemists and process engineers in industry and universities increasingly think that the dynamic growth of chlorine chemistry during the 1950's and 1960's represents a decisive mistake in twentieth century industrial development, which would not have occurred had our present knowledge of environmental damage and health risks due to chlorine chemistry then been available.' 1

PVC was patented in 1913 as the first synthetic product. During the 1930's, large amounts of chlorine became available in Nazi Germany as a consequence of a programme meant to make Germany independent of imported cotton in case of war. This programme concentrated on the production of rayon, and to this end large amounts of caustic soda from the chlor-alkali industry were needed. After years of experimenting with stabilisers, lubricants and softeners, it was found that fibres could be made from PVC; these had the added bonus of using up the excess chlorine produced by the expanded chlor-alkali industry. What had previously been a toxic waste by-product of caustic soda manufacturing now became a marketable commodity.

Within a few years PVC had become the most important mass synthetic material in Germany apart from polyethylene. The 1950's were characterised by the odour of the softeners mainly in PVC. 2 The 1960's saw a huge rise in PVC production. Since then, as other products made with chlorine, such as PCBs and CFCs, have been banned and the use of chlorine as a disinfectant is declining, there is more chlorine that needs to find a 'sink', as the industry calls it.

PVC is that 'sink' and its use is growing as all other uses of chlorine decline - PVC currently accounts for some 30% of global chlorine production.

PVC creates environmental problems throughout its life cycle. The production of PVC powder involves the transport of dangerous explosive materials and the creation of toxic wastes. Then, because PVC on its own is almost useless as a plastic, it must be combined with a number of chemical additives to make it soft and pliable, heavy metals to make it hard or give it colour, and fungicides to stop bacteria from eating it. Thus, PVC production also gives rise to a huge secondary - and toxic - manufacturing industry.

The product itself, when bought by the consumer, can be immediately dangerous. For instance, certain additives, such as those used in flooring, will evaporate into the air. The most common plasticiser additive is a suspected carcinogen.

The disposal of PVC creates further environmental problems. When burned, it releases an acidic gas, as well as toxic dioxins and other organochlorines because of its chlorine content. Landfilled, it eventually releases additives which can threaten groundwater supplies. PVC is not a natural material and will therefore not biodegrade- a feature which the PVC industry is in fact proud of.

But what happens when landfills run out? The PVC industry is trying to set up recycling plans, but the range of PVC products makes it impossible to recycle, since each PVC product contains many different additives. The industry admits that recycling is expensive and of value primarily from the point of view of public relations. 3

Meanwhile, our world is filling up with PVC products and the industry is expanding into Latin America and Asia. PVC has always been a low-price product (after all, it originated as a method of disposing of industrial waste!), and this price advantage is the key to its success.

Many traditional, environmentally more acceptable and generally 'better' materials have been displaced by cheap PVC substitutes. In many uses, not only is it difficult for consumers to recognise that products are made from PVC (and the PVC industry is vehemently opposed to labelling its products), but it is often difficult to buy alternatives, as a virtual materials monopoly has been established.

In parts of the world, the dangers of the PVC industry and its products are recognised, and some countries - particularly the German-speaking and Scandinavian countries - have restricted the use of those products. Local authorities are starting to make their public buildings PVC-free, while a number of supermarkets, hospitals and furniture stores are no longer using PVC products.

The PVC industry would like us to believe that their products vastly improve the quality of our lives.

But Greenpeace, together with scientists and environmentalists around the world, believes PVC to be uniquely damaging during production, use and disposal. We need to replace PVC with more environmentally safe materials.

Because all of us use these products in our daily lives, we should be aware of their consequences for ourselves and the environment we live in.

The following factsheets will examine in more greater detail the various stages of PVC production, use and disposal. Then we will ask you to help us put an end to this polluting industry and its products.

1 Sondergutachten des Rates von Sachverstandigen fur Umwe/tfragen vom September 1990 "Abfallwirtschaft"

2 Greenpeace Austria "History of Chlorine Chemistry. November 1991

3 "Proces-Verbal de la Seance du Conseil D'Enterprise Tenue Le 3 Avril, 1990," Solvay.

Factsheet 2

PRODUCTION

FROM SALT OF THE EARTH TO TOXIC SOUP

PVC is considered by its proponents, such as Norsk Hydro, as 'an extremely resource efficient plastic with low energy consumption ... nearly 60% of its composition is based on common salt, a product available in almost unlimited quantities.' 1

What this statement does not reveal is that in the course of PVC production, common salt is turned into chlorine gas and organochlorines - one of the most dangerous group of chemicals ever synthesised. It is this use of chlorine that distinguishes PVC from other plastics and makes it so dangerous.

The statement is also misleading about energy consumption. Like most plastics, PVC is composed of fossil fuels which are non-renewable resources. Ethylene is produced from these fuels and then combined with chlorine, which is often produced on site.

However the production of both ethylene and chlorine is highly energy intensive. Germany is the largest producer of chlorine in Europe; its production accounts for 25% of all energy consumed by German industry and 2% of total national demand.2

For the PVC industry to claim PVC is more energy efficient than alternative materials is therefore far from accurate.

Moreover, as high-volume users, the industry obtains energy at cheaper prices - in effect, the industry is thus being subsidised by small consumers and taxpayers. In Austria, for instance, the chlorine industry pays 30% less electricity costs than the normal chemical industry rate.

A PAIR OF POISONS

Chlorine and ethylene are next combined to make ethylene dichloride (EDC). EDC is highly toxic and easily absorbed through the skin. It causes cancer and birth defects; damages the liver, kidneys, and other organs; and can cause internal haemorrhaging and blood clots. It is also highly flammable: the vapour can explode, generating hydrogen chloride and phosgene (two highly toxic gases that can cause Bhopal-type accidents). 3

The EDC is then used to make vinyl chloride monomer (VCM).

It is impossible to produce organochlorines without wastes or residues and in the case of PVC production many of these residues, or 'tars', used to be incinerated at sea.

Now, following the global ban on ocean incineration agreed in 1990, these residues and wastes are either incinerated on land, generating the same type of toxic emissions, sent to landfills, or injected into deep wells.

However, not all waste residues are incinerated, vented or dumped. Through a process called chlorolysis, approximately a third of these residues are turned into new chlorinated products. Many are familiar: the chlorinated solvent perchlor-ethylene is the common dry cleaning fluid and a suspected carcinogen; carbon tetrachloride is an ozone-depleting chemical and a known human carcinogen). Other uses of chemical by-products include pesticides, CFCs, cleaning fluids, and the 'fragrance' used in toilet products and for coffins.4

As is true of all chlorine-containing products, these new applications spread more toxic emissions into the air, soil and water. Through the use of unnecessary 'toilet disinfection blocks', organochlorines have for years been washed into the sewer system. The use of similar products in coffins causes highly toxic emissions such as dioxins from crematoria.

The VCM made from EDC is an extremely toxic, flammable, explosive and carcinogenic gas. Ninety-five percent of its production is exclusively for use in PVC.

Symptoms of VCM poisoning include softening of bones, deformation of fingers, skin complaints, impotence, bad circulation and shortness of breath, liver damage and even a special form of liver cancer, angiosarcoma. Up to 1990, 157 deaths have resulted from VCM-caused angiosarcoma and 140-150 further such deaths are expected within the next three decades for this one illness alone.5

Strict standards have consequently been set in many countries to limit worker exposure, as well as the amount of unpolymerised

VCM allowed to remain in finished products (although these standards may not exist in foreign factories or their products).

However, standards can never solve the problem. VCM is impossible to contain within a plant no matter how tight the system. It has been estimated that up to 80% of the dioxins found in the sediments of the River Rhine in Holland are caused by the manufacturing of VCM. 6 In West Germany alone, about 330 tonnes of VCM entered the environment during production and processing during 1989. 7

In Sweden, Norsk Hydro's PVC factory annually emits 140 tons of VCM. 8 And these are countries with tight monitoring standards. More worrying, in the UK, ICI acknowledges the annual release of 1,700 tonnes of VCM to the atmosphere at their Merseyside operation alone. 9

The reality is that the chemicals used to produce PVC are toxic; it is impossible to contain all these chemicals during manufacture - no matter how sophisticated and well monitored the plant is; and the risk of spills, accidents, and bad on-site management only intensifies the problem.

A documented list of repeated spills of EDC and VCM at the Formosa PVC plant in Louisiana in the USA reveals contamination of ground water supplies and repeated worker sickness. 10
The local communities have now organized to shut the plant down.

The final PVC powder needs a wide range of additives before a PVC product can be manufactured. It is transported all over the world for further compounding and processing. The fact that PVC uses so many additives makes the PVC industry a major market for much of the plasticiser and mining industries (see Factsheet 4)

Thus, besides being linked to new organochlorine manufacture, the PVC industry provides an end use for other, often toxic, materials and processes. Almost no other industry supports and encourages such toxic dependency at all levels.

1 Clayton, Harold. Environmental Consultant, Norsk Hydro at 12th Plastics Seminar, Portugal, November 1991.

2 VCI: "Dialogpapier Chlor. " Frankfurt, January 1992, page 20.

3 "Effects of Ethylene Dichloride. " US EPA Region VI, Administrative Order in the Matter of Formosa Plastics Corporation, Texas, Docket Number RCRA VI-3013-001-87, p. 3.

4 Kollmann, H. et al: "Stoffstrome und Emissionen durch Produktion, Verwendung und Entsorgung von PVC " JUELSpez-543, Juelich 1990.

5. Ibid.

6 Evers, Enk, "De Vorming van PCDFs, PCDDs en gerebteerde Verbindingen bij de Oxychlorering van Etheen." University of Amsterdam. 1989, MTC publication nr. MTC89EE.

7 Claus F., Frieze H., & Gremler D. "Es geht auch ohne PVC: Einsatz-Entsorgung-Ersatz." Hamburg: Rasch u. Rohring, 1990.

8 Norsk Hydro, "PVC and the Environment" April, 1992.

9 ICI Merseyside, UK Environmental Brochure. 1992.

10 Mandell, D and Lewis, S.J. "The Formosa Plastics Story."
National Toxics Campaign Fund 1991.

Factsheet 3

THE DANGERS OF TRANSPORT

In view of the nature of vinyl chloride monomer (VCM), it is extremely disturbing that most of the vast quantity of VCM produced worldwide is manufactured far from where it will be eventually polymerised into PVC. It is therefore transported around the world from industrial plant to industrial plant, by road, rail and sea.

The risk of accidents represent present dangers to communities living along these transport routes.

When transported, VCM is compressed and liquified. Any leaks can lead to explosions, since ignition temperatures and critical temperatures are both low (minus 77 and below 160 degrees Celsius, respectively). 1 Ignition may be caused by flames, sparks or hot surfaces.

When VCM escapes, it forms pools of mist which, being heavier than air, creep along the ground. If ignited, they will flash back to the source of leakage.

Large VCM fires are almost impossible to contain. VCM is only slightly soluble in water and reverts to a gaseous state quickly, floating above the water until it forms a gas.

On the water surface, it combines with air to form explosive mixtures. VCM leaked into sewage systems is also highly explosive.

Serious rail transport accidents involving VCM are well documented; at least 17 took place between 1964 and 1980. 2

In each case the VCM caught fire, and in 11 cases the neighbouring population had to be evacuated.

Three examples:

28 March 1978: A freight train carrying, among other things, tanks containing VCM and butadine was derailed near Lewisville, Arkansas, USA. The tanks exploded and burst into flames.

The fire spread to nearby chemical plant of the J.P. Petroleum Co. where crude oil and petrochemical products were stored. The fire raged out of control and the plant was almost completely destroyed. 1,700 inhabitants of Lewisville had to be evacuated.

8 May 1980: Collision at the Nurnberg switch yard in Germany. One maneouvering unit consisting of 8 Russian tank cars, loaded with 50 tons of VCM each, could not be sufficiently slowed down and the tanks exploded.

26 July 1980: A freight train was derailed near Louisville, Kentucky, USA, and two VCM tank cars erupted in flames. Two thousand people had to be evacuated. All attempts to extinguish the fire failed. Five days later, specialists finally managed to extinguish the blaze.

Minor incidents involving VCM transport are even more frequent. The West German Federal Agency for the Environment lists 42 incidents involving VCM up to 1985 worldwide.

Yet up to 1,000 tonnes of compressed VCM are transported from Solvay's plant in Rheinburg, northern Germany, to another Solvay plant in Ferrara, Italy by rail each week.

The shipments pass through some of Europe's most densely populated residential and industrial areas. And this is just one example, concerning one plant.

Commenting in 1989 on such transport of VCM, a German toxicologist stated:

"...we conclude that the transport of such a highly dangerous chemical by rail or by road cannot be justified, because it poses an extreme threat to the population in the event of fire or explosion, and can conceivably cause incalculable material damage". 3

The transport of VCM by ship poses direct threat to the world's oceans. Hydro Polymers Ltd, one of Europe's largest PVC manufacturers, is the UK arm of the Scandinavian petrochemical concern Norsk Hydro (which also has PVC operations in Norway, Sweden and Singapore).

Hydro Polymers produce 125,000 tonnes/year of PVC resin, and 60,000 tonnes/year of PVC compound.4

All this volume is produced from VCM which is transported across the North Sea in weekly shipments from Rafnes, Norway, to Teesside in the UK.

With increased production capacity planned, Hydro Polymers will soon be shipping even greater volumes of VCM across one of the world's stormiest seas.

The chemical giant ICI also ships huge quantities of VCM across the North Sea - at least 100,000 tonnes annually from the UK to its plant in Willemshaven in Northern Germany. ICI also ships 80,000 tonnes of VCM annually from Willemshaven to Portugal.5

In 1984, the freighter 'Brigitta Montari', carrying 1300 tonnes of VCM, sank off the Yugoslavian coast and could not be salvaged. By 1987, it had become apparent that VCM was leaking from the vessel. The ship was salvaged in 1988, but an unknown volume of VCM had already been released into the marine environment. 2

It is predicted that the Far East and Latin America will remain significant importing regions for the remainder of this decade. Clearly, the transport of millions of tonnes of this toxic chemical is a cause for major concern.

1 Media Documentation Greenpeace Switzerland October 12 1989: "Background on SBB Transports of Vinyl Chloride."

2 Ahrens, A., Henseling, K.O. "Vom Lasbgen Salzsauregas zum Margannebecher. Die Geschichte des PVC." Wechselwirkung Nr43, 1989.

3 Communication from Prof. Dr. O. Wassermann, Toxicological Dept. of Kiel University, 20111189.

4 Norsk Hydro company brochure.

5 "Verzicht auf PVC & Chlorchemie. Fakten und Argumente fuer den Ausstieg." Die Grunen im Bundestag, Bonn 1989.

Factsheet 4

ADDITIVES

THE TOXIC DEPENDENCY

PVC is unique among plastics for another reason other than the fact it contains chlorine. PVC cannot be used without a range of additives. This is because PVC on its own is unstable and must always be used with additives called stabilisers.

PVC in its normal state is hard and brittle so plasticisers are used to make the material soft and flexible while others add colour (heavy metals), or make it fire resistant (flame retardants), or protect the material from bacteria and fungal growth (biocides).

Other chemicals are also added such as antistatic compounds, optical brighteners, impact modifiers and anti-oxidants. Of the many thousands of additives used with PVC, 150 are used in significant volumes.

These additives were originally developed to make PVC a marketable commodity- since it was essentially a waste product - but they may now in fact comprise more than 60% by weight of a finished product!

What happens to these chemicals when they are used to make different PVC products? They may be washed out (leached), lost to the air (volatilization), consumed by microbes (for this reason PVC sometimes contains 'biostabilisers', usually containing heavy metals); or they may pass into other materials by direct contact (migration). Whatever the case, PVC additives have now contaminated the environment on a global scale.

For instance over 1 million tonnes of plasticisers are used in western Europe annually, which 77% are used in PVC production. By far the most important plasticiser is Di-2-ethylhexyl-phthalate, commonly known as DEHP.

Total world annual production of this substance is estimated (1987) at between 3 and million tonnes. 1 Most is used for PVC production. It is now found everywhere in the environment (in Atlantic fish, bird eggs, marine mammals, corn plants) and is suspected to cause cancer in humans, according to USA research. DEHP is released in significant amounts into the environment throughout its whole lifecycle: 1% during production (mainly in waste waters); 0.05% during distribution; 1% during plastic blending, and further amounts from PVC products during use and disposal. 2

The migration of DEHP and similar plasticisers from cling film into foods, especially fatty foods such as dairy products, has led many manufacturers to offer non-PVC film. In Austria, DEHP is banned in packaging that has direct contact with food. In Switzerland, the use of DEHP for the manufacture of toys for children aged less than three years was banned in 1986, and in Germany its use in teething rings is 'not recommended'. In the Netherlands the potential ecotoxicological consequences appear better recognised - DEHP is on the priority list of environmentally toxic substances. It is also a priority pollutant in the USA. 3

Because it is to a limited extent water soluble, DEHP is carried with effluents into sewage plants, where it accumulates in sewage sludges and contaminate what could be a good fertilizer and soil conditioner. It is also fat soluble and will be absorbed into fatty products with which it comes into contact. Softening agents are therefore present in blood stored in PVC blood bags and consequently in the blood of patients who have received blood transfusions and of dialysis patients, and in food-stuffs which have been in contact with PVC (see Factsheet 6).

As with the plasticiser DEHP, the PVC industry supports other toxic industries. For instance foaming agents are used in some PVC products to economise on materials, to facilitate shaping car dashboards) and in the manufacture of upholstery. Eighty-five percent of all chemical foaming agents are used for PVC products. 4

PVC is inherently unstable and must there nearly always be used with additives known as stabilisers. This is not true of other plastics. Stabilisers are based on heavy metals: lead was the earliest, but cadmium, tin, barium and zinc are also used in large volumes.

Heavy metals are toxic not only to humans (bioaccumulation with severe organic consequences) but also to ecosystems.

Major problems exist with heavy metal stabilisers, (barium/tin, lead and cadmium compounds), plasticisers (phthalates) and flame retardants (such as bromine and phosphorous compounds). Plasticisers are organic compounds.

PVC in its normal state, at room temperature, is hard and brittle; plasticisers render the material soft and flexible. Different amounts of plasticisers are added to achieve differing material characteristics: unplasticised or U-PVC contains less than 10-12% plasticiser (even U-PVC may therefore contain significant amounts), while flexible PVC may contain up to 60% plasticiser by weight. 5

Through the medium of PVC, large volumes of these substances are being dispersed throughout the globe and will eventually be released into the environment. Almost half of processed PVC contains lead-based stabilisers; organo-tin stabilisers are prevalent in PVC food packaging where transparency is required; barium/cadmium stabilisers are present in PVC for construction applications. 6 Heavy metals, especially cadmium, can be released from PVC during incineration.

If they are successfully trapped by incineration plant filters, the filter residues must be disposed of as hazardous waste - a costly process. In Germany, almost 50% of cadmium use is in the plastics sector. 7

In 1991, the German Council of Experts for Environmental Issues recommended:

'...the complete and immediate substitution of cadmium in PVC products by other, less environmentally damaging materials, i.e., not by lead stabilisers. In as far as PVC products cannot be manufactured without the use of such stabilisers, for example in the construction sector, then these products should not be used'. 8

In 1987, Denmark banned the use of cadmium in PVC and the European Community has recommended its phase-out to a minimum level in products. However, lead is often substituted for cadmium, which does nothing to alleviate the problem of heavy metal emissions from incinerator plants, nor the potential problems of land filling.

Another class of additives is flame-retardants; roughly a third of all plastic-applications flame retardants end up in PVC. PVC is inherently fire-resistant as a result of its high chlorine content; it may even be self-extinguishing. However, softening agents and other additives may be highly flammable, particularly in soft PVC, requiring the addition of fire retardants. But fire retardants lead to an increase in the formation of smoke, thereby necessitating yet another group of additives - smoke diminishers.

Fillers such as chalk or soot (as for vinyl LP records) are used to expand the material and reduce the cost of PVC products.

The need for biocides has been brought about precisely by the use of additives, which attract microbes and bacteria. This 'biological deterioration' is particularly pervasive in cable shafts, under floor coverings and behind badly applied wall coatings.

The addition of biocides in the product present yet another toxic waste problem when the product reaches the end of its life and is disposed of. The very nature of the complex cocktail of different additives within PVC products is also a primary reason why PVC products can not be recycled.

1 Wams, TJ. "Diethylhesylphthalate as an Environmental Contaminant - A Review." The Science of the Total Environment, 66,1-66, 1987.

2 "Persistent Organics. " Water Research Centre 1990, CEST London.

3 Sondergutachten des Rates von Sachverstandigen fur Umweltfragen vom September 7990 "Abfallwirtschaft" Stuttgart 1991.

4 Claus F., Frieze H., & Gremler D. "Es geht auch ohne PVC: Einsatz-Entsorgung-Ersatz." Hamburg: Rasch u. Rohring, 1990.

5 Eder, G. "Ein okologischerAlptraum." Mullmagazin 1141988.

6 Brahms, E. et al: "Papier Kunststoff Verpackungen. Eine Mengen und Schadstoffbetrachtung." UBA Benchte 1189. Berlin 1989.

7 Chug F., Frieze H., & Gremler D. "Es geht auch ohne PVC: Einsatz-Entsorgung-Ersatz." Hamburg: Rasch u. Rohring, 1ssn

8 Sondergutachten des Rates von Sachverstandigen fur Umweltfragen vom September 1990, Abfallwirtsschaft Stuttgart 1991, paragraph 775.

Factsheet 5

DANGER OF THE PRODUCT

PVC AND FIRE

Among the most serious dangers that PVC poses to humans and the environment is when PVC is burned. The widespread use of PVC in modern homes - for vinyl flooring, vinyl wallpapers, shower curtains, window frames, electrical equipment including cable and wire insulation, and Venetian blinds to name but a few items - ensures that house and building fires will probably involve PVC products.

If this happens, an acrid smoke and dangerous organochlorine emissions, such as dioxin, will be generated.

The smoke containing hydrogen chloride (HCI) is readily formed from the chlorine present, and this combines with moisture (for example, in the lungs) to form hydrochloric acid, which can cause serious burns to people, as well as considerable material damage. 1

However PVC need not burn for this to occur; in fact, its chlorine content may actually prevent ignition but some of the worst fires have involved smouldering rather than burning PVC products. PVC decomposition products can lead to injury and death, despite the PVC industry's assertion that:

'Once PVC is made to burn, it does give off HCI, but at concentrations far below anything which could even be considered as a lethal dose...'. 2

The HCI given off during fires also reacts with the many additives present in PVC, creating even greater volumes of toxic fumes. 3 In addition, heavy metals contained in PVC stabilisers will be released and this is especially dangerous in the case of cadmium. 4

One of the best documented cases of this is that of the Beverly Hills Supper Club Fire of 1977. During the fire PVC wiring decomposed forming a 'wispy grey-white smoke' with no visible flames. An employee at the entertainment centre described how her fingernail polish reacted with the smoke eating through her fingernails. She developed second-degree burns wherever the smoke touched her.

By the time flames became visible and the alarm was raised, it was too late. Those present began to leave rapidly, but whoever came into contact with the smoke fell to the ground.

A total of 161 people died without any direct involvement with the flames, before any wood started burning, and before carbon dioxide reached dangerous levels. Four more died of after-effects. Many survivors suffered serious respiratory injuries. These deaths and injuries were a direct result of the presence of PVC. 5

Even if no people are present, serious material damage to buildings can take place as a result of fires in the presence of PVC. In particular, electrical switch apparatus often has to be overhauled - a measure which would not be necessary in the absence of PVC. 6

For this reason, PVC is banned in many hospitals, schools, telecommunication towers, banks, power plants and military installations.

The formation of extremely toxic compounds known as polychlorinated-dibenzodioxins and -furans (PCDDs and PCDFs) has been linked to PVC use and decomposition for some time, although the industry has attempted to deny or minimise the evidence. Recent studies confirm the fact that burning or smouldering PVC releases these compounds. 7

According to the German Ministry of Health (BGA) and the German Federal Office of the Environment (UBA):

'Because halogenated plastics (in particular, PVC and plastics containing brominated flame retardants) may lead to dioxin emissions in case of fire, during recycling and during disposal, it is recommended that in areas susceptible to fire, the use of plastics containing chlorine and bromine should be completely excluded, as far as is possible. UBA and BGA propose a ban on the use of plastics containing chlorine and bromine in apparatus susceptible to fire, in the manufacture of chip-board, as well as the labelling of plastics containing chlorine and if necessary a ban on the use of PVC in packaging'. 3

But how should 'areas susceptible to fire' be defined? In view of the frequency of domestic fires, this statement may be interpreted to cover most domestic use of PVC products.

The German Ministry of Health followed up this statement with an official recommendation that in cases of fire involving the presence of even small amounts of PVC, thorough clean-up operations by specialised firms should remove all residues, to limit the health danger posed by dioxins and furans. This recommendation applies to fires in flats, schools, offices and shops. 9

Even the European PVC producer, Norsk Hydro, admits that for applications with very high fire risk, such as oil rigs and nuclear installations, more expensive high performance insulating materials are preferable to PVC. 10

It was because of a building fire and the dioxins generated from the burning PVC furniture and cables that the first PVC ban in public buildings came into being in 1987 in Bielefeld, Germany. Subsequent studies done on the effects of incinerating PVC confirmed that from both an economic and ecological view, PVC products must be replaced.

1 Plehn, W., Lohrer, W.: "Umweltbelastung durch PVC", Staub, Reinha/tung der Luft 47(1987)718.

2 "Face the Facts: Addressing the Issues on PVC and the Environment" European Vinyls Corporation 1989.

3 Wallace, D.N.: "Dangers of Polyvinyl/Chloride Wire Insulation Decomposition" Journal of Combustion Toxicology, Vol 8(1981).

4 Plehn, W., Lohrer, W.: "Umweltbelastung durch PVC", Staub, Reinhaltung der Luft 47(1987)718.

5 Wallace, D.N. op cit

6 "Jahresbencht 1990." Umweltbundesamt Berlin, p112.

7 "Untersuchung der moglichen Umweltgefahrdung helm Brand von Kunststoffen" Theisen, Jochen et al, Gesellschaft fur Arbeitsplatz-und Umweltanalytik 1991.

8 Bundesgesundheitsblatt 8190, pp 350-354.

9 Bundesgesundheitsblatt 1190.

10 Norsk Hydro company brochure.

Factsheet 6

SHORT-LIVED GOODS

PACKAGING, TOYS, AND MEDICAL USES

Short-life PVC goods are those that last two years or less before they are thrown away. Such examples are PVC packaging, medical supplies, office supplies and records. However, the use and disposal of these products causes many problems.

The impact made by the plastics industry on the packaging sector, especially for foodstuffs and domestic goods, is enormous. In most industrialised countries, the packaging sector accounts for between 20% and 40% of all plastics: 1

United States	30%
Japan	26.5%
UK	35%
(West) Germany	22%

PVC, in turn, is a major packaging material, typically accounting for 15-20% of plastics packaging. The UK packaging industry pressure group INCPEN estimates that 18% of PVC produced in Western Europe is used in packaging, with half this amount used for bottles. 2 All the problems associated with PVC also apply to PVDC, another chlorinated plastic widely used in packaging.

An inherent characteristic of packaging is a short lifespan. Once it has served the purposes of display, containment and protection it becomes waste - light but voluminous.

This waste is either landfilled or incinerated; only in a few areas within Europe are attempts being made to recover it.

A significant market development in the mineral/table waters and soft drinks sector is the use of PVC bottles, especially for non-carbonated beverages. Apart from the volume such packaging occupies in kitchen and municipal trash bins (PVC bottles are strictly non-reusable), concern has been voiced as to possible health risks.

In 1991, an Italian institute reported evidence of the migration of vinyl chloride monomer from PVC bottles into drinking water, 3 concluding that the introduction of limits on storage times for PVC-packed foods should be considered by industry and public authorities.

Additionally, microbes present in bottled water may reproduce more readily on PVC surfaces than inside glass bottles. 4 This is especially relevant for non-carbonated bottled water, which is being consumed in increasing volumes owing to consumer distrust of public water supplies in many areas. In France, approximately 25% of PVC is used for such bottles! The German 'Katalyse Institut' recommends pouring the contents of opened PVC bottles away if they have been left to stand in inappropriate conditions, for example in direct sun. 5

The use of PVC cling film is a well-known consumer issue in Europe. The plasticiser dioctyladipate, or 'DOA', has been shown to be directly transferred from film to food ('migration') and in Germany such film is now only allowed for packing fresh meat. Less harmful alternatives are widely available - do not use cling film that is not specifically declared to be PVC-free.

PVC packaging leads to major problems when incinerated and has spurred the phase-out of PVC packaging in some countries. (see Factsheet 10) Its chlorine content leads to the formation of corrosive hydrochloric acid and highly toxic chlororganic substances such as dioxins and furans, not to mention the disposal of contaminated ash.

As the Research Centre at Juelich, Germany noted in its preliminary study of the PVC material flow:

'...by this measure the (amount) of chlorine, the potential for the formation of dioxins during incineration as well as the release of plasticisers and tin into the environment could be reduced. Furthermore, the high disposal costs caused by the PVC element in waste incineration would be avoided.' 6

While chlorine may be present in other forms of waste, the amounts present in PVC packaging are disproportionately high.

A study commissioned by the German Federal Ministry for Research and Technology and published in 1989 7 calculated that rigid PVC packaging such as bottles and pots was responsible for over 50% of total chlorine in German household waste, while constituting no more than 0.5% of the waste by weight. Overall, PVC packaging accounted for 60% of the chlorine present in household waste, with a further 20% from other PVC products such as shoes, household goods, imitation leather, etc.

The tide is now turning away from PVC packaging. Large retail chains such as Tengelmann in Germany and Irma in Denmark have almost eliminated their PVC packaging, and reusable glass is making a come-back, particularly for dairy products.

Most importantly, manufacturers are beginning to realise the market potential of 'green consumerism' and the cost of consumer boycotts. Herlitz, one of Europe's largest manufacturers of stationery items, has been substituting its PVC products for over two years. It has developed a 'blister-free blister pack' to replace the traditional 'blister pack', whereby a small product is encased in a transparent plastic bubble on a cardboard backing. 8

Contrary to statements by the PVC industry, it is not a question of either choosing between PVC packaging and lower living standards, food wastage and environmental disadvantages.

On the contrary, PVC packaging is one of the sectors in which substitutes are most readily available and could most easily be achieved.

PVC effects are also being taken seriously in the area of baby toys most notably because of the dangers of plasticisers. In Switzerland the use of DEHP for the manufacture of toys for children younger than three years was banned in 1986, and in Germany its use in teething rings is 'not recommended.' In the Netherlands, the potential ecotoxicological consequences appear better recognised - DEHP is on the priority list of environmentally toxic substances. It is also a priority pollutant in the USA. 9

Medical applications of PVC involve no more than 3% of total PVC output but is a major PR point for the industry claiming that PVC is essential in hospitals. PVC is used for probes, catheters and as material for tubing as in haemodialysis machines to clean the blood in kidney disease patients. But the use of PVC in the medical sector leads to two problems beyond those already described: effects on individual health, and the peculiarities of small, hospital-operated incineration plants.

Because PVC only becomes flexible when plasticisers such as DEHP are added, hospital tubing and bags contain DEHP which can migrate into fluids. DEHP has in fact been detected in the blood held in blood banks. Dialysis patients who receive long-term and regular blood transfusions and whose blood comes into contact with the PVC tubing system of a dialysis machine receive high levels of DEHP per treatment. These patients suffer from a long list of illnesses such as skin and liver irritations as well as common circulatory heart disease. Once the body no longer came into contact with PVC these symptoms improved and then worsened again with renewed contact with PVC. The Society for Chronic Kidney Diseases in Germany has stated that the presence of plasticisers need not be the case and should be avoided by patients and doctors alike. 10

Hospitals are now rejecting the use of PVC and many in Denmark, Germany and Austria are eliminating the use of PVC products.. Other substitutes such as plasticiser free polyethylene is used, latex gloves are replacing PVC ones and for dialysis systems new machines with porous glass internal tubing are being developed.

1 Johnson, D. "The Future of Plastics. Applications and Markets Worldwide" Financial Times, London 1990.

2 INCPEN Factsheet May 1990.

3 Benfenati, E et al: "Migration of Vinyl Chloride into PVC-Bottled Drinking-Water assessed by Gas Chromatography-Mass Spectrometry" Fd. Chem. Toxic. Vol 29 Nr 2, 1991.

4 "Kommt Bar niche in die Tute! Lebensmittelverpackung und Mullvermeidung" Ed. Katalyse eV, Kiepenheuer & Witsch, Cologne 1991.

5 Claus F., Frieze H., & Gremler D. "Es geht auch ohne PVC: Einsatz-Entsorgung-Ersatz." Hamburg: Rasch u. Rohring, 1990.

6 Kollmann, H.et al: "Stoffstrome und Emissionen durch Produkbon, Verwendung und Entsorgung von PVC ")UEL-Spez-543, Juelich 1990.

7 Brahms, E. et al: "Papier Kunststoff Verpackungen. Eine Mengen und Schadstoffbetrachtung. " UBA Berichte 1189. Berlin 1989.

8 Company information, Herlitz Berlin.

9 "Persistent Organics", Water Research Centre 1990, CEST London.

10 Claus, F. et al. op cit

Factsheet 7

LONG LIVED GOODS

A GROWING MOUNTAIN OF PRODUCTS

PVC applications span not only those sectors where it is most visible, such as packaging and consumer goods, but also sectors such as construction, vehicle manufacture and medical use. Such products exist ten to twenty years or more before their disposal.

The following table highlights the major sectors of PVC use in a typically industrialised European country: 1

SECTOR	% PVC
Construction	58
Packaging	17
Automotive	4 (approx)
Electrical	4 (approx)
Furniture	4 (approx)
Other	13 (approx)

In the construction sector, PVC is used for products such as Buttering, down pipes, flooring, profiles, panelling and window frames. Because PVC is unstable in the presence of ultraviolet light, it must be stabilised for outdoor use, usually with cadmium-based stabilisers. Unlike short-life products, long-term use of such materials has generally been considered unproblematic because its consequences have not yet become evident.

Germany used 1.5 million tonnes of cadmium-stabilised PVC for windows in 1990.2 In the United Kingdom, PVC windows and door frames are expected to account for 90% of the market by 1992. 3 A recent study estimates annual growth rates of 7-8% in this sector throughout Europe until 1995. 4

Clearly, traditional materials such as wood are being abandoned in favour of PVC, although the end disposal of this material presents enormous problems. Because of the 15 - 20 year time lag between production and disposal, we have not yet had to come to grips with this problem.

PVC is widely used in vinyl flooring, especially in kitchens and bathrooms, as well as in public buildings. Vinyl wallpapers, also made of PVC, are displacing traditional materials. Both these products contain large amounts of additives (see Factsheet4), especially plasticisers.

These plasticisers are not an integral component of the products and can therefore escape into the air and the effects are well documented: PVC flooring releases particularly high concentrations of plasticiser and contributes to the 'sick building syndrome' commonly reported in modern office blocks. In Sweden 24 cases of sick building syndrome were studied. In 8 of them PVC floorings were involved and a range of additives within the PVC were identified.5 The typical composition of PVC flooring and vinyl papers (% weight) 6 is as follows:

	Flooring	Vinyl Paper
PVC	30-50	50-80
Stabilisers (heavy metals).	05-1	2-3
Plasticisers	25-50	10-20
Flame retardants	unknown	unknown
Lubricants	1	--
Fillers	25-50	10-15
Pigments	1	1-3

These products are extremely dangerous in cases of fire (see Factsheet 5). Not only are toxic fumes of hydrogen chloride readily formed, even without actual burning, but recent studies confirm the formation of extremely toxic dioxins and furans in fires in the presence of PVC. 7 The German Ministry of Health (BGA) and the German Federal Office of the Environment (UBA) have issued a joint statement recommending the complete exclusion of PVC in areas susceptible to fire (see Factsheet 5).

For all long-life products, the question of landfill disposal has reached crisis proportions in many communities. Although much demolition waste will presumably be disposed of in separate landfills, waste from repairs and decoration will find its way into normal municipal landfills, where additives may be leached out and find their way into the environment (see Fact-sheet 8). In Germany alone, some 7 million tonnes of PVC are in current use in the construction sector. 8

The town of Bielefeld (Germany) has found that not only is the substitution of PVC by traditional materials such as wood, stone and metal achievable,but the alternative materials are in fact superior, leading to reduced repair costs (see Factsheet 10). Many other local authorities in Germany, Denmark and elsewhere have confirmed Bielefeld's findings.

PVC is also proving a problem in the automotive sector, where it is widely used for plastic parts such as interior trim, as well as in sealants and as under seal. Its chlorine content presents serious problems when vehicles are scrapped.

Large industrial shredders reduce complete vehicles to fistsized pieces within seconds in order to recover useful metals for recycling.

Unfortunately, it is not possible completely to separate metal from plastic by this method; thus, the scrap delivered to the steel industry is contaminated with PVC.

Not only does this lead to considerable dioxin and fur an emissions,9 but the heavy metals present in PVC stabilisers may be released. 10 Steel works, like waste incinerators, cannot prevent environmentally damaging emissions.

The use of PVC in white goods (refrigerators, washing machines, etc.) exacerbates such emissions, since these products are routinely shredded along with cars and the metal scrap recycled.

1 Becker, G.W., Braun, D. "Kunststoffhandbuch2/2 Polyvinylchlorid" Munich 1986 (Table refers to former West Germany).

2 Kollmann, H.et al: "Stoffstrome und Emissionen durch Produktion, Verwendung und Entsorgung von PVC" JUEL-Spez-S43, Juelich 1990.

3 "Britain's Plastics Industry", Jordans Reports, 1990.

4 Johnson, D. "The Future of Plastics. Applications and Markets Worldwide", Financial Times, London 1990.

5 Swedish National Testing and Research Institute, Report 1990:25.

6 Adelmann, G. "PVC-Bodenbelege und Vinyltapeten. Trendzum gihiger wohnen in Ausstieg aus der PVC-Nutzung." Workshop 516 Oct 1990, Ed. Aktionskonferenz Nordsee eU

7 "Untersuchung der moglichen Umweltgefahrdung helm Brand von Kunststoffen" Theisen,)ochen et al, Gesellschaft fur Arbeitsplatz-und Umweltanalytik 1991.

8 "Umweltbelastungen durch PVC - ein Uberblick" Umweltbundesamt 1991.

9 Tysklind, M., Sederstrom, G., Rappe, C et al, "PCDD and PCDF Emissions from Scrap Metal Melting Processes at a Steel Mill, Chemosphere 19, 705-710, 1989. Oberg, T., Allhammar, G., "Chlorinated Aromatics from Metallurgical Industries - Process Factors Influencing Production and Emissions" in Chemosphere 19, 711-716, 1989.

10 Reimann, D.O., "Schwermetalle und anorganische Schadstoffe in Hausmull mit ihrer Verteilung auf die feste und gasformige Phase" VGB Kraftwerkstechnik 68(1988)837-841

Factsheet 8

PVC RECYCLING

THE MYTH OF PVC RECYCLING

A major goal set by the PVC industry to improve its image is to create the impression that PVC is an environmentally acceptable material - one that can be recycled. The US plastics industry has noted that:

'The image of plastics among consumers is deteriorating at an alarmingly fast pace. Opinion research experts tell us that it has plummeted so far and so fast, in fact, that we are approaching a "point of no return".' 1

In response to this increased public awareness, the plastics industry launched two major public relations efforts. The first - to demonstrate the 'biodegradability' of plastics - failed miserably. Their second effort at greenwashing has been more successful. Their strategy has been to build on society's positive response to recycling while increasing PVC's market share and avoiding any attempt to legislate product bans or restrictions.

As one spokesman for the American plastics industry has said:

'If we can get our act together and show the world just how recyclable these valuable polymers are and that industry stands behind the commitment to prove it, then ...it won't be a 60 billion pound market shrinking to 45 because 15 billion pounds were recycled, it will be an 80 or 90 or 100 billion pound market which has EXPANDED because those plastics are being recycled. 2

In reality, post-consumer plastics recycling is negligible, despite the fact that the PVC industry feels itself under intense pressure to prove the recyclability of chlorine-containing plastic. That pressure has been increased by the fact that Denmark, Sweden, Switzerland, Germany, and Austria have placed restrictions on PVC packaging owing to the incineration problems it presents.

PVC belongs to the family of plastics known as thermoplastics. These plastics, which include polyethylene, polypropylene and polystyrene, can be remelted and reformed, in contrast with the thermosets such as polyurethane which cannot be remelted or reformed.

PVC can therefore theoretically be recycled, and reprocessing of scrap during production routinely takes place, usually in the interests of production economics rather than of environmental protection. Genuine recycling, however, is 'post consumer' - that is, it takes place with products which have already completed a useful life. Attempts to recycle these post consumer PVC plastics are fraught with problems.

1. PVC is not a single material. Pure PVC is unusable and must therefore be combined with a wide range of additives (see Factsheet 4). The thousands of different formulae used for different products - and often for similar products made by different manufacturers - prevent PVC being recovered from the waste stream as a single material would be.

It cannot be compared with glass, for example, which merely needs sorting by colour.

PVC plastic will now carry this symbol so different plastics can be sorted, supposedly for recycling. This labelling provides consumers with the opportunity to boycott the purchase of PVC products.

Moreover, many PVC additives are toxic, restricting the number of products which can be made from recyclate - who would want a child's toy containing a cocktail of cadmium stabilisers, polybrominated flame retardants and plasticisers?

2. PVC REcycling is really DOWN cycling. In cases where PVC is not removed from the waste, the only products which can be manufactured from the resulting low-quality recyclate are thick-walled items (park benches, fence posts etc) for which there is little market demand. To use plastics recyclate for these wood and concrete substitutes is not only of doubtful economic benefit, it also has the effect of efficiently distributing potentially toxic products throughout the landscape.

This is not true recycling. Rather, it is 'down-cycling', which in effect simply delays the inevitable disposal of the product to landfill or incineration plants. It leaves the way clear for increased plastics production and increased profits, instead of using recyclate to replace primary production.

3. Plastics are costly to collect and recycling schemes are uneconomic. The burden for collection, disposal of contaminated salt waste from incinerator plants, and upkeep of landfills is put on the taxpayer. Recently, the town of Hallein in Austria (home of a Solvay branch, the largest chlorine producer in Europe) voted against cooperating with a PVC recycling project because of the extra cost to its citizens and because it was contrary to the town's waste reduction policy.

It is widely agreed by the plastics industry that current recycling efforts are not profitable, with recycled products and resin often more expensive than virgin plastic.

A memo from Solvay in fact admitted that the big public relations campaign launched in Europe to publicize the fact that PVC products are recyclable was more for the public relations value than anything else. 3

4. Plastic waste trade. While industry is extolling the virtues of incineration and the safety of landfill, new evidence has revealed 'plastic dumping'.

An examination of shipping records by Greenpeace confirmed an exploding plastics waste trade, which reached a volume of 200 million pounds per year in the USA in 1991.

Although waste brokers claim the plastic will be recycled, it was discovered that up to 40% of imported plastic is simply dumped. PVC process and post consumer waste was listed on many of the ships' manifests. 4

The amount of PVC products is increasing with no safe disposal route. The inability to recycle post consumer PVC products is only delaying the inevitable waste crisis. The only solution is to globally phase out PVC production.

1 Letter by Larry Thomas, President of the Society of the Plastics Industry, December 22, 1989 in Greenpeace: Hazardous Exports Prevention Patrol -- Focus on Plastics & Plastic Waste Trade. Washington, DC, 1992.

2 Forman, M. in American Metal Market, November 1991 quoted in Greenpeace Hazardous Exports Prevention Patrol report. op cit

3 Proces-Verbal De La Seance Du Conseil D'Enterprise Tenue Le 3 Avril, 1990, ' Solvay.

4 Greenpeace: Hazardous Exports Prevention Patrol - Focus on Plastic Trade. Washington DC 1992.

Factsheet 9

DISPOSAL OF PVC

NO SAFE DISPOSAL

One statement can be made with absolute certainty: PVC products will end up as waste. This is not only because of the nature of the products - many PVC products are cheap, mass produced consumer goods that have a short life and cannot be repaired - but also because the many formulations and additives present in different PVC products make them impossible to recycle in the true sense of the word.

Even the few products that are made from post consumer PVC discarded products will sooner or later end up in the dustbin - usually sooner.

Currently, millions of tons of PVC products are disposed of by incineration or landfill, the costs of which are borne by the general public both in economic and human health terms.

As the German Council of Experts for Environmental Issues concluded in its 1991 Waste Management Report:

'The use of PVC as a sink for chlorine is, in a manner of speaking, subsidised by consumers and the general public by way of the costs of disposal.' 1

LANDFILL: NO HIDING PLACE FOR WASTE

In the UK, most waste is landfilled. Although the chemical industry claims that PVC can safely be landfilled, many of its additives, especially plasticisers, can be released either by the activities of micro-organisms or by the direct action of corrosive liquids in the landfill. 2

Tests have shown that toxic stabilisers (barium/cadmium) can be leached from plasticised PVC under landfill conditions. These heavy metals can be absorbed by plants, and products containing them should not be disposed of in normal landfills. 3

Even in a so-called "well-managed" landfill, the composition of the 'leachate' (the liquid seeping through the body of the landfill) is unpredictable, varying with the nature of the landfilled waste, the amount of rainfall, the temperature and a host of other factors. This leachate can react with PVC, which can consist of up to 60% plasticiser by weight, 4 together with other additives (e.g., stabilisers, lubricants, flame retardants (see Factsheet 4) in varying amounts.

The increasing volume of PVC being landfilled, and the fact that not even the best landfill membranes can never prevent leachate escaping into the outside environment, set the scene for future pollution of aquifers supplying drinking water.

INCINERATION: SPREADING TOXINS INTO THE AIR, LAND AND WATER

Many countries incinerate a large proportion of their municipal solid waste, sometimes with energy recovery. The chemical industry supports this method of waste management and has coined the term 'white coal' to validate the use of waste plastics as a fuel. The calorific value (heat content) of plastics is cited to justify such incineration - and to leave the way clear for maintaining and even increasing primary production. In fact only 10% of the energy used in PVC can be recovered. 5

This also disregards the fact that incineration is a source of toxic emissions to air, land and water and in the case of PVC additional problems arise.

The chlorine content of PVC makes it completely unsuitable for incineration. Whenever chlorine is burned, HCI (hydrogen chloride) is formed. This poisonous, corrosive substance must be removed from flue gases to avoid serious environmental pollution, and this entails high capital investment, efficient monitoring, and sizeable amounts of energy. It was for this reason in fact that the chlorine and PVC industry created ocean incineration since the emissions were not captured by scrubbers but spewed onto the ocean surface.

PVC is also one of the greatest sources of dioxins and other organochlorines. The incineration of a kilogram of PVC produces up to 50 micrograms of dioxin (TEQ), enough to initiate cancer in 50,000 laboratory animals. 6

Recent evidence of dioxin's toxicity details reproductive problems in offspring of parents contaminated with low levels of dioxins. Hormone changes and both demasculinization and defeminization of both sexes are now occurring in wildlife populations.

Many scientists predict such changes are occurring at human level now. 7

Incineration also produces toxic ash which must be disposed of in landfills. In the case of PVC for every 1 tonne of PVC burned, 0.9 tonnes of waste salts are created. Because these are contaminated with heavy metals or whatever additives there were in PVC products the salt must be disposed of. The costs of such emission cleaning and disposal are actually higher than the cost of the new PVC product. 8

In Germany, the Council of Experts for Environmental Issues issued a special report on waste management in 1990 concluding:

'Even assuming the possibility and technical implementation of pollution-free PVC incineration by means of end-of-pipe measures, it will remain necessary to remove the hydrochloric acid that is formed from the flue gas, to bind it as a salt and to store it....therefore the waste volume to be stored cannot be reduced by means of incineration.' 9

Finally, the PVC industry, well aware of the negative public image of their product have evolved an intriguing public relations concept-- the 'closed chlorine cycle'.

Briefly, the acidic gas from the incinerator is neutralized using large quantities of caustic soda to produce salt. This, the industry maintains, is then re-introduced into the process to produce more chlorine and hence PVC. In reality this only perpetuates MORE production of chlorine, rather than closing the cycle because the production of caustic soda entails the production of almost equal amounts of chlorine.

Also the salts that are created after neutralization are usually contaminated with heavy metals and other additives contained in the various PVC products thereby preventing its re-use. 10

It is obvious that the only solution to PVC's disposal problems is not to produce the product in the first place.

1 Sondergutachten tea Rates von Sachverstandigen fur Umweltfragen vom September 1990 "Abfallwirtschaft" Stuttgart 1991, paragraph 754.

2 Plehn, W., Lohrer, W.: "Umweltbelastung durch PVC", Staub, Reinhaltung der Luft 47(1987)7/8.

3 Raenby, B., Albertsson, A. C, 'Effects on Growing Crops of Plastics Stabilised or Pigmented with Cadmium Compounds: Preliminary Results of Pot Experiments with Spring Wheat' Ambio 7(1978)Nr4.

4 Eder, G. "Ein okologischerAlptraum." Mullmagazin 1/41988.

5 Greenpeace Germany Recycling Report. June 1992.

6 Ibid.

7 Statement of scientists.

8 Greenpeace Germany Recycling Report op cit

9 Sondergutachten des Rates von Sachverstandigen fur Umweltfragen vom September 1990 "Abfallwirtschaft" Stuttgart 1991, paragraph 770.

10 Greenpeace Germany Recycling Report op cit.

Factsheet 10

PVC BANS AND PHASE-OUTS

THE WAY FORWARD TO CLEAN PRODUCTION

The PVC industry would like us to believe that their product is vital to modern society, and point to the fact that it is used widely almost everywhere. This development is not due to the superior qualities of PVC, but rather to the fact that it can undercut many traditional materials - wood, metals, glass - in price.

If costs as a whole are considered, rather than merely the purchase price of a PVC product, traditional materials will be seen to be more economic in the long-term.

Forward-looking companies, local authorities and institutions have been becoming increasingly aware of the threats posed by PVC and many have taken action.

In June 1987, following a public hearing, the German town of Bielefeld decided to ban the us of PVC in all its public buildings after a fire in bowling alley had been found to produce high levels of dioxins in its ash. It was concluded that PVC furniture and wire casing were responsible. 1

Two years later, Bielefeld had achieved 90% substitution in its construction sector. Over sixty German towns and local authorities have since followed Bielefeld's example.

Far from discovering that PVC substitution is costly and painful process, the Bielefeld authorities' only regret is that they did not take their decision earlier.

The alternatives to PVC have demonstrated superior qualities and the budget for repairs has decreased. Over 60 local authorities in Germany now have a PVC phase-out programme for public buildings.

In 1990 the Swedish government entered into a voluntary agreement with industry to ban PVC containers for foodstuffs and beverages.

Although there has been some reduction in the use of PVC containers, as yet the agreement has not lead to a total ban. In Switzerland, in 1991, regulations came into force allowing only recyclable material to be used for beverage packaging. PVC is not allowed.

The German retail chain Tengelman has also taken the decision to replace PVC packaging, despite pressure from the PVC industry to reverse its policy. Most PVC packaging has now been replaced with polypropylene substitutes. 2 In Austria, two of nine states have prohibited PVC in public buildings, and three regional capitals now have a PVC prohibition. In Vienna, hospitals have experimented with PVC alternatives; blood bags and tubes are expected to be fully substituted with non-PVC materials by July 1992.

Recently, a new hospital was opened with PVC replacements for the majority of uses, e.g., window frames, floorings, wall-paper, and disposables.

The Vienna underground no longer uses PVC coated cables, while PVC packaging is being phased out in all Austrian supermarkets. Aarhus, the second largest city in Denmark, is reducing the use of PVC in hospital and other institutions.

The town has distributed a handbook for identifying products which contain PVC, with information on 500 PVC-free hospital and office articles. Grennau hospital in Aarhus has been substituting PVC products since 1986 and is now 70% PVC free. Irma, the largest supermarket chain in Denmark, has achieved a 99% reduction of PVC.

In Norway, the Environment Department has taken the initiative to consult with the packaging industry to discuss a phase-out programme. In Sweden, IKEA, one of the world's largest furniture distributers, announced in late 1991 that it would use environmentally friendly substitutes for PVC and that it would phase out all PVC products; no new articles made of PVC will be introduced unless no PVC-free substitute exists.

The tide has turned. The dangers posed by PVC products are now understood. Indeed, the PVC industry, recognising that market saturation has been achieved in Western Europe and North America, is now planning to expand to the newly- and less-industrialised countries. 3

It is now paramount that this toxic industry does not expand and PVC bans and phase-outs must therefore become an urgent priority for both hemispheres.

1 Claus F., Frieze H., & Gremler D. "Es geht auch ohne PVC Einsatz-Entsorgung-Ersatz. .v Hamburg: Rasch u. Rohring, 1990.

2 'Packaging, an Environmental Perspective' Landbank Consultancy 1991.

3 Johnson, D. "The Future of Plastics. Applications and Markets Worldwide", Financial Times, London 1990.