VINYL 2010

The Voluntary Commitment of the PVC Industry

Progress Report 2002

1 Foreword

This second report on the Voluntary Commitment of the PVC industry fulfils our promise to publish an annual progress review. Public reporting is a key element of our voluntary approach and it demonstrates our willingness to work openly with all stakeholders.

The past year has been very important for the European PVC industry partners involved in implementing the Voluntary Commitment. We have forged ahead with our 'learning by doing' approach, strengthening the partnership and confidence between each part of our supply chain.

After external consultation and internal debate, we extended the Voluntary Commitment in October 2001 to include additional commitments on the total replacement of lead stabilisers and recycling schemes for both flooring and roofing membranes.

This year has also seen us introduce external verification for our progress report and the development of Vinyl 2010, a legal structure to oversee future implementation.

We are very proud to see that the voluntary approach we set in motion four years ago is now well underway and delivering real progress. The experience is very exciting for us within the industry because it is the first time that such a voluntary approach involving so many companies has been initiated across Europe. We believe it will certainly be used as a future blueprint within the chemical industry to help progress towards sustainable development.

Now we are well underway, the key challenge that faces us is to achieve targets by the deadlines we have set ourselves. We know this will not be easy because these targets are very challenging. However, we are confident and determined to succeed.

This annual report acts as a driver for progress and we welcome the transparency that it brings. Our next step in accountability will be to create a Monitoring Committee that independently reviews our progress. We hope this will be set up in 2002, involving representatives from the European Commission, Trade Unions, NGOs, consumer organisations and European Parliament.

I hope that in reading this report, you will agree we are making excellent progress. Our commitment towards continuous improvement remains absolute and we will carry on seeking new ways to enhance the sustainability of PVC applications that we offer to our customers during the coming year.

Jean-Pierre Pleska
Chairman of Vinyl 2010

2 Contents

3 Verification statement

Det Norske Veritas (DNV) is an autonomous, independent Foundation with the objective of safeguarding life, property and the environment

Vinyl 2010 – The Voluntary Commitment of the PVC Industry sets out a 10-year programme aimed at meeting the challenges of sustainable development and continuous environmental improvement throughout the entire PVC-lifecycle. The 2002 Progress Report presents the achievements in 2001 related to the 10-year programme. DNV has performed an independent review of this report.

The scope of the review has been to verify the contents of the 2002 Progress Report and to issue a verification statement. Special emphasis was placed on the projects described in chapter 7C.

This verification statement is accompanied by a report detailing the verification process, including suggestions for improvement.

The work has been based on document review, interviews, meetings with Vinyl 2010 representatives, and information available on the internet.

The verification process has consisted of the following tasks:

- Review of plans and project presentations.
- Review of progress reports for the projects.
- Review of minutes from the various project steering group and committee meetings.
- Interviews and correspondence with relevant personnel.
- Review of project contracts.

The underlying information or data on which the above-listed documents are based has not been a part of the verification scope.

The financial data presented in chapter 7D has not been verified, but based on communication with the Vinyl 2010 accountants, it is our belief that the figures are correct. We have not verified the project "Taking the Natural Step", the results of the ECPI sponsored DEHP risk assessment or the table "Tonnes of stabiliser systems", with ensuing paragraphs on page 9.

It is our view that the verified contents of the Progress Report, truthfully presents the work carried out in 2001 towards fulfilling the Voluntary Commitment. We have seen enthusiasm and commitment amongst the Vinyl 2010 participants and feel they are well underway in implementing their 10-year programme.

Bjørn Faanes

Kristin Hansen

Høvik, 25 April 2002
DNV Consulting Norway

4 Key achievements in 2001

- ESPA members will stop selling cadmium based stabiliser systems.
  Complete. The use of cadmium in all stabiliser systems placed on the European market was phased out in March 2001.
- EuPC will communicate to its members not to use cadmium based stabilisers.
  Complete. Information communicated to EuPC members during 2000 and 2001.
- EU targeted risk assessment on alternatives to cadmium based stabiliser systems due to be issued.
  Delayed. The risk assessment was reviewed by the CSTEE, which required more information. See page 9 for more details.
- ESPA publishes 2000 statistics for the three main uses of lead.
  Complete. See page 9 for more details.
- First batches of PVC waste introduced at Tavaux feedstock recycling plant in France.
  Complete. See page 15 for more details.
- Recycling trial starting at DOW/BSL in Schkopau.
  Complete. See page 15 for more details.
- ECVM and EMCEF seminar for industry managers and HSE experts in EU accession countries.
  Complete. See page 7 for more details.
- EPPA (EuPC sector group for window frames and related profiles) begin implementation of plans for window frame waste collection and recycling across Europe.
  Complete. See page 11 for more details.
- Trials start at hydrolysis plant at Stigsnaes in Denmark.
  Complete. See page 16 for more details.
- Updated PVC LCA published by the Association of Plastics Manufacturers in Europe.
  Complete. LCA published in March 2002.
- First batches of PVC cable waste recycled via Vinyloop® process at Ferrara in Italy.
  Complete. See page 10 for more details.
- ECVM confirms compliance with S-PVC Charter for PVC production at all member company plants.
  Delayed. See page 6 for more details.
- EPFLOOR (EuPC sector group for flooring) master plan to be developed by October 2001.
  Complete. See page 12 for more details.
- TEPPFA (EuPC member association for pipes and fittings) compiles plastics pipe collection and recycling scheme development plans in Germany, France, Spain and Italy. Other activities are undertaken all over Europe.
  Complete. See page 10 for more details.
- Completion of PVC waste feedstock recycling trial at DOW/BSL plant in Schkopau, Germany.
  Delayed. See page 15 for more details
- Construction of pilot plant and initial trials completed for REDOP Project in the Netherlands.
  Initial trials completed. See page 16 for more details.
- Second Voluntary Commitment progress report published and externally verified.
  Complete. See page 2 for more details.

5 Vinyl 2010

Meeting the challenge of sustainable development

The Vinyl 2010 identity has been developed to represent action by the industry to deliver a sustainable future for PVC.

The Voluntary Commitment was originally signed in 2000. It set out a challenging 10-year plan to deliver continuous improvement in product stewardship across the PVC lifecycle. An updated version was produced and signed in October 2001, in light of comments that were made during the public and political consultation following the European Commission's Green Paper on PVC.

Amongst other things it incorporates additional targets for replacement of lead stabilisers, and for recycling flooring and roofing membranes.

A new identity for the Voluntary Commitment, the organisation behind its implementation and the projects being run, has also been introduced: 'Vinyl 2010 – meeting the challenge of sustainable development.'

The new identity will help communicate what the PVC industry is trying to achieve and explain the impact it is already making. It represents real commitment to progress and therefore you will see it featured throughout this report.

The logo features 4 people, each representing part of the supply chain – resin manufacturers, stabiliser producers, plasticiser manufacturers and converters. 'Vinyl 2010' was chosen because the work currently underway covers the ten-year period up to 2010. The logo will usually be accompanied by the slogan 'meeting the challenge of sustainable development'.

Meeting the challenge of sustainable development is exactly what the PVC industry is doing through the work described in the following pages. It is a tough challenge, but no other EU-industry sector has come up with such an integrated approach that covers each part of the supply chain. We hope people come to recognise Vinyl 2010 as representing real projects, achieving real progress. It also stands for transparency because we will involve stakeholders in monitoring our progress.

6 A pioneering approach to EU sustainable development policy

Vinyl 2010 is a lynchpin in the EU's sustainable development strategy for PVC and sets out a comprehensive policy mix by completing existing legislation with a pioneering voluntary approach.It also marks a precedent in EU policy making on sustainable development.

Vinyl 2010 is the result of three years work, building on the industry's commitments presented in March 2000. This process was fuelled by the European Commission's consultation on the Green Paper on PVC and by Member States and European Parliament comments. For the first time in the EU, an industry supply chain has united around voluntary commitments covering an entire material lifecycle and all of its key markets.

This second annual progress report demonstrates the industry's continuing commitment to publicly report on its programme of achievement and progress. To further build a process of accountability and the inclusion of stakeholders, a monitoring process will be initiated. Through this process, Vinyl 2010's detailed commitments will be continuously reviewed by a Monitoring Committee. Representatives from the Member States, the European Commission, members of the European Parliament, Trade Unions and other interested parties will be invited to participate in this Monitoring Committee.

To offer the possibility of progressing implementation of the industry's commitments and guarantee democratic control, the Vinyl 2010 programme is designed as a 'two-step approach'. It will be reviewed in 2004-2005, following an in-depth evaluation of the industry's performance by the Monitoring Committee. The European Parliament and Council of Ministers should then decide on its transfer into an appropriate legal framework for Voluntary Agreements.

This 'two-step approach' provides the flexibility to embrace new developments in recycling and waste management technology, as well as the challenges presented by enlargement of the European Union.

The European Institutions' endorsement of Vinyl 2010 as a central element of the sustainable development strategy for PVC will give a clear signal and great encouragement to the 530 000 people working in the PVC industry across Europe and their customers.

7 Progress against commitments

A. PVC manufacture

COMMITMENT

PVC manufacturers commit to ensuring that each VCM and Suspension PVC plant in Europe fully complies with the 1995 ECVM Charter. A compliance rate of 96% was achieved in June 2000, and full compliance will be externally audited and published by the end of 2002. The potential for further plant optimisation is being investigated in 2001.

Last year the PVC industry reported that there were still a small number of plants falling short of the high standards required by the 1995 S-PVC Charter. It was expected that the few remaining shortcomings would be fully resolved before the end of 2001.

Acting on this deadline, the decision was taken mid-2001 to commission new independent verification of the ECVM member company sites. A formal agreement to that effect was reached with Det Norske Veritas. To allow sufficient representative results to be collated the plants will be audited during the first half of 2002 and these results verified at the end of this six-month period. This will allow completion of the verification before the end of 2002 and publication of the results soon afterwards.

In parallel, the PVC industry has updated the memorandum underpinning the Charter, titled "On the environmental impact of the manufacture of polyvinyl chloride (PVC) – A description of Best Available Techniques". On the basis of this description the industry completed its contribution to a document "Best Available Techniques for Producing Polymers" that will be communicated before the end of 2002 to the Integrated Pollution Prevention and Control Bureau of the European Union (IPPCB).

COMMITMENT

PVC manufacturers commit to comply with the Emulsion PVC Charter signed in February 1999. The Charter's deadline for compliance is the end of 2003 and compliance will be externally audited and published by mid 2004.

The IPPCB is in charge of preparing Best Available Techniques Reference Documents (BREF) as prescribed by the IPPC Directive 96/61/EC.

This directive concerns 'integrated pollution prevention and control.' It lays down measures to prevent or reduce emissions in the air, water and land from industrial activities. The industry document will provide valuable information for the BREF preparation and the industry is looking forward to a fruitful dialogue with the IPPCB.

The potential for further plant optimisations was discussed during a conference attended by the manufacturing managers of ECVM member companies in June 2001. It appeared that some companies had already committed to and published continuous improvement targets relating to energy and resource efficiency. Efforts are currently under way to build on such undertakings in the context of the whole industry. During 2002 Vinyl 2010 will start developing a report reviewing its current position and plans on the journey towards a sustainable PVC industry in Europe.

COMMITMENT

The PVC industry commits to:

- The development of European health, safety and environmental standards;
- Employee training;
- Standards transfer to EU accession countries;
- Dialogue on European works councils.

In September 2001, The European Commission Directorate-General Enlargement Technical Assistance Information Exchange Office (TAIEX) hosted a seminar on promoting health, safety and environmental (HSE) standards across the PVC industry. The event, which took place in Poland, was organised in co-operation with ECVM and European Mine Chemical and Energy Workers Federation (EMCEF).

The collaboration of ECVM with TAIEX and EMCEF formed part of the industry's work with its stakeholders to raise standards of product stewardship across Europe.

COMMITMENT

PVC resin, plasticiser and stabiliser manufacturers commit as individual companies to:

- Continue to improve their resource consumption (material and energy use) during manufacture;
- Set ongoing targets to reduce resource consumption where economically and ecologically this is warranted;
- Review their progress towards such targets on an annual basis.

A seminar was organised for industry managers and HSE experts from Eastern European countries that have applied to join the EU. It focused on the production of Vinyl Chloride Monomer (VCM) and PVC resin, in particular minimising exposure during manufacture, worker safety and emissions control.

Delegates heard presentations on the experiences of PVC producers in complying with legislation and raising standards of HSE management. The objective was to motivate and provide knowledge that will help former Eastern European PVC producers comply with EU HSE regulations as soon as possible. The ultimate goal is to secure a sustainable future for PVC across all of Europe.

Taking the Natural Step

During 2001, ECVM member companies EVC International and Norsk Hydro produced their first progress reports against the 'UK Eco-Efficiency Code of Practice for the Manufacture of Suspension PVC'.This code of practice is part of an Environmental Charter developed and agreed under the auspices of the PVC Co-ordination Group, which comprises UK retailers, the UK Environment Agency and UK PVC resin producers.

In line with the code, EVC International and Norsk Hydro published data on emissions from PVC manufacture through the whole of their manufacturing processes. These were also quantified for each tonne of PVC produced. Full details of the UK Charter, Code of Practice and each company's progress is available on their websites, which can be found by following the member company links on the ECVM website (see page 26).

B. Additives

Plasticisers

In 2001, the European plasticiser industry spent more than €1.1 million continuing its research programme aimed at providing the necessary scientific studies and expertise to ensure that plasticisers are being used without risk to human health or the environment.

Among the most important research projects completed was an ECPI sponsored two-generation reproduction toxicity study for di-(2-ethyhexyl) phthalate (DEHP). It clearly showed that the likelihood of adverse health effects to be much less than previously thought and the findings are now considered crucial to the finalisation of the EU risk assessment on DEHP.

COMMITMENT

The plasticisers industry will continue to conduct research in order to provide scientific studies and expertise to help policy-makers develop well informed decisions at the earliest possible time.

Also part of the DEHP risk assessment is a fish multigeneration study, which began in 2001 and will be completed in 2002. It is being carried out along similar lines to those previously carried out on DINP and DIDP and which proved influential in arriving at the qualitative risk assessment conclusions that there is no risk to fish from these substances.

Important for the completion of outstanding data for the risk assessment of Dibutyl Phthalate (DBP) will be a project aimed at gaining more knowledge of the low effect concentrations of the substance which have been seen in certain plant species. This study also began in 2001 and will be completed later this year.

Risk Assessments

EU risk assessments are nearing completion on Dibutyl phthalate (DBP), Di-(2-ethylhexyl) phthalate (DEHP), Diisononyl Phthalate (DINP), Diisodecyl phthalate (DIDP) and Butyl benzyl phthalate (BBP).

The risk assessments on DINP, DIDP and DBP were essentially completed in 2001 but have now to go through a final approval process by the EU Commission and EU Parliament before being published in the EU Official Journal. As no risk reduction measures beyond those already in place will be necessary for DINP and DIDP, this final approval should happen in 2002.

Finalisation of the DEHP risk assessment has been delayed in order for important new data to be taken into consideration from studies conducted in Germany and the United States. Final publication of the DEHP risk assessment is therefore unlikely to be before the end of 2002/early 2003 which will be about the same time as that for BBP.

ECPI continues to work with the respective rapporteurs to provide the necessary information to fill any data gaps.

COMMITMENT

The industry sector will continue to improve the already sizeable scientific database of its products consistent with Responsible Care® principles and use it to propose improvements based on the results of EU risk assessments.

Lifecycle Inventory

COMMITMENT

Industry supports the concept of Lifecycle Inventory (LCI) evaluation of materials in order to highlight possible improvements. An eco-profile report was published in 2001 and will be regularly updated to provide the basis for additional lifecycle work covering plasticised PVC products.

ECPI completed a major project to calculate the eco-profile of high-volume phthalate esters at the end of 2000. The calculations, which allow users to carry out life cycle assessments of their own products, were published in 2001 on the ECPI web site (see page 26). The eco-profile also allows the industry to identify possible ways of improving manufacturing of high volume phthalates.

Stabilisers

COMMITMENT

The use of cadmium in all stabiliser systems placed on the European market was phased out in March 2001, as part of the initial steps of the Voluntary Commitment. This took into account technical feasibility in line with Council Resolution of 25 January 1988 (88/C30/01).

No members of ESPA will sell such products in the European Union, Norway and Switzerland, and EuPC will communicate to its members not to use cadmium based stabilisers.

ESPA members have stopped selling all cadmium stabilisers in the European Union, Norway and Switzerland as agreed in March 2001.

EuPC communicated to its members not to use cadmium based stabilisers during the course of 2000 and 2001.

COMMITMENT

ESPA members will continue to research and develop alternative stabilisers to the widely used and highly effective lead-based systems.

ESPA members are working actively on research and development of alternatives to lead. The reduction in the use of lead-based stabilisers by all end users has resulted in a normal technical and commercial process of market competition. At this stage, any indication of cost would be premature.

Tonnes of stabiliser systems	1998	1999	2000
Formulated Lead Stabiliser [1]	112383	117995	120421
Formulated Solid Stabilisers containing Cd [2]	940	259	242
– Cd content	33	21	24
Formulated Mixed Metal Solid Stabilisers eg. Ca/Zn systems [3]	14494	16701	17579
Tin Stabilisers [4]	15241	15188	14666
Liquid Stabilisers – Ba/Zn or Ca/Zn [5]	16404	16527	16709
Liquid Stabilisers containing Cd [6]	230	148	146
– Cd content	17	10	9

Note: Formulated means that these systems are complete stabiliser/lubricant packages and may also include pigments or fillers as a service to the customer.
1 Used in pipe/profiles for construction and electrical cables. 2 Used only in construction profiles. 3 Includes food-contact and medical applications, plus all lead replacement systems. 4 Used primarily in rigid applications including food-contact use. 5 Used in the wide range of flexible PVC applications, calendered sheet, flooring etc. 6 Used in flexible and rigid applications. This used to be the primary stabiliser system for flexible applications but has decreased to very low use levels.

COMMITMENT

ESPA produce yearly statistics showing which stabilisers are purchased by the converters. It will also produce statistics showing which stabilisers are being used in window and profile production, pipe and cable applications.

It is important to understand that these tonnage figures represent sales to EU Countries, plus Norway and Switzerland (except that the figures for lead and mixed metal systems include Turkey). Some of the PVC products made with these stabilisers are exported, but in a similar way stabilisers included in imported PVC products are not included.

The overall increase in the use of lead stabilisers is due to the addition of a new member, which makes the statistics more comprehensive. They are now close to 100% of the total use.

This is especially important as the 2000 figures are a reference for the new revised lead reduction agreement.

COMMITMENT

Currently there is no unacceptable risk identified in the use of cadmium stearate and laurate which would preclude the continued recycling of these products. ESPA members will continue to work with the Commission on targeted risk assessment for such products.

The revised cadmium risk assessment has included recycled cadmium profiles in its methodology and this has been reviewed by the CSTEE. There is no suggestion that such recycling is an issue and indeed it keeps cadmium out of the waste stream and waste dumps, where the CSTEE considered that the landfill issue required more information.

ESPA has now joined, and is actively participating, in a voluntary EU risk assessment on lead overseen by the Dutch Authorities.

C. Waste management

Mechanical recycling projects

PROJECT UPDATE

Ferrara project – Vinyloop®
Timescale: 2001 – 2002

The Vinyloop® technology developed by Solvay allows the recycling of PVC, together with most of its additives, into a compound that can easily be used for production of high quality products.

The Ferrara plant, owned and operated by a joint venture between Solvin, Adriaplast, Tecnometal and Vulcaflex is the first commercial plant using this technology. It is designed to treat 10 kt/a of cable waste. Mechanical completion of the plant was achieved in November 2001 and start-up in January 2002.

COMMITMENT

The plastics pipe and fitting producers represented by TEPPFA, commit to mechanically recycle increasing quantities of PVC pipes and fittings at their end-of-life. The commitment is to recycle at least 50% of the collected available quantity of pipe and fittings waste by 2005.

An annual report will be provided to the European Commission.

PROJECT UPDATE

TEPPFA – pipes and fittings
Timescale: 2000-2005

The plastics pipe and fitting producers, represented by TEPPFA[1] (EuPC sectorial association for pipes and fittings) undertook a number of actions during the past year. Their overall objective is to set up collection and mechanical recycling schemes for pipes and fittings in all EU countries.

Recycling technology and equipment is available and hence the technical content of the project is limited to creating quality standards, improving sorting of PVC from other plastics and increasing the share that is recycled in pipes and other construction products. The project mainly focuses on the supply source of waste, on the managerial, legal and economic aspects of collection and the motivation of all stakeholders.

Four priority countries (Germany, France, Spain, Italy) were selected for in-depth supply/demand studies, a full description of planned collection and recycling systems, leading to a business plan. In countries with limited actual experience, pilot collection schemes are being set up. In Germany, the focus is on the legal and organisational aspects. Recent waste availability studies, as well as actual collection experience show lower volumes of available collectable waste than previous estimates based on theoretical models. This is mainly due to the longer actual lifetime of plastics pipe systems. Initiatives are also taken in other EU countries where the study and set-up phase are at a preliminary stage.

The objective is to have operational systems in the priority countries by the end of 2002 and in all EU countries by the end of 2003. These schemes will be managed by the local associations. TEPPFA will provide technical know-how, manage the flows of funds and information and promote the use of recyclate.

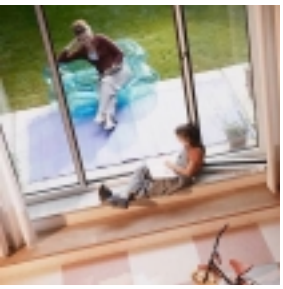
All the costs of different collection and recycling systems will be studied, the mid-term objective remaining to set up self sustaining schemes.

1 TEPPFA: The European Plastics Pipes and Fittings Association

COMMITMENT

The window frame sector, represented by EuPC, commits to mechanically recycle increasing quantities of PVC window frames at the end of life of this application. The commitment is to recycle at least 50% of the collectable available quantity of window profile waste by 2005.

An annual report will be provided to the European Commission.



PROJECT UPDATE

EPPA – window profiles

Timescale: 2000 – 2005

The window profile sector, represented by EPPA (EuPC sector group for profiles) undertook a number of actions during the past year. The overall objective is to set up collection and mechanical recycling schemes for windows and related profiles in all EU countries.

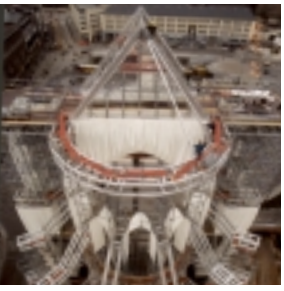
As for pipes, technology and equipment is available and the technical content of the project is limited to increasing the collection rate of post consumer windows, quality standards and increasing the share recycled in high value applications.

The project mainly focuses on the supply of waste, managerial, legal, economic aspects and the communication and motivation of all stakeholders, trying to maximise the number of participants. As profiles are a more recent application than pipes, the availability patterns of post-consumer waste are still very uncertain and required substantial efforts to unravel.

Waste availability studies carried out in the main EU countries showed much lower volumes than previous estimates based on theoretical models. This was followed by an extensive study to analyse the existing schemes and propose management structures and ways to finance the chain deficit. Endorsement and implementation of the proposals are expected in 2002.

The major conclusions from the study were that a one-size-fits all approach is not viable and schemes have to be set up at member state level. In view of the expected volumes, priority should be given to the optimisation of the existing systems in Germany, Austria, Holland and Denmark together with new schemes in the UK and France. On a European level a monitoring and reporting format has to be elaborated.

2 EPPA: European PVC window Profile and related building Products Association



PROJECT UPDATE

Ferrari project – Texyloop®

Timescale: 2002 – 2006

The project proposed by the French Ferrari company will be developed on the basis of the Vinyloop® technology to recycle PVC-coated fabrics. The treatment of fibres required a specific technological development that is currently being successfully developed on a pilot scale, allowing the fibres to be recycled as well as the PVC compound. The process will be called Texyloop®.

The project entails building a market development unit of 2 kt/a in 2003, to be followed by a 10 kt/a commercial plant due for completion in 2006 and using the same infrastructure. The site for the commercial unit will be located in France. The plant may receive some public subsidies.

COMMITMENT

The flooring sector, represented by EPFLOOR, commits to recycle increasing quantities of PVC flooring at the end of life of this application. The commitment is to recycle at least 50% of the collectable available quantity of PVC flooring waste by 2008.

An annual report will be provided to the European Commission.

PROJECT UPDATE

EPFLOOR

Timescale: 2001 – 2005

The flooring sector, represented by EPFLOOR[3], developed a draft master plan in order to deal with collection and recycling.

The draft master plan concluded that conventional mechanical recycling of PVC flooring has a potential limited to a few thousand tons per year because the recyclate can only be used in a specific type of calendered products. This led EPFLOOR to select the Vinyloop® process as the preferred recycling option at the present time. Trial runs demonstrated that the recyclate works well in a large range of new flooring products, both calendered and coated.

EPFLOOR has activated the development of existing collection scheme early in 2002 and a recycling operation based on Vinyloop® technology could start-up in the course of 2003 in Germany. EPFLOOR has chosen Recinyl® as the trade name for the recyclate. Waste not suitable for Vinyloop® could go to feedstock recycling.

3 EuPC PVC Flooring Sector Group

COMMITMENT

The PVC industry commits to develop the use of high-quality mechanically recycled PVC in new products. It is important to bear in mind that the PVC industry has already developed a systematic take back scheme for production waste and will develop similar schemes for installation and transformation waste.

COMMITMENT

The PVC industry will examine how recycling schemes already operating in some European countries (e.g. German scheme for PVC window frames as well as several schemes for pipes) could be expanded for use in other EU countries.

This commitment is being met through the implementation of a number of the recycling projects described within this report (e.g. TEPPFA, EPPA and EPFLOOR).

New mechanical recycling projects launched in 2001

The following additional projects have been approved for funding by Vinyl 2010 in 2001. At this stage initial investigations into the most suitable recycling technology are being undertaken.

COMMITMENT

The roofing membranes sector, represented by ESWA, commits to recycle increasing quantities of PVC roofing membranes at the end of life of this application. The commitment is to recycle at least 50% of the collectable available quantity of PVC roofing membranes waste by 2005.

An annual report will be provided to the European Commission.

PROJECT UPDATE

ESWA project

Timescale: 2002 – 2005

The roofing membranes sector, represented by ESWA[4] (EuPC sectoral association for roofing membranes) will undertake a study in 2002. During 2001 a Project Group was set up, a co-ordinator appointed and a preliminary data collection exercise took place.

During 2002 a second research phase consisting of technology screening, an investigation into the use of recyclate and additional R&D (if required) will be undertaken.

Investigation of collection aspects and an inventory of potential recycling technologies are also included as well as some pre-engineering work. Support from Vinyl 2010 has been requested and provided for this phase.

This will be followed by a phase covering 2003-2004 that will be used to set up a legal entity, prepare a European business plan, further project development and the construction of a plant (if necessary) or developing partnerships. Of paramount importance is the development of an adequate collection scheme for the roofing waste in priority markets. Implementation would start in 2005.

4 European Single ply Waterproofing Association

PROJECT UPDATE

European Plastics Recycling (EuPR)

Timescale: 2002 – 2003

The objective of this project is to create favourable conditions for PVC mechanical recycling, ensure the development of sufficient recycling capacities, make proposals for the creation of an efficient and cost effective European network of collection centres and develop, with PVC converters, good quality recyclate to enable sufficient market penetration.

Three steps are planned:

- Step I: Study on "The Picture of PVC mechanical Recyclers in Europe": identify recyclers, capacities, reliability and efficiency, technologies used, regulatory framework, quality standards. This research was started in November 2001 and is due to be completed by June 2002.
- Step II and III: Installing pilot projects, creating an electronic market for PVC waste, promotional activities and identification of required investments.

PROJECT UPDATE

EPCOAT (coated fabrics)

Timescale: 2002 (study) and beyond

The coated fabrics sector, represented by EPCOAT[5] will undertake an initial sector study in 2002. As this market is fragmented in various applications, from textile architecture to truck covering or advertising, an in-depth investigation to identify waste sources, collection schemes and suitable technologies is required.

A preparatory planning and start-up phase was completed in 2001 involving the formation of a project group and the completion of a preliminary data collection exercise.

During 2002 the following activities will be carried out:

- an EU-wide study for technology screening
- investigation into the use of recyclate by application
- additional research and development if required

In addition, investigation of collection aspects and an inventory of recycling capacities will also be carried out as well as some pre-engineering work. Support from Vinyl 2010 is requested for this phase.

This is to be followed by a phase covering 2003-2005 that will be used to start recycling operations, further project development and the construction of a plant (if necessary) or developing partnerships.

Paramount is the development of an adequate collection scheme for the coated fabric waste all over Europe.

A pool of technologies will be available to treat the different types of waste (per application and quality).

Commercial implementation is planned to start in 2004 depending on the technologies.

5 EuPC PVC Coated fabrics sector group

PROJECT UPDATE

ACRR project

Timescale: 2002 – 2003

The plastics industry resin producers (ECVM and APME), additive manufacturers (ESPA), converters (EuPC) and recyclers (EuPR) signed in September 2001 a Partnership Agreement with the Association of Cities and Regions for Recycling (ACRR). The objective is to improve the recycling of plastic waste collected by local authorities.

Three activities are planned:

1. Define a communication strategy and develop communication tools to improve the collection of selected types of plastic waste. Initial phase to involve collection of data on public/private communication strategies and good practice for collection and sorting of plastics, in partnership with plastics recyclers

2. Pilot communication campaigns in two cities, assessing the results and elaborating guidelines for future actions

3. Pilot projects in these cities to increase the recycling of waste streams selected on the basis of existing best practices

The project started in January 2002 and will last for 18 months. To start with, a questionnaire will be sent to all ACRR members in order to get a better picture from what is a very complex and diverse situation. Ultimately, the findings will help the industry improve co-operation with local authorities and make a tangible impact on collection of plastic waste around Europe, including PVC.

Feedstock recycling projects

COMMITMENT

PVC producers commit to invest 3.3 million euro by end of 2002 in a pilot plant, with the objective to recover the chlorine and hydrocarbons. Depending on the outcome (expected for middle of 2002) a decision on the building of a commercial scale plant will be made.

PROJECT UPDATE

Tavaux pilot plant

Timescale: 1999 – 2002

An industry partnership under the leadership of ECVM has built a pilot plant at Tavaux in France, based on the slag bath gasification technology developed by Linde in Germany (see page 24 for more details).

A comprehensive commissioning period started at the end of 2000 and was completed in June 2001. Technical problems, not related to the technology itself, required corrective actions including some modifications in auxiliary parts of the plant.

Following these modifications, a continued trial programme is currently under way to check the design configuration of the reactor, optimise the operating conditions and select the preferred waste feeding system. The complete destruction of the PVC molecular structure that had been observed in the laboratory has not yet been confirmed in the plant. The effects of residence time and waste feeding are currently being investigated. However, slag formation and overflow as well as gasification effects have been observed.

At this stage of the trial programme, it is too early to draw any firm conclusions, however the current programme is on track to provide results on which a decision will be taken as to whether to expand the project to a commercial scale. Completion of the programme is scheduled for the end of 2002, with preliminary conclusions expected by mid 2002.

PROJECT UPDATE

DOW/BSL project

Timescale: 2002 and possibly beyond

Dow has operated since 1999 a commercial feedstock recycling plant at its Schkopau site near Leipzig in Germany, capable of treating 45 kt/a of chlorinated waste products (see page 24 for more details).

Initial trials carried out in 2000 demonstrated that the technology is robust and suitable to treat large quantities of most kinds of PVC waste products, including cables, flooring, roofing membranes, garden hoses and automotive dashboard skins.

A 1,000 ton trial was planned in 2001 but the actual volume was much lower due to difficulties in setting up an efficient management link between the individual waste suppliers and the operator of the recycling plant. The 2001 trials have confirmed the expected logistic requirement problems for supplying large volumes of PVC waste from a large amount of individual waste suppliers or collection points while meeting economic, administrative compliance and quality assurance requirements.

A continuation of the trial is planned for 2002. The objective will be to test improved logistics schemes and get additional, more accurate insight into the total cost of treating PVC waste via this route. The PVC industry is hopeful that a positive outcome from these trials will lead to longer term contractual arrangements to exploit as much of the possible capacity available. This is provided the cost remains competitive with other recycling technologies.

COMMITMENT

The PVC industry will continue investigating in parrallel other potential feedstock recycling processes and will complete assessments of environmental and economic benefits of these processes.

PROJECT UPDATE

Stigsnaes project

Timescale: 2001 – 2002

Stigsnaes Industrimiljo A.S. in Denmark is the owner of a commercial 50 kt/a hydrolysis plant. A two-step process for recycling of PVC waste is being tried out (see page 24 for more details).

A programme of trials has been carried out since 2001 with the support of the Danish plastics industry and the Danish EPA in order to test step 1 in the commercial plant and step 2 on a pilot scale. The trials are proceeding in two phases:

- Phase 1 to assess modifications required in the tubular reactor and demonstrate feasibility of the hydrolysis by treating about 200 t of PVC waste, including cables and flooring
- Phase 2 to test the separation and post-heating and produce about 20 tons of liquid and solid product fractions for evaluation.

Phase 1 was successfully completed during the fourth quarter of 2001, demonstrating that dechlorination to well below 0.1% wt of chlorine can be achieved, and that the flow through the tubular reactor meets the expectations, but that plant modifications will be necessary to ensure continuous operation at high throughput. Completion of Phase 2 is expected in May 2002.

PROJECT UPDATE

Redop® project

Timescale: 2001 – 2002

This process targets the mixed plastic waste fraction from municipal waste (see page 24 for more details). Contrary to the "PVC rich" streams for which the processes above are particularly suited, this mixed plastics fraction contains usually 0.5 to 5.0 wt. % chlorine. It comprises the following steps:

- Post separation of plastic and paper from municipal solid waste
- Separation of the mixed plastics fraction from the paper fraction
- De-chlorination of the mixed plastics fraction, using a novel process developed by DSM Research
- Co-injection (together with coal) into a blast furnace for the production of pig iron

The project is run in the Netherlands, managed by DSM Research, with the participation of waste management companies, the plastics industry and a steel manufacturer. The technical feasibility of all steps was demonstrated in 2001 and preliminary economic assessments look very promising. A decision will be taken during the first quarter of 2002 about production of ton quantities for trials in a commercial blast furnace.

New feedstock recycling projects considered in 2001

PROJECT OUTLINE

NKT–Watech

Timescale: 2001 – 2002

The NKT–Watech process consists of a two-step pyrolysis in a stirred vessel (see page 24 for more details) and has been demonstrated on a 1m^3 scale pilot plant.

This project has been presented to the Management Committee of Vinyl 2010 with a request for adequate financial support to participate in the scaling-up to commercial size. A decision should be taken by the end of 2002, taking into account the total available quantities of PVC waste and the development of alternative technologies (i.e. Stigsnaes) in Denmark.

Incineration projects

COMMITMENT

The PVC industry commits to support incineration technology developments in order to minimise the quantities of salt residues produced and develop purification technologies, with the objective to recover the salt to be reused in chemical processes, and minimise the final residues to be disposed.

PROJECT OUTLINE

MVR project

Timescale: 2001 – 2002

MVR (Müllverbrennungsanlage Rugenberger Damm) is an advanced 320 kt/a energy recovery plant owned by the City of Hamburg. It is designed to handle much higher hydrochloric acid levels in the raw gas than most conventional plants, which provides more flexibility in waste treatment. Moreover, the hydrochloric acid is recovered as a 30% aqueous solution, the purity of which makes it suitable for the most demanding uses within the chemical sector.

During the summer of 2001, trials were carried out by adding PVC waste to the normal waste streams that feed the plant, in order to reach the maximum design level of hydrochloric acid in the raw gas. About 500 tonnes of PVC waste were processed over a five-week period.

The trials were extremely successful. No modifications were observed in the composition of the slag or the fly ash. Steam generation was not affected. Hydrochloric acid production increased in proportion to the added PVC waste. The level of dioxins in the gaseous effluent remained extremely low, well below mandatory limits. During a subsequent planned maintenance shut-down, the plant was thoroughly inspected and no traces of abnormal corrosion were detected.

In addition to the experiments at MVR, a group of experts is preparing an overview of state-of-the-art technologies for the treatment of incineration residues. The focus is on minimisation and detoxification of the salts arising from the neutralisation of the acid gases. Part of this screening has been carried out by the Dutch consultant TNO (Rijpkema, L.P.M., 2000. MSWC salt residues: Survey of technologies for treatment. TNO R2000/317)

Once this survey is complete, the PVC industry will communicate its findings in order to encourage the building of new incinerators according to such technologies.

Other projects

Comparative eco-efficiency study of recovery technologies

A comparison of the various recycling and recovery processes is required to demonstrate that they meet the major criteria of sustainable development. The industry believes that the social benefits do not differ significantly from one process to another, allowing the focus to be placed on environmental and economic aspects.

So-called 'eco-efficiency' studies cover both aspects. Standardised methodologies have been developed and internationally recognised institutes carry out such studies in all kinds of fields. One of these is PE Europe, a spin-off of the Institute for Polymer Testing and Polymer Science (IKP) of the University of Stuttgart.

PE Europe and Vinyl 2010 have agreed on a preliminary technical scope for such a study comparing recovery technologies: mechanical recycling (Vinyloop®), various feedstock recycling processes and a modern plant for energy and hydrochloric acid recovery from municipal waste, such as MVR (Hamburg). Landfill will be used as common reference case in order to assess the cost differential and ecological benefits of the various options.

Funds have been earmarked to carry out the study in 2002, insofar as all the experimental results are available. The conclusions will be used by Vinyl 2010 as a tool for highlighting optimisation possibilities and for assessing the potential of the various technologies to progress to commercial implementation.

D. The Vinyl 2010 management and financial scheme

A common view was achieved regarding the most suitable structural and legal framework to ensure efficient management and full transparency of all the activities related to the Voluntary Commitment.

COMMITMENT

A rolling three-year framework programme will be proposed by the management entity of Vinyl 2010 and approved by the individual associations. This programme will describe the projects selected in order to meet the industry commitments as set out in section 2 of the updated Voluntary Commitment.

Statutory agreements were submitted in December 2001 to the competent authorities in order to apply for creation of an international non-profit association called "Vinyl 2010". The formal approval Decree is expected mid-2002. The necessary adaptations in the legal structure of the founding associations of Vinyl 2010 were progressed in parallel.

The concept of a rolling multi-annual framework programme has been progressively embodied in a series of 'project contracts' clarifying the financial, verification and other commitments of Vinyl 2010 and the entities managing the various projects. These contracts are currently under negotiation.

The eight projects launched in 2000 were pursued in 2001 and are expected to be continued into 2002 and beyond.

- TEPPFA (pan-European collection and recycling of pipes)
- EPPA (pan-European collection and recycling of window frames)
- Vinyloop® Ferrara (Italy)
- Ferrari, now called Texyloop® (France)
- EPFloor (pan-European collection and recycling of flooring products)
- DOW/BSL feedstock recycling (Germany)
- Stigsnaes feedstock recycling (Denmark)
- REDOP feedstock recycling (Netherlands)

Six additional projects were launched in 2001 and are expected to be continued into 2002 and beyond (except MVR project which is being funded for one year).

- ACRR (pan-European collaboration with cities and regions to promote plastics recycling)
- MVR energy and HCl recovery (Germany)
- Eco-efficiency study of various recovery technologies
- EPCOAT (pan-European collection and recycling of coated fabrics)

- ESWA – Edelweiss (pan-European collection and recycling of roofing membranes)
- EuPR (pan-European networking of PVC recycling companies)

A feedstock recycling project based on the NKT–Watech technology has been considered but no funding has been agreed yet.

COMMITMENT

The PVC industry will set up a formal legal entity, Vinyl 2010, to manage the Voluntary Commitment. A Management Committee, made of two representatives of each of the four associations, is currently leading the process.

The relevant financial data are indicated below, in thousands of euro.

The actual funding was significantly below the amount foreseen for 2001. The main reason is that some major projects were slower than expected to enter the main project phase. This should not have any impact on the achievements of the targets at the deadlines.

PROJECT	Total expenditure		PVC industry expenditure
	Estimated total expenditure of current project phase (k euro)	Total expenditure in 2001 (k euro)	Contribution from Vinyl 2010 in 2001 (k euro)
TEPPFA	4467	577	577
EPPA	361	361	361
Vinyloop® Ferrara	10500	10500*	1000
Texyloop® (France)	18000	435	–
EPFLOOR	452	452	452
DOW/BSL	350	44	19
Stigsnaes	870	609	183
Redop	300	300	1
ACRR	145	–	–
MVR	8	–	–
Eco-efficiency study	130	–	–
EPCOAT	500	–	–
ESWA	400	–	–
EuPR	420	–	–
TOTAL		**13,278**	**2,593**

* This amount represents the expenditure between September 2000 and December 2001.

8 Vinyl 2010 projects around Europe

This page refers to Vinyl 2010 projects that had been set-up before the end of 2001. The Vinyl 2010 activities will extend into other EU countries in which there are currently no projects in future years.

EU wide

Pipe recycling (TEPPFA)
Starting with Germany, France and Spain, a programme to develop collection and mechanical recycling of pipes and fittings at the end of their useful life across the EU.

EU wide

Window recycling (EPPA)
In view of the expected volumes, priority should be given to the optimisation of the existing systems in Germany, Austria, Holland and Denmark together new schemes in the UK and France.

Italy

Cable and film recycling (Vinyloop®)
Mechanical recycling of cables and films using Vinyloop® technology developed by Solvay.

France

Coated fabric recycling (Texyloop®)
Research project to identify best solution for coated fabric recycling using technology based on Vinyloop® process.

EU wide

Flooring recycling (EPFLOOR)
Starting with Germany, Italy and Spain, an investigation into new methods of collection and recycling technology potential for flooring products across the EU.

Germany

Feedstock recycling (DOW/BSL)
Trials of mixed rigid and flexible PVC waste at existing commercial plant in Schkopau.

Denmark

Feedstock recycling (Stigsnaes)
Trials of mixed rigid and flexible PVC using two step process.

Netherlands

Feedstock recycling (REDOP)
Recycling of mixed plastics based on process of using plastics with limited (specific) chlorine content as a reducing agent in blast furnaces across the EU.

Germany

Energy and HCl recovery (MVR)
Treatment of soft PVC waste at advanced energy recovery plant owned by the City of Hamburg with recovery of hydrochloric acid.

EU wide

Coated fabric recycling (EPCOAT)
Starting with France, a programme to develop collection and recycling of coated fabrics across the EU.

EU wide

Roofing recycling (ESWA)
Starting with France, a programme to research the potential for collection schemes and the technology for recycling of roofing membranes across the EU.

EU wide

Mechanical recycling (EuPR)
Starting with Belgium, a programme to formalise networking of PVC recycling companies to help create favourable conditions for PVC mechanical recycling across the EU.

Countries to be decided

Recycling (ACRR)
Pan-European collaboration with the Association of Cities and Regions for Recycling (ACRR) to improve the recycling of plastic waste collected by local authorities.

9 Key milestones for 2002

QUARTER 1

- Start up of Vinyloop® – Ferrara plant
- Decision taken about ton production of Redop project for trial in a commercial blast furnace

QUARTER 2

- ESPA publishes 2000 statistics for the three main uses of lead
- Completion of Phase 2 of the Stignaes project expected in May 2002
- Phase I of the EuPR study on "The picture of PVC mechanical recyclers in Europe" completed by June 2002

QUARTER 3

- Endorsement and acceptance of EPPA proposals expected
- Following the completion of the efficiency study a decision will be taken regarding the scaling-up of feedstock recycling in Denmark

QUARTER 4

- Completion and publication of results of the ECVM S-PVC Charter re-verification
- EU risk assessments on DBP, DEHP, DINP, DIDP and BBP completed
- Operational systems for TEPPFA project in place in priority countries by end of 2002
- Second research phase concerning technology screening for ESWA project completed
- Research concerning technology screening and use of recyclate concluded for EPCOAT project
- Decision taken on the applicability of the Linde technology
- Results from the improved logistics scheme for delivering larger quantities of waste to the DOW/BSL plant
- EPFLOOR to complete Development Programme

10 Glossary of terms

Definitions for some of the terms used within this report are provided below:

Additives

Materials that are blended with polymers to make them easy to process and give the physical properties required in the end-application. Before PVC can be made into products, it has to be combined with a range of special additives. The essential additives for all PVC materials are heat stabilisers and lubricants; in the case of flexible PVC, plasticisers are also incorporated. Other additives that may be used include fillers, processing aids, impact modifiers and pigments.

Best Available Techniques (BAT)

BAT is the latest stage in development of activities or methods which indicate the suitability of techniques for preventing or minimising emissions to the environment, without predetermining any specific technology or other techniques. The European IPPC Directive further defines:

- *techniques* as encompassing both the technology used and the way the installation is designed, built, maintained, operated and ultimately decommissioned
- *available* as developed on a scale which allows implementation in the relevant industrial sector under economically and technically viable conditions, as long as they are reasonably accessible to the operator

CSTEE

Scientific Committee for Toxicity, Ecotoxicity and the Environment. The CSTEE is a high level independent advisory committee of the European Commission on scientific and technical questions relating to the toxicity and ecotoxicity of chemical, biochemical and biological compounds whose use may have harmful consequences for human health and the environment. Its advice is requested by the Commission on new developments that may cause concern for consumer health.

Eco-efficiency

Concept of combining economical aspects and assessment of environmental impact, the latter often in the form of a LCA. Eco-efficiency therefore takes into account two of the three criteria of Sustainable Development.

Emulsion PVC

Emulsion PVC (E-PVC) is produced using water, vinyl chloride monomer and an initiator soluble in water. Emulsion PVC applications are mostly plastisols and calendering, profiles, flooring, wallcoverings, coated fabrics and sealants.

End-of-life

The final stage in a material or product lifecycle. Materials or products at the end of their life can no longer be re-used and must be sent either for energy recovery, recycling or disposal.

Feedstock recycling

Feedstock recycling is a form of material recycling, particularly well suited to mixed plastics waste. The technology breaks plastics down into their chemical constituents. These can be used as building blocks for a wide range of new industrial intermediate and consumer products. In effect, the plastics are reprocessed at the place of origin, the petrochemical complex.

Horizontal Initiative

In 1997, as part of the debate on managing end-of-life vehicles, the European Commission embarked on the Horizontal Initiative. The purpose of this review was to gather information on environmental and socio-economic factors associated with the PVC lifecycle, focusing particularly on waste management.

Industry charter

ECVM has two industry charters, one covering production of PVC by the suspension process and the other covering PVC produced by the emulsion process. These charters contain tough environmental standards for production and give commitments of cross-industry co-operation and agreement including research, sharing environmental control expertise and working with stakeholder groups.

Incineration

The burning of material to convert it, at least partly to gases, to reduce its bulk and sometimes recover the energy it contains.

Incineration (with energy recovery) is important as a sustainable waste management option for PVC.

Landfill

Landfills are carefully engineered waste disposal sites. Their aim is to provide a safe and controlled environment into which waste can be deposited and where it is subject to biological breakdown. Engineering solutions are employed to ensure that landfills do not cause pollution in the form of emissions to water and air, or have a negative visual impact on the surrounding landscape.

Lifecycle Assessment

Lifecycle assessment (LCA) is a technique for assessing the potential environmental impacts throughout a product's life (i.e. cradle-to-grave) from raw material acquisition through production, use and disposal.

Mechanical recycling

The process by which an end-of-life product is reprocessed, without changing the chemical structure of the material, into the same or alternative second-life applications.

Mechanical recycling makes ecological and economic sense whenever sufficient quantities of homogeneous, separated and sorted waste streams can be made available. Products collected for recycling this way include bottles, flooring, pipes, roof coverings and window profiles.

OSPARCOM

The Convention for the Protection of the Marine Environment of the North-East Atlantic was opened for signature at the Ministerial Meeting of the Oslo and Paris Commissions in Paris during 1992. This is concerned with the pollution of the sea by materials originating on land. Most of the countries bordering the North East Atlantic area, the North Sea and the Baltic Sea are represented.

Plasticiser

These are organic compounds, sometimes mixed with polymers to make a more flexible plastic. The commonest plasticisers are the phthalates, adipates and citrates. By product type, some 35 per cent of PVC is used for plasticised applications.

Polymer

An organic material composed of long-chain molecules made up of many monomer units. Most polymers have a chain backbone of carbon atoms. Polymers are almost always blended with additives before use. Plastics = polymers + additives.

Recycling

The conversion of materials from end-of-life products into second life applications. This second life may be a repeat of the first or something entirely different.

Recyclable

A material or product that is capable of being recovered via mechanical or feedstock recycling is said to be recyclable.

Renewable resource

Resources that can be reproduced by natural processes at a rate that matches or exceeds human consumption, e.g. salt, solar energy. Non-renewable resources are produced by natural processes, but at a slower rate than human consumption, e.g. oil, coal, natural gas.

Responsible Care®

Responsible Care® is the world-wide chemical industry's commitment to continual improvement in all aspects of Health, Safety and Environment performance and to openness in communication about its activities and achievements. National chemical industry associations are responsible for the detailed implementation of Responsible Care® in their countries.

Stabiliser

A stabiliser is a complex mixture designed to have a preventative and curative action in PVC, during processing and to protect the product during its life, including photodegredation. PVC degrades by dehydrochlorination, autooxidation and mechanochemical chain scission and the stabiliser has to prevent these different mechanisms. It also has to remove polyene sequences that give rise to colour development.

Suspension PVC

Suspension PVC (S-PVC) is produced using water, vinyl chloride and an initiator that is soluble in the monomer. The main applications for this type of PVC are pipes, cables, rigid profiles, building applications and injection moulding.

Sustainable development

The Brundtland Commission described the challenge of sustainable development as "meeting the needs of the present without compromising the ability of future generations to meet their own needs". This encompasses a combination of environmental, social and economic criteria.

VCM

Vinyl Chloride Monomer (VCM) is the monomer building block for the production of the PVC polymer.

11 PVC recycling technologies in detail

In the context of Vinyl 2010, there are two main types of recycling technology being used and developed: mechanical and feedstock.

Mechanical Recycling

Mechanical recycling makes ecological and economic sense whenever sufficient quantities of homogeneous, separated and sorted waste streams can be made available. In these cases, the quality of the recyclate allows production of the same or similar products.

In mechanical recycling processes, the chemical composition remains unchanged. Conventional mechanical recycling entails separation, grinding and feeding of ground product into the conversion equipment. Products collected for recycling this way include flooring, pipes, roof coverings and window profiles.

Conventional mechanical recycling of mixed plastics waste is also possible to a limited extent. Whereas all technologies applied for virgin material can be used to recycle homogenous waste, recycling of mixed plastics requires special technologies.

Vinyloop® is a new process which allows mechanical recycling of PVC, together with most of its additives, into a compound that can be easily used for production of high quality products. The process is based on dissolution in a solvent, filtration to separate non-PVC materials and precipitation of PVC compound by boiling off the solvent. The process is especially well suited to single stream composite products, many of which are to be found as soft PVC waste.

Feedstock Recycling

Feedstock recycling technologies for mixed plastics are gaining in importance. They 'crack' molecules by thermal treatment to recover the hydrocarbon and other components of the polymer. These can be used to manufacture new chemical products, including plastics. In the case of PVC-rich feedstocks, hydrochloric acid (HCl) is the major component to be recovered either for re-use in VCM/PVC production as a raw material, or in other chemical processes.

Slag bath gasification (Tavaux)

The core aspect of this process is the reactor, where decomposition of the PVC waste takes place in a molten slag bath at 1400 - 1600°C. HCl and syngas (a mixture of hydrogen and carbon monoxide) are the products targeted for recovery.

Hydrolysis (Stigsnaes)

This involves a two-step process:

- Hydrolysis at 250°C of PVC waste products in the presence of caustic soda, yielding sodium chloride and a dechlorinated fraction. Sodium chloride is cleaned so that it can be discharged to the sea without any risk for the environment. Recovery of sodium chloride by evaporation is an option also being considered.
- Pyrolysis of the dechlorinated fraction to produce a liquid organic phase and a solid residue containing the inorganic components of the waste. The organic phase can be used as feedstock for petrochemical processes or for energy recovery; the solid residue is suitable for being transformed into sandblasting material in the on-site "Carbogrid" plant.

Dehydrochlorination of mixed plastic from MSW (Redop)

This is a project investigating the use of mixed plastics with limited (specified) chlorine content as a reducing agent in blast furnaces. The process begins with dehydrochlorination and granulation of the waste. The granules are then injected into a steel-making blast furnace, as a substitute for coke.

Rotary Kiln with HCl and energy recovery (DOW/BSL)

The main process equipment is a rotary kiln with an after-chamber for efficient conversion. HCl is recovered as a 20% aqueous solution which is fully purified to make it suitable for producing chlorine and/or VCM on site. Energy is recovered through the production of medium pressure steam.

Pyrolysis (NKT–Watech)

This process involves a two-step pyrolysis in a stirred vessel:

- Hydrochloric acid liberated at 220°C, reacts with filler and added lime/calcium carbonate to form calcium chloride
- Above 350°C, the polymer chains break down. Light organic material escapes, leaving a solid coke residue

The residual coke, calcium dichloride and heavy metals are treated to make them suitable for selling.

12 Abbreviations

CEFIC	European Chemical Industry Council
CEN	European Committee for Standardisation
CSTEE	Scientific Committee for Toxicity, Ecotoxicity and the Environment
DBP	di-butyl phthalate
DEHP	di-2-ethylhexyl phthalate
DINP	diisononyl phthalate
DIDP	diisodecyl phthalate
DG Enterprise	Directorate General Enterprise
DG Environment	Directorate General Environment
EPPA	European PVC Window Profiles & Related Building Products Association (Sectorial Association of EuPC)
E-PVC	Emulsion PVC
ECPI	European Council for Plasticisers and Intermediates
ECVM	European Council of Vinyl Manufacturers
EPCOAT	EuPC PVC Coated Fabrics sector group
EPFLOOR	EuPC PVC Flooring sector group
ESPA	European Stabilisers Producers Association
ESWA	European Single ply Waterproofing Association (Sectoral Association of EuPC)
EuPC	European Plastics Converters
EuPR	European Plastics Recyclers
EU	European Union
HSE	Health, Safety and the Environment
ICCA	International Council of Chemical Associations
ISO	International Standards Organisation
LCA	Lifecycle Assessment
MSW	Municipal Solid Waste
MSWC	MSW Combustion
MSWI	MSW Incineration
PVC	Polyvinyl chloride
REDOP	Reduction of Ore in blast furnace plants by Plastic
S-PVC	Suspension PVC
TEPPFA	The European Plastic Pipes and Fittings Association (Sectoral Association of EuPC)
VCM	Vinyl Chloride Monomer

13 The European PVC Industry Associations

Please visit www.vinyl2010.org if you would like more information on the Voluntary Commitment or any of the activities described within this document. Alternatively, please contact any of the organisations listed below:

The European Council of Vinyl Manufacturers (ECVM)

Represents the European PVC producing companies and is a division of the Association of Plastic Manufacturers in Europe (APME). Its membership includes the 10 leading European PVC producers which together account for 98 per cent of Europe's production of PVC resin.

Avenue E van Nieuwenhuyse 4, B-1160 Brussels
Tel: + 32 2 676 74 43
Fax: + 32 2 676 74 47
www.ecvm.org

European Plastics Converters (EuPC)

EuPC represents approximately 30,000, predominantly medium-sized, plastic processing operations in Europe. These companies have over one million people on their payrolls, 85% of whom work for companies that employ less than 100 people. The individual members combine to produce a processing capacity of more than 30 million tonnes of plastic every year.

Avenue de Cortenbergh 66, Bte 4, B-1040 Bruxelles
Tel: + 32 2 732 41 24
Fax: + 32 2 732 42 18
www.eupc.org

The European Stabilisers Producers Associations (ESPA)

ESPA represents the whole of the European stabilisers industry through its four branches:

- European Lead Stabilisers Association (ELSA)
- European Tin Stabilisers Association (ETINSA)
- European Calcium Organic Stabilisers Association (ECOSA)
- European Liquid Stabilisers Association (ELISA)

Avenue E van Nieuwenhuyse 4, B-1160 Brussels
Tel: + 32 2 676 72 86
Fax: + 31 2 676 73 01
http://espa.cefic.org

The European Council for Plasticisers and Intermediates (ECPI)

ECPI represents the interests of 11 member companies that are involved in the production of plasticisers. Plasticisers are esters (mainly phthalates) which are used generally in the production of flexible plastic products, predominantly PVC.

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www.ecpi.org

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